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KNOWLEDGE, PREVALENCE AND RISK FACTORS OF ANAEMIA AMONG PREGNANT WOMEN

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ABSTRACT
Pregnancy has some physiological changes which complicate the process of diagnosis and treatment. Over 200 million people suffer from anaemia especially among women of reproductive age. Anaemia is a major health problem among pregnant and non-pregnant women. Anaemia during pregnancy is considered as a public health problem especially in developing countries. The World Health Organization (WHO) defined anaemia during pregnancy as a haemoglobin concentration of less than 11g/dl. In severe anaemia, the haemoglobin level is 6g/dl. Anaemia threatens both mother and foetus. The causes may be multifactorial, such as nutrient deficiency, parasitic infections or chronic infections. It may also be due to acute blood loss. It may also depend on geographical location and economic status. The effects of anaemia on mothers are tiredness, weakness, dizziness and affects the immune system. In children, it may cause preterm delivery, low birth weight. On both the mother and the fetus it can cause mortality and morbidity. Intake of balanced diet and awareness programmes on anaemia is a measure to prevent anaemia. This study is to evaluate the awareness and prevalence of anaemia among pregnant women. A cross-sectional survey was conducted containing a set of self-developed questionnaires. The data was collected and analysed using SPSS software. The results are analysed and tabulated. The result was gained as follows, 25% of the participated population's haemoglobin level is less than 11, 75.89% of the population participated are aware that anaemia can affect pregnant women, 66.07% of the population agree that haemoglobin level less than 11 can cause anaemia. From the study, it is obvious that there is an awareness between the effects of anaemia during pregnancy.

Keywords: Anaemia; haemoglobin; pregnant; prevalence; risk factors; women.

INTRODUCTION

Pregnancy has some physiological changes which interfere with the diagnosis of disorders and suitable treatment. This fits with anaemia. Anaemia is defined as reduced Haemoglobin (which initiates oxygen flow to the organ) concentration or lack of red blood cells. Haemoglobin concentration helps in the estimation of anaemia. The World Health Organization (WHO) defined anaemia during pregnancy as a haemoglobin concentration of less than 11g/dl. The Haemoglobin concentration of severe anaemia is 6g/dl. Anaemia during pregnancy is the major public health problem in developing countries (Chatterjee and Fernandes, 2014). During anaemia, plasma volume is higher than red blood cell mass which results in

physiological problems. Anaemia can also be due to nutritional deficiency. For the production of red blood cells, iron, vitamin b12 and folic acid are the other components which are required.

Lack of any one of the nutritional components also results in anaemia (Hart and Kanter, 1990). It is the major factor affecting the women's health, especially during reproductive age. It is considered as a significant problem when the prevalence of anaemia is greater or equal to 40% and it is also considered as a severe health problem. The World Health Organisation has estimated that 58% of pregnant women are anaemic in developing countries. It also causes adverse effects during pregnancy (Black *e t al.*, 2013). 56% of the pregnant women in the family of low middle income are affected with anaemia due to less dietary intake (Black *e t al.*, 2013). Anaemia threatens both mother and foetus. Anaemia is the second most common cause of maternal death (Kalaivani, 2009). Anaemia can be acquired or hereditary. Acquired Anaemia can be due to parasitic infections such as malaria or hookworm (Brooker, Hotez and Bundy, 2008) or it can also be due to chronic infections TB and HIV (Msuya *et al.*, 2011), or loss of blood or can be iron deficiency anaemia.

The leading cause of anaemia is due to iron deficiency or acute blood loss (Ononge, Campbell and Mirembe, 2014). Iron deficiency anaemia is due to imbalance in iron absorption and the need of the body. Imbalance can arise from less dietary intake of iron. There is a high need for iron during the second and third trimester during pregnancy, if the demand is not met the women will become anaemic. Anaemia has a high risk of maternal and perinatal mortality (Allen, 2000). The symptoms of anaemia are tiredness, paleness, and dizziness (Stevens *e t al.*, 2013). In severe cases of anaemia, it may also cause chest pain or headache. It also causes impairment of the mother's immune system. About 26% of anaemia occurs during labour (Nelofar and MD Social and Preventive Medicine, 2018). Anaemia causes 23% of maternal death (Black *e t al.*, 2013). Anaemia in pregnant women has adverse effects in a foetus like preterm birth, low birth weight of the foetus (Muganyizi and Kidanto, 2009) intrauterine growth retardation and intrauterine death of the foetus (Gebre and Mulugeta, 2015).

In the world, approximately 200 million people per year suffer from anaemia with the highest prevalence rate among women in reproductive age, infants, and with poor socioeconomic status (Galloway *e t al.*, 2002). The anaemia can be prevented by a balanced diet, containing proteins, iron, vitamins, from the egg, meat, and whole wheat. The Ministry of Health in most of the developing countries have organised awareness programmes and supplement of iron and folic acid in the form of tablets during pregnancy (Galloway *et al.*, 2002). Even though the prevalence of anaemia has not decreased. This study is created in such a way to create knowledge about anaemia and awareness of its risk factors to avoid maternal and perinatal mortality. It also provides baseline data for planning awareness programs to reduce the rate of anaemia. Our team has previously conducted numerous bioinformatics studies (Seppan *e t al.*, 2018) (Samuel and Thenmozhi, 2015), morphological and morphometrical studies (Krishna, Nivesh Krishna and Yuvaraj Babu, 2016) (Pratha, Ashwatha Pratha and Thenmozhi, 2016) (Choudhari and Thenmozhi, 2016) (Kannan and Thenmozhi, 2016), morphometrical studies (Nandhini *e t al.*, 2018) (Subashri and Thenmozhi, 2016) (Keerthana and Thenmozhi, 2016) (Hafeez and Thenmozhi, 2016), online surveys (Thejeswar and Thenmozhi, 2015) (Sriram, Thenmozhi and Yuvaraj, 2015), in vivo animal experimental researches (Menon and Thenmozhi, 2016), and genetic studies (Johnson *e t al.*, 2020) (Sekar *e t al.*, 2019), in various research fields which led us to carry out this study on knowledge, prevalence, and risk factors of anaemia among pregnant women.

