International Digital Organization for Scientific Research ISSN: 2579-0781
IDOSR JOURNAL OF EXPERIMENTAL SCIENCES 7(1) 57-78, 2022.

Factors associated with iron deficiency aneamia among pregnant women at Chuk hospital in Kigali, Rwanda.

[1]Chinenye Mercy Nwankwo and [2]Fardosa Hashim Abdullahi

[1]Community Health Department, Kabale School of Medicine, Kabale University, Uganda.
[2]Jomo Kenyatta University of Agriculture and Technology, Kenya;
Email: mnwankwo@kab.ac.ug; fardosahashim@gmail.com

ABSTRACT

Iron is a vital element in all aerobic organisms, and it plays critical role in pregnancy owing to the increased demand for blood for the growing foetus and placenta. This research assessed deficiency anaemia in pregnancy, dietary practices and influencing factors among pregnant women in CHUK Hospital. It adopted descriptive survey approach on the pregnant antenatal care clinic services among 93 respondents from 121 attendants. It Involved the use of primary and secondary data collected through systematic reviews, records and survey. The validated tool used to seek required information. The results showed that socioeconomic influence with p-value of 0,006129 in proportion of women in the study with iron deficiency anaemia. Similar statistical significant relationship 0.029136 was found with dietary practices in proportion to women in the study with iron deficiency anaemia. In conclusion, appropriate programme regime for combatting the deficiency during pregnancy period might be too short period to manage iron deficiency anaemia. Socio-economic elements contributed to iron deficiency anaemia among pregnant women attending CHUK Hospital. A balanced diet, rich in proteins, iron and vitamins from good sources like liver, meat, eggs, green peas, figs, beans, whole wheat and green bananas remains very critical in tackling iron deficiency anaemia problem among the pregnant women. Indeed, dietary practices can therefore be concluded to be associated with IDA in pregnant women attending ANC services at CHUK Hospital. Individual level factors such as physical activities was found to be beneficial to pregnant women; however, it was also noted that pregnant women with specific conditions should always seek approval from their health officers before engaging in any physical activities.

Keywords:Associated Factors, Iron Deficiency Anemia, Pregnant Women, CHUK Hospital

INTRODUCTION

Iron deficiency anaemia (IDA) is the most frequent nutritional deficiency in pregnancy, with an impact on maternal and foetal morbidity and mortality [1,2,3,4]. It is regarded as the most important preventable cause of perinatal complications, such as premature delivery, intrauterine growth retardation and neonatal and perinatal death. [5,6,7,8] assert that iron deficiency anaemia is extremely common - particularly in the developing world - reaching a state of global epidemic. While the condition may be common, a lot of people normally aren't aware they have iron deficiency anaemia [9,10,11,12]. It's possible to experience the symptoms for years without ever knowing the cause. In women of childbearing age, the most common cause of iron deficiency anaemia is a loss of iron in the blood due to heavy menstruation or pregnancy [13,14]. A poor diet or certain intestinal diseases that affect how the body absorbs iron can also cause iron deficiency anaemia. Iron deficiency during pregnancy is one of the leading causes of anaemia in infants and young children. Physiological anaemia occurs in pregnancy because blood volume increases to a greater extent than red cell mass, thus leading to a reduction in blood viscosity and resulting in a dilutional anaemia. British Committee for Standards in Haematology, [15,16,17] define anaemia as an Hb level <110 g/L at booking; haemodilution will result in further drops during pregnancy and

subsequent reduction in oxygen-carrying capacity. In the second and third trimesters the diagnostic level for anaemia is an Hb level of <105 g/L. Postpartum the diagnostic level is 100 g/L. The importance of a fall in haemoglobin during pregnancy indicates a healthy plasma volume expansion; this has been appreciated for some time [18,19,20]. Their study revealed lowest perinatal mortality was associated with a lowest recorded maternal haemoglobin concentration of between 9-11g/dL suggesting that routine iron supplementation of women with a lowest Hb of 9.0 g/dL or more is unlikely to improve the perinatal mortality rate, although maternal benefits may accrue from such intervention. Anaemia and deficiencies of vitamin A and iodine are highly prevalent among pregnant women and estimates indicate that almost half of the pregnant women and one third of non-pregnant women worldwide have anaemia [21,22]. Many women go through the entire pregnancy without attaining the minimum required intake of iron. Globally, an estimated 9.8 million pregnant women have night blindness and 19.1 million pregnant women have low serum retinol concentrations, with Africa and South-East Asia having the highest proportions [23,24]. Iron deficiency in pregnant women affects their metabolism and iron status of their foetuses. Prevalence of iron deficiency anaemiacould be affected by several factors which include socioeconomic conditions, lifestyle and health-seeking behaviors across different communities. Iron is a vital element in all aerobic organisms, and it plays critical functions in the human body. Anaemia continues to be a major public health problem in the occupied Palestinian territory [24], consider that anaemia above 40% in women and young children is a severe and between 20% - 39.9% as moderate public health problem, despite the fact that the Palestinian Ministry of Health has protocols on the management of IDA provides iron supplements free of charge to women. In Asia, the prevalence of anaemia was estimated to be 44% in non-pregnant women and 60% in pregnant women.Iron deficiency anaemiais a serious public health problem affecting more than 700 million people in the world [25]. It is the most globally prevalent nutritional problem reaching an epidemic level in many developing countries [26]; it is considerably more prevalent in the developing regions (59.0%) than in the industrialized world (14.0%). Iron deficiency anemia affects all people at all ages, but it is especially found in females particularly in pregnant women and children [27]. Zimmerman & Hurrell in the year 2007, further indicae that IDA is the most common nutritional deficiency encountered in the developed world with up to 50% of cases resulting from insufficient iron intake. In settings where iron deficiency is not the only cause of anemia, approaches that combine iron interventions with other measures are needed. Strategies should include addressing other causes of worldwide prevalence of anemia 1993–2005 anemia and should be built into the primary health care system and existing programmes [28]. These strategies should be tailored to local conditions, taking into account the specific etiology and prevalence of anaemia in a given setting and population group. Pregnancy, delivery and lactation constitute a major drain on the iron reserves of women. Program review and secondary analysis of demographic health survey of Rwanda and MHCIP (USAID) found out that maternal anaemia, even moderate cases, increases the risk of dying during childbirth. The value for Prevalence of anaemia among pregnant women in Rwanda was at a minimum 19.40% as of 2011 compared to 29.80% in 1990 over the past 21 years an all-time high [29] Maternal anemia control programs are the primary maternal nutrition program worldwide, yet they lack adequate funding and have, therefore, failed to significantly reduce maternal anaemia in developing nations especially in Rwanda. Pregnancy signifies an important life-cycle in the life of any woman. It is the most exciting period of expectations and fulfilments; however, it is a condition of great stress because of many anabolic

activities that take place during this time and foetal growth takes place with extensive changes in maternal body composition and metabolism [30]. Good nutrition is essential during pregnancy and is important for the baby to grow and develop and also for the mother to stay healthy without complications. The World health organization recommends that pregnant women take between 30mg to 60mg of iron daily, that is, at least three servings of iron-rich foods, such as spinach, lean meats, beans, and breakfast cereals each day [31]. During pregnancy, the iron requirements significantly go up owing to the increased amount of blood in the body. Consequently, there is need for more iron to make more haemoglobin to cater for the increased blood, the growing baby and the placenta [32]. Numerous studies in the developing countries have shown that anaemia, especially iron-deficiency anaemia, is highly prevalent among pregnant women [33] and is defined by the WHO as haemoglobin levels of <11 g/dL.IDA is recognized as the world's most prevalent nutritional disorder, affecting more than two billion people in both developed and developing countries. According to the Rwanda Demographic and Health Surveys (DHS) 2014/2015 report [34], prevalence of anaemia among women is recorded at 15.7%. This indicates an increase in prevalence compared to the 2010 Rwanda DHS figures recorded at 14.2%.Iron deficiency is linked with increased risk in pre-term delivery, low birth weight, inferior neonatal health among other complications [35]. The risk of death also increases substantially in severe anaemia, creating a significant economic impact on the healthcare system of any country. It is against this backdrop that the study assessed the factors associated with iron deficiency anaemia among pregnant women in CHUK Hospital, Kigali.With special reference to the individual and socio-economic related factors and the women dietary practices.

