

Effect of Preconception Picture-Based Educational Program on Awareness and Adherence to Iron-Folic Acid Supplements among Women Planning for Pregnancy

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Abstract:

Background: The correct development of the embryo is contingent upon the consumption of folic acid prior to conception. The utilization of picture-based education is an exceptional method for enhancing the awareness and compliance of women with iron-folic acid supplementation. **Aim:** The current study aimed to examine the effect of preconception picture-based educational program on awareness and adherence to iron-folic acid supplements among women planning for pregnancy. **Design:** A quasi-experimental research design (Two-Groups, study and control) was used to attain the aim this research. **Study Setting:** This research was conducted at family planning clinic and Obstetrics & Gynecological ward affiliated to Benha University Hospitals in Qaliobya governorate, Egypt. **Sample:** A purposive sample, of 230 women (divided equally into study and control group) planning to get pregnancy were recruited according to inclusion and exclusion criteria. **Tools:** Six main instruments were used: a structured self-administered questionnaire, women's knowledge questionnaire, women's attitude questionnaire, women's adherence assessment sheet, barriers for adherence to the iron-folic acid supplementation intake and visual analog satisfaction scale **Results:** there was a high statistically significant difference between study and control group women relating to knowledge, attitude adherence and barrier to iron-folic acid supplementation. after implementation of picture-based education program. Moreover, more than two-thirds of women in study group were highly satisfied with intervention. In both groups, there was a statistically significant positive correlation between the total knowledge score and the total (attitude and adherence) scores during the pre- and post-intervention phases. **Conclusion:** Preconception picture-based educational program had desirable effect in enhancing women's awareness (knowledge and attitude), exhibiting better adherence to iron-folic acid supplementation with lower barriers, improving Hemoglobin level, and attaining high satisfaction; which reflected approval of the research hypotheses. **Recommendations:** A preconception picture-based educational program should be disseminated in all maternity hospitals to enhance the knowledge, attitude, and adherence of women attending outpatient clinics to preconception iron-folic acid.

Key words: Preconception, Picture-based educational program, Awareness, Adherence, Iron-folic acid supplements.

Introduction

Preconception counseling (PCC) is a crucial healthcare intervention in obstetrics and gynecology, PCC aiming to improve the health of prospective parents and reduce risk factors for poor maternal and neonatal outcomes. A lack of PCC can contribute to high maternal and

child morbidity and mortality, combining PCC with prenatal care is more effective (*Başli, & Aksu, 2024*).

Bryan initiated the folic acid (FA) narrative in 1964. Bryan, a youthful consultant obstetrician in Liverpool, conducted research on the causes of placental abruption. Bryan

discovered a correlation with folate deficiency and observed a higher incidence of congenital malformations in folate deficiency (vitamin B9) (*House, et al., 2022*). The synthesis of DNA, protein, and DNA/protein methylation is dependent on FA which is an essential vitamin B. It provides one-carbon compounds (*Goshu, et al., 2022*). FA enhances women's health and pregnancy outcomes, making it increasingly crucial preconception and during pregnancy (*Raad, & AbuAlhommos, 2021*).

Folic acid and iron can be derived from several foods as folate. Sources of iron and FA are red meat, citrus fruits, bean sprouts, liver, egg yolks, and leafy dark greenery. Furthermore, Fortified foods, such as whole grains and supplements, can be used to obtain iron and FA. The consumption of FA alone has been shown to prevent neural tube defects (NTDs) such as anencephaly, spina bifida, or encephalocele, in conjunction with other minerals and vitamins during preconception (*Sabi et al., 2022*).

Pregnant women are advised to consume 0.4–0.8 mg of FA daily, as per the United States Preventive Service Task Force (USPSTF) (*Zhou et al., 2024*). To reduce the likelihood of NTDs, low birth weight, and maternal anemia, and preterm birth, the World Health Organization currently advises that women who are intending to become pregnant ingest 60 mg of iron and 0.4 mg of FA per day for a period longer than 90 days (*Dong et al., 2023*). Large doses (4–5 mg/day) are recommended for women who are at an elevated risk of neural tube defects, including those with diabetes, a body mass index of 30 or higher, or who are taking antiepileptic medications or other folate antagonists, according to explicit guidelines. Additionally, it is advised that individuals who have experienced a neural tube defect during a previous pregnancy consume 4 mg of FA daily (*Dwyer et al., 2022*).

By increasing hemoglobin levels, iron and FA supplements (IFAS) decrease the incidence of anemia and elevate the average blood hemoglobin level of pregnant women by 10.2 g/l. Furthermore, decreases perinatal mortality by 34%–45% and reduces the incidence of anemia and iron deficiency anemia

by 69% and 66% at term, respectively (*Anato, and Reshid, 2024*).

Mothers' abnormalities, such as anemia, peripheral neuropathy, placenta abruption, and neonates' abnormalities, including congenital abnormalities such as (NTDs), are associated with iron and folate deficiency. The NTDs are severe conditions that have a global impact on mortality and morbidity, affecting the spine and brain. Anencephaly, spina bifida, and encephalocele are among the numerous types of NTDs (*Wojtowicz et al., 2022*).

Women's perspectives and thoughts formulation socio-demographic characteristics, such as age, gender, and educational attainment, ethnicity, income, marital status, and reproductive history, contribute to the influence of FA supplementation (*Begashaw, et al., 2022*). The difficulties in putting educational programs into practice may be the cause of variations in IFA awareness, perception, and use. Additionally, numerous variables function as a barrier related with the use of IFA supplements, including low utilization, which has been connected to a desire not to become pregnant, high cost of IFA pills, forgetfulness, and ignorance. Health education interventions are a useful strategy for increasing awareness and perceptions of micronutrient supplementation (*Pan, et al., 2023*).

Mayer's cognitive theory of multimedia learning (CTML) emphasized three principles: (1) Auditory and visual channels are utilized by humans to process information, (2) A finite amount of memory is allocated to each channel, and (3) Learning is the deliberate process of organizing and filtering information. Picture-based educational materials may enhance the effectiveness of educational materials for preconception women by enhancing their awareness, in accordance with Mayer's CTML theory, perception and adherence to FA supplements (*Nana, et al., 2023*).

Importantly, various studies appear that the inclusion of visuals in conjunction with verbal and textual information is advantageous. Maintaining a high level of proficiency in the provision of picture-based education acquisition could reduce healthcare expenditures and

enhance the safety of women. In health contexts, picture-based education is a common practice and is often strategically displayed in venues as a reminder for women who require repeated and significant notifications. Picture based teaching strategies enable educators to adjust instruction and examine comprehension until the knowledge is grasped. (Yu, et al., 2021). Picture based education simplify complex knowledge and aid with memory retention. The picture superiority effect is a common explanation for the recall of visually presented information. According to the picture superiority effect, a relevant picture increases information retention by 6.5 times after 3 days compared to text alone (Peters, & Nordness, 2023)

Visuals and text are employed in picture-based education to address the following topics: Lifestyle, dietary habits, IFAS guidelines, negative impacts of NTDs, and risk factors for anemia and NTDs. The IFAS guide delineates the administration process, the optimal time for administration, the absorption process, potential adverse effects, and meals that are rich in iron and FA. The primary messages were as follows: "consume a diverse diet," "administer one IFAS tablet daily for a minimum of 90 days," "consult with a healthcare provider if a woman experiences any IFA tablet-related complaints," "maintain and achieve a healthy weight," "avoid toxic substances and environmental contaminants," "attend antenatal care (ANC) and regularly monitor one's health." " The following are recommended: " Refrain from interacting with or in close proximity to toxic substances; or residing in an environment that is either abusive or stressful" and "acquaint yourself with the family history of both you and your partner." (Berhane & Belachew, 2022).

Maternity nurses should provide counseling and education to women about the importance of FA, the recommended dosages during the preconception and pregnancy period, as well as its sources. Additionally, In order to prevent long-term complications for both the mother and the fetus, they help women understand the repercussions of FA deficiency. Therefore, In order to raise awareness of the benefits of FA, it is essential to implement nursing education initiatives and campaigns. This can be achieved through a variety of

methods, such as verbal discussions, picture-based education, leaflets, pamphlets, or referrals to high-risk groups (Carter et al., 2022).