MATERIALS AND METHODS

A cross-sectional study was done using an online setting among the population of pregnant women. The approval was obtained from the Institutional Review Board. No approval needed for humans and animals. The number of participants participating in the study was 112. The previous study sample size was 495 pregnant women (Toteja *et al.*, 2006). The sampling method was simple random sampling. Measures taken to minimize bias was randomization which include all variables. A pre-tested self-developed questionnaire was circulated. External validity includes homogenization and replication of experiment and cross verification with existing studies. The questionnaire was circulated online. Data collection software used was google forms. The questions were given with options, for the easy convenience of the participants. The method of representation was a bar chart. The data collected was analysed using SPSS software and The 1orrelation graph was found using the Pearson chi-square test. Independent variables include demo graphs such as age, gender and dependent variable include anaemia among pregnant women.

RESULTS AND DISCUSSION

37.50% of the population participated in the age group of 20-30 and 33.04% were from the 31-40 age group and 29.46% were from above 40 (Figure 1). 51.79% of the population's haemoglobin level is between 11-12 g/dl and few populations of 25% haemoglobin level are less than 11g/dl and 23.21% have greater than 12g/dl (Figure 2). 75.89% of the population is aware that anaemia can affect pregnant women though 10.71% are not aware and 13.39% have no idea (Figure 3). Figure 4 represents the association between age and awareness of anaemia can affect pregnant women using the Chi-square test. 66.07% of the women agreed that haemoglobin levels less than 11 can cause anaemia, 18.75% strongly agree that haemoglobin concentration less than 11 causes anaemia (Figure 5). Figure 6 represents the association between age and Haemoglobin concentration <11g/dl cause anaemia using the Chi-square test.

Very few populations of 21.43% report infectious disease and severe blood loss are the other reasons which can cause anaemia and 41.96% reported only blood loss can cause anaemia,

17.86% chose no idea (Figure 7). Figure 8 represents the association between age and other reasons which can cause anaemia using the Chi-square test. 43.75% agreed that symptoms of anaemia are weakness and tiredness and 41.07% strongly agreed that weakness and tiredness are common symptoms though 8.04% disagree that weakness and tiredness are not the symptoms (Figure 9). Figure 10 represents the association between age and symptoms of anaemia using the Chi-square test.

80.36% of the pregnant women population are aware that iron deficiency is the major cause of anaemia and 9.82% of the population reported that vitamin intake is the common type of anaemia and 9.82% has reported no idea (Figure 11). 94.64% of the population agreed that haemoglobin levels less than 6g/dl cause severe anaemia, 5.36% reported false (Figure 12). Figure 13 represents the association between age and Haemoglobin <6g/dl cause severe anaemia using the Chi-square test. When the question of effects of severe anaemia on mother and fetus was asked, 35.71% of the population chosen babies are born with less weight, 19.64% report death of pregnant women, 26.79% says no idea, only 17.86% report the effect of severe anaemia is the death of pregnant women and less born weight of the fetus (Figure 14). Figure 15 represents the association between age and effects of severe anaemia using the Chi-square test.

50% of the participants reported that anaemia causes growth retardation in children though only 14.29% reported that anaemia can cause both growth retardation and death of the fetus (Figure 16). 52.68% of the

population is aware of folifer tablets provided during pregnancy, 28.57% report no idea about folifer tablets, 18.75% are not aware of folifer tablets provided during pregnancy (Figure 17). Figure 18 represents the association between age and awareness of folifer tablets using the Chi-square test. 25.89% report iron and folic acid are the major nutritional supplements provided in folifer tablets, 28.57% chose only iron, 25% chose only folic acid, 19.64% chose no idea (Figure 19). 58.04% of the participating pregnant women population is aware of awareness programmes conducted on anaemia, though 19.64% report no idea about awareness programs and 22.32% are not aware of awareness programs (Figure 20).

In this study, the people participating are mostly from the age group 20-30 which is in correlation to the previous study where the participants are, mostly from the age group of 20-30 (Buseri *e t al.*, 2008). 25% of the population reported haemoglobin levels less than 11g/dl cause anaemia. The previous study also found that haemoglobin levels less than 11g/dl cause anaemia (Buseri *e t al.*, 2008). 23.2% of pregnant women have been reported to have haemoglobin less than 11g/dl. The World Health Organization also reported haemoglobin level less than 11g/dl can cause anaemia in pregnant women. 21.4% of the population reported that infectious disease and severe blood loss are also other causes of anaemia. Previous literature also shows that infectious disease and severe blood loss are other reasons which can anaemia (Urassa *e t al.*, 1997). Another study had reported that HIV and Malaria are infectious diseases that cause anaemia (Okube *e t al.*, 2016). In this current study, 80.4% of the participants are aware that iron is the common deficiency of anaemia. The previous study has also found iron is the major nutrient causing anaemia (Haram, Nilsen and Ulvik, 2001). Another study also reported that iron is the major cause of anaemia (McClure *e t al.*, 2014). 94.6% agreed that haemoglobin levels less than 6 cause severe anaemia. Previous literature found haemoglobin levels of less than 6 cause severe anaemia (Nandan *e t al.*, 2018). The World Health Organisation (WHO) also reported that haemoglobin levels less than 6 cause severe anaemia (Schulze, 1990). The current study reports,
17.9% of the participants reported the effects of severe anaemia as the death of pregnant women and less born weight of the foetus. Another study reported that severe anaemia causes maternal and perinatal mortality (Wafula *e t al.*, no date). In this current study, 67% of the population agreed that anaemia causes growth retardation in the foetus which is in correlation to the previous study (Muganyizi and Kidanto, 2009). The current study reports, 52.7% of the population are aware of folifer tablets provided during pregnancy. The previous study reported folifer tablets are provided during pregnancy (Levy *e t al.*, 2005). 25.9% of the population is aware of nutritional supplementation in the folifer tablets which is in correlation to the previous study.