METHODOLOGY

This study adopted across –sectional descriptive design and the study was conducted in CHUK Hospital being one of the referral Hospitals in Kigali province which attends to approximately 122 pregnant women for antenatal clinic in a month. The study used systematic sampling with a sampling interval of 2 to select 93 pregnant women attending ANC. A validated semi-structured questionnaire was used to collect the required data Hemoglobin values was observed on selected individual files and categorized according to the WHO criteria; Normal (11 g/dL or higher), Mild (10–10.9 g/dL), and moderate (7–9.9 g/dL). Mild and moderate levels (<11 g/dL) of hemoglobin are defined as anemic. Data analyzed with nominal or ordinal scale, chi-square test to ascertain the significance of any observed changes between exposed and outcome. ODD ratio to measure the association between exposures (factors associated) and outcomes (IDA) in themes and the relationship between them Study site : CHUK, the University Teaching Hospital of Kigali is located in the center of Kigali district of Nyarugenge. It is the main public health institution in the country.It serves 1,000,000 people from a largely urban area. It was built in 1918 and in 1928 it functioned as a health center from 1994-1996, CHUK has served as health center, a district hospital and as a referral hospital. The hospital works in partnership with Rwanda Biomedical Center.Its departments include: Internal Medicine, Surgery, Pediatrics, Gyn-obstetrics,Emergency, ENT, Stomatology, Physiotherapy ,Dermatology, OPD, Opthamology. The study adopted a descriptive survey research design. This design allowed us to review surveillance studies, and also case reports regarding the factors associated with iron deficiency among pregnant women. CHUK Hospital being one of the referral Hospitals in Kigali province which attends to approximately 122 pregnant women for antenatal clinic in a month, (CHUK,2016). The sampling techniques used in the study was systematic sampling with a sampling interval of 2 to select 93 pregnant women attending ANC to determine the variables – socio-Demographic characteristics of the pregnant women, personal level factors of

the pregnant woman with regards to iron deficiency Anemia and nutritional status of the pregnant women. The study population was formed by all eligible pregnant women attending antenatal care clinic at CHUK Hospital in Kigali.

The sample size was calculated using Sloven's formula (Yamane, 1967) as shown below:

$$n = \frac{N}{1+Ne^2}$$

$$= \frac{(122)}{1 + 122(0.05)^2}$$

$$= 93.4865$$

Where;
N = the population size
e = the margin of error (for this research study was set at 95% confidence level corresponding to 0.05). A sample size of 93 was obtained.

Inclusion Criteria

All pregnant women aged between 18years and 45 years were eligible to participate in this survey. This is based on the working age in Rwanda. Eligible pregnant women who willingly give their consent to participate in the study.

Exclusion Criteria

Eligible pregnant women who do not give their consent to participate in the study. It is conceptualized that independent variables such as the socio-economic elements, dietary practices and individual level factors of the pregnant women all influence the dependent variable, which is, assessing factors associated with iron deficiency anaemia. A semi-structured questionnaire was used to collect the required data for this study. To obtain a complete overview and understanding, the questionnaire was divided into distinct sections as guided by the research questions. These questionnaires were administered to eligible pregnant women with the help of a research assistant. Additionally, I obtained secondary data from laboratory for blood samples records for pregnant women to assess anaemia occurrences. To ascertain the validity and reliability of the questionnaires, a pre-test was carried out at La croix du sud Hospital. Respondents participating in the pre-test was not included in the final research study. Feedback, thoughts and views obtained from the participants' during pre-test formed the data collection tool to be used in this study including appropriately adjusting instruments, rephrasing, re-editing and re-sequencing the final data collection tools. To give a comprehensive understanding of the research topic, the study adopted semi-structured questionnaires targeting pregnant women in CHUK Hospital. Questionnaires were administered to all the respondents.

In order to enrich the data gathered for the study, subsequent desk review of Hospital blood samples records for pregnant women was undertaken to assess anaemia occurrences. Haemoglobin values was observed on selected individual files and categorised according to the WHO criteria; normal (11 g/dL or higher), mild (10–10.9 g/dL), and moderate (7–9.9 g/dL). Mild and moderate levels (<11 g/dL) of haemoglobin are defined as anaemic. Additional review of articles and writings related to factors associated with iron deficiency was carried out to obtain secondary data. Filled questionnaires were edited of any errors, incompleteness and then coded. Then data was entered into Statistical Package for Social Sciences (SPSS). Distribution analysis was carried out on the entered data including calculating measures of central tendency and dispersion. Analysed data was then presented in form of tables and figures for easier understanding. To analyse the variables with nominal or ordinal scale, chi-square goodness of fit was used to ascertain the significance of any observed changes between exposed and outcome. ODD ratio will be used to measure the association between exposures (factors associated) and outcomes (IDA).Identification of information relevant to research objectives and

research questions was carried out and lastly, development of a summary report that identified the main recurring themes and the relationship between them.

Study Results

This presents the data analysis and findings of this research study. The collected data was analyzed using statistical techniques. These included mean, percentages, frequencies, odds ratio and chi-square tests. This study was guided by three research questions, that is, what is the number of pregnant women with iron deficiency anaemia among pregnant women in CHUK Hospital? What are the dietary practices of the pregnant women in CHUK Hospital? What are the individual- level factors about iron deficiency anaemia among pregnant women in CHUK Hospital? Under each research question, the data was analysed and discussed. The final section of this chapter provides a summary of analysis and discussion of unstructured question and interview guide responses. Respondents aged between 19 years to 27 years recorded 80.90% forming the larger part of those interviewed, followed by 28 years to 36 years at 13.49%, 37 years to 45 years at 4.49%, and less than or equal to 18 years at 1.12% was the least represented age group. Out of the respondents interviewed, 11.24% were single, 59.55% married, 21.35% cohabiting, 6.74% widowed, and 1.12% divorced. The respondents' were asked to specify their highest level of education. Findings indicate that most of the respondents have completed both secondary (61.80%) and tertiary education (26.97%). The least completed level of education was primary at 11.23%. The findings show that most of the respondents had between 4 to 5 members in their nuclear family. This was followed by those nuclear families that had between 0 to 3 members in their household. Only 2 out the 89 interviewed had more than 8 family members in their household

Table 1 Summary of the study participants Demographic Characteristics (n = 93)

Variable	Category	Frequency	%	95% Confidence Intervals
Age	Less than 18yrs	1	1.12	(.000305245 - .061832636)
	18yrs - 27yrs	72	80.90	(.783892777 - .930913658)
	28yrs - 37yrs	12	13.49	(.079670264 - .234427517)
	38yrs - 47yrs	4	4.49	(.013343771 -.116289253)
Marital Status	Single	10	11.24	(.061946458 - .205523866)
	Married	53	59.55	(.533802397 - .737720644)
	Cohabiting	19	21.35	(.148178502 - .328871675)
	Widowed	6	6.74	(.028430732 -.146347305)
	Divorced	1	1.12	(0.000305245 - .061832636)
Level of Education	Primary	10	11.23	(.061887742 - .205370482)
	Secondary	55	61.80	(.558819649 - .759389179)
	Tertiary	24	26.97	(.199960738 - .393804755)
Grouped Number of Member in Nuclear Family	0 – 3 Members	35	39.33	(.320773077 - .530043005)
	4 – 7 Members	52	58.42	(.521521524 - .726348254)
	8 -11 Members	2	2.25	(.002948945 - .081533178)

Ante-Natal Care Commencement

A percentage of 65.17% started ANC visits when they were 1 week to 13 weeks while 25.84% started their ANC visits between 14 weeks to 26 weeks after pregnancy. Thirdly, 8.99% of the respondents only started ANC visits they were 27 weeks to 40 weeks pregnant. The findings imply that most respondents who visited ANC Clinic at CHUK Hospital appreciated the importance of ANC visits as soon as pregnancy was confirmed. The respondents were also to indicate how many weeks pregnant they were when they started ANC.

