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Knowledge, Attitude and Practice Related to Iron Deficiency Anemia among Women of Child Bearing Age, Khartoum, Sudan

Tagreed Ahmed (1st Author with equal contribution)
Jazan University – Faculty of Medicine
Department of Anatomy Jazan, KSA

Osman Abdelrahman, (1st Author with equal contribution)
Roving senior officer, Operations, Health Insurance
The Mediterranean and Gulf Cooperative Insurance and Reinsurance Company. Riyadh, KSA

Abstract:
Background: This cross-sectional study was conducted at Khartoum locality, Khartoum, Sudan. Ibrahim Malik teaching hospital was selected to carry out the study on their antenatal care clinic. The study was conducted in the period between October to December 2014.

Purpose: We have accomplished this study due to our beliefs regarding the importance of maternity health and the key factors affecting it. One of the major and underrated factors is the importance of iron. It is necessary to explore the factorsthat lead to the development of iron deficiency anemia among pregnant Sudanese women in order to design effective interventions that reduce the burden of the problem.

Methodology: A questionnaire with close-ended statementswas distributed to pregnant women who attended the antenatalcare clinic at Ibrahim Malik hospital.The questionnaire consisted of thirty-three standardized questions divided into four sections: Section A of the questionnaire covered questions on the demographics of respondents; Section B contained questions to evaluate the knowledge of respondents; Section C contained questions to evaluate the attitudes of respondents; Section D contained questions on practices of the respondents.

For the calculation of the total score for risk groups of iron deficiency anemia, the weights assigned for selecting a specific group were as follows: pregnant women and children (5 points); pregnant women only (2.5 points); children (2.5 points);nursing mothers (2.5 points); elderly (1 point). The sum of frequencies for each category was then multiplied by the assigned weight points. The total sum of points calculated for all categories was then divided by the expected full total sum of the score which is the product of multiplying the sum of frequencies by 5.

Using different weights for each selected item, the same procedure was followed to calculate the total sum of scores for the selection of food items. The score weights assigned for different food items were as follows: meat (5 points); pourpier (2.5 points); vegetables (2.5 points); pigeon pea (2.5 points); legumes (2.5 points); fruits (2.5 point); Grewiatennax (2.5 points); milk (1 point); others (1 point).

Results:
The total number of participants in this study was 119 women. The mean age of the participants was 27.3 ±5 (Mean±SD). The mean level of hemoglobin for the participants was 10.4 + 0.12 gram/dl (mean ± SD). Levels of hemoglobin were also found to decrease with multiparity, and primigravida had higher hemoglobin levels compared to multiparous women.60.7 % of pregnant women were identified as a high-risk group for iron deficiency anemia. 47.1 % have agreed on the importance of meat, and only 20.2 % have agreed on the importance of legumes for pregnant women. Meanwhile, 72.2 % stressed the importance of fruits during pregnancy. Interestingly, (58.0 %) stated that it is necessary to consume milk and dairy products. Interestingly, only five women mentioned that the pregnant woman should eat what she usually eats, but in a greater amount.

Regarding their beliefs and attitude about the importance of taking iron tablets, 98.3% have admitted the beneficial effects of these tablets on the health of both the mother and the fetus.

All women involved in the study have confirmed the importance of eating iron-rich foods during pregnancy. 86.6 % of pregnant women in the study managed to report the record of their last hemoglobin measurement. 57.1 % of the participants reported that they regularly drink tea after meals. Ninety-five participants (79.8 %) reported regular use of iron tablets during pregnancy.

Conclusion: Overall, findings indicated that women who had poor knowledge of iron deficiency anemia, had unfavorable attitudes and weak practice and those who had good knowledge had appropriate behavior. Levels of knowledge and attitudes towards the factors contributing to the development of iron deficiency anemia during pregnancy were shown to be acceptable.