Since it is common among women and pregnant women of various age groups it has to be prevented by early diagnosis and corrective measures like consumption of iron and folic acid tablets, available iron-rich foods and regular antenatal check-ups can be suggested to prevent anaemia during pregnancy. Since anemia is a major public health problem, it can be prevented by proper primary health care measures, early diagnosis and anaemia screening procedures during pregnancy. Thus the survey serves as evidence to the consensus that there is an awareness of anaemia and its effects in pregnant women.

CONCLUSION

Thus we conclude that this survey study added knowledge and created awareness on anemia and its effects among women during pregnancy. But the prevailing risk factors of anemia need to be spread

among all women and proper preventive and corrective measures has to be adopted by them to avoid further complications.

AUTHORS CONTRIBUTION

Sharwini Baskar contributed for the conception of the study, developed the questionnaires and performed data collection, interpretation of the results, wrote the manuscript from the support of the Guide.

Dr M. Karthik Ganesh contributed for guidance, the design of the work, verified the analytical methods, supervised the findings of the work, revised the article and final approval for publication.

Dr S. Preetha contributed to the critical review and formatting of the draft manuscript and supervision.

CONFLICT OF INTEREST

None declared

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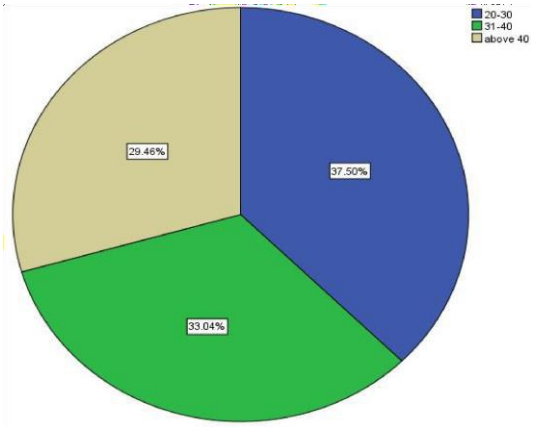

Figure 1: Pie chart showing the percentage distribution of the age groups of the participants. 37.50% of the population participated were in the age group of 20-30 (blue), 33.04% were from the 31-40 age group (green) and 29.46% were above 40 years of age (grey). Majority of the participants were aged between 20-30 years old.

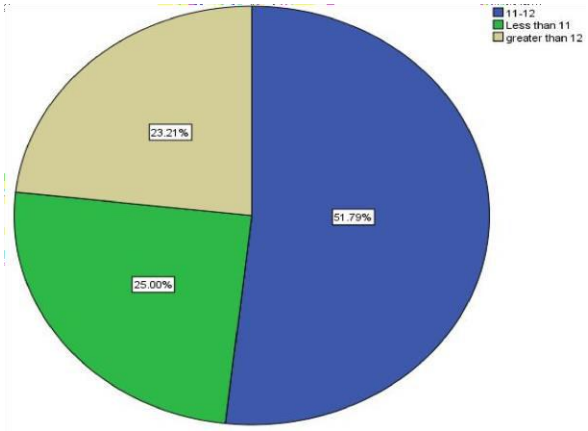

Figure 2: Pie chart depicting the percentage distribution of haemoglobin concentration of the participants. 51.79% of the population haemoglobin level is between 11-12 g/dl (blue) and few populations of 25% haemoglobin level are less than 11g/dl (green) and 23.21% have haemoglobin greater than 12 (grey). Majority of the participants' Haemoglobin concentration is between 11-12g/dl.

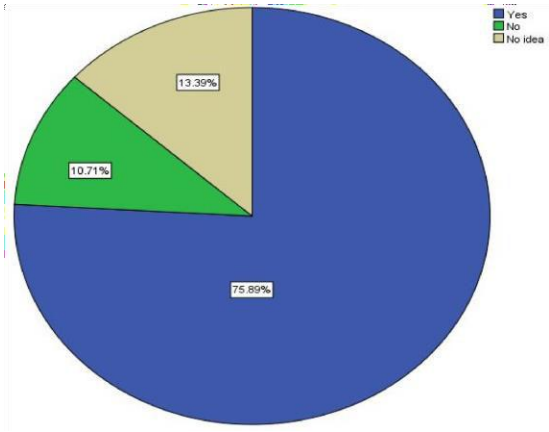

Figure 3: The pie chart exhibiting the percentage distribution of awareness on anaemia can affect pregnant women. 75.89% of the population is aware that anaemia can affect pregnant women (blue), 13.39% report no idea (grey) about anaemia during pregnancy and 10.71% were not aware (green) of anaemia can affect pregnant women. Majority of the population were aware of chances of occurrence of anaemia in pregnant women.

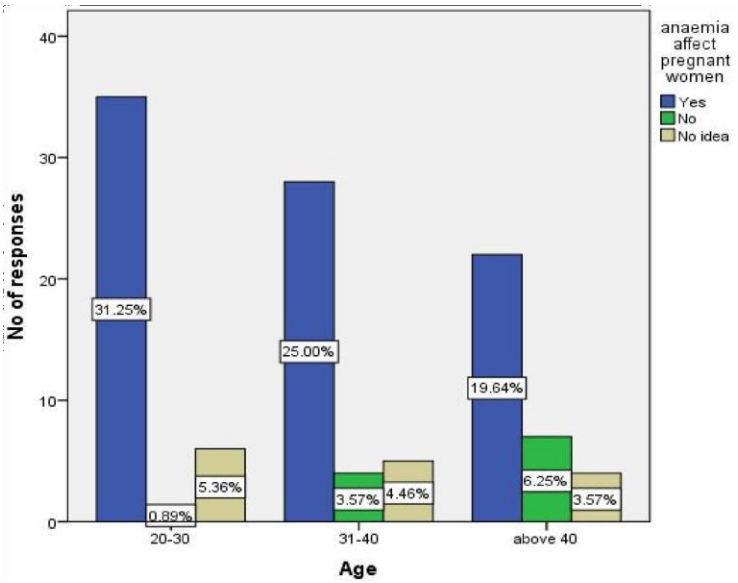

Figure 4: Bar graph showing the association between age and awareness of anaemia affects pregnant women. Blue colour denotes 'yes', green denotes 'no', grey denotes 'no idea'. The X-axis represents the age of the participants and the y-axis represents the number of responses. 31.25% of the participants of the age group 20-30 were aware that anaemia can affect pregnant women than the age groups of 31-40 which were 25% and above 40 years of age was 19.64%. This indicates that participants of the age group 20-30 were more aware that anaemia can affect pregnant women than the other age groups and was statistically not significant. Chi-square test showing p=0.14 (p>0.05 indicating statistically not significant).