Table 2. Weeks Pregnant when ANC was started

Weeks/Months Pregnant at start of ANC Visit	Frequency	%	95% Confidence Interval
1-13 Weeks/1-3 Months	58	65.17	(.596556596 - .791759705)
14-26 Weeks/4-6 Months	23	25.84	(.189497167 - .380825421)
27-40 Weeks/7-9 Months	8	8.99	(.044036755 - .177223719)

Motivators for Ante-Natal Care Commencement

According to the responses, most of the pregnant mothers who visited ANC clinic at CHUK hospital had varied reasons as to why they started visiting the clinic. Out of the respondents interviewed, a larger percentage (19.10%) began ANC visits as a result of encouragement by family members. However, the respondents cited encouragement from friends (2.25%) as the least influencing factor when it came to visiting ANC clinic.

Table 3 shows respondents' responses when asked what encouraged them to start antenatal care visits.

What encouraged you to start ANC	Frequency	%	95% Confidence Interval
Encouraged by Family	17	19.1	(.128421795 - .301939588)
Encouraged by Friends	2	2.25	(.002948945 - .081533178)
Illness	15	16.85	(.108357619 - .275311826)
Routine Habit whenever pregnant	11	12.36	(.070674789 -.220006997) 0.2200069970.220006997)
To confirm pregnancy	9	10.11	(.053390954 - .19064676)
To check for gestational age	13	14.61	(.089693366 - .247505052)
To prevent complications	9	10.11	(.053390954 - .19064676)

Socio-Economic Elements

First objective was concern with determining the socio-economic factors of pregnant women with iron deficiency anaemia in CHUK Hospital. This objective was assessed by asking the respondents their average monthly household income, number of infants they were taking care of, how they got to know about iron deficiency, where to get iron deficiency information and finally if they tested for iron deficiency anaemia. Majority of the respondents (32.58%) recorded a monthly income for their household from RWF 100,001 to RWF 150,000. Only 8 respondents stated that they only totaled an income of RWF 50,001 to RWF 100,000 monthly for their households. Additionally, the respondents were asked to state the number of children/infants they took care of at their households. Most of the respondents at a cumulative 79.78% were taking care of 3 or fewer children. A percentage of 13.48% were taking care of zero infants as at the time of this study. Only two households were taking care of more than five children; one had 6 children and the other had 7 children, the highest number recorded.

Socio-Economic Elements findings: showed average monthly household income of 100,000 to 150,000 RWF, 0 to 3 numbers of infants, sources of information on IDA from community events and health care workers as presented in the tables below

Table 4

Variable	Category	Frequency	%	95% Confidence Intervals
Average Monthly Income	RWF 50,001 – 100,000	8	8.99	(.044036755 - .177223719)
	RWF 100,000 – 150,000	29	32.58	(.254091501 - .456443657)
	RWF 150,001 – 200,000	10	11.24	(.061946458 - .205523866)
	RWF 200,001 – 250,000	14	15.73	(.098948966 -.261488118)
	RWF 250,001 – 300,000	13	14.61	(.089693366 - .247505052)
	RWF 300,000 >	15	16.85	(.108357619 - .275311826)
No. of infants under care	0 – 3 infants	77	86.5	(.857912344 - .972624564)
	4 -7 infants	12	13.45	(.079416476 - .23384164)

Variable	Category	Frequency	%	95% Confidence Intervals
Information Sources	Radio	19	21.35	(.148178502 - .328871675)
	Television	5	5.62	(.02127881 - .130369163)
	Newspaper/Magazine	2	2.25	(.002948945 - .081533178)
	Poster	1	1.12	(0.000305245 - .061832636)
	Billboards	0	0.00	
	Community Events	34	38.20	(.30949684 - .517874285)
	Doctor/Nurse	6	6.74	(.028430732 - .146347305)
	Community Health Worker	22	24.72	(.179208799 - .367872807)

Test for IDA in the study:

A large number of the respondents had tested for IDA, 86.52%. Only 13.48% of the respondents were yet to test for IDA. Most of those who had test had it public health centers.

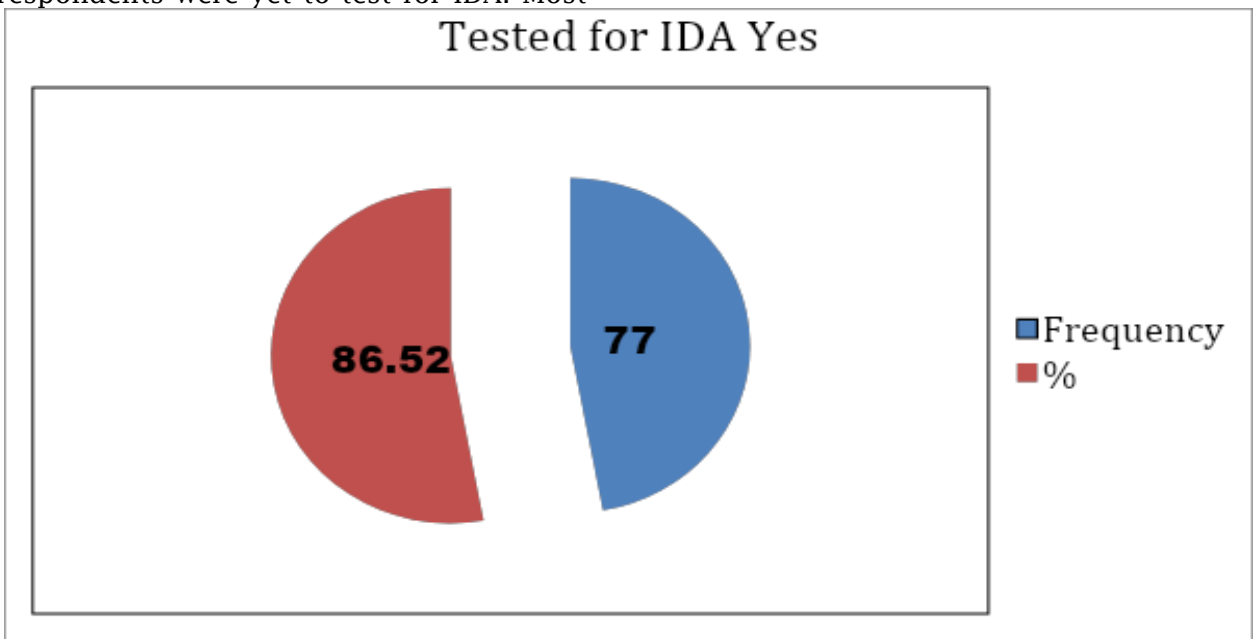

Fig.1 Dietary Practices;

- About 52 women eat water soluble while 35 fat soluble
- Also 59 women experience discomfort
- About 81 women in the study experience change in eating habit