Keywords:- *Knowledge; Attitude; Practice; Khartoum; Anemia.*

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I. INTRODUCTION

Anemia is a condition in which the number of red blood cells (RBCs) and/or the amount of hemoglobin in the blood falls below normal levels [1,2,3]. Anemia, especially iron-deficiency anemia (IDA) is one of the most widespread public health problems that affect populations in both developed and developing countries. According to the WHO, anemia affects 1.62 billion people, which corresponds to 24.8% of the population. And about 2.2 billion people were estimated to be iron deficient[4]. The highest prevalence of anemia and iron deficiency occurs among pre-school children (47.4%) and pregnant women (41.8%) [4,5,6]. Although in the developed world it is not so widespread as in developing countries, it is still not completely solved in the United States, Canada, and European countries. Recent reports showed that from 3.5% to 7.4% of pregnant women in the USA had IDA in the first trimester. In the third trimester, it is even higher: from 15.6 to 58% [7]. However, Africa has the highest proportion of individuals affected accounting for 47.5% of preschool children and 67.9% of pregnant women[6].

Anemia can result from a wide variety of isolated or coexisted causes including nutritional deficiencies, worms' infestations, parasitic infections, and hemoglobinopathies, however, iron deficiency is the most common cause of anemia worldwide, and it is generally assumed that 50% of the cases of anemia are due to iron deficiency [4, 6]. Although IDA is usually due to nutritional insufficiency of iron, it may also be caused by an underlying medical problem such as gastrointestinal blood loss, malabsorption syndrome, chronic inflammatory disease, or heavy menstrual losses.

II. MATERIAL AND METHODS

A. Study design and sample size

This is a descriptive cross-sectional study. Ibrahim Malik Teaching Hospital (IMTH) was selected for the study. A convenient purposive sampling technique was adopted.

The study was conducted in the Khartoum state of Sudan. All pregnant women attending the antenatal clinic in Ibrahim Malik Teaching Hospital during the study period were asked to participate in the study. Those who met the criteria of inclusion and consented to participate were selected for participation in the study.

Pregnant women who attended the selected maternity clinics regardless of their gestational age, educational level, or residence area are included. Women who were suffering from a severe illness unrelated to iron deficiency or those who are health professionals will be excluded from the study.

The records of hemoglobin levels were obtained from the antenatal follow-up records. The questionnaire consisted of thirty-three standardized questions divided into four sections: Section A of the questionnaire covered questions on the demographics of respondents; Section B contained questions to evaluate the knowledge of respondents; Section C contained questions to evaluate the attitudes of respondents; Section D contained questions on practices of the respondents.

Questions of Section B were used to testify to the knowledge of pregnant women regarding risk groups of IDA, nutrition, types of iron-rich diet, substances interfering with intestinal iron absorption, and the importance of iron tablets. Section C investigated the attitude of pregnant women towards the importance of visiting the antenatal care units, the importance of monitoring the hemoglobin level at the inter-pregnancy interval.

The last section included questions to investigate the actual practices of pregnant women about the issues of the most important foods, tea consumption, and use of iron tablets, as well as the birth spacing, the number of pregnancies, and the last record of hemoglobin level.

Total scores of participants' responses were tabulated in frequency tables. A working scale was specifically designed to weigh the relative importance of each item selected by the participants. For the calculation of the total score for risk groups of IDA, the weights assigned for selecting specific group were as follows: pregnant women and children (5 points); pregnant women only (2.5 points); children (2.5 points); nursing mothers (2.5 points); elderly (1 point). The sum of frequencies for each category was then multiplied by the assigned weight points. The total sum of points calculated for all categories was then divided by the expected full total sum of the score which is the product of multiplying the sum of frequencies by 5.

Using different weights for each selected item, the same procedure was followed to calculate the total sum of scores for the selection of food items. The score weights assigned for different food items were as follows: meat (5 points); pourpier (2.5 points); vegetables (2.5 points); pigeon pea (2.5 points); legumes (2.5 points); fruits (2.5 point); Grewiatenax (2.5 points); milk (1 point); others (1 point).

B. Data Analysis

The data were analyzed using SPSS software package (IBM®*SPSS* version 16.0). Simple frequencies were calculated for the open and close ended questions. Cross tabulation and Chi-square (κ^2) were used to analyze the data. Statistical tests were used to analyze the relationship of knowledge and attitude, knowledge and practice, and attitude and practices as well as the relationship of each of knowledge, attitude and practices with the demographic and health and demographic data.

C. Ethical consideration

Ethical clearance was obtained from the appropriate health authority and institutions involved. Informed consent was obtained from all participants before enrollment in the study.