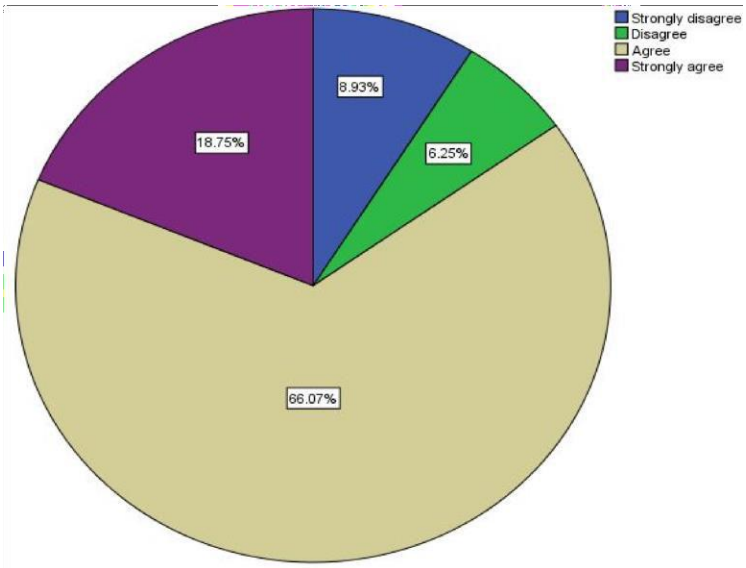

Figure 5: The pie chart depicting the percentage distribution of awareness on Haemoglobin concentration <11g/dl cause anaemia. 66.07% of the women agreed (grey) that the haemoglobin level <11g/dl can cause anaemia and 18.75% of the participants strongly agree (purple), though 8.93% of the women strongly

disagreed (blue) and 6.25% of the participants disagreed (green) that haemoglobin concentration <11g/dl cause anaemia. Majority of the participants agree that Haemoglobin concentration <11g/dl can cause anaemia.

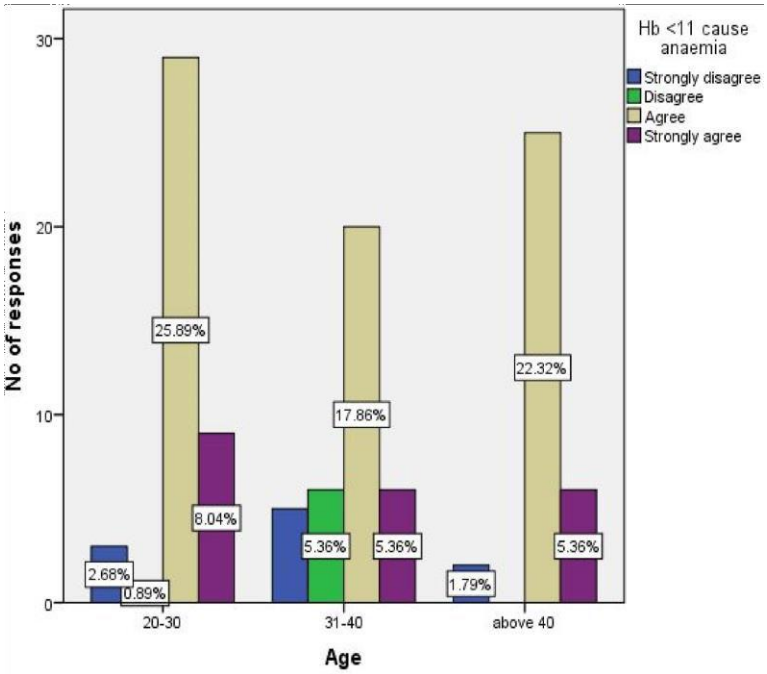

Figure 6: Bar graph showing the association between age and awareness of haemoglobin concentration <11g/dl causes anaemia. Blue colour denotes 'strongly disagree', green denotes 'disagree', grey denotes 'agree', purple denotes 'strongly agree'. The X-axis represents the age of the participants and the y-axis represents the number of responses. 25.89% of the participants of the age group 20-30 were aware that anaemia can affect pregnant women than the age groups of above 40 which were 22.32% and 31-40 years of age was 17.86%. This indicates that participants of the age group 20-30 were more aware that haemoglobin concentration <11g/dl causes anaemia than the other age groups and was statistically significant. Chi-square test showing p=0.046 (p<0.05 indicating statistically significant).

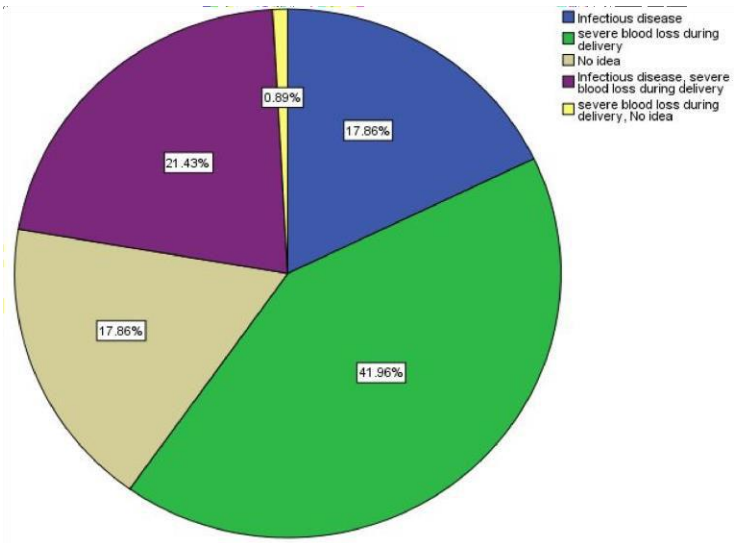

Figure 7: The pie chart showing the percentage distribution of awareness of other reasons which can cause anaemia. Very few populations of 21.43% report infectious disease and severe blood loss are the other reasons (purple) which can cause anaemia, 41.96% reported only blood loss can cause anaemia (green), 17.86% of the population chose no idea (grey). Majority of the participants chose severe blood loss as the other reason which can cause anaemia.