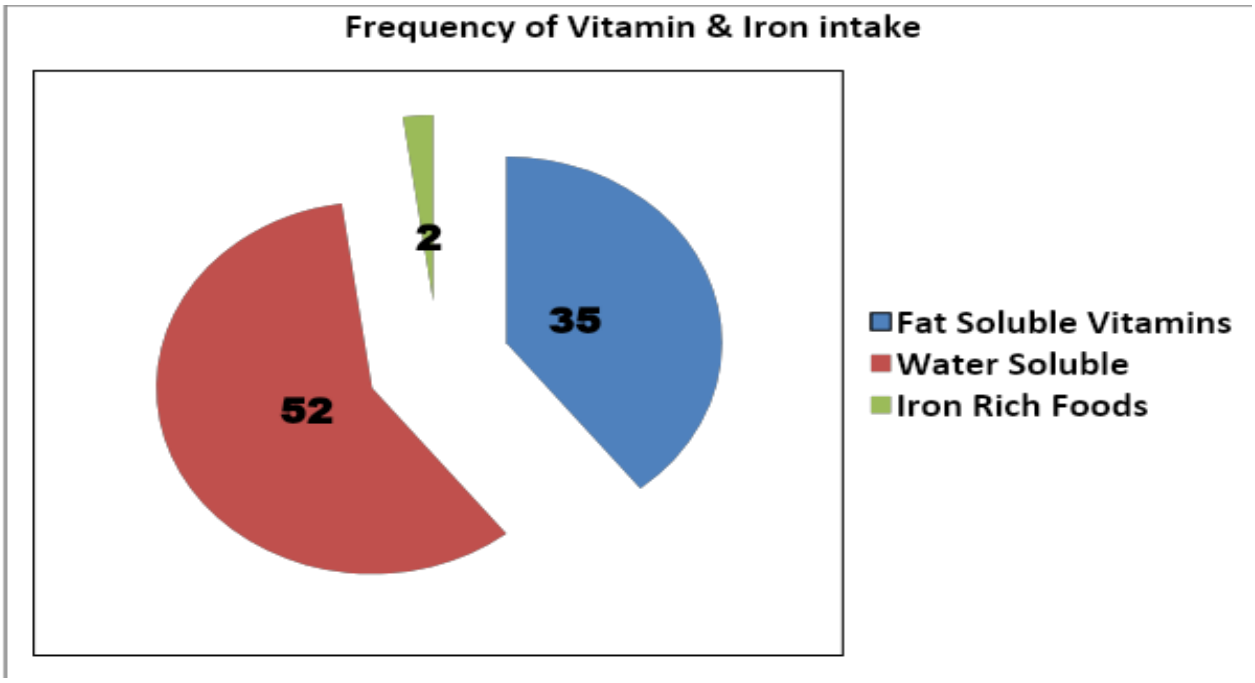

Fig. 2

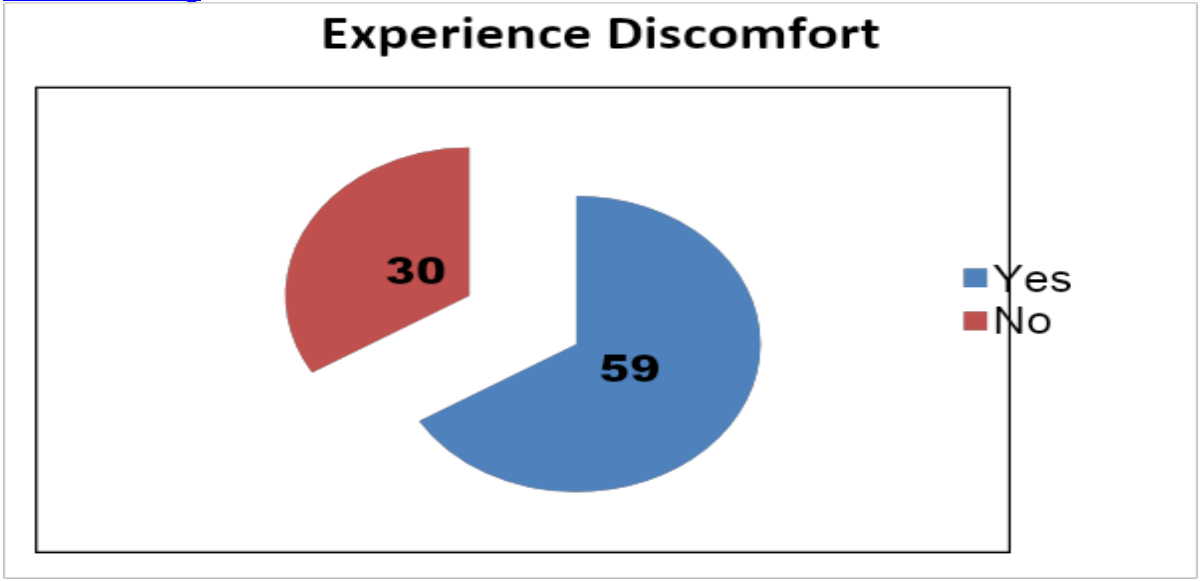
Experience Discomfort
30
59
Yes
No

Fig. 3

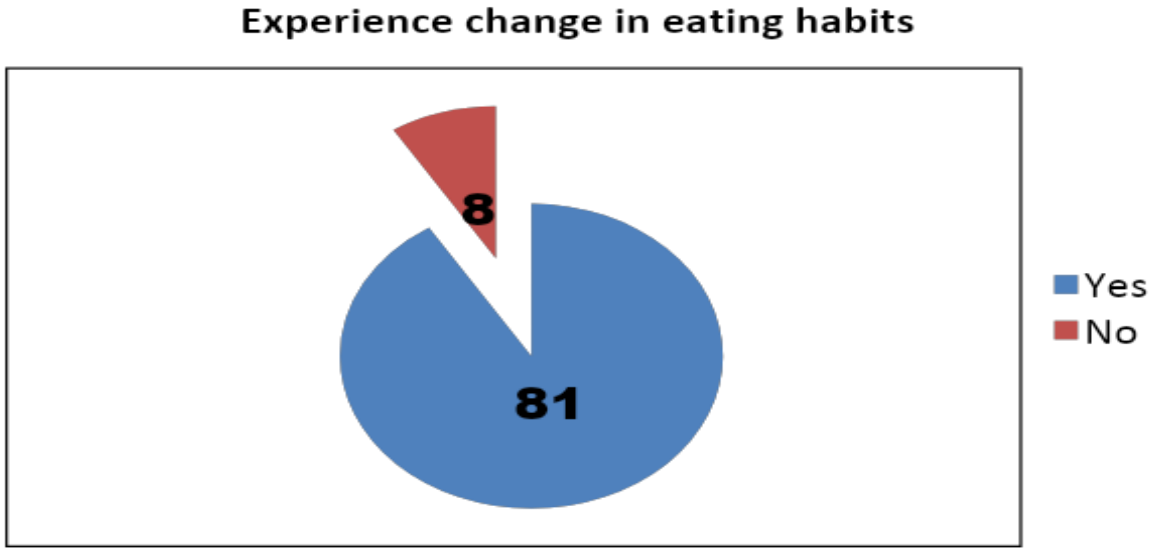
Experience change in eating habits
8
81
Yes
No

Fig.4

Dietary Practices

The second objective of this study was to determine the dietary practices of pregnant women attending CHUK Hospital.