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Food item	Frequency*	%	Score+
Fruits	86	72.2	215
Milk	69	58.0	69
Vegetables	57	47.9	142.5
Meat	56	47.1	280
Legumes	24	20.2	60
Pigeon pea	12	10.1	30
Total	**304**		**796.5 (52.4 %)**

Table 1: Knowledge on types of food needed during pregnancy

+Scores were calculated using a scale of relative weights for different items as described in material and methods

*The number of participants who identified a particular type of food needed during pregnancy.

III. RESULTS

The total number of participants in this study was 119 women. The mean age of the participants was 27.3 ±5 (Mean=SD).

The mean level of hemoglobin for the participants was 10.4 + 0.12 gram/dl (mean ± SD). According to the CDC definition of anemia during pregnancy fifty women (42.0 %) of the group investigated in this study had hemoglobin levels below the cut-off point of anemia. Sixteen women representing 13.4% of the participants didn't report their hemoglobin level. While the rest of women (44.5%) were categorized as not anemic.

However, in this study, although not significantly different, the levels of hemoglobin were found to decrease with the gestational age.

Levels of hemoglobin were also found to decrease with multiparity, and primigravida had higher hemoglobin levels compared to multiparous women.**Figure (1)**

Although the differences were not statistically significant, participants who had bleeding or abortion events showed slightly lower levels of hemoglobin compared to those who didn't experienced such conditions.

Fifty-six women (47.1 %) have indicated the importance of meat, and only twenty-four (20.2 %) have identified the importance of legumes for pregnant women. Meanwhile eight six women (72.2 %) stressed the importance of the fruits during pregnancy. Interestingly, sixty-nine women (58.0 %) stated that it is necessary to consume milk and dairy products. Interestingly, five women mentioned that the pregnant woman should eat what she usually eats, but in greater amount, the results are shown in **Table 1** below.

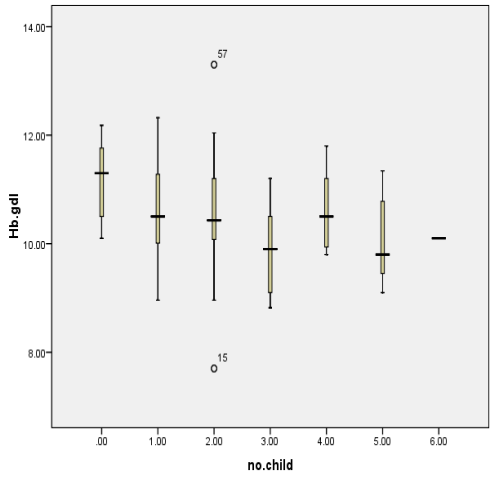

Fig. 1: The levels of hemoglobin decreases with number multiparity

Regarding the knowledge on sources of rich-iron foods, thirty-eight women (31.9%) identified meat as the most important source of iron. Forty-three (36.1 %) mentioned green leafy vegetables as an important source of iron. Large proportion (42.0 %) of women have specifically mentioned the green leafy vegetable pourpier (purslane), while (22.8 %) have indicated the legume, pigeon pea as important sources of iron. However, few women mentioned the wild fruit Grewiatennax, bread,lemon, fishes and eggs as iron-rich sources. Twenty-four (20.2 %) women have incorrectly mentioned milk as an important source of iron. **Table 2**

Meanwhile twenty-six women (21.8%) failed to identify at least one iron-rich food. Overall, a totalof ninety-three women (78.2%) have correctly mentioned at least one of the iron-rich foods.

Eighty-six women (72.3 %) have correctly identified the effect of tea drinking on the intestinal absorption of iron, and ninety-one have correctly identified the effect of vitamin c (ascorbic acid) on the iron absorption. However, very small number of the participants admitted that they do not know the effect of either tea or vitamin C as shown in **Figure 2** below.

Food item	Frequency*	%	Score+
Pourpier (purslane)	50	42.0	125
Fruits	53	44.5	106
Vegetables	43	36.1	107.7
Meat	38	31.9	190
Milk	24	20.2	24
Pigeon pea	27	22.8	67.5
Grewiatennax	05	4.2	12.5
Others#	11	9.2	11
Total	**251**		**643.5 (51.3 %)**

Table 2: Knowledge on iron-rich foods

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[+] Scores were calculated using a scale of relative weights for different items as described in material and methods

