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Anaemia in subsaharan Africa: A review of causes, risk factors, diagnostic challenges and evident based management

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Abstract

Anemia is a serious health condition in Sub Saharan Africa (SSA). The region is vulnerable to multiple underlying causes of anaemia that are many and varied. It affects children under five years, nonpregnant women, pregnant women and the elderly. Many interventions that include nutritional food fortification and infection control programmm through malaria infection control and many other infection control programs were designed in order to reduce the prevalency of anemia in SSAcountries but low success was acheived due to so many varied factors. So in this review we discussed on the major causes of anemia, risk factors, diagnostic challenges and management of anemia in SSA.countries. The methodology used was to review previous literatures on the subjects.

Keywords: Anemia; Causes of anemia in SSA countries; Risk factors; Diagnostic challenges; Management of anemia

1 Introduction

Anemia is a condition in which hemoglobin (Hb) concentration and/or red blood cell (RBC) numbers are not sufficient to meet an individual's physiological needs (WHO 2011). This occurs when there is increase in red blood cell destruction, decrease red blood cell production and blood loss. These reflects on the value of hemoglobin (Hb) concentration in all the risk group. For pregnant women a haemoglobin value lessthan 11g/dl, in children the Hb values are classifieid based on the ages as six month to five years of age, 12g/dl for children 6-14 age and 13g/dl for men (Beautler and Waalen, 2006). Anemia resulted into a serious public health problems in SSA, such as poor mental development, decrease work out put, low immunity to fight infections, abnormal growth in children, children mortality and maternal mortality (Giogieff, 2011.). Decrease Hb concentration or Packed cell volume are commonly used to diagnosed anaemia (Schreir, 2018). It can also be diagnosed using RBC count, mean corpuscular volume, blood reticulocyte count and blood film analysis, (Balarajan, 2011). In clinical practice, Hb concentration is the most commonly used hematological assessment method and the most common indicator used to define anemia. The role of Hb to carry oxygen to the tissues explains the most common clinical symptoms of anemia, which include fatigue, shortness of breath, bounding pulses or palpitations, and conjunctival and palmar pallor (WHO 2003). When haematological data are not available; clinical signs and medical history are another method used to diagnose anemia, but they are not enough in their ability to identify and clasify the anemia (Chalco et al., 2005). In children under 5 years of age severe anemia is defined by WHO as Hb <70 g/L and Hb <80 g/L in all other age groups, although other definitions, includes Hb <50 g/l as severe anaemia. Clinically

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these values can result to hearth failure and dearth. (Schreir, 2018). Assigning appropriate Hb thresholds to define anemia is necessary for ensuring that anemia is correctly identified, and its harmful effects prevented.Many programs were developed to address the effect of anaemia in SSA but less is achieved in cutting the manace of anaemia in SSA. For most of these programs to succeed there is the need for thorough understanding of the various causes of anaemia, its complications and proper treatment.

Sub-Saharan Africa (SSA) is a region vulnerable to anemia, with an estimated 190 million cases occurring in SSA countries (Kaasebaun, 2016). There are many underlying factors that give rise to anaemia in SSA and those factors are varied but preventable. Aneamia is more frequent in the SSA as people in the region suffer from insecurity, malnutrition, Illiteracy, infectious diseases, population growth and aging population (Black et al., 2013). SSA has the highest regional prevalence of anemia with a slower decline over time than in other regions (Mclean etal., 2009). Many control strategies were developed in SSA, efforts have been focused on nutrition related interventions such as iron supplementation through food fortification programs (Mwangi et al., 2017). Also the United Nations Children's Fund (UNICEF) and World Health Organization (WHO) embark on prevention and management of infectious diseases through deworming, malaria prevention using chemotherapy and insecticide-treated net (ITN]) and water and environmental sanitation agenda (WHO 2019). However, more is expected from the governments of the SSA countries to identify the vulnerable population and tailored the interventions to them. Children under five are at the highest risk, followed by women of reproductive age, pregnant women and the elderly. Without proper treatment, anemia can cause numerous health outcomes in adults including fatigue, low work productivity, and heart failure. In children, anemia can affect cognitive and motor development, and directly contribute to child and maternal mortality (Black et al., 2013). In SSA countries, anemia frequently co-occur with other health conditions such as malaria, schistosomiasis, and HIV (Scott et al., 2014). We review in this article the causes of anemia in SSA, risk factors, challenges on laboratory diagnosis and management.