Significant of the study:

The quality of maternal nutrition during and prior to pregnancy is a critical factor in the health of both the mother and the infant. FA and iron deficiency may be linked to an increased risk of anemia and preeclampsia, and cleft palate, in addition to congenital defects of the heart, urinary tract, and extremities. In industrialized nations, the prevalence of NTDs has been decreasing in recent years. Simultaneously, It continues to be significantly elevated in the less developed nations of the Middle East, Africa, Latin America, and Egypt.

On a global scale approximately 300,000 infants are born each year with NTDs (Kindie and Mulu, 2022). The prevalence of congenital central nervous system malformations in Egypt is one to two cases per 1,000 births (Hassan, et al., 2022). Moreover, around 40% of pregnant women globally have anemia, demonstrating its impact on them and their unborn children. For the prevention of anemia, iron and FA are still crucial, especially before conception and during pregnancy (Seidu, et al., 2024). In Egypt, about (37.5%) of pregnant women suffer from anemia and mainly result from inadequate intake of iron. In Asia (48.2%), Africa (57.1%), Europe (25.1%), and America (24.1%) and India (33.0%), anemia is a condition that affects expectant women (Hamdy, et al., 2024)

Pictures based education allows women to absorb enormous amounts of facts fast. Using photos to illustrate complex processes is a common teaching aid in today's educational systems around the world. The utilization of preconception iron and FA, as well as women's awareness and perception of the IFAS in preventing NTDs, were significantly low, as demonstrated by numerous studies conducted in a variety of regions (Raad and AbuAlhommos, 2021). So, current research looks at how an educational program based on pictures to make

women more knowledgeable about and devoted to IFAS before they get pregnant.

Aim:

Current study aimed to examine the effect of preconception picture-based educational program on awareness and adherence to iron-folic acid supplements among women planning for pregnancy.

Hypotheses:

H1: It's expected that women who will receive a preconception picture-based educational program will exhibit improved knowledge than those not receive it.

H2: It's expected that women who will receive a preconception picture-based educational program will exhibit a more positive attitude than those who will not receive it.

H3: It's expected that women who will receive a preconception picture-based educational program will exhibit better adherence to iron- FA supplements and improved Hemoglobin level than those who will not receive it.

H4: It's expected that women who will receive a preconception picture-based educational program will exhibit less barriers for adherence to iron- FA supplements than those who will not receive it.

H5: It's expected that women who will receive a preconception picture-based educational program will exhibit high satisfaction after program implementation.

Operational definitions:

Picture-Based Educational Program:

Is instructing students through the use of imagery, which enables them to immediately comprehend the content, including survival language, key words, sentence structures, stories, and other forms of content.

Conceptual definitions:

Preconception health care: Is a set of medical and nursing procedures intended to prevent and control health risks related to a woman's behavior, biology, and social interactions, either before or during pregnancy to conceive a healthy child during the reproductive years.

Awareness: The definition of awareness of IFAS is the act of having "heard" or "read" about IFAS during the preconception period with the intention of achieving pregnancy.

Adherence: Is the degree to which an individual's actions align with medical or health advice. If pregnant women consumed 65% or more of the IFAS over a one-month period, which is equivalent to consuming the supplement at least four times per week, they are regarded as "adherent" to the supplement. This is determined through the use of recording, reporting, and verifying their cards.

Subjects and method

Research Design:

In order to accomplish the objective of this investigation, A quasi-experimental research design was implemented, which consists of two groups: the control group and the study group.

Study Setting:

The family planning clinic and Obstetrics & Gynecological ward are both affiliated with Benha University Hospitals in Qaliobyah governorate, Egypt, where this research was done. Family planning clinic is located at 1st floor of hospitals, consists of waiting area and one room to provide family planning services to all women regardless of their social backgrounds. Obstetrics & Gynecological ward is located at 6th floor of surgery hospital and provide medical treatment for all for all women with gynecological problems.

Sampling:

Sample type, size, criteria and technique: a purposive sample of 230 women who attended the aforementioned location,

including those who requested to remove contraception in order to conceive and those who had spontaneous abortions but refused to employ a contraceptive method with the intention of becoming pregnant. The sample was chosen for six-month period based on the

- In the age group of 18–45 years.
- Having smart phones and WhatsApp application.
- Volunteered to participate in the study.

- Can read and write.

Exclusion criteria:

- Women who have consumed IFAS or any other micronutrient within the last two months.
- Women who are physically or mentally impaired are obligated to provide assent.
- Drop out of women and the impossibility of accessing her.

To prevent bias during data collection, the study group (n=115) was recruited from the women who were admitted to the clinic on the first day and fulfilled the selection criteria from the outset of the data collection. The control group (n=115) was recruited from the women who were admitted on the second day of data collection and met the same criteria. This process was repeated on each subsequent day.

following criteria: *inclusion and exclusion criteria:*

Inclusion criteria:

Figure (1): CONSORT flow diagram

Tools of data collection:

Data was gathered using six tools.

Tool I: A structured self-administered questionnaire: Researchers devised it after conducting a comprehensive review of relevant literature. It consisted of two components:

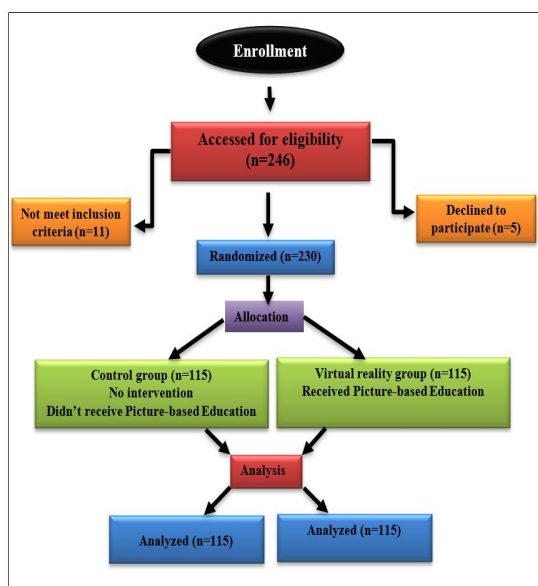
Part (1): Socio-demographic data of studied women: It consisted of six components: age, residence, educational level, occupation, monthly income, and source of information.

Part (2): Obstetric history of studied women: The three items were as follows: parity, gravidity, and the use of family history of NTDs.

Tool II: Women's knowledge questionnaire: It was designed by researchers after reviewing a related literature (*Bernardo.,2022*), (*Abd El Rahman et al., 2022*), (*Fahim et al., 2023*) and (*Harrison et al., 2024*) and translated into Arabic to measure women's knowledge regarding preconception care IFAS and neural tube defects. It comprised of 4 parts; each part consisted of questions with total of 39-multiple-choice questions. These 4 parts were:

Part (1): Knowledge about preconception care: it included "5 questions" as (meaning of preconception care, importance, barriers, most important preconception supplementations and healthy diet before pregnancy).

Part (2): Knowledge regarding iron supplementation: it encompassed "15 questions" (the definition of iron deficiency anemia, risk factors, causes, symptoms of iron deficiency, symptoms of increased iron diagnostic tests, significance of iron



supplementation, recommended dose of iron, optimal intake time, sources of iron-rich nutrients, enhancers and inhibitors of iron absorption, complications of iron deficiency on the mother and fetus, control measures for iron supplementation side effects, prevention of IDA, and treatment).

Part (3): Knowledge regarding folic acid supplementation: It included "15 questions" that covered the following topics: the meaning of FA deficiency anemia, risk factors, causes, symptoms of FA deficiency, symptoms of increased folic acid diagnostic tests, importance of folic acid supplementation, recommended dose of FA, best time for intake, enhancers and inhibitors of FA absorption, source of folic acid-rich foods, complications of FA deficiency on the mother and fetus, control measures for FA supplementation side effects, prevention, and treatment.