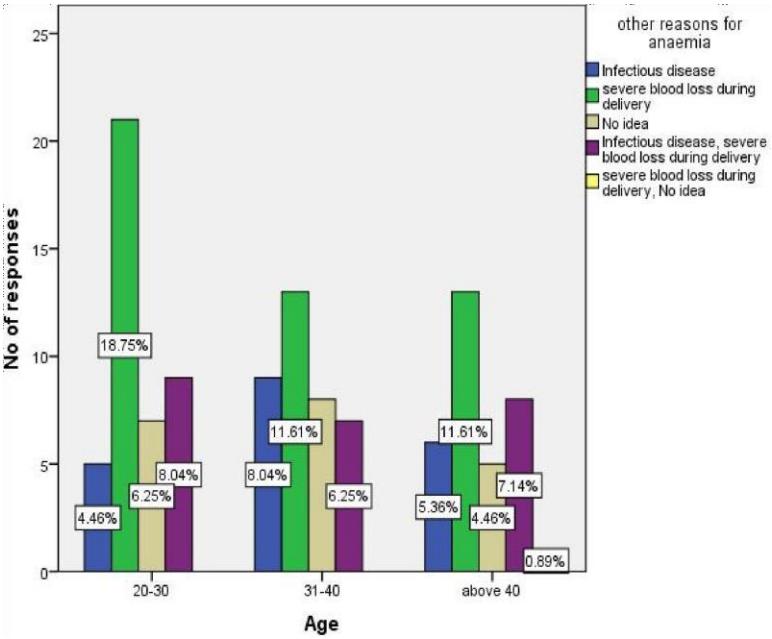

Figure 8: The graph depicts the association between age and awareness of other reasons for anaemia, where blue colour denotes 'infectious disease', green denotes 'severe blood loss', white denotes 'no idea', purple denotes 'infectious disease and severe blood loss'. The x-axis represents the age of the participants and the y-axis represents the number of responses. 25.89% of the participants of the age group 20-30 were aware that anaemia can affect pregnant women than the age groups of above 40 which were 22.32% and 31-40 years of age was 17.86%. This indicates that participants of the age group 20-30 were more aware that haemoglobin concentration <11g/dl causes anaemia than the other age groups and was statistically not significant. Chi-square test showing p=0.06 (p>0.05 indicating statistically not significant).

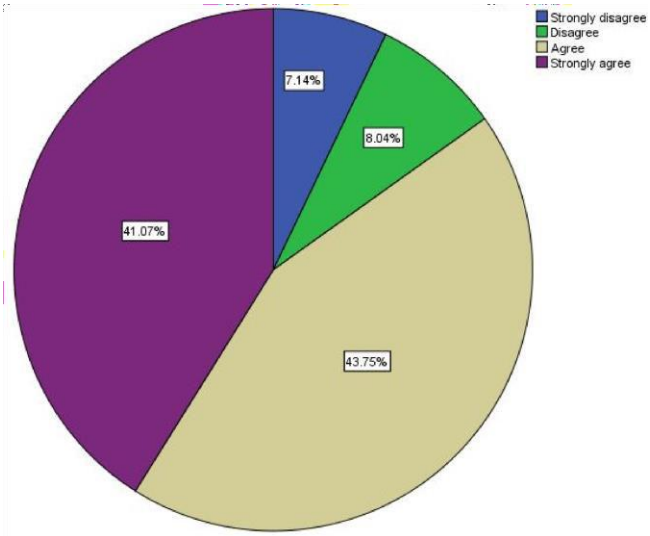

Figure 9: Pie chart depicting the percentage distribution of awareness of common symptoms of anaemia. 43.75% agreed (grey) that symptoms of anaemia are weakness and tiredness and 41.07% strongly agreed (purple) that weakness and tiredness are common symptoms of anaemia though 8.04% of the participants disagreed (green) and 7.14% population strongly disagree (blue) for weakness and tiredness are common symptoms. Majority of the population agree weakness and tiredness are the common symptoms of anaemia.