2 Methodology

Relevant literatures on the subject matter were consulted using the keyword: anaemia , causes of aneamia in SSA, risk factors, challenges of laboratory diagnosis of anaemia in SSA and management of anaemia in SSA. Literatures were assessed using the google search engine and advanced search engine using google scholar.

2.1 Causes of anemia in SSA

Anaemia in SSA is associated with so many factors and most of these factors are increasing and hence the prevalence of anaemia in SSA is on the increase. Despite many interventions on the control of anaemia in the region but still there is growing cases of anaemia in the SSA. Most reserchers look more at the nutritional causes of anaemia in SSA. Anaemia is an indicator of good governance and hence most of the underlying causes of anaemia in SSA are on the increase. For anaemia control programs to be successful government most addresses isues of: Insecurity, curruption, Economy, illiteracy, cultural issues, population control, food insecurity, environmental pollution control, water sanitation and government policy on health development. All these are associated with the causes of anaemia in SSA. Other causes includes; Nutritional deficiency, Infection, Cancer and haemoglobinapathy (Balarajan et al 2011)., Namaste et al., 2017., Pasricha et al., 2013). Anemia in SSA can only be prevented if the governments and supporting partners bring and implement policies that can reduced and control the causes and improve on the diagnosis and treatment of the disease. . In this review we discussed on the: nutritional, infectious and sickle cell diseases as the major causes of anemia in SSA countries.. Even though many of the causes of anemia are inter related..

2.2 Nutritional deficiency

Nutritional deficiency occurs when the dietery intake of those nutrients is not sufficient to make up to the recommended requirements for an individual normal growth and delopment (Badham, 2007). Nutritional deficiencies anemia is the most common health problem in both developed and developing countries. It occur when there is inadequate amount of nutrients that are needed by the haematopoietic system for RBC production and maintainance (Balarajan et al.., 2011). Nutrient deficiency are caused by inadequate dietary intake, increased nutrient losses due to haemorrhage and infection, impaired absorption and nutrients metabolism. In most cases nutrient deficiency anaemia is corrected using food supllements that cosist of the dietary formular for correcting the anaemia. Nutritional deficiency that causes anaemia includes; deficiency of iron, vitamins, folate, riboflavin, copper and zinc (Zariwala et al., 2013).

2.2.1 . Iron deficiency

Iron deficiency is more vulnerable in SSA due to poor condition o f life that which result into poor dietry intake and exposure to infection. SSA have high population of people leaving in rural areas which mainly depends on low quality food that are not refined and have low iron intake, most of these food have natural subtances that inhibit iron absorbtin

as such iron deficiency is the major causes of aneamia in the region (Badham, 2007). Maitaining iron balance among the risk group is very difficult in SSA. The sociocultural sytem of leaving have a lot of negative consequences in maintaining iron balnce within the risk group.The early marriage and multiple pregnancy brings a lot of physiological changes whch distort iron absorbtion, demand and depletion of iron stores. This phenomenon exposes women of reproductive age into deficiency of iron which reslt into anaemia. Children in SSA are also prone to iron deficiency due to increase requirements as result of rapid growth. The low socio-economic status, illiteracy and culture in SSA denies the affected risk group access to the required food stuff that will boost there iron need. Most of the food items (fish, meat,poultry vegetables and fruits) that contains a very good source of iron are within reach in the rural regions of SSA but due to ignorance, illiteracy and socioeconomic situations in the region this dietry source will not be privided unless on occations. Pregnant women require extra iron to support the gowth and development of the fetus that have a higher risk of developing iron deficiency (Badham, 2007). Deficiency of iron is the common and most frequent cause of anemia in SSA. Many of the interventions on anemia control in SSA were based on preventing iron deficiency through iron supplements to vulnerable groups. Food fortification and dietary diversification were food based strategies to combat iron deficiency anemia in SSA (WHO 2001).