Part (4): Knowledge about neural tube defects: it included "4 questions" as (definition of NTDs, causes, complication and prevention).

Scoring system:

The weighting of all knowledge questions was determined by the number of elements included in each question (multiple choice questions). There are four options for each question: one correct answer, two incorrect answers, and I am uncertain. Each question was given a score (1) for the accurate response, and a score of 0 for the incorrect response or "don't know." The total score was determined by adding the scores of all queries. By calculating the mean of responses to all queries, the aggregate mean score of knowledge was ascertained. The scores can range from 0 to 39, with a higher score indicating a greater level of knowledge. Also, the cumulative knowledge score was categorized as follows:

- Good: $\geq 75\%$ - 100% of total score (30 – 39 score).
- Fair: 50% - <75% of total score (20 – 29 score).
- Poor: <50% of total score (0 – 19 score).

Tool III: Women's attitude questionnaire: It was designed by researchers after reviewing a related literature (*Nivedita and Shanthini, 2016*), (*Mida et al., 2021*), (*Mahmoud et al., 2022*) and (*Harrison et al., 2024*) also translated into the Arabic language. It was implemented to evaluate women's perspectives regarding preconception IFAS and NTDs. It consisted of a total 14 statements divided into two parts:

Part (1): Attitude toward iron supplementation: It contained "5 statements," including the following: (Regular CBC checkups and blood tests are essential prior to pregnancy, a special diet is necessary even before pregnancy, iron tablets are beneficial for both the mother and the fetus, women who are planning to become pregnant should consume iron tablets despite a healthy diet, and complications caused by iron supplements can be prevented by adhering to the doctor's instructions).

Part (2): Attitude toward folic acid supplementation and neural tube defects (NTDs): It contained "9 statements," which included the following: (eating foods rich in FA can create a generally healthy person, FA supplements are inexpensive, it is simple to get the recommended amount of FA, eating a diet rich in FA would be inexpensive,) Even when I am not pregnant, I have the ability to mitigate or prevent the occurrence of embryonic neural tube defects. If I do not have a family history of neural tube defects, I am not at risk of having an infant with a neural tube defect. Neural tube defects are a severe and preventable condition that can result in lifelong disabilities and even mortality. Having a baby with a birth defect would have a detrimental impact on my social, familial, and professional life.

Scoring system:

A three-point Likert scale continuum was employed to evaluate each statement. Each statement was assigned a score of two if it was "agree," one if it was "uncertain," and zero if it was "disagree." The statement-by-statement scores were combined to determine the cumulative attitudes score. An optimistic outlook was indicated by higher scores on a

scale of 0 to 28, which was used to assess the attitudes of women. **Total attitudes score was categorized into:**

- Positive attitude: $\geq 60\%$ -100% of total score (17–28 score).
- Negative attitude: $< 60\%$ of total score (0–16 score).

Tool IV: Women's adherence assessment sheet: After conducting a review of pertinent literature, researchers developed it to assess the extent to which women adhere to their IFAS intake. It consisted of two parts:

Part (1): Adherence to the IFAS intake assessment sheet: The aim of this investigation was to assess the extent to which the physician adhered to the prescribed dosage of IFAS during the three-month intervention period. Based on the premise that one tablet of IFAS is consumed daily beginning with the removal of the last contraceptive device or after spontaneous abortion, the women were expected to consume ninety IFAS pills (*Sendeku et al., 2020*) (*WHO, 2022*).

Scoring system:

The participants were distributed into two categories according to their compliance with the IFAS intake, as indicated below:

- **Adherent:** By taking at least 72 IFAS pills, or at least 80% of the complete dosage during the prescribed time.
- **Not adherent:** If they were unable to consume at least 72 IFAS tablets or at least 80% of the total ingestion during the specified period.

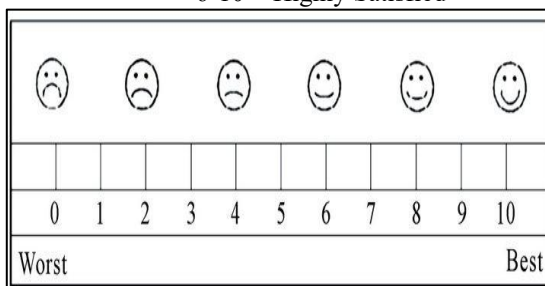
Part (2): Hemoglobin level assessment sheet: It was implemented to evaluate the hemoglobin concentration of women during their initial appointment and three months later. The degree of anemia was estimated according to the cut off point of the (*WHO, 2018*), it is divided into three degrees concerning Hb level:

- **Normal level** (>10.9 g/dl)
- **Mild anemia** (9.0– 10.9 g/dl)
- **Moderate anemia** (7.0-8.9 g/dl)
- **Severe degree anemia** (<7.0 g/dl)

Tool V: Barriers for adherence to the IFAS intake: It was created by researchers after conducting a thorough examination of relevant literature (*Silubonde et al., 2022*), (*Sanghvi et al., 2023*) and (*Jhaveri et al., 2023*) and used to assess obstacles that act as a barrier for adherence to the IFAS intake. It comprised 11 items, including the absence of a comprehensive preconception care program, inadequate training of caregivers in risk assessment and health promotion skills, lack of knowledge about the importance of pre-pregnancy IFAS, lack of cultural background about preconception care, fault family beliefs (husband and/or mother-in-law) about pre-pregnancy supplements, lack of resources and financial ability to obtain iron and FA, lack of health insurance that provides iron and FA, the crisis of the unavailability of medicines, including nutritional supplements, in many pharmacies, constant forgetting to take iron and FA daily and the need to be reminded by a family member or friend, supplements have a bad taste which discourages me from using them, supplements have many side effect as including nausea, vomiting constipation, dark colour of the stool).

Tool VI: Visual analog satisfaction scale (VAS): It was adopted from (*Singer and Thode 1998*). The VAS scale is a tool in which a score of 0 (zero) indicates that the subject was dissatisfied with the preconception picture-based education, while a score of 10 indicates that the subject was highly content. Women's satisfaction was categorized as following:

- 0= Unsatisfied
- 1-5 = Satisfied
- 6-10 = Highly Satisfied



Administrative approval:

A written formal approval was obtained from the dean of the faculty of nursing and then delivered to the director of Benha University hospitals to obtain the consent to conduct the study after explaining its purpose.

Tools validity and reliability:

A panel of three jury experts in the field of obstetrics and gynecological nursing at Benha University evaluated the validity of questionnaires to guarantee the precision, relevance, comprehensiveness, and applicability of the tools. Some items necessitated minor modifications, such as their inclusion, exclusion, or reformulation. The tools were deemed legitimate by the experts.

Tools reliability:

The instruments' reliability was evaluated using the Cronbach's Alpha coefficient test, which revealed that each exhibited the following internal consistency:

| Tool | Cronbach's alpha value |
|---|-------------------------------|
| Tool II: Women' knowledge questionnaire. | ($\alpha = 0.81$). |
| Tool III: Women' attitude questionnaire. | ($\alpha = 0.83$). |
| Tool IV: Women's adherence assessment sheet. | ($\alpha = 0.87$). |
| Tool V: Barriers for adherence to the IFAS intake. | ($\alpha = 0.92$). |
| Tool VI: Visual analog satisfaction scale (VAS). | ($\alpha = 0.96$). |

Ethical consideration:

Before initiating the investigation, the following ethical considerations were assessed: Approval for the study was obtained from the scientific research ethical committee of the nursing faculty at Benha University (research code: REC-OBSN-P66). An official permission from the designated study settings was obtained for the fulfillment of the study. The researchers elucidated the purpose and significance of the

study in order to instill confidence in women prior to implementing the tools. The researchers secured the oral consent of women to participate in the study, and confidentiality was guaranteed. The women were not exposed to any physical, social, or psychological hazards as a result of the study. After conducting a statistical analysis, all data collection tools were destroyed in order to maintain confidentiality. The research tools were free of any immoral statements and adhered to human rights. The women were permitted to discontinue their studies at any point.