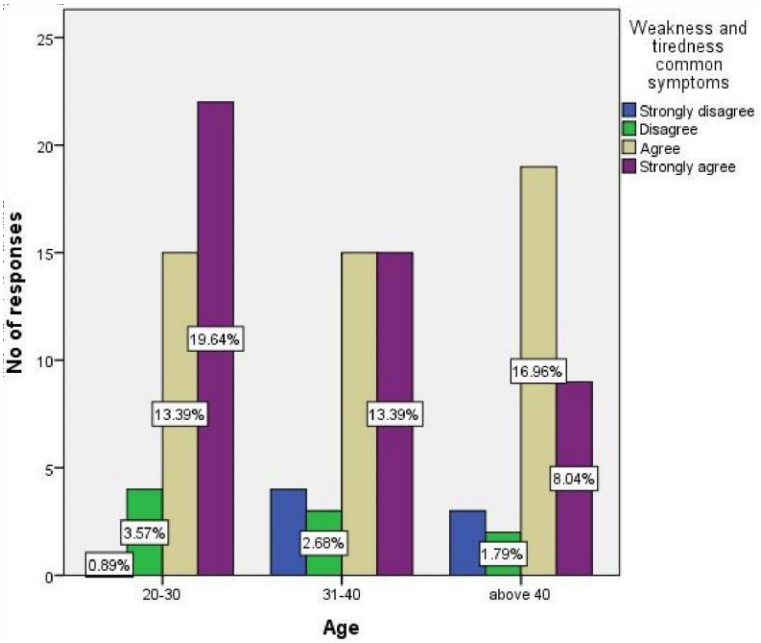

Figure 10: The graph depicts the association between age and awareness of common symptoms of anaemia, where blue colour denotes 'strongly disagree', green denotes 'disagree', grey denotes 'agree', purple denotes 'strongly agree'. The x-axis represents the age of the participants and the y-axis represents the number of responses. 19.64% of the participants of the age group 20-30 strongly agree that weakness and tiredness are the common symptoms of anaemia than the age groups of 31-40 which were 13.39% and above 40 years of age was 8.04%. This indicates that participants of the age group 20-30 were more aware of common symptoms of anaemia than the other age groups and was statistically not significant. Chi-square p=0.27 (p>0.05 indicating statistically not significant).

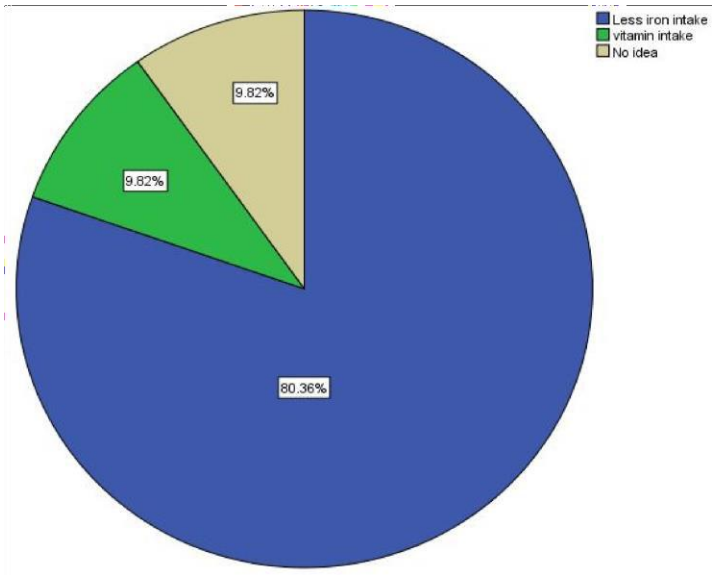

Figure 11: The pie chart exhibiting the percentage distribution of awareness on the major cause of anaemia. 80.36% of the pregnant women population are aware that iron deficiency is the major cause of anaemia (blue) and 9.82% of the population reported that vitamin intake is the common type of anaemia (green) and 9.82% has reported no idea (grey). Majority of the population report less iron intake is the major cause of anaemia.

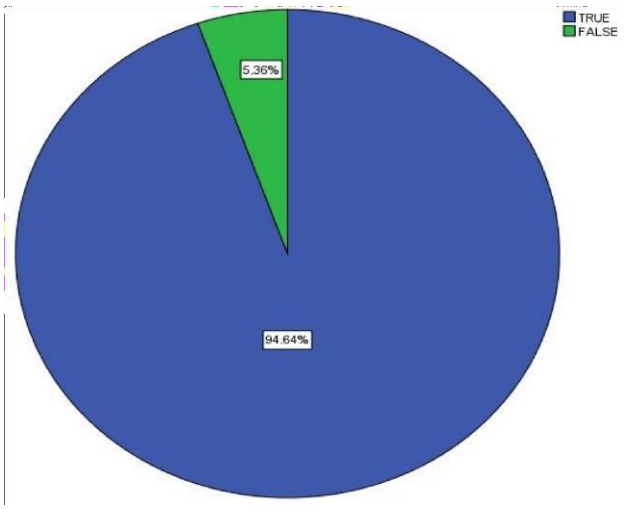

Figure 12: The pie chart depicting the percentage distribution of awareness on Haemoglobin concentration <6g/dl causes severe anaemia. 94.64% of the population were aware (blue) that haemoglobin levels less than 6 cause severe anaemia and 5.36% of the population was not aware of haemoglobin <6g/dl cause severe anaemia (green). Majority of the participants were aware that Haemoglobin concentration <6g/dl causes severe anaemia.

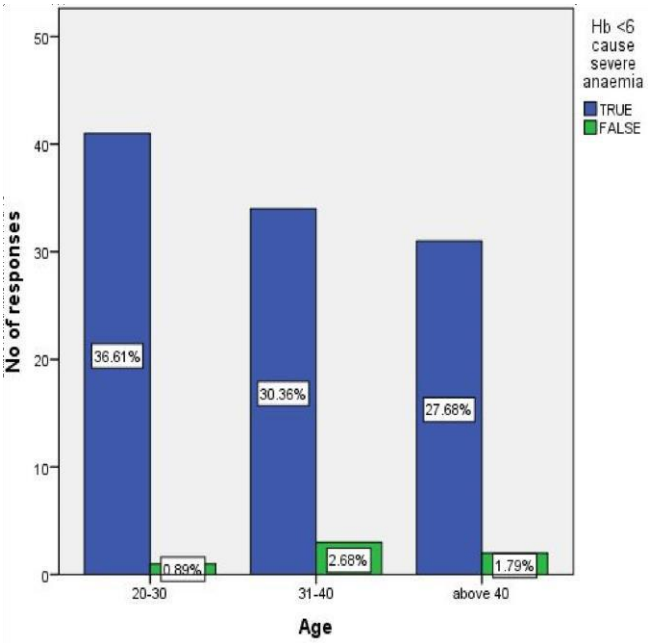

Figure 13: The graph depicts the association between age and awareness on haemoglobin concentration <6g/dl cause severe anaemia, where blue colour denotes 'true', green denotes 'false'. The x-axis represents the age of the participants and the y-axis represents the number of responses. 36.61% of the participants of the age group 20-30 were aware that haemoglobin concentration <6g/dl caused severe anaemia than the age groups of 30-40 which was 30.36% and above 40 years of age was 27.68%. This indicates that participants of the age group 20-30 were more aware that haemoglobin concentration <6g/dl causes severe anaemia than the other age groups and was statistically not significant. Chi-square test showing p=0.51 (p>0.05 indicating statistically not significant).