The study tried to determine the weight changes experienced by the respondents, before pregnancy and after being pregnant. Before pregnancy, most of the women weights were between 45 kilograms and 54 kilograms (51.69%). Only two respondents weighed 85 kilograms and more before pregnancy. After becoming pregnant, it is normal for women to add about 10 kilograms to 15 kilograms. This is depicted in the above results, with a total 6 women hitting 85 kilograms and above compared to their earlier weight. Majority of the women weighed between 55 kilograms to 64 kilograms after becoming pregnant. Only 1 person still weighed less than 45kgs, interestingly she was also less than 18 years old. Furthermore, the respondents were also asked to indicate the number of meals they had before becoming pregnant and the number of meals they were now having after becoming pregnant. As indicated in the findings, majority of women either had two (32.58%) or three (39.33%) meals before pregnancy. Eating well and healthy remains essential to the baby's health. All the pregnant women surveyed increased the no. of meals they had each day while they carried their pregnancies; including 3 of the 89 women who were now feeding more than five number of meals per day. According to the findings, most of the respondents were taking all the vitamins and iron rich foods with water soluble vitamins B and C (41.57%) recording the highest. Iron rich foods such as lean meat, fish, spinach, cereals was the least taken, 23.60%. Folic acid and prenatal vitamins were the most taken among the pregnant women, these were also provided by government health centres and health workers. This study also sought to identify if the pregnant women experienced any discomforts during their pregnancies. Fifty nine of the 89 women indicated that they had at least experienced one or more discomforts while 33.71% of those sampled indicated that they were yet to experience any discomforts. Additionally, the pregnant women who experienced discomforts were asked to list some of the discomforts they had. Haemorrhoids and swelling of feet & hands were the predominant discomforts mentioned especially by the pregnant women who were in their last trimester.The foods we eat on a daily basis affects how our bodies work, how we grow, and how we maintain strength and energy. Consequently, all these apply to pregnant women. The respondents among other things, were asked if they have had to change their eating habits since becoming pregnant and if at all in some cases these resulted from the discomforts they had experienced. A record 91.01% of the respondents admitted that they were no longer eating some of the foods and snacks as they would before they got pregnant. Most of the pregnant women interviewed admitted to changing their own eating habits whereas a few others mentioned other external influences including community health workers, health official and partners

Table 5

Variable	Category	Frequency	%	95% Confidence Interval
Grouped Weight before Pregnancy	Less than 45kgs	21	23.6	(.169016166 - .354821121)
	45–54kgs	46	51.69	(.448810964 - .659178745)
	55-64kgs	13	14.61	(.089693366 - .247505052)
	65-74kgs	6	6.74	(.028430732 - .146347305)
	75-84kgs	1	1.12	(0.000305245- .061832636)
	85kgs & above	2	2.25	(.002948945 - .081533178)
Grouped Weight after Pregnancy	Less than 45kgs	1	1.12	(0.000305245 - .061832636)
	45–54kgs	23	25.84	(.189497167 - .380825421)
	55-64kgs	38	42.7	(.35504097 - .565934847)
	65-74kgs	17	19.1	(.128421795 - .301939588)
	75-84kgs	4	4.49	(.013343771 - .116289253)
	85kgs & above	6	6.74	(.028430732 - .146347305)
No. of meals taken before Pregnancy	One	16	17.98	(.117979423 - .28912469)
	Two	29	32.58	(.254091501 - .456443657)
	Three	35	39.33	(.320773077 - .530043005)
	Four	8	8.99	(.044036755 - .177223719)
	Five	1	1.12	(0.000305245 - .061832636)
	Five & above	0	0	
No. of meals taken after Pregnancy	One	1	1.12	(0.000305245 - .061832636)
	Two	27	30.34	(.232192851 - .431664767)
	Three	49	55.06	(.484893301 - .693251268)
	Four	3	3.37	(.007553028 - .099388289)
	Five	6	6.74	(.028430732 - .146347305)
	Five & above	3	3.37	(.007553028 - .099388289)

Other dietary findings on weight and meals taken before and after pregnancy

Table 6

Dietary weight and meal variables	Women weight	Frequency	%	95% Confidence Intervals
Grouped weight before pregnancy	45–54kgs	67	75.29	(.714544521 -.883950182)
	55 kg and above	22	24.72	(.179208799- .367872807)
Grouped weight after pregnancy	45kg to 64 kg	62	69.66	(.647943505 - .833675295)
	65 kg and above	27	30.33	(.232106089 -.431547328)
No. of meals taken before Pregnancy	1 - 3 meals	80	89.89	(.906215413 - .9930454460
	4 and above	9	10.11	(.053390954 - .19064676)
No. of meals taken after Pregnancy	1 - 3 meals	77	86.56	(.856915707 - .974116135)
	4 and above	12	13.48	(.079606806 -.234281076)

Dietary findings

Some food that are challenging to eat and access by the women in the study were mostly fruits, Yogurt, vegetables and rice

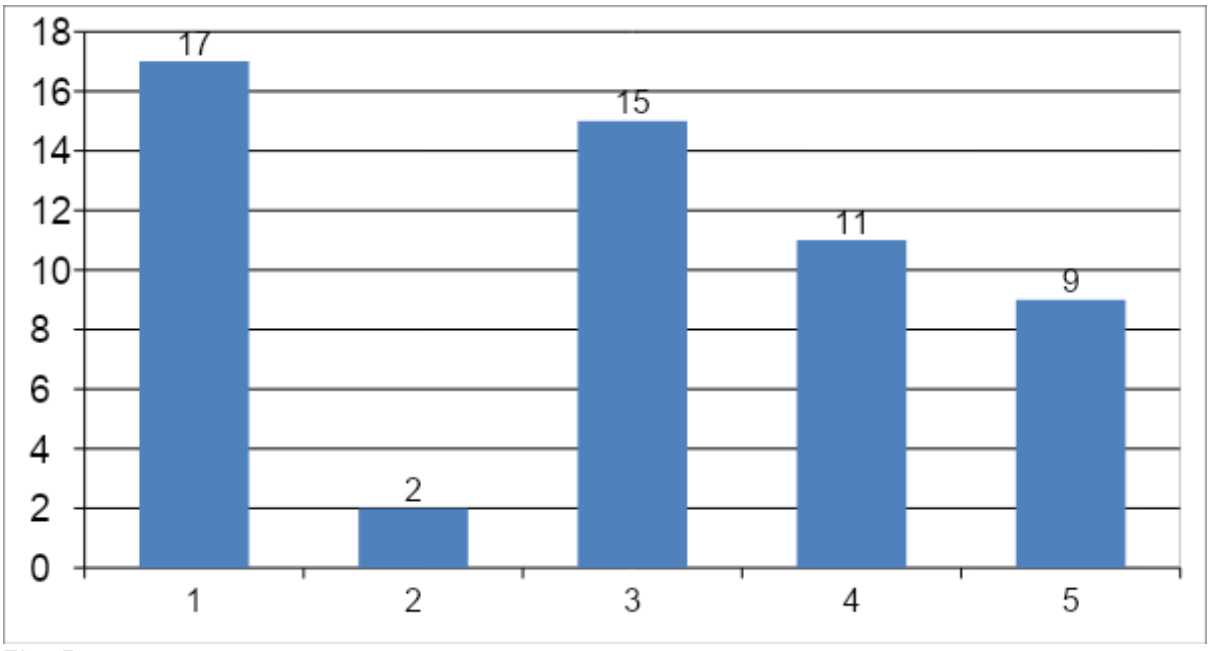

Fig. 5

Personal food variables of interest

Majority of women in the study were more concerned about healthy eating during pregnancy, and ways to stretch the food budget