Pilot study:

To evaluate the clarity, objectivity, feasibility, and applicability of the instruments, as well as to identify potential obstacles and issues that could impede data collection and impact the researcher, the pilot study was conducted on 10% of the total sample duration, which was three weeks and involved fifteen women. Additionally, the study was designed to identify any unique issues with the statements, such as the sequence and clarity of the questions. It also facilitated the estimation of the time required for data collection. In order to prevent contamination of the sample, the pilot sample was excluded from the study and modifications were implemented in accordance with the prototype results.

Field work:

The research was carried out from the beginning of September, 2024 and completed at the end of February 2025 covering six months. The study was conducted by the researchers at the aforementioned location on Mondays, Tuesdays, and Thursdays from 9:00 a.m. to 1:00 p.m. until the predetermined duration was reached. The researchers interviewed the women in small groups or individually; on average, 2-4 women were interviewed per day. The brochure (handout) was left in the research location at the conclusion of this study to be distributed to all women, thereby ensuring that the benefit is disseminated.

Preparation, interviewing, assessment, and analysis comprised the four phases of the present investigation. phase of implementation,

and phase of evaluation. These phases were started in waiting room and completed on obstetric and gynecological examination table at the outpatient clinics, to preserve women's privacy and maintain their confidentiality.

Preparatory phase:

During the preparatory phase, the researchers conducted a comprehensive review of the relevant literature on the research problem, which is the initial phase of the research, both domestically and internationally. This facilitated the researchers' preparation of the necessary data collection tools and provided them with a better understanding of the magnitude and gravity of the research topic. The tools were disseminated to three experts in the field of obstetrics and gynecological nursing at the Benha University faculty, and the jury results were determined afterwards.

In this research, the researchers established a WhatsApp group to facilitate the regular addition of women to the study group. As well as, the brochure that the researchers prepared for the study group contained essential messages that were conveyed through images, text, and brief videos. In order to ensure that the women could understand the information and to accommodate their dearth of knowledge, the brochure was specifically designed in a straightforward Arabic language.

Interviewing and assessment phase:

In the waiting area of outpatient clinics or gynecological wards, the researchers extended a warm welcome to the women and introduced themselves to each woman who participated in the study. Explicated the objective of the investigation, ensured their adherence to interventions, and obtained oral consent to participate in the investigation at the commencement of the interview.

Firstly, (*Tool: I*) was disseminated to the women in order to assess their socio-demographic data and obstetric history. Five minutes was the average time required to complete the questionnaire. Then, the researchers distributed (*Tool: II*) to evaluate women's comprehension of neural tube defects,

IFAS, and preconception care, the average duration required to complete this questionnaire was 10 minutes. Furthermore, (*Tool: III*) was also distributed to assess women's attitude regarding preconception care IFAS and neural tube defects, the average duration required to complete this questionnaire was 5 minutes. But, (*Tool: IV*) was used three months after intervention to assess women's adherence to the IFAS intake and (*Tool: V*) was used after intervention to assess women's barriers for adherence to the IFAS intake and finally, (*Tool: VI*) was used to for women in study group to assess their satisfaction toward the preconception picture-based education.

At the end of assessment phase, the researcher distributed the designed brochure only to the women of study group contained comprehensive knowledge about the research topic. Moreover, the prepared key messages based on pictures or images, texts and short videos was showed to them on laptop screen.

Implementation phase

For study group:

– *In waiting area and immediately after assessment*, the researchers provided two consecutive sessions with a ten-minute break in between, each session lasting about half an hour on basis of picture-based nutrition education:

– preconception care, importance, barriers, most important preconception supplementations and healthy diet before pregnancy

• *First session:* was concerned with preconception supplementation and a healthy diet, which included warnings about the adverse effects of NTDs, risk factors for anemia and NTDs, lifestyle, dietary patterns, and IFAS guidelines. Information on the following subjects is contained in the IFAS guide: the optimal dosage, the optimal timing, the most effective absorption methods, the potential adverse effects of the IFAS, and substances that are high in iron and FA.

• *Second sessions:* was about the significance of adhering to the IFAS intake and preconception care. As well as, barriers for adherence and how to overcome these barriers. the researchers

– The women were afforded the opportunity to engage in a discussion regarding the educational content and to address any misunderstandings following the completion of the education sessions. Subsequently, participants were provided with educational brochures that were accompanied by take-home messages and illustrated to facilitate their comprehension of the material they had acquired.

– During this session, For the duration of the investigation. In addition, the control groups and all participants were administered the IFAS (thirty iron capsules containing 60 mg of ferrous sulfate and 0.5 mg of FA) on a monthly basis, as confirmed by the researchers, which is three months, whether at the women's own expense due to their financial ability or through health units or government medical centers in their residential areas or by informing them of their rights to health insurance for female employees or providing supplements for non-employees through the university's charitable pharmacy or charitable organizations that help them obtain supplements.

– *Duration of the intervention:* For a duration of three months, the study group was provided with health education and counseling that was based on visual aids. During this time, the women in the study group were reminded to take their IFAS by sending picture-based educational messages via the WhatsApp group. The important messages encompassed communications such as:

📖 Consume a variety of foods.

📖 Please consume one IFAS tablet daily for a minimum of 90 days.

📖 If you have any concerns regarding IFA tablets, please contact your healthcare provider.

📖 Reach and maintain a healthy weight.

📖 Before and during pregnancy, it is recommended that you visit a health facility.

📖 Check your health frequently.

📖 Avoid toxic substances and environmental contaminants.

📖 Avoid living in a stressful or abusive environment.

📖 Avoid working with or living around toxic substances.

📖 Learn your and your partner's family history.

– Women's in both study and control groups were provided with given a chart to

record the days they took the supplement pills in order to calculate their adherence to taking them as recommended by the doctor during clinic visits in every month.

– During clinic visits in every month, there was an interactive and awareness meeting with women and their partners and discussion on the issues. Assisting women with any concerns that may arise, reducing attrition rates, and increasing the involvement of partners in reproductive health were also critical outcomes of these meetings.

For control group: The control group was advised by the researchers to visit the healthcare facility on a monthly basis for any clarifications and to take IFAS, as preconception services are not available to women who intend to become pregnant. The researchers did not intervene in any conditions with the control group; only the IFAS count was conducted. The control group received comparable nutrition information subsequent to the conclusion of the investigation.

Evaluation phase:

For study group: the efficacy of preconception picture-based education in enhancing knowledge and attitude was assessed one month after the intervention, utilizing the same knowledge and attitude questionnaire format (**Tool: II and III**) which were used during the assessment phase. Three-month after implementation of preconception picture-based education, adherence with the preconception IFAS, hemoglobin level (**Tool: IV**), barriers for preconception IFAS adherence (**Tool: V**) and satisfaction with the preconception picture-based education (**Tool: VI**) was evaluated. **For control group:** the women were assessed in the same manner in the study group except for their satisfaction.

Statistical analysis:

Before the data was entered into the computer system, it was verified. To organize, classify, computerize, and analyze the data collected, appropriate statistical methods and tests were employed. There was an update to version 22.0 of the Statistical Package for Social Sciences (SPSS). Frequencies, Means, standard deviations, and percentages comprised

descriptive statistics. The research hypotheses were assessed using inferential statistics, including the independent t-test and Chi square test. A p-value of ≤ 0.05 was indicative of statistical significance, while a p-value of > 0.05 did not indicate the existence of a statistically significant difference. A highly statistically significant difference was indicated by a p-value of $P \leq 0.001$.

Results:

Table (1): Clarifies that more than two-thirds and more than half (68.7% & 56.5%) of both control and study groups respectively were in the age group (25 – <35 years) with a mean age of 28.91 ± 5.19 and 29.38 ± 5.90 years old respectively. Concerning residence, less than two-thirds and less than three-quarters (65.2% & 70.4%) The rural area was the residence of both the control and study groups. It was demonstrated that the control and study groups contained over half (53.0%) and less than two-thirds (60.9%) of individuals with secondary education, respectively. Housewives comprised over two-thirds and over three-quarters of the control and study groups, respectively, according to their occupations (69.6% and 76.5%). Therefore, The socio-demographic data of the control and study groups did not exhibit a statistically significant difference ($p > 0.05$), suggesting that the groups were homogeneous.