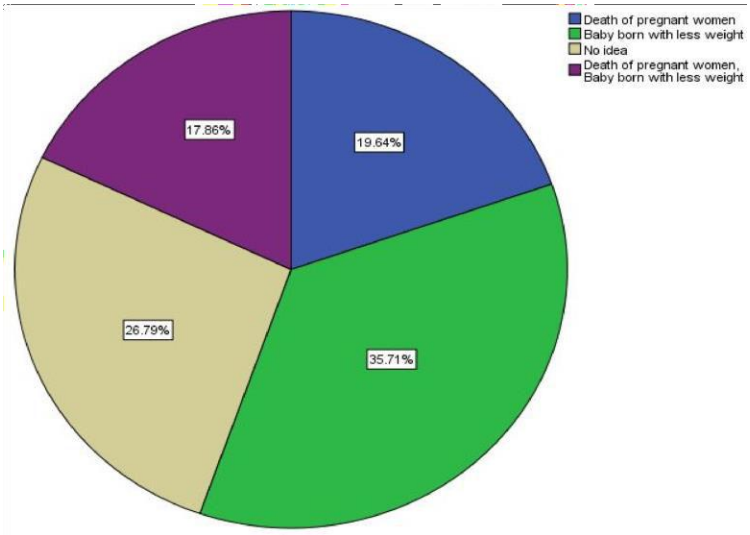

Figure 14: The pie chart showing the percentage distribution of awareness on the effects of severe anaemia. 35.71% of the population chose less born weight of the baby (green) 17.9% report the effect of severe anaemia is the death of pregnant women and less born weight of the fetus (purple), 19.64% chose the death of pregnant women (blue), and 17.86% of the population report no idea (grey) about effects of severe anaemia. Majority of the population report severe anaemia results in the less born weight of the baby.

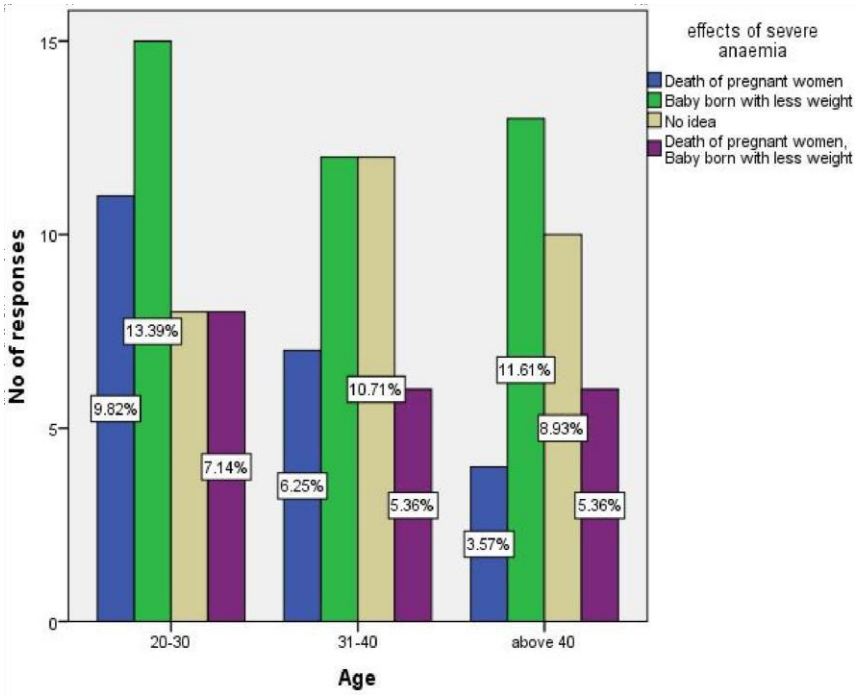

Figure 15: The graph depicts the association between age and awareness on effects of severe anaemia, where blue colour denotes ‘death of pregnant women’, green denotes ‘less weight of newborn baby’, grey denotes ‘no idea’, purple denotes ‘death of pregnant women and baby born with less weight’. The x-axis represents the age of the participants and the y-axis represents the number of responses. 13.39% of the participants of the age group 20-30 were aware of the effects of severe anaemia than the age groups of above 40 which were 11.61% and 31-40 years of age was 10.71%. This indicates that participants of the age group 20-30 were more aware of the effects of severe anaemia than the other age groups and was statistically not significant. Chi-square test showing $p=0.71$ ($p>0.05$ indicating statistically not significant).

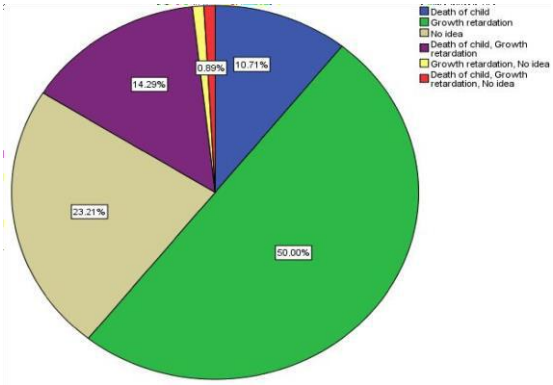

Figure 16: The pie chart representing the percentage distribution of awareness on the effects of anaemia in children. 50% of the participants reported that anaemia causes growth retardation in the fetus (green) though only 14.3% reported that anaemia can cause both growth retardation and death of the fetus (purple), 23.21% participants chose no idea (grey), and 10.71% of the population chose the death of the child (blue) as effects of severe anaemia in children. Majority of the participants report that severe anaemia causes growth retardation in children.