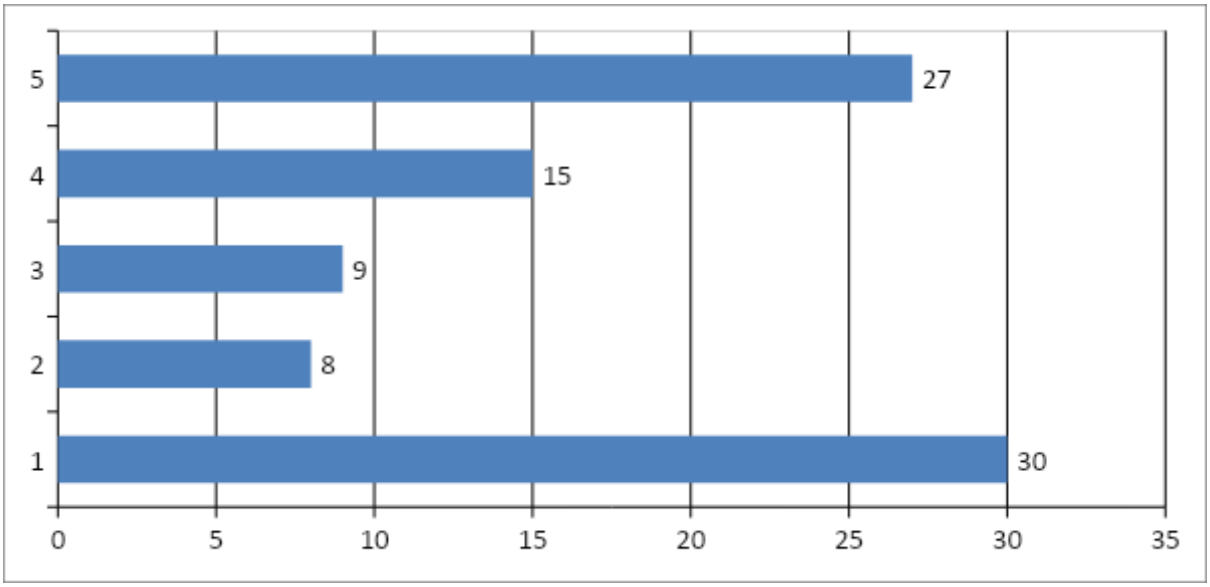

Fig. 6

Other Results

Chi-square test result of 7.512, degree of freedom (2-1)*(2-1) of 1, the p-value was 0.006 at significance level of 0.05 showing the proportion of women with IDA is related to their socio-economic elements.Further statistical analysis on relationship of socio-economic elements and proportion of pregnant women with IDA, odds ratio was calculated. OR= a/b c/d = (27/20)/(12/30) = 3.375. Therefore, the odds-ratio for respondents making =<RWF 200,000 versus >RWF 200,000 having IDA versus not having IDA is 3.375. These results imply that, those making an average monthly income of less than or equal to RWF 200,000 had higher odds of suffering from IDA as opposed to those who made more than RWF 200,000 [36,37]. Relationship between the Dietary Practices and Proportion IDA among Pregnant Women. Chi-square test result of 7.0716, D.F. (3-1)*(2-1) of 2, the p-value was 0.029136 at significance level, 0.05. This result showed there is a relationship between dietary practices and proportion of women with IDA.

Table 7

	Observed Yes (Expected Yes)	Observed No (Expected No)	Total
Fat Soluble Vitamins	21(15.34)	14(19.66)	35
Water Soluble	18(22.79)	34(29.21)	52
Iron Rich Foods	0(0.88)	2(1.12)	2

Source: CHUK Hospital, Laboratory

Further calculation relationship of the two variables, odds ratio was calculated.
OR= a/b c/d = (21/14)/(18/36) = 3. Therefore it imply that, there are higher odds of having IDA if a pregnant woman does not adopt good dietary practices.

Table 8 Summary of Individual Level Factors

Variable	Response Category	Frequency	%	95% Confidence Interval
Respondent area of Interest	Healthy eating during Pregnancy	30	33.71	(.265016276 -.468966096)
	Healthy snacks for pregnancy	8	8.99	(.044036755 - .177223719)
	Breastfeeding my baby	9	10.11	(.053390954 - .19064676)
	Food Resources in my area	15	16.85	(.108357619 - .275311826)
	Ways to stretch my food budget	27	30.34	(.232192851 - .431664767)
Challenging Foods to eat/access	Yoghurt, cheese	17	31.48	(.243068268 - .444436942)
	Iron rich foods	2	3.7	(.009706972 - .103182136)
	Fruits	15	27.78	(.207819584 - .402841198)
	Vegetables	11	20.37	(.139330232 - .317371089)
	Bread, cereals, rice, pasta	9	16.67	(.107101259 - .272825659)
Engage in physical activity	Yes	32	35.96	(.287004915 - .493662982)
	No	57	64.04	(.58372465 - .781148156)

Source: CHUK 2016

Chi-square test of significance was applied to test individual level factors and proportion of pregnant women with Iron Deficiency Anaemia variables is independent of each other. The chi-square test result was 1.757. Using degrees of freedom (2-1)*(2-1) of 1, the p-value was 0.184974 at significance level, 0.05. This result shows that the p-value (0.184974) is lesser than the significance level (0.05). This study therefore fails to reject the null hypothesis; individual level factors and proportion of IDA among pregnant women are independent. Thus, we can conclude that there is no significant relationship between individual level factors/preferences and the proportion of women with IDA. To further measure the relationship of the two variables, individual level factors and proportion of pregnant women with IDA, odds ratio was calculated. Therefore, the odds-ratio for respondents engaging in physical activities versus those not engaging having IDA versus not having IDA is 1.803. This result implies that, those engaging in physical activities are only slightly affected byIDA compared to those who are not engaging in physical activities.

Table 9

individual level factors and proportion of pregnant women with IDA Iron Deficiency Anaemia variables	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.757a	1	0.261		
Continuity Correction[b]	0.819	1	0.365		
Likelihood Ratio	1.803	1	0.261		
Fisher's Exact Test					
Linear-by-Linear Association	1.248	1	0.264	0.283	0.183
N of Valid Cases	89				

Discussion of Findings

The three specific objectives guiding this study are analyzed and its findings discussed in this section in subsequent paragraphs. The socio-economic status of the respondents mainly represented by their monthly average household income was analysed. This study showed that households who had an average monthly income of RWF 200,000 or less were 3.375 (odds) likely or susceptible to IDA related diseases. Results of a study in Pakistan showed that patients with a monthly income of less than Rs 5,000 had a haemoglobin value which was 1g/dL lower than those with a monthly income of greater than Rs 5,000; which is almost similar to this study results [37,38,39]. If direct or indirect effects of maternal IDA disrupt the development of the foetus, this could result in a snowball effect for the mother and the baby [40,41]. In households that struggle economically, it will even become much more difficult to manage the effects of IDA once a pregnant woman acquires it. Thus, the need for health stakeholders to provide insurance schemes and subsidies for such families. As expected especially across the socially disadvantaged households, the public health centres took lead in carrying out most of the IDA tests for the pregnant women. Similarly, the community events organized and facilitated by the community health volunteers together with other stakeholders were the most attractive source of information for IDA and iron related information. This findings corroborates with the [42] study which concluded that 56 % of pregnant women in low-income countries suffered from anaemia compared to 18 % In high-income countries. Anaemia is one of the main nutritional deficiency disorders affecting a large proportion of the population, not only in developing but also in industrialized countries [43]. The results of our study showed that good dietary practices had a significant association with the proportion of IDA among pregnant women. Our results indicated that most of the pregnant women had adjusted the number of meals they were having per day upwards; with three meals or more (68.54%) per day compared to an average of two days previously. According to the findings, most of the respondents were taking all the vitamins and iron rich foods with water soluble