2.2.2 Vitamin B12 Deficiency

Vitamin B12 is a water soluble vitamins that is only synthesize by microorganisms. Its dietary source includes meat, eggs, beans, milk and fish.Vitamin B12 is very important in cell growth and development and hence rapidly deviding cell have tendency to be deficient of this vitamin and caused an abnormal cell production (Elena et al., 2021). Its deficiency in an adult will affects the bone marrow and causes the production of abnormal red cells known as megaloblastic cells that will results to anaemia this affects the aged people in SSA (Elena et al., 2021). In an infant, deficiency of Vitamin B12 will affects the development of the central nervous sytem and causes many neurological deformities and this is very common in SSA (Elena et al., 2021)..Vitamin B12 deficiency are caused by: Malabsorption, autoimmune and dietary insufficiency. In SSA deficiency is commonly caused by insufficient dietary intake of the nutrient and from malabsorption (Allen, 2008). Malabsorption occur due to either autoimmune disease in which autoantibodies are formed against intrinsic factor essential for B12 absorption or in bacterial and parasitic coinfections (Green et al., 2017). Deficiency due to low dietary intake can be corrected by increasing the dietary intake of the nutrients. Vitamin B12 is recommended for pregnant women in SSA to avoid giving birth to baby with Vitamin B12 deficiency as it is common in SSA.. Deficiency of B12 in infants will delay the developments of central nervous system of the infant which will cause some neurological deformities to the brain but this can be corrected by replenishing the nutrients.

2.2.3 Foliate deficiency

Foliate is involve in the synthesis of biomolecules such as lipids, protein and DNA. Its deficiency is linked with so many diseases conditions including anaemia and some congenital disorders (Safi et al., 2012). Folate deficiency in SSA affects women of reproductive age and young children with result into maternal anaemia, birth defects and poor development in young children (Fishman et al., 2000). There is poor surveillance in SSA on the health consequences of folate deficiency on the risk group in the SSA region (Zaganjor et al., 2016). Folate deficiency in SSA occur due to low dietary intake and consumption of unfortified cereals (Allen, 2008). Folic acid supplementation programs were introduced through food fortification and daily intake (Eichholzer 2006). Though; folate is available in many food items that includes legumes, eggs, vegetables, fruits, banana and liver. Pregnant women and women of reproductive age were recommended to take folic acid daily to avoid deficiency as there is increase demand during pregnancy and lactation (Balarajan, 2011). Malaria and other infections in SSA increases the risk of folate deficiency among the risk group (Fishman et al., 2000).

2.3 Infection

2.3.1 Malaria

Malaria is among the most common causes of severe anaemia among the risk group in SSA. especially in the western part of SSA where malaria accounted for about 25% of anemia prevalency. About 35% of anaemia in children in SSA was as a result of malaria infection, also 200,000 to 500,000 pregnant women with severe anemia were as a result malaria caused *by* P. falciparum. P falciparum infection in pregnancy is the cause of up to 10,000 maternal anaemia deaths in sub-Saharan Africa annually (Steketee et al., 2001). Pregnant women, infants and pre school children (PSC) are group at risk of developing severe anaemia as a result of P falciparum infection in SSA

P.falciparum is the most dominant malaria parasite specie in SSA and also the most dangerous specie among all the species. Causing malignant malaria, that which resulted to severe malaria that resulted to severe anamia, difficulty in treatment and other complications that results to death (WHO. 2017). As of 2015 about 90% cases of malaria was

recorded in SSA and 92% death as result of malaria caused by P.falciparum was recorded in SSA (WHO. 2017). There is a very strong relationship between iron and P.falciparum specie and this may be the reason that makes its dominance in the SSA region (Spottiswoode et al., 2014). This relationship always poised a challenge in most of the iron intervention programs in SSA regions as the region is having the highest prevalence of iron deficiency anaemia, iron supplementation is supposed to be part of the intervention program in solving iron deficiency but this also triggers a negative consequences as the P.falciparum also depends on this iron for its own survival. And hence iron deficiency may be a drawback to severe malaria in SSA (Spottiswoode et al., 2014).