* The number of participants who identified a particular type of food as good source of iron

other types of foods include bread, raisin, carrot, okra, watercress and lemon

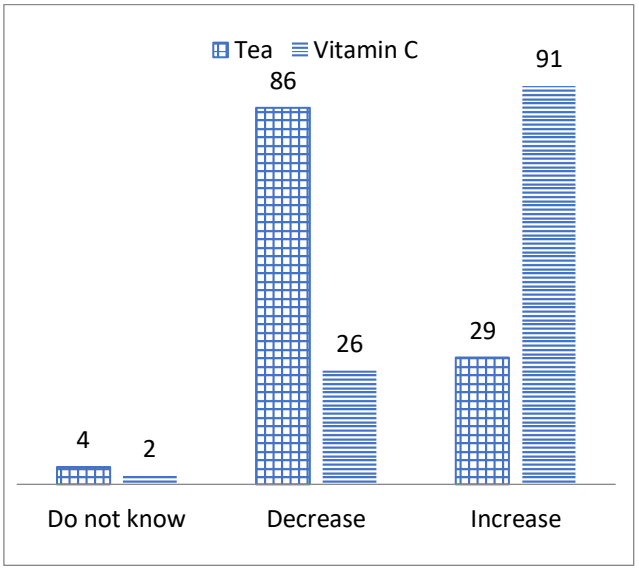

Fig. 2: The distribution of participants by their knowledge on the effect of tea and vitamin C on iron absorption in the gut

Regarding believes and attitude about the importance of taking iron tablets, one hundred and seventeen women (98.3%) have admitted the beneficiary effects of these tablets on the health of both the mother and the fetus.

Out of the 119 participants involved in this study 118 women (99.2 %) agreed on the importance of attending the maternity clinic during pregnancy. Only one woman (.8%) failed to report her believe about this issue.

All of the participants involved in the study exhibited positive attitude regarding the importance of monitoring the hemoglobin levels during pregnancy.One hundred and three women (86.6 %) managed to report their record of her last hemoglobin measurement.

Meanwhile, the reports about the actual practice have shown that sixteen participants (13.4 %) failed to report their hemoglobin level indicating unfavorable practice with regard to this issue.

All women involved in the study have confirmed the importance of eating iron-rich foods during pregnancy. This indicate a wide spread of the awareness of the importance of iron for the health of fetus and pregnant mothers.

Most of the women (89.9 %) have indicated the importance of continuing iron supplementation during nursing. Only twelve women (10.1 %) reported that it is not necessary to continue iron intake after delivery. These results show a positive attitude with regard to the mothers' need to replenish their iron store postpartum.

All the women in the study stressed the importance of birth spacing for the health and wellbeing of the mother. This result indicated the awareness and wide acceptance of family planning programs among the study population.

Sixty-eight women (57.1 %) reported that they regularly drink tea after meals.

Ninety-five women (79.8 %) reported a regular use of iron tablets during pregnancy, and another twenty women (16.8 %) reported that they use iron pills occasionally. Only four women admitted that they do not use iron pills at all. **Figure (3)**

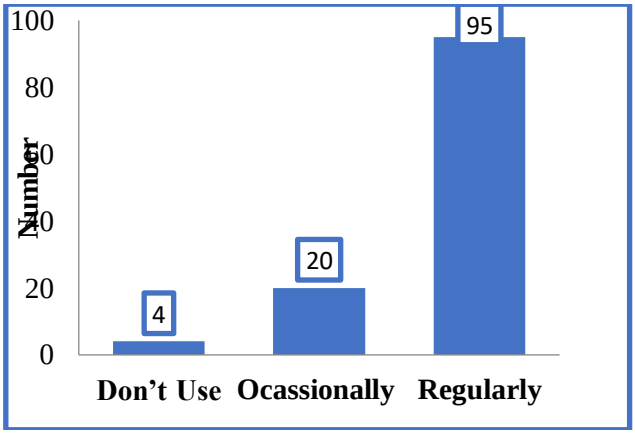

Fig. 3: Usage of iron supplement pills by participants

The average birth spacing interval for the multiparous women in the study group was 14 months. Out of the ninety-one multiparous women in the study, twenty-three (25.3 %) have reported a birth spacing interval of 12 month or less, thirty women (32.9 %) have reported a birth interval between 12 to 24 month, and thirty-eight women (41.8 %) have had a birth interval of more than 24 month. **Figure (4)**