vitamins B and C (41.57%) recording the highest. Iron rich foods such as lean meat, fish, spinach, cereals was the least taken, 23.60%. Folic acid and prenatal vitamins were the most taken among the pregnant women, these were also provided by government health centres and health workers. Major research studies on IDA and dietary practices have indicated the need for women of childbearing age to be provided with nutritional education regarding food sources of iron, especially prior to becoming pregnant, and taught how food choices can either enhance or interfere with iron absorption. [19], asserts that if this trend is replicated, the results suggest that, even in the face of stressed economic conditions, improving infant iron status through good dietary practice has the potential for major societal impact in countries where iron deficiency is widespread. Using chi-square and odds ratio analytical techniques, this study showed no significant relationship between individual level factors/preferences and the proportion of women with IDA. This was in spite of the fact that respondents recorded varied responses with regards to eating preferences, engaging in physical activities, breastfeeding and individual areas of interests. The UN [42] reported that anaemia prevalence more so among pregnant women varies considerably owing to several differences and factors, for instance, lifestyle, health-seeking behaviours and norms & traditions across different cultures. Additionally, [43] Anaemia in pregnancy arises from a variety of factors which include the physiological haemo-dilution of pregnancy, increased demand of the foetus on maternal stores of iron and folic acid, poor nutritional diet, infections and infestation such as malaria and hookworm and some adverse cultural practices. The strength of cultural beliefs enormously influences women's healthy lifestyle and family participation in antenatal care programme [8]. In line with this study findings, individual preferences on even the types of food to eat could be pegged on strong cultural beliefs including food taboos, such as pregnant women being forbidden to eat meat, fish or eggs and the family's attitudes toward pregnancy such as pregnant women should take care of herself and her pregnancy, but the husband will take the necessary decisions regarding to his wife's pregnancy. For instance, Agus & Horicuhi's study carried out in Indonesia on barriers to prevention of IDA among pregnant women found that husbands decided where the pregnant woman should attend her antenatal care, be it to the health professional or to the traditional healer and where the pregnant woman should give birthing process, be it at home or at the public health. Drawing on the results and the summary of findings including information obtained from the secondary sources like the hospital laboratory records, this research study draws three conclusions. These conclusions are categorized into three areas in line with the study research questions. These included determining the socio-economic factors of pregnant women with iron deficiency anaemia among pregnant women in CHUK Hospital, determining the dietary practices of the pregnant women in CHUK Hospital, and identifying the individual-level factors about iron deficiency anaemia among pregnant women in CHUK Hospital. Even though Rwanda records the lowest anaemia prevalence as compared to the other east African region countries, Iron deficiency is still recorded at 21% among pregnant women in south province and is even higher among children under five years (Boy He further noted that beyond the socio-economic elements, iron statuses in some areas were impacted by the richness of the soil. In line with our study findings, socio-economic elements contributed to iron deficiency anaemia among pregnant women

attending CHUK Hospital. Women from poor economic conditions as evidenced by our study are most likely to suffer IDA owing to late access and start of iron supplementations whenever required, poor adherence & unaffordability of daily doses. Relative socio-economic factors such as having large households, low income also persists to derail the efforts of combating IDA. [9], asserts that early child health consequences of poverty and pregnancy are multiple, and often set the mother and the new-born child on a life-long course of disparities in health outcomes, for instance, increased risks for preterm birth, Iron Deficiency Anaemia, intrauterine growth restriction, and neonatal or infant death. World Health Organization [43] notes that even though nutritional anemia affects members of both genders and of all age groups, the situation is more predominant among women and contribute to maternal morbidity and mortality, as well as low birth weight. Studies have implied that iron deficiency anaemia during pregnancy are better prevented rather than cured, and adoption of healthy dietary practices remains paramount. This in turn justifies the provision of irons supplement, folic acids and other prenatal vitamins to all pregnant women by the Rwanda government. Folic acid forms stable complexes with iron, which result in the slow release of iron and small amounts being available for absorption in the upper part of the intestine, so reducing the discomfort of iron therapy [9]. A balanced diet, rich in proteins, iron and vitamins from good sources like liver, meat, eggs, green peas, figs, beans, whole wheat and green bananas remains very critical in tackling iron deficiency anaemia problem among the pregnant women. Indeed, dietary practices can therefore be concluded to be associated with IDA in pregnant women attending ANC services at CHUK Hospital. Thirdly, individual level factors association with iron deficiency anemia among pregnant women at CHUK Hospital was determined. The primary cause of anemia during pregnancy worldwide is iron deficiency secondary to chronic inadequate dietary intake and menstruation, heightened by the physiologic demands of the fetus and maternal blood volume expansion during pregnancy [15]. Individual level factors such as physical activities was found to be beneficial to pregnant women; however, it was also noted that pregnant women with specific conditions should always seek approval from their health officers before engaging in any physical activities. Moreover, misconceptions among some pregnant women on the effect of iron supplementation and the development of side-effects were also likely to lead to IDA. [19] in their study carried out among Hispanic and non-Hispanic populations found that cultural variation especially in dietary patterns may influence iron availability and body iron stores and contribute to an increased risk for iron deficiency anaemia. This emanates from the different socio-cultural practices and beliefs that surrounded some communities & religions making it difficult to effectively prevent IDA. Though smoking and alcohol intake is noted to inhibit the absorption of iron, it was not of great concern among the sampled population at CHUK Hospital as very few close to zero pregnant women were taking the same.

The dietary practices:

Most respondents added between 10 to 15 kg in the course of their pregnancy.There was fair intake of Vitamins and iron among pregnant women. Majority of women find it challenging to eat and access fruits, Yogurt, vegetables and rice. Most women were more concerned about healthy eating during pregnancy, and food budget.

The socio-economic factors in the study:

Socio-Economic study elements showed average of monthly household income of 100,000 to 150,000 RWF, 0 to 3 numbers of infants to carter for, sources of information on IDA from community events and health care workers. A large number of pregnant women had test for IDA from public health centers.

Individual level factors:

There are significant relationship between individual level choices and preferences and IDA, Statistical analysis indicates a positive relationship. Findings from records showed responses that varied ranging from food is available but expensive, food is not of good quality, food is not available among other reasons.

CONCLUSION

In conclusion, appropriate programme regime for combatting the deficiency during pregnancy period might be too short period to manage iron deficiency anaemia. Socio-economic elements contributed to iron deficiency anaemia among pregnant women attending CHUK Hospital. A balanced diet, rich in proteins, iron and vitamins from good sources like liver, meat, eggs, green peas, figs, beans, whole wheat and green bananas remains very critical in tackling iron deficiency anaemia problem among the pregnant women. Indeed, dietary practices can therefore be concluded to be associated with IDA in pregnant women attending ANC services at CHUK Hospital. Individual level factors such as physical activities was found to be beneficial to pregnant women; however, it was also noted that pregnant women with specific conditions should always seek approval from their health officers before engaging in any physical activities.

RECOMMENDATION

Based on the foregoing summary discussion and conclusion the study makes the following recommendations. According to our findings, socio-economically disadvantaged pregnant women who had IDA in most cases did not seek prenatal care early enough but waited till their second or third trimesters to seek ANC services. Traditionally, community health workers and health stakeholders should continue to ensure that all women of child bearing age continue to test for IDA and institute appropriate regimens as pregnancy period might be too short a duration to manage iron deficiency anaemia. This study also recommends for maternal healthcare stakeholders and the Government of Rwanda through the Ministry of Health to provide women of childbearing age with information and resources concerning nutrition and food sources of iron. In tandem with this, these women should also be taught on the importance of making rational food choices, particularly avoiding those foods which might inhibit or affection the absorption of iron while pregnant and even also before pregnancy. Lastly, this study noted that most pregnant women and healthcare providers understood the risks associated with individual level factors differently, the pregnant women evaluated the risks subjectively, through their own experiences, whereas healthcare providers assessed the risks in a more objective manner. Hence, this occasions the need to educate more pregnant women on the effects of their individual level preferences in relation to developing of Iron Deficiency Aneamia.

REFERENCES

1. Abu-Ouf, M., & Jan, M. (2015). The impact of maternal iron deficiency and iron deficiency anaemia on child's health. Saudi Med Journal; Vol. 36(2): Pp. 146–149.