There were lots of discussions and arguments on risk assesment of iron deficiency and severe malaria in SSA. A Randomized control study among children infected with malaria showed that daily iron supplementation with folic acid increased the risk of hospitalization and also death in SSA (Moya-Alvarez et al., 2016). Also in- vitro studies showed that P. falciparum preferencially invades reticulocytes during iron intervention and causes multiple growth of the parasite (Pasricha et al., 2018) . Many of these studies were conducted in many regions of the SSA. And it has now concluded that any iron intervention using iron supplementation or iron rich food in children that successfully treat anaemia would induce reticulocytosis and such intervention will transiently increase the risk of malaria infection unless accompanied by reliable malaria prevention (Pasricha et al., 2018). It was also found that iron supplementation with concurrent treatment and survey of malaria in a malaria endemic region has no effect on malaria increase and seviarity (Neuberger et al., 2016). Similar study on the effects of iron supplementation on preganat women in malaria endemic region of SSA was conducted it was found that iron supplementation on pregnant women has no effect on the increase risk of P.falciparum infection and malaria severity on both the women and the fetus or the neonate and hence iron supplementation was recommended for pregnant women on antenatal (Mwangi et al., 2017).

The process by which *plasmodium parasites* causes anemia is complicated, It involves rupturing the red cells, reducing the production of new red cells and It also destroys the parasitized and unparasitized red cells by the spleen through the action of macrophages. These processes causes reduction of red blood cell that resulted to the reduction of haemoglobin and hence the oxygen carrying capacity of the red cells is reduced. If these procedures continues it can cause hypoxia, congestive heart failure and other complications. Children, infant and pregnant women are at risk of malaria because they don't have a strong immune system against the infection and this reslts into malaria and anaemia. It was discovered recently that a protein produced by immune cells during malaria infection can also trigger severe anemia (Kai and Roberts, 2008). About 400,000 pregnant women in SSA have moderate to severe anemia annually due to malaria infection (Guyatt and Snow, 2001).

2.3.2 Human Immuno-deficiency Virus infection (HIV)

Anemia is among the most frequent hematological complications among HIV/ AIDS individuals.It is anaemia of chronic setting that have a blood film features of normochromic and normocytic appearance with a low reticulocyte count and normal iron stores (Redig and Berliner, 2013). Anaemia is a common complication among HIV positive individuals and it has been an indicator of the HIV / AIDS progression and mortality (Johannessen et al., 2008). The predominant cause of anaemia in HIV/AIDS is anaemia of inflammation and also known as anemia of chronic disease.It is characterized by low red blood cell production as a result of the action of some proinflammatory cytokines such as tumor necrosis factor-α and interleukin-6.(17). Literatures also have indicated that antiretroviral treatment of pregnant women with zidovudine (AZT) can lead to early onset of anaemia (Areechokchai et al., 2009). Anaemia in HIV/AIDS patients in SSA have multiple factors due to inflammatory response to multiple infections and diseases, dietary deficiencies, blood loss, medications and antibodies to antiretroviral agents (Moyle, 2002). SSA states are having the highest cases of HIV/AIDS pandemic that accounts for 22.5 million people, about 68% of global total of people living with HIV/AIDS in 2009 (WHO, 2011). About 1.3 million Africans died of HIV in 2009 and this is 72% of the global total.

2.3.3 Tuberculosis

Tuberclosis (TB) patients are vulnerable to anaemia and it is more vulneraTB/HIV coinfected patients (Papathakis and Piwoz, 2008).In a study from Malawi, more than three-quarters (77%) of TB patients without HIV were anemic, while 88% of TB/HIV coinfected patients were anemic (Van Lettow et al. 2005). While in Uganda, 71% of TB/HIV coinfected patients were anemic (Shah et al., 2001). Anemia among pulmonary TB patients developed as results of: inflammation, increased blood loss from hemoptysis (blood in sputum), decreased RBC production, poor appetite and nutrients deficiency (Papathakis and Piwoz, 2008). In Tanzania, Gambia, and South Africa TB is the primary cause of anemia (Hell et al., 2018, Kerkhoff et al., 2016).

2.4 Sickle cell disorders

Sickle cell disorder is one of the major causes of anaemia in SSA affecting both sex groups and all ages (Kassabaun et al., 2014). The SSA regions are having the highest number of individuals with sickle cell trait and this increases the chance of giving birth to sickle cell individual (Model and Darlison 2008). In sickle cell disorder, sickle shaped red blood cells are formed due to abnormal haemoglobin. And this causes an obstruction of smaller blood vessels, damages larger blood vessels, causes severe pain, residual organ damage, chronic haemolytic anemia and shortened life span (WHO, 2016). Young children with the disorder have an increased risk of infections and malnutrition. And these results to poor health consequences, painful episodes and increased hemolysis (Ansong et al., 2013). Management and control of the disease condition in SSA is very difficult and this lessen the survival chance of the patient.