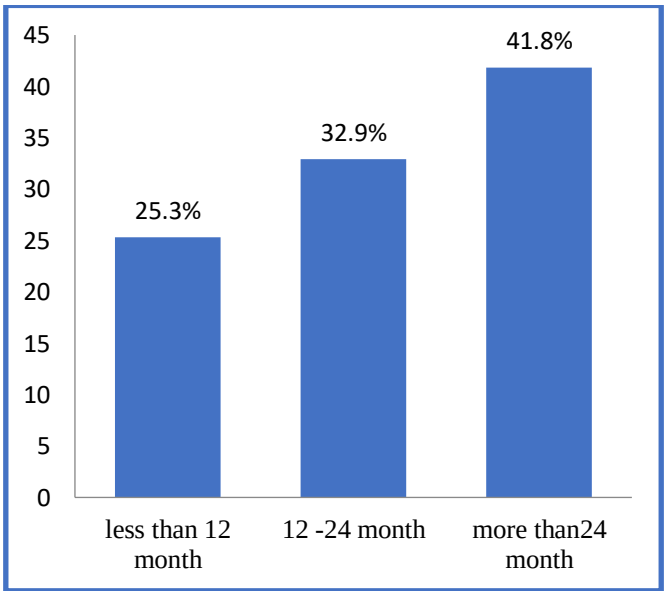

Fig. 4: The distribution of participants by the length of birth interval

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Regarding food consumption during pregnancy, **Table (3)** below, shows the results of the iron-rich foods consumed by the women during the last two days. A total of eighty-one women (68.1 %) indicated that they consumed no legumes in their meals during last two days. These results are revealing a wide gap between the women's knowledge and their actual practice with regard to the importance of eating legumes during pregnancy.

Fifty-nine women (49.6 %) indicated that they have consumed some type of fruits during the last two days. These results reflect a considerable concordance between the beliefs and practices with regard to the importance of fruits during pregnancy.

Food item	Frequency*	%	
Meat	59	49.6	295
Milk	47	39.5	47
Vegetables	62	52.1	155
Legumes	38	31.9	95
Pigeon pea	07	05.9	17.5
Others	23	19.3	23
	236		**632.5 (53.6 %)**

Table 3: Food consumption during the last two days

* The number of participants who indicated intake of a particular type of food during pregnancy

IV. DISCUSSION

Lack of knowledge, unfavorable attitudes and malpractices are substantially contributing to the widespread of IDA among women of childbearing age in most of developing countries[8]. According to the American center of Disease control (CDC) definition of anemia during pregnancy, fifty women (42.0 %) of the group investigated in this study had hemoglobin levels below the cut-off point, with a mean level of hemoglobin of 10.4 + 0.12 gram/dl. The prevalence of anemia in this study is similar to that reported in previous studies from different parts of Sudan [9,10,11]. Moreover, in this study, although not significantly different, the levels of hemoglobin were found to decrease with the gestational age, and were also found to decrease with multiparity. This is not surprising, because fall in hemoglobin levels in late pregnancy reflects normal physiological changes including expansion of plasma volume, and is not necessarily a sign of poor maternal nutrition. However, the decreased hemoglobin in multiparous women could be a consequence of depleted iron store, as multiparous women tend to have greater menstrual losses that increase with parity. Additionally, although the differences are not statistically significant, participants who had bleeding or miscarriage events have also shown slightly lower levels of hemoglobin compared to those who did not experienced such conditions. These findings are of interest because iron deficiency is a recognized cause of miscarriage which in turn leads to depleted iron stores in the body and increased risk of multiple miscarriages. However, although, all of the participants involved in the study exhibited a positive attitude regarding the importance of monitoring the hemoglobin levels during pregnancy, the results of actual practice showed that sixteen participants (13.4 %) failed to report their hemoglobin level.

The majority of women investigated had satisfactory knowledge on the risk factors of IDA. The overall score of the respondents on the knowledge of risk groups of IDA was 53.2 %. However, this reveals that 46.8 % of women need further health education on the risk factors of IDA, and health education programs in the antenatal care clinics could have positive impact.