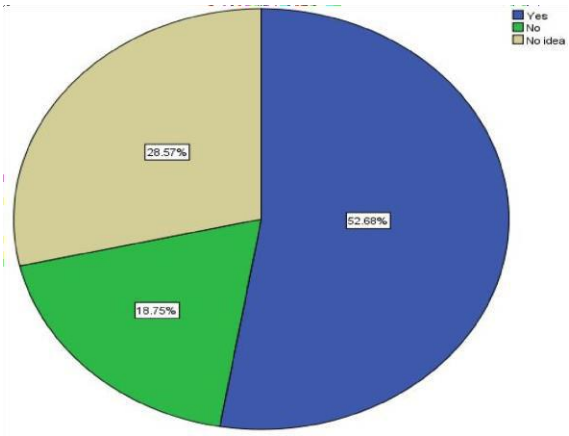

Figure 17: The pie chart depicting the percentage distribution of awareness of folifer tablets provided during pregnancy. 52.68% of the population is aware of folifer tablets provided during pregnancy (blue), 28.57% chose no idea (grey) and 18.75% of the population were not aware (green) of folifer tablets provided during pregnancy. Majority of the population were aware of folifer tablets provided during pregnancy.

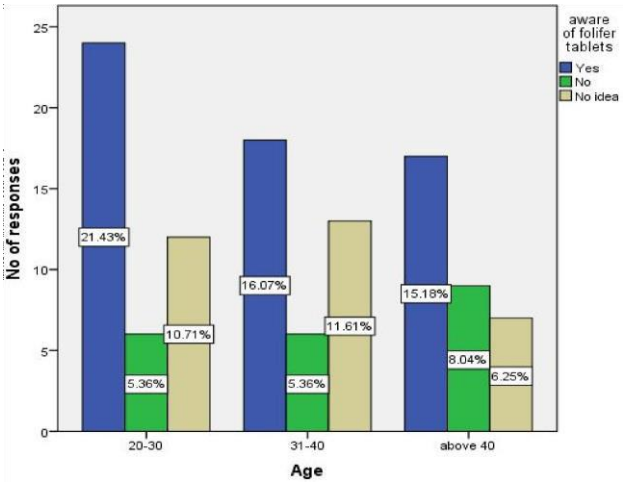

Figure 18: The graph depicts the association between age and awareness of folifer tablets provided during pregnancy, where blue colour denotes ‘yes’, green denotes ‘no’, grey denotes ‘no idea’. The x-axis represents the age of the participants and the y-axis represents the number of responses. 21.43% of the participants of the

age group 20-30 were aware of folifer tablets provided during pregnancy than the age groups of 30-40 which was 16.07% and above 40 years of age was 15.18%. This indicates that participants of the age group 20-30 were more aware of folifer tablets provided during pregnancy than the other age groups and were statistically not significant. Chi-square test showing p=0.50 (p>0.05 indicating statistically not significant).

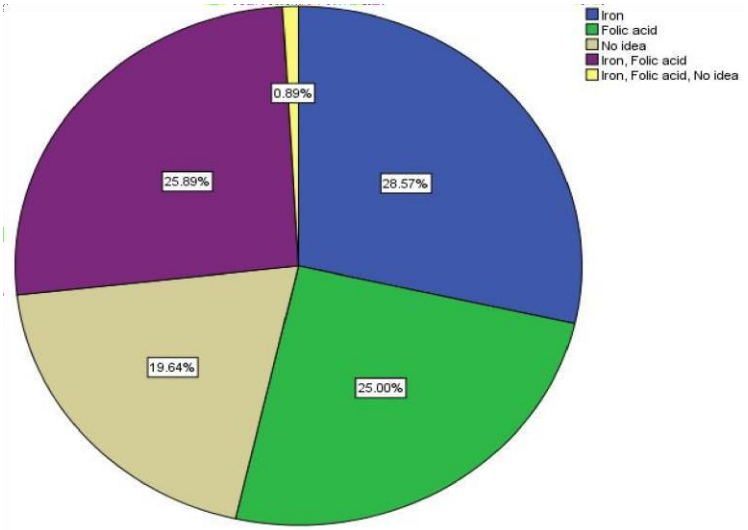

Figure 19: The pie chart exhibiting the percentage distribution of awareness of nutritional supplementation in folifer tablets. 25.89% report iron and folic acid are the major nutritional supplements in folifer tablets (purple), 28.57% chose iron (blue) as the major nutritional supplement in folifer tablets, 25% population chose folic acid (green) 19.64% of the participants report no idea (grey) `about the major nutritional supplement in folifer tablets. Majority of the participants report iron is the major nutritional supplement in folifer tablets.

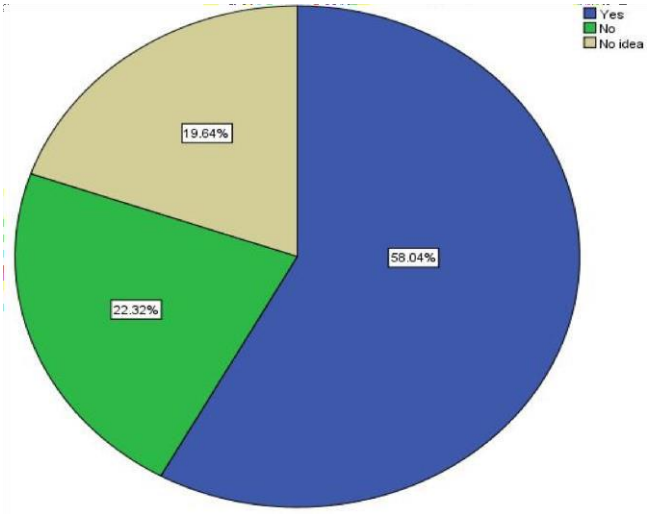

Figure 20: The pie chart representing the percentage of awareness of programmes conducted on anaemia. 58.04% of the participating pregnant women population is aware of awareness programmes conducted on anaemia (blue), 22.32% of the population were not aware (green), and 19.64% chose no idea (grey) about the programmes conducted on anaemia. Majority of the participants were aware of programmes conducted on anaemia.