2.5 Risk factors for anemia in SSA

The population groups most vulnerable to anemia in SSA countries include; children under 5 years of age, particularly infants and children under 2 years of age; elderly people (Adult over 50 years of age) pregnant women and non-pregnant women. Females were consistently at greater risk of anemia than men across almost all geographic regions and in most age groups.

2.6 Challenges on diagnoses of anemia in SSA countries

Anemia is most commonly diagnosed in the laboratory by a low Hb concentration or a low hematocrit (Schreir, 2018), anemia can also be diagnosed using RBC count, mean corpuscular volume, blood reticulocyte count, blood film analysis, or Hb electrophoresis (Balrajan et al., 2011). Hb concentration analysis is the common hematological method used and the most common indicator used to define anemia. Though due to multiple factors that causes anemia, the strategy recommended in diagnosis and treatment of anemia involves diagnosing the anemia using hemoglobin concentration and identifying the causes of the anemia.These involves a lot of laboratory procedures. Most laboratories in the SSA lack capacity to carry out most of these tasks of finding the causes of anemia and hence the condition couple with the primary factors (Malaria, sickle cell disesses, Iron diffeciency) causes the loss of lives of the vulnerable people in the SSA countries. Deficiency of Iron is the major cause of anemia in SSA. But it is difficult to be diagnosed in most of the health facilities in the SSA. Due to the fact that most facilities lack the adequate resources to carry out these procedures. Serum ferritin concentration is a marker used for detecting iron deficiency and it is recommended by WHO. It is an early marker for detecting iron deficiency. But the concetration of this marker in SSA is affected by inflammatory response due to infection and therefore interpretation of serom ferritin test in SSA need to be done in cocurrent test reslts of some of this response proteins such as C- reactive protein or alpha- 1- acid glycoproteins (Martin et al., 2021). These tests can not be performed in most conttries in the SSA due to limited resources in the health sector and lack of laboratory facilities (Martin et al., 2021). Serum ferritn concentration can be measured using an immunoassay kit that is not expensive, readily available and easy to perfomed. Detecting iron deficiency and the causes of iron deficiency is very crucial in treatment of anaemic patient in SSA. Serum ferritin is one of the markers that can be used to detect iron deficiency early though there are other tests like serum iron concentration, total iron-binding capacity and peripheral blood films and bone marrow examination (Trust et al., 2006) There are also challenges in identifying the primary causes of anaemia in SSA. Malaria serve as one of the major causes of anamia in children and also affects the pregnant mothers and their babies in the SSA regions but identifying this is a very big challenges in the region. Malaria microscopy is the gold standard technique in diagnoses of malaria but it is halted by so many challenges in the SSA as a result of those challenges there were over diagnoses of malaria in the region causing wrong treatment of malaria that resulted to anti malarial drug resistance and may even likely causes a mutant strain of the parasite.Some of the challenges that affects malaria microscopy in the SSA regions includes; Lack of equipments and good reagents, Lack of power and good laboratory facilities and lack of staff and microscopy skills (Moerman et al., 2003). However, WHO introduces the use of malaria rapid diagnostic test (RDT) in the region to reduce the drawbags of treatment of both malaria and anaemia without diagnoses of suspected cases of malaria (WHO., 2011). The sensitivity and specificity of the RDT was validated and it was shown to be a very accurate technique of diagnoses of malaria.It was recommended to be used in remote areas of the SSA where microscopy willnot be available (Wongsrichanalai et al., 2007).Schistosomiasis and helminthiasis are another condition that causes anaemia either through loss of blood or through inflammation in the SSA. These conditions are very difficult to be diagnosed in the SSA regions. Most of the technique used in the regions are not very sensitive in detecting the diseased condition and even the collection of the right specimen is a challenge and these in most cases causes a missed diagnoses.The tecnique is based on isolating parasitic eggs in urne and stool samples (Paul et al., 2002). A very sensitive and specific polymerase chain reaction (PCR) techniquehave been developed that detects the DNA of the parasite in stool, urine and serum or plasma (Gray et al., 2011). But these technique is expensive compared to the conventional method used in the SSA and also due to resourse limitations on health in the regions this test technique can not be obtained in the region. But the test is more convenient and more accurate than the conventional technique. Early diagnoses of sickle cell disorders will give a better management option and may reduces