2. Allen, L. (2000). Anaemia and Iron deficiency: effects on pregnancy outcome. *The American Journal of Clinical Nutrition vol. 71*
3. American College of Obstetricians and Gynecologists, (2008). *ACOG Practice: Anaemia in pregnancy*. Obstet Gynecol. Bulletin No.95;Pp. 112
4. Beutler, E. (2003). *Iron deficiency and overload*. Hematology Am Soc Hematol Educ Program. Pp. 40-61
5. Bodnar, L., Cogswell, M., & Scanlon, K. (2002). *Low income postpartum women are at risk of iron deficiency*. Journal of Nutrition, vol. 132, no. 8, Pp. 2298–2302
6. Agus, Y., & Horiuchi, S. (2012). Rural Indonesia women's traditional beliefs about antenatal care. BMC Res Notes
7. Chowdhury, H. A, Ahmed, R., Jebunessa, F., Akter, J., Hossain, S., & Shahjahan, M. (2015). Factors associated with maternal anemia among pregnant women in Dhaka city. BMC Women's Health 1(15), 15-77
8. Lozoff, B., Jimenez, E., & Smith, J. (2006). Double burden of iron deficiency in infancy and low socio-economic status: a longitudinal analysis of cognitive test scores to 19 years. Arch Pediatr Adolesc Med. 160(11), 1108–1113.
9. Rukhsana, A., Nabia, T., Malik, M. A., Mobeen, I., Tara, J., & Shan, R. (2009). Low haemoglobin levels, its determinants and associated features among pregnant women in Islamabad and surrounding region. J Pak Med Assoc. 59(2), 86-90
10. United Nations Administrative Committee on Coordination, Subcommittee on Nutrition (2000). Fourth report on the world nutrition situation: nutrition throughout the life cycle. Geneva: ACC/SCN in collaboration with International Food Policy Research
11. Bothwell, T. (2000). Iron requirements in pregnancy and strategies to meet them. AmericanJournal of Clinical Nutrition, vol. 72, no. 1, Pp. 257–264
12. Boy, E. (2015). *Iron deficiency in Rwanda: a low-moderate public health problem.* Unpublished Ministry of Health reports, Rwanda
13. Brabin, J. (1991). *The risks of severity of malaria in pregnant women*. Applied field research in malaria; Report No 1 WHO, Geneva
14. British Committee for Standards in Haematology (2011). *UK Guidelines on the management of iron deficiency in pregnancy*
15. Brutus, S. et al. (2013). *Self-Reported Limitations and Future Directions in Scholarly Reports: Analysis and Recommendations*. Journal of Management; Pp. 48-75
16. Cochran, W. G. (1977). Sampling techniques (3rd edition) New York: John Wiley & Sons
17. Cox, N. H., &Lorains, J. (1986). The prognostic value of blood glucose andglycosylated haemoglobin estimation in patients with stroke. *Postgraduate medical journal*, 62(723),7-10
18. Crompton, T. et al. (2003). Controlling disease due to helminth infections. Geneva, World Health Organization.
19. Eley, S., Sive, A., Shuttleworth, M. & Hussey, D. (2002). A prospective, cross-sectional study of anaemia and peripheral

iron status in antiretroviral naive, HIV-1 infected children in Cape Town. *South Africa BMC Infect Dis.*

20. Eriksen, L., Milman, N., & Bergholt, T. (2005). Iron prophylaxis during pregnancy - How much iron is needed? A randomized dose-response study of 20-80 mg ferrous iron daily in pregnant women. *Acta Obstetricia et Gynecologica Scandinavica,* vol. 84, no. 3, Pp. 238–247.
21. Foote, M., Sullivan, M., Ruth, J., Oremo, J., Sadumah, I., Williams, N., et al (2013). Determinants of Anaemia among Preschool Children in Rural, Western Kenya. *The American journal of tropical medicine and hygiene; Vol. 88(4),* Pp. 57–67.
22. Gebre,A., &Mulugeta,A. (2015). Prevalence of Anaemia and Associated Factors among Pregnant Women in North Western Zone of Tigray, Northern Ethiopia: A Cross-Sectional Study. *Journal of Nutrition and Metabolism, Vol. 2015*
23. Gray, D. (2004). *Doing Research in the Real World;* Sage Publications, London
24. Green, K., Sousa-Figueiredo. C., Basanez, G., Betson, M., Kabatereine. B., & Fenwick, A. (2011).Anaemia in Ugandan preschool-aged children: the relative contribution of intestinal parasites and malaria. Parasitology. Vol. 15 Pp. 34–45
25. Hallberg, L., & Rossander-Hulten, L. (1991). Iron requirements in menstruating women. American Journal of Clinical Nutrition, vol. 54, no. 6, Pp. 1047–1058
26. Harrison, A. (2001). Anaemia in Pregnancy: Maternity care in developing countries. RCOG PRESS Pp. 113-128
27. Hibbard, M., (1988). *Controversies in therapeutics. Iron and folate supplements in pregnancy:supplementation is valuable only in selected patients*. Br Med J.
28. Hoa, P., Khan, N., Van Beusekom, C., Gross, R., Conde, W., & Khoi, H. (2005). Milk fortified with iron or iron supplementation to improve nutritional status of pregnant women: an intervention trial from rural Vietnam. *Food and Nutrition Bulletin*, vol. 26, no. 1, Pp. 32–38
29. Kothari, C. R. (2004). Research Methodology: Methods and Techniques. New Age International Pvt. Ltd Publishers.
30. Larson, P. (2207). Poverty during pregnancy: Its effects on child health outcomes. *Paediatrics Child Health, 12*(8), 673-677
31. Little, P. et al. (2005). Haemoglobin concentration in pregnancy and perinatal mortality: a London- based cohort study. Am J ObstetGynecology Vol. 6; Pp. 193 - 220
32. McMahon, L. (2010). Iron deficiency in pregnancy. *Obstetric Medicine, Vol. 3,* Pp. 17–24
33. Miles, B., & Huberman, M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd edition). Thousand Oaks: Sage
34. Milman, N. (2011). *Anaemia still a major health problem in many parts of the world.*
35. Mukherji, J. (2002). *Iron deficiency anaemia in pregnancy*. Rational Drug Bulletin, vol. 12, Pp.2–5
36. Simbauranga, R., Kamugisha, E., Hokororo, A., Kidenya, B., & Makani, J. (2015). Prevalence and factors associated with severe anaemia amongst under-five children hospitalized at Bugando Medical Centre, Mwanza, Tanzania. *BMC Hematology*irdah, M., Yaghi, A., & Yaghi, R. (2014). Iron deficiency anaemia among kindergarten children living in

the marginalized areas of Gaza Strip, Palestine. 36; Pp. 132–138

37. Stevens, A., Finucane, M., & De-Regil, M. (2013). Global, regional, and national trends in hemoglobin concentration and prevalence of total and severe anaemia in children and pregnant and non-pregnant women for 1995-2011: a systematic analysis of population- representative data. *The Lancet Global Health* 1(1) Pp. 16-25
38. Toteja, S., Singh, P., Dhillon, S., Saxena, N., Ahmed, U., Singh, P, et al. (2006). Prevalence of anaemia among pregnant women and adolescent girls in 16 districts of India. Food Nutr Bull Pg. 311-315
39. UNICEF/UNU/WHO/MI, (1998). '*Preventing iron deficiency in women and children technical consensus on key issues*,' in Technical Workshop, UNICEF, New York, NY, USA
40. UNICEF, (2011). The Implementation of In-Home Fortification and Nutrition Education to Combat Anaemia and Micronutrient Deficiencies Among Children 6-23 Months in Rwanda. *In-Home FortificationPhase 1 Final Report*
41. Viteri, F. (1992). *Iron. Global Perspective*. In: Ending Hidden Hunger. A Policy Conference on Micronutrient Malnutrition. The Taskforce for Child Survival and Development. Atlanta, Georgia.
42. WHO (2012). Guideline: Daily iron and folic acid supplementation in pregnant women. World Health Organization, Geneva
43. WHO (2008). Worldwide prevalence of anaemia 1993–2005: WHO Global Database on Anaemia.CDC,Atlanta