The overall score of the women investigated was 52.4 % on the scale of nutritional requirements during pregnancy. They also scored 51.3 % on answering the questions about iron-rich sources of food, and their score on the actual nutritional practices during pregnancy was 53.6 %.These results reveal a high degree of consistency between the women's knowledge, attitudes and practices with regard to the nutritional aspects. However, results indicated that around 47.6% of the women need further counseling in order to change their attitudes and practices with regard to nutritional aspects. Interestingly, more than two thirds of the women (72.2 %) stressed the importance of the fruits intake during pregnancy, and 53 participants (44.5%) indicated fruits as good source of iron. Although, fruits in general are known as good sources of minerals, ascorbate and citrate which may increase iron uptake in the duodenum[12], however, fruits do not necessarily provide significant amount of bio available iron due to the presence of phytates, phosphates, oxalates and phenolic derivatives such as tannins which impede iron absorption in the gut[13] . Thus, women should be aware of the types of fruits they consume during pregnancy. Moreover, forty-three (36.1%) participants have mentioned vegetables as good source of iron. Although, particular types of green leafy vegetables and legumes are known iron-rich sources. Again, care should be taken, because most green vegetables are also rich phytic acid which interferes with iron absorption in the gut.

Fifty-nine (49.6 %) of the women have reported consumption of meat during the last two days. Although meat is an excellent nutritional source for iron, high quality proteins and vitamins, this practice of having meat as a regular component of meals could actually be reflecting a common attitude among Sudanese households rather than awareness about the importance of meat for pregnant women.

An interesting point was that, twenty-four respondents (20.2%) have incorrectly mentioned milk as a good source of iron, and forty-seven women (39.5 %) have reported regular drinking of milk. This reflect a widely spread believe about the importance of milk as a good nutritional source for pregnant women. It is important to note that, milk could have adverse effects, because, although milk is an excellent source of most essential nutrients and minerals for human, it is exceptionally poor in iron, and may result in decreased serum ferritin levels [14,15,16].

Legumes are a rich source of food proteins. Amongst various legumes, pigeon pea (*Cajanuscajan*) occupies an important place as an excellent source of proteins, carbohydrates and fats and is significantly rich in trace elements, and minerals including calcium, magnesium, iron, zinc, and copper [17].Besides its high nutritional value, pigeon pea is also used as traditional folk medicine in various parts of the world. Ironically, 47% of the women investigated have indicated pigeon pea as an important nutritional source for pregnant women; however, only seven women (5.9 %) have reported consuming this legume during pregnancy. This reveals a wide gap between knowledge, attitude and practice.

In accordance with the common belief among Sudanese women, five participants (4.2%) have mentioned frosk also known as gangeran (*Grewiatennax*) as an important source of iron. This plant species is known for its edible fruits which are nutritionally balanced and rich in iron and calcium [18], and it is traditionally considered as special diets for pregnant women and anemic children in some parts of Sudan. However, scientific research is needed to document the beneficiary effect of such food on pregnancy and iron content of the body.

Sufficient level of knowledge has been shown by the women with regard to knowledge on the importance of iron supplement. One hundred and seventeen women (98.3%) have recognized the beneficiary effects of these tablets on the health of both the mother and the fetus. On the other hand, knowledge about the effect of tea, and ascorbic acid (vitamin C) on the absorption of iron was also reasonable. However, around 25% of the respondents were not aware of the fact that iron absorption is inhibited by tea and could be increased by ascorbic acid found in orange juice and fresh fruit. This point should be carefully considered bearing in mind the increasingly spread habit among Sudanese of drinking tea after meals.

The intake of iron pills is important to reduce the risk of IDA in pregnancy. An increasing positive attitude was found in this study regarding to the daily use of iron supplements during pregnancy. The majority of women (98.3%) agreed on the beneficiary effects of these tablets on the health. However, when investigating the actual practice, twenty women (16.8 %) mentioned that they use them occasionally and four women (3.4 %) admitted that they never use them at all.

A positive attitude was also observed in terms of the importance of attendance in antenatal care clinics. It is clear from the findings that more than 99% of the participants agreed with the importance of this visits. On the other hand, positive attitude about the disapproval of multiple pregnancies was reported by almost all women of the studied group. However, results showed that the average birth spacing interval for the multiparous women in the study group was reasonably acceptable. Out of the ninety-one multiparous women in the study, only twenty-three have reported a birth spacing interval of 12 month or less, thirty women have reported a birth interval between 12 to 24 month, and 38 women had a birth interval of more than 24 month. These findings indicated the awareness and wide acceptance of family planning programs among the study population.

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