the morbidity and mortality of the patients (WHO. 2006). Prenatal diagnoses of the deseases condition using the chorionic villus sampling to detect the fetal haemoglobin is available. The test technique uses the DNA and it can be detected at first trimester of the pregnancy and this may give the parent an option of either terminating the pregnancy or to continue with it (Frenette and Atweh, 2007). Most countries in SSA have serious set back in the provision of health and is more in the medical laboratory diagnostic services were more resources is needed for its provision. The challenges that cripple the laboratory services in SSA includes: Lack of laboratory infrastructure, lack of skilled staff, Poor policies, no synergy between clinical and research laboratories, lack of power supply and poor funding. All these affects the quality of health provison in SSA and deteriorate patients management (Birx et al., 2009).

3 Management of anaemia

For Proper management and control of anaemia to be successful an appropriate strategy that will addressed the specific causes of aneamia should be employed. Anaemia has a multiple variable ethiology in different locations that are specific to the environment and specific to the predominant factors that causes anaemia in that region. Therefore based on the different characteristics on the causative factors anaemia is best control by the following steps: Diagnosis and management of the causes of the anaemia, Correcting the haemoglobin value to a therpeutic level and management and prevention of complications (Osungbade and Oladunjoye, 2012)

3.1 Diagnosis and Management of the underlying cause of anaemia

Identifying the cause of anemia is a very important step in treating anaemia. Anemia having multiple causative factors requires a critical diagnostic approach to identify the cause. Most often anaemia is being treated using iron either by using iron based food supplements or by blood transfusion and this treatment in many cases tends to have many side effects as the condition may warrant. Iron deficiency is the major caused of anaemia in SSA.The underlying causes of iron deficiency in SSA includes: Nutritional deficiency, Inflammation due to infection and intestinal loss of blood.Treatment of iron deficiency anaemia without identifying the inherent cause will lead to complication and severity of the anaemia which may even lead to death (Pasricha et al., 2018). More especially in the SSA where people are prone to infection and most of this infective organisms require iron for growth. Therefore; treating anemia using blood transfusssion and other iron therapy without identifying and treating the underlying cause as is the common practice in SSA may only end up in complications (Pasricha et al., 2018) . Food fortification with iron and other micro nutrients is used to manage iron deficiency caused by nutritional deficiency among the risk group. Also treatment of infection due to parasitic, Viral and bacterial infection can also reduces iron deficiency by inhibiting the inflamtory mechanism and intestinal loss of blood . Water sanitation and environmental sanitation wii reduce helminthiasis, Schisomiasis and other parasitic infection and this will prevent intestinal blood loss as well as iron lost. Proper diagnosis and treatment of malaria using treated mosquitoe net and Artemisinin based combination therapy (ACT) may reduce the prevalence of anaemia in SSA. ACT is recommended in the treatment of malaria in SSA as it minimizes the case of drug resisitance. Drugs such as albendazole or mebandale can be used to manage and control hookwarm infection in SSA. Praziqantel is recommended for the management of schistosomiasis in SSA. It is very effective in management of scistosomiasis and can be used even with pregnancy (Hoque et al., 2009). It can be administered according to the height using the dose pole principle (WHO 2001). Early diagnosis and treatment of HIV and AIDS infected individuals in SSA can help managed the diseased complications which include anaemia. Also early diagnosis and treatment of haemoglobinopathies may help reduce the prevalency of anaemia in SSA. Sickle cell anaemia will be inproved by early treatment intervention usin analgesics, antibiotics and vitamins supplementations.