Table (2): Describes that the control and study groups were multigravida in 73.3% and 75.6% of the cases, respectively. As well as, less than two-thirds and more than two-thirds (61.7% & 68.7%) were multipara respectively. According to family history of NTDs, the minority (0.9%) of control group and none of (0.0%) study group had NTDs case. Therefore, No statistically significant difference was observed in the obstetric histories of the control and study groups ($p > 0.05$), indicating that the groups were homogeneous.

Figure (1): Indicates that the control and study groups collectively comprise the majority of the sample (60.9% and 65.2%), (43.5% and 38.3%), and (34.8% and 30.4%), respectively, obtained their information from relatives or acquaintances, the internet, and doctors or nurses.

Table (3): This suggests that there was no statistically significant difference in the total mean score of knowledge between the two groups during the pre-intervention phase ($P > 0.05$). Nevertheless, at one month post-intervention, the study group's total mean score was markedly higher than that of the control group ($P < 0.001$).

Figure (2): Demonstrates that the control and study groups, respectively, had an adequate understanding of preconception IFAS at the pre-intervention phase, with over one-third and approximately two-fifths (49.6% and 47.8%) each. However, Less than one-quarter and more than three-quarters of the control and study groups, respectively, displayed adequate knowledge one month after the intervention.

Table (4): indicates that there was no statistically significant difference in the total mean score of attitude between the two groups during the pre-intervention phase ($P > 0.05$). Nevertheless, the cumulative mean score of the study group was substantially higher than that of the control group one month post-intervention ($P < 0.001$).

Figure (3): Presents evidence that the control and study groups, respectively, maintained a favorable perspective on preconception IFAS during the pre-intervention phase, with over one-third and approximately two-fifths (37.4% and 40.9%). However, One month following the intervention, the control group exhibited a positive attitude, while the study group exhibited a positive attitude. Specifically, over one-third (39.1%) and less than three-quarters (73.9%) of the respective groups exhibited a positive attitude.

Table (3): shows that the cumulative mean score of adherence with the preconception IFAS of women's three months post-intervention was the study group was significantly higher than the mean score of women in the control group ($P < 0.001$).

Figure (4): Illustrates that; three-months post-intervention, the minority (7.8%) of women in control group were adherent with preconception IFAS versus and the majority (80.0%) of women in study group

Table (4): This suggests that there was no statistically significant difference in the total mean score of hemoglobin level between the two groups during the pre-intervention phase ($P > 0.05$). Nevertheless, the study group exhibited a significantly higher overall mean hemoglobin level score than the control group after three months of the intervention ($P < 0.001$).

Table (6): shows that, In terms of adherence to preconception IFAS, A highly statistically significant difference was observed between the control and study groups, with the exception of the item "Lack of health insurance that provides iron and FA." in which neither the control nor the experimental groups differed from one another statistically.

Figure (5): Illustrates that; after implementation of preconception picture-based education, The intervention was highly satisfactory for more than two-thirds of the women in the study cohort (68.7%).

Table (8): clarifies that; During the pre- and post-intervention phases, there was a highly statistically significant positive correlation between the total knowledge score and the total (attitude and adherence) scores for both groups ($P \leq 0.001$).

Table (9): clarifies that; In both groups, a highly statistically significant positive correlation ($P \leq 0.001$) was observed between the total attitude scores and the total adherence scores during the pre- and post-intervention period.

Table (1) Distribution of the studied women in both groups according to their Socio-demographic data (n=230).

| Socio-demographic data | Control group n=115 | | Study group n=115 | | X ² /FET | P value |
|----------------------------|------------------------|------|----------------------|------|---------------------|------------|
| | No | % | No | % | | |
| Age: | | | | | | |
| 18- <25 | 21 | 18.3 | 31 | 27.0 | 3.75 | 0.153 |
| 25 – <35 | 79 | 68.7 | 65 | 56.5 | | |
| 35-45 | 15 | 13.0 | 19 | 16.5 | | |
| Mean ± SD = | 28.91±5.19 | | 29.38±5.90 | | - | - |
| Residence: | | | | | | |
| Rural | 75 | 65.2 | 81 | 70.4 | 1.44 | 0.230 |
| Urban | 40 | 34.8 | 34 | 29.6 | | |
| Level of education: | | | | | | |
| Primary education | 3 | 2.6 | 5 | 4.3 | 2.44 | 0.294 |
| Secondary education | 61 | 53.0 | 70 | 60.9 | | |
| University education | 51 | 44.4 | 40 | 34.8 | | |
| Occupation: | | | | | | |
| Housewife | 80 | 69.6 | 88 | 76.5 | 1.41 | 0.235 |
| Working | 35 | 30.4 | 27 | 23.5 | | |
| Monthly income: | | | | | | |
| Sufficient | 37 | 32.2 | 30 | 26.1 | 1.03 | 0.310 |
| Insufficient | 78 | 67.8 | 85 | 73.9 | | |

*A Statistical significant $p \leq 0.05$

**A Highly Statistical significant $p \leq 0.001$

Table (2): Distribution of the studied women in both groups regarding their obstetric history (n=230).

| Obstetric history | Control group n=115 | | Study group n=115 | | X2 | P value |
|--------------------------------|------------------------|------|----------------------|-------|------|------------|
| | No | % | No | % | | |
| Gravida: | | | | | | |
| Primigravida | 25 | 21.7 | 19 | 16.5 | 1.01 | 0.314 |
| Multigravida | 90 | 78.3 | 96 | 83.5 | | |
| Parity: | | | | | | |
| Nulliparous | 24 | 20.9 | 18 | 15.7 | 1.38 | 0.499 |
| Primipara | 20 | 17.4 | 18 | 15.6 | | |
| Multipara | 71 | 61.7 | 79 | 68.7 | | |
| Family history of NTDs: | | | | | | |
| Yes | 1 | 0.9 | 0 | 0.0 | 1.00 | 0.316 |
| No | 114 | 99.1 | 115 | 100.0 | | |

*A Statistical significant $p \leq 0.05$

**A Highly Statistical significant $p \leq 0.001$

*The results aren't mutually exclusive

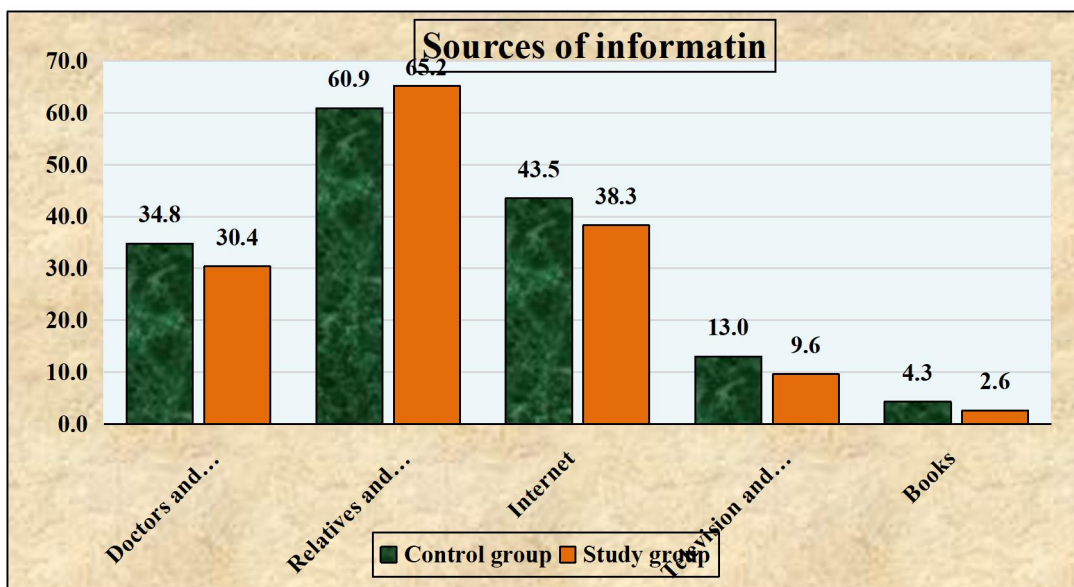


Figure (1): Distribution of studied women according to their source of information regarding preconception iron-folic acid supplements in both groups before intervention (n.=230).

Table (3): Mean score of knowledge regarding preconception iron-folic acid supplements (IFAS) in both groups at pre and one-month post-intervention phases (n=230).

| Knowledge parts | Possible score | Control group n=115 | Study group n=115 | Independent t-test | P- value |
|---|----------------|------------------------|----------------------|--------------------|----------|
| | | Mean ± SD | Mean ± SD | | |
| Knowledge regarding preconception care | | | | | |
| Pre-intervention | 0-5 | 1.91±0.94 | 1.88±0.93 | 0.281 | 0.779 |
| One-month post-intervention | | 2.00±0.93 | 3.90±0.93 | 15.39 | 0.000** |
| Knowledge regarding iron supplements | | | | | |
| Pre-intervention | 0-15 | 9.23±2.33 | 9.27±2.29 | 0.114 | 0.909 |
| One-month post-intervention | | 9.56±2.27 | 13.08±1.61 | 13.52 | 0.000** |
| Knowledge regarding folic acid supplements | | | | | |
| Pre-intervention | 0-15 | 8.01±2.36 | 7.59±2.44 | 1.31 | 0.189 |
| One-month post-intervention | | 8.31±2.53 | 12.83±1.93 | 15.16 | 0.000** |
| Knowledge regarding neural tube defects | | | | | |
| Pre-intervention | 0-4 | 1.03±0.86 | 0.92±0.93 | 0.949 | 0.344 |
| One-month post-intervention | | 1.12±0.90 | 3.49±0.73 | 21.89 | 0.000** |
| Total score | | | | | |
| Pre-intervention | 0-39 | 20.19±3.57 | 19.66±3.94 | 1.06 | 0.287 |
| One-month post-intervention | | 20.99±3.88 | 33.28±2.799 | 27.53 | 0.000** |

*A Statistical significant $p \leq 0.05$

**A Highly Statistical significant $p \leq 0.001$

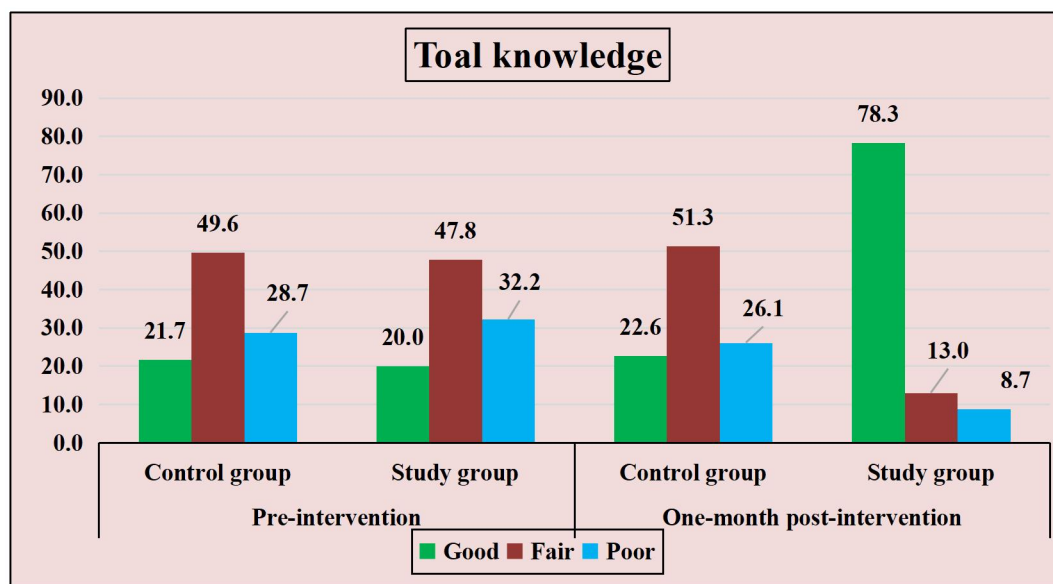


Figure (2): Total mean score of knowledge regarding preconception iron-folic acid supplements (IFAS) in both groups at pre and one-month post-intervention phases (n=230).

Table (4): Mean score of attitude regarding preconception iron-folic acid supplements (IFAS) in both groups at pre and one-month post-intervention phases (n=230).

| Attitude parts | Possible score | Control group n=115 | Study group n=115 | Independent t-test | P- value |
|---|----------------|------------------------|----------------------|--------------------|----------------|
| | | Mean ± SD | Mean ± SD | | |
| Attitude regarding iron supplements | | | | | |
| Pre-intervention | 0-10 | 4.13±1.75 | 4.10±1.78 | 0.149 | 0.882 |
| One-month post-intervention | | 4.20±1.72 | 8.73±1.32 | 22.34 | 0.000** |
| Attitude regarding FA supplements and NTDs | | | | | |
| Pre-intervention | 0-18 | 7.83±3.79 | 7.62±3.78 | 0.481 | 0.677 |
| One-month post-intervention | | 8.15±3.93 | 15.32±2.53 | 16.42 | 0.000** |
| Total score | | | | | |
| Pre-intervention | 0-28 | 11.95±4.27 | 11.71±4.03 | 0.444 | 0.657 |
| One-month post-intervention | | 12.34±4.39 | 24.05±2.87 | 23.87 | 0.000** |

*A Statistical significant $p \leq 0.05$

**A Highly Statistical significant $p \leq 0.001$

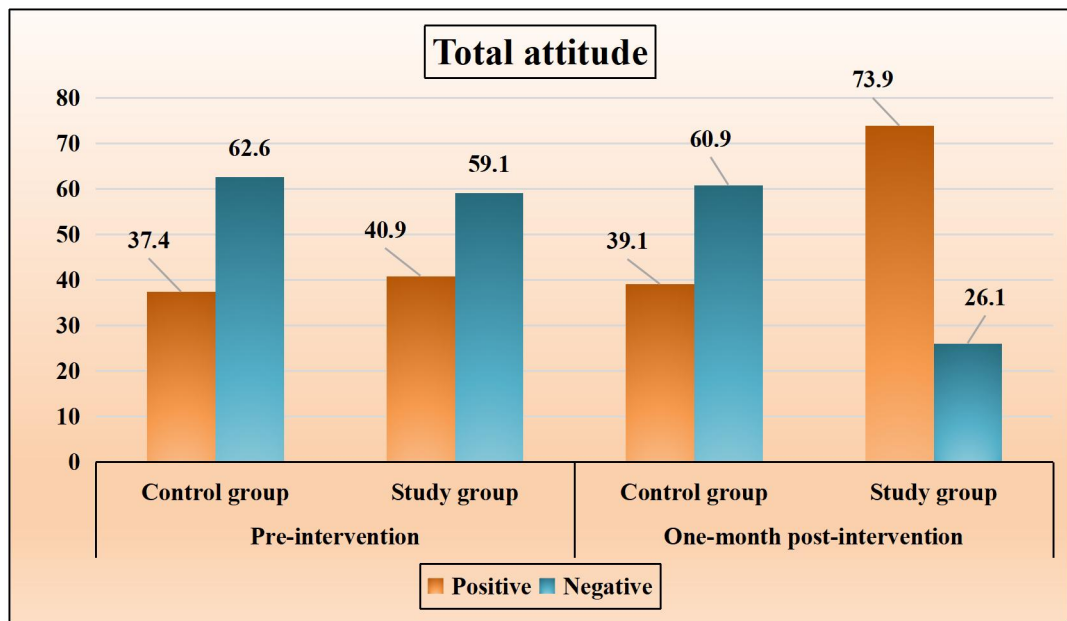


Figure (3): Distribution of studied women in both groups regarding their total attitude about preconception iron-folic acid supplements (IFAS) at pre and one-month post-intervention phases (n=230).

Table (5): A comparison between women's mean scores of adherence with the preconception iron-folic acid supplements (IFAS) in both groups three-month post-intervention (n=230).

| Adherence to the preconception (IFAS) | Possible score | Control group n=115 | Study group n=115 | Independent t-test | P- value |
|---------------------------------------|----------------|------------------------|----------------------|--------------------|----------|
| | | Mean ± SD | Mean ± SD | | |
| Three-month post-intervention | 0-90 | 26.04±18.22 | 72.27±14.93 | 21.03 | 0.000** |

*A Statistical significant $p \leq 0.05$

**A Highly Statistical significant $p \leq 0.001$

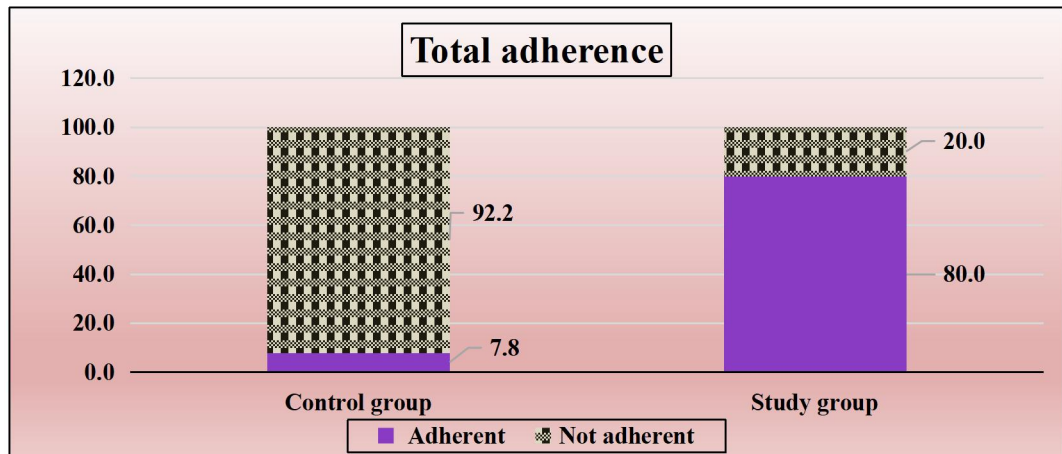


Figure (4): Distribution of studied women in both groups regarding total adherence with preconception iron-folic acid supplements (IFAS) in both groups three-month post-intervention (n=230).

Table (6): A comparison between women's mean scores of Hemoglobin level in both groups at pre-intervention (Baseline) and three-month post-intervention phase (Endline) (n=230).

| Hemoglobin level | Control group n=115 | Study group n=115 | Independent t-test | P- value |
|---|------------------------|----------------------|--------------------|----------|
| | Mean ± SD | Mean ± SD | | |
| Pre-intervention (Baseline) | 9.70±1.31 | 9.94±1.36 | 1.34 | 0.181 |
| Three-month post-intervention (Endline) | 9.64±1.31 | 11.05±1.05 | 8.95 | 0.000** |

*A Statistical significant $p \leq 0.05$

**A Highly Statistical significant $p \leq 0.001$

Table (7): Distribution of the studied women regarding their barriers for preconception iron-folic acid supplements adherence (IFAS) in both groups after intervention (n=230). 54

| Barriers for preconception (IFAS) adherence | Control group n=115 | | Study group n=115 | | X2 | P-value |
|---|------------------------|-------|----------------------|------|---------------|----------------|
| | Yes | | Yes | | | |
| | No | % | No | % | | |
| Lack of a comprehensive preconception care program. | 100 | 87.0 | 25 | 21.7 | 98.57 | 0.000** |
| Inadequate training of caregivers in risk assessment and health promotion skills. | 94 | 81.7 | 18 | 15.7 | 100.52 | 0.000** |
| Lack of knowledge about the importance of pre-pregnancy iron and folic acid supplements. | 97 | 84.3 | 12 | 10.4 | 125.99 | 0.000** |
| Lack of cultural background about preconception care. | 115 | 100.0 | 64 | 55.7 | 65.53 | 0.000** |
| Fault family beliefs (husband and/or mother-in-law) about pre-pregnancy supplements. | 115 | 100.0 | 72 | 62.6 | 52.88 | 0.000** |
| Lack of resources and financial ability to obtain iron and FA | 93 | 80.9 | 71 | 61.7 | 10.28 | 0.001** |
| Lack of health insurance that provides iron and FA | 87 | 75.7 | 90 | 78.3 | 0.221 | 0.639 |
| The crisis of the unavailability of medicines, including nutritional supplements, in many pharmacies. | 99 | 86.1 | 31 | 27.0 | 81.80 | 0.000** |
| Constant forgetting to take iron and FA daily and the need to be reminded by a family member or friend. | 83 | 72.2 | 10 | 8.7 | 96.19 | 0.000** |
| Supplements have a bad taste which discourages me from using them. | 65 | 56.5 | 37 | 32.2 | 13.81 | 0.000** |
| Supplements have many side effects as including nausea, vomiting constipation, dark color of the stool. | 101 | 87.8 | 25 | 21.7 | 101.38 | 0.000** |

*A Statistical significant $p \leq 0.05$

**A Highly Statistical significant $p \leq 0.001$

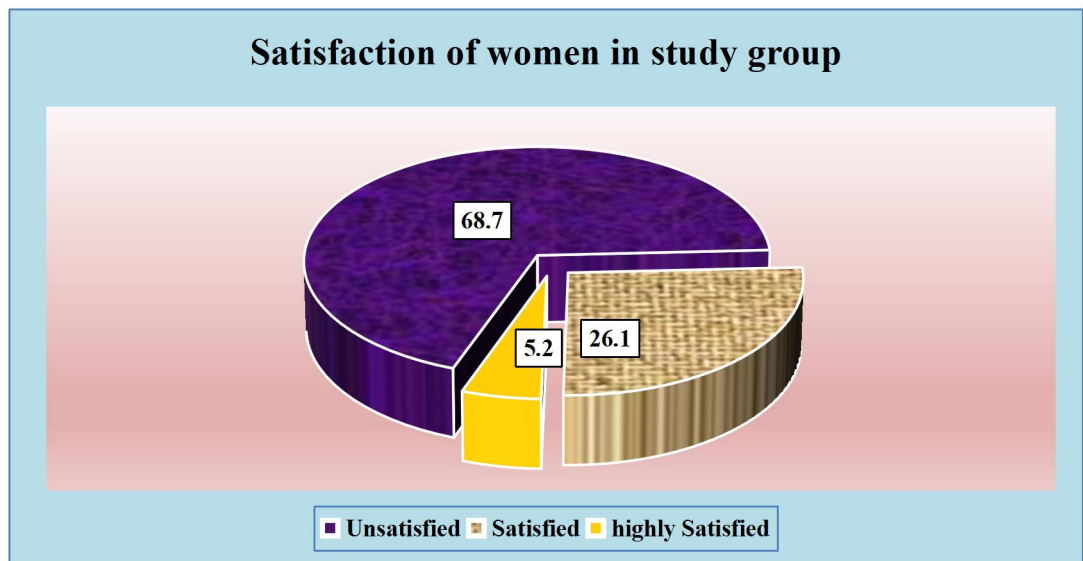


Figure (5): Distribution of studied women in study group regarding their total satisfaction with the preconception picture-based education after intervention (n=115).

Table (8): Correlation between total knowledge score and total scores of (attitude and adherence) at pre and post-intervention phases (n=230).

| Variables | Total knowledge | | | | | | | |
|------------------------|---------------------|---------|-------------------|---------|-------------------|---------|-------------------|---------|
| | Control group n=115 | | | | Study group n=115 | | | |
| | Pre-intervention | | Post-intervention | | Pre-intervention | | Post-intervention | |
| | r | P-value | r | P-value | r | P-value | r | P-value |
| Total attitude | 0.569 | 0.000** | 0.664 | 0.000** | 0.458 | 0.000** | 0.632 | 0.000** |
| Total adherence | 0.610 | 0.000** | 0.698 | 0.000** | 0.557 | 0.000** | 0.722 | 0.000** |

**A Highly Statistical significant $p \leq 0.001$

Table (9): Correlation between total attitude and total adherence scores at pre and post-intervention phases (n=230).

| Variables | Total attitude | | | | | | | |
|------------------------|---------------------|---------|-------------------|---------|-------------------|---------|-------------------|---------|
| | Control group n=115 | | | | Study group n=115 | | | |
| | Pre-intervention | | Post-intervention | | Pre-intervention | | Post-intervention | |
| | r | P-value | r | P-value | r | P-value | r | P-value |
| Total adherence | 0.524 | 0.000** | 0.733 | 0.000** | 0.487 | 0.000** | 0.647 | 0.000** |

**A Highly Statistical significant $p \leq 0.001$

Discussion

An opportunity to discuss the benefits of preconception, improve physical health and disease activity, and counsel women about the hazards of pregnancy. Preconception care is the source of IFAS. Picture-based education can help women gain more awareness about IFAS, modify their attitudes, and become more adherences to IFAS, which reflect on better maternal and neonatal outcomes (*Abdikarim, et al., (2025)*).

The objective of this study was to examine the influence of a preconception picture-based educational program on the awareness and adherence to IFAS among women who are planning to become expectant.

Additionally, based on the most recent research findings, the control and study groups

were primarily composed of individuals between the ages of 25 and 35, with a mean age of 28.91 ± 5.19 and 29.38 ± 5.90 years, respectively, in terms of personnel attributes. Less than two-thirds and less than three-quarters of the control and study groups, respectively, resided in rural areas. When it comes to the standard of education, it was illustrated that more than half and less than two-thirds of both control and study groups respectively had secondary education. Housewives comprised over two-thirds and over three-quarters of both the control and study groups, respectively, according to their occupations. Therefore, In terms of socio-demographic data that reflected group homogeneity, However, there was no statistically significant difference between the control and study groups. So, women's lack of knowledge and negative attitude regarding preconception IFAS could be contributed by the average level of education and rural residence of the women under investigation.

The most recent findings of the study were consistent with *Hassan, et al., (2024)*, who evidenced that there were no statistically significant differences between the control group and the study group in terms of personnel data. The study group's mean age was 30.96 ± 5.367 , while the control group was 29.22 ± 5.91 . Women lived in rural areas at a rate of two thirds and less than two thirds respectively. In terms of education, The study and control categories are correspondingly composed of less than two-thirds and less than half of secondary school graduates. Conversely with current study, less than half of women in the study and control groups are workers. Increasingly, current study results were nearly similar to *Abd-Elfatah, et al., (2023)* who demonstrated that the majority of the women under investigation were between the ages of 25 and 34, with a mean \pm SD of 38.25 ± 6.89 . Additionally, over half of the women resided in rural areas. Pointed to qualifications, it was illustrated that one third and one quarter of them had a secondary and university or higher certificate respectively. Regarding working status, more than two thirds of them were housewives. This reflected studies homogeneity as both studies were carried out in Egypt that reflected same sociodemographic characteristics.

Concerning obstetrics history, based on the current research findings, Control and study groups were multigravida in proportions of less than three-quarters and more than three-quarters, respectively. As well as, less than two-thirds and more than two-thirds of them were multipara respectively. According to family history of NTDs, NTDs were diagnosed in a limited number of individuals in the control group and none in the study group. Therefore, The lack of a statistically significant difference in obstetric history between the control and study groups indicated that the groups were homogeneous.

These results were in accordance with *Zhou, et al., (2024)* who demonstrated that the intervention and control groups were over half and less than three-quarters, respectively, were multigravida, less than three fifths and two-thirds of them respectively were multipara. According to family history of NTDs, there was no history of NTD in the control group and study group. Therefore, there was no statistically

significant difference between the control and intervention groups in terms of obstetric data. Moreover, the findings of this investigation were uniform. with *Mekonnen, et al., (2021)*, that the study group and control group had a plurality of women and over three-quarters of women, respectively, were pregnant for a second or third time, and more than two-thirds and less than two-thirds, respectively, were multipara. Additionally, only 0.5% of the intervention group and no family history of NTD cases among the control group.

Concerning the source of information of studied women, current research results displayed that (three-fifths & two-thirds), (more than two-fifths & less than two-fifths), and (more than a third & less than a third) of both control and study groups, respectively, obtained their information regarding the benefits of pre-conception iron-folic acid supplements from relatives or friends, the internet, and doctors or nurses, respectively. These outcomes were comparable to *Hassan, et al., (2024)* who disclosed that the study group and the control group relied on friends and family as their primary sources of information, with less than two-thirds and less than three-fifths, respectively, followed by internet and social media (less than fifth and fifth) respectively, information from medical staff (less than quarter and quarters) respectively. Since both studies were conducted in Egypt, which could be explained from the researchers' perspective, as Egyptians relied on previous experiences with family members, friends, and social media to obtain information rather than from medical personnel.

As regards knowledge of studied women regarding preconception IFAS, In the pre-intervention phase, Based on the results of the current investigation, Statistically, there was no significant difference in the total mean score of knowledge between the two groups ($P > 0.05$). However, One month post-intervention, the cumulative mean score of the study group was significantly higher than that of the control group ($P < 0.001$). Increasingly, the current research results suggest that a significant proportion of the control and study groups, specifically over one-third and approximately two-fifths, possessed a sufficient understanding of preconception IFAS, respectively, during the

pre-intervention phase. However, one month following the intervention, the control and study groups possessed less than one-quarter and more than three-quarters of the necessary knowledge, respectively. Women's better knowledge can be attributed to great communication during educational sessions with researchers, who provided information about AFAS using picture-based education.

These findings have been fortified and improved by *Saragih et al., (2022)*, determined that there was no statistically significant difference in the quantity of information regarding folic acid supplementation between the control and intervention groups of women prior to the intervention, Two months following the intervention, The intervention group demonstrated a highly statistically significant difference from the control group in terms of their high level of knowledge. Which reflected the fact that providing information for women regarding IFAS results in better knowledge as they give more attention, and opportunity for clarification during provided sessions. This can be explained as educational program significantly improved the knowledge scores of premarital females regarding neural tube defects, iron and FA intake, and preconception care.

The aforementioned discoveries were consistent with *Mohammed, et al., (2022)* which suggested that the comprehensive knowledge between the pre-test and post-test is highly statistically significant. however, one month after intervention less than a third, and less than half of studied women had average and good knowledge respectively. The initial study hypothesis was that women who participate in a preconception picture-based educational program will exhibit superior knowledge in comparison to those who do not, was corroborated by the aforementioned results.

Increasingly, the findings of the present investigation are corroborated by *Cui, et al., (2022)* The research demonstrated that at the pre-intervention, over seventy-five percent of women in the intervention group and over two-thirds of women in the control group possessed an adequate understanding of folic acid supplementation and the prevention of neural tube defects. However, there was no statistically

significant difference between the two categories. With a highly statistically significant difference between the two groups, the intervention group demonstrated a significantly higher level of knowledge than the control group three months after the intervention.

The reason for this outcome could be attributed to the favorable influence of picture-based education and its efficiently structured sessions. The material included in the program was viewed as crucial and specific to the women being studied, thus leading to high levels of engagement and contentment among them during the educational sessions. Moreover, in order to enhance their awareness, the women were provided with an instructional brochure to follow.

Regarding the women's attitude, as per the most recent research findings, During the pre-intervention phase, Between the two groups, there was no statistically significant difference in the total mean score of attitude ($P > 0.05$). However, one-month post-intervention, mean score of the experimental group was significantly higher than that of the control group ($P < 0.001$). According to the researchers, this is because a rise in attitude level is a direct result of a rise in knowledge level. Additionally, this implies that the instructional sessions' effectiveness and their beneficial impact were demonstrated by