3.2 Restoration of the haemoglobin concentration to normal levels

Anaemia affects the production of rbc aswell as the production of haemoglobin due to so many mechanism. Deficiency of nutrients such as iron and other vitamins result in the decrease of haemoglobin and rbc production and hence anaemia set in. For anaemia to be prevented and managed these deficiency of this nutrients and other measures need to be improved. Iron supplements through food forthification and therapeutics dose improved the iron supplies and hence increased the synthesis of haemoglobin as well as the rbc production. Many strategies that will add iron to the dietary containts of the food stuf in SSA were developed and recoomended both locally and internationally. This strategies includes Industrial food fortification, Biofortification and point of care fortification. Iron food fortification is recommended fo pregnant women preschool children and other risk group.Iron food fortification have been used to increase the haemoglobin concentration and have been used for anaemia prevention in SSA. Other therapeutic iron supplements include Oral iron supplements and Intravenous iron supplements these are also used for the treatment of anaemia. Oral iron supplements includes: Ferrous sulfate, ferrous gluconate and ferrous fumerate. Parenteral iron supplements as iron dextran is also used when there is intolerance to oral iron especially in pregnancy. Supplementals iron drops for low birth weight infants was also recommended. The iron supplements will help increase their iron stores and improve their growth and developments as they require more iron for growth and developments iron supplements

for low birth weight infant can start as early as from 2 months as their iron stores begin to deplete between 2 to 3 months after delivery. Vitamins are also required to improve the production of rbc and concentration of haemoglobin synthesis. Vitamins supplements were recommended for all the risk groups.Vitamin A spplements is recommended for breastfeeding mothers but it should not be given to pregnant women as it can cause miscarriage and birth defects. Vitamin B12 is also required in children and pregnant women it can be given orally or intramuscularl (Robert and Brown, 2003). Folic acid supplementation is also recommended to pregnant women, brest feeding mothers and to patients with folate deficiency. It is routinely given to pregnant women (Hirrpasa, 2019). Blood transfusion is another effective measure of treating anaemia (Badham, 2007). Depending on the patient, blood type and the anaemic condition Blood transfusion can be autologous transfusion, exchange transfusion or direct transfusion with blood products. It is recommended that blood transfusion should only be used if other treatment has failed (Badham 2007). Blood transfusion in SSA have a lot of safety challenges. Due to poor resources and poor government policy on blood transfusion every blood transfused in most SSA countries carrries a chance to transmissible infection such as HIV, Hepatitis, Syphilis and other pathogens. Blood transfusion is very common in SSA. Most anaemia cases end up with blood transfusion and this causes an increase in the prevalency of hepatis and other transfusion related diseases in the region (Badham, 2007).

3.3 Prevention and treatment of complications

Complications may arise due to lack of treatment and delay in diagnosis. The complicatons may vary due underlying causes of the anaemia. Complications in pregnant women will lead to premature labour, given birth to low weight babies and icreases the risk of blood loss during delivery (Ofarril-Santoscoy et al., 2013). In children complications may affect growth and mental development and most of this complications in chidren may caused a permanent deformity. Other complications include Restles leg syndrum (RLS). Prevention of these complications .involves early diagnosis and proper treatment of anemia. Nutritional supplements that which includes iron and vitamins should be used for pregnant women and chidren. Other complications will be prevented by diagnosis and proper treatment of the underlying cause such as malaria treatment and prevention.Seasonal malaria chemotherapy will minimse malaria in preschool chidren.

4 Conclusion

Sub-Saharan Africa (SSA) is a region vulnerable to anemia, several attempts were made on reducing the burden of anaemia in the region, but slow progress has been achieved, this is largely due to multiple factors; that include; poor primary health care provision, poor government policy on health, challenges on laboratory diagnosis, lack of trained health care providers and poor management and diagnosis of the condition. Interventions were designed to address the major causes of anaemia in SSA countries; such as iron supplementation for pregnant women and children, malaria services, HIV and tuberculosis services. All these were targeted toward reducing the causes of anemia in SSA countries but these interventions were not adequately enough to tackle the problems of anemia in the region. The intervention only benefitted those leaving in the cities while those in the rural areas were not opportune to receive the interventions. Moreover the rural areas in the SSA countries suffers from poor health care facilities, malnutrition, infectious diseases and all other factors that causes anemia as discussed.The underlying causes of anemia in SSA countries are many, varied and largely preventable.Therefore, adequate attention should be given to the emerging causes of anemia in SSA countries such as; malaria, HIV/AIDS, tuberculosis and sickle cell diseases. Diagnosis and management of anemia and its causes should be improved. The involvement of government of the SSA countries can effectively combine and balance the needs for programme implementation, monitoring and evaluation, research and community involvement.

Compliance with ethical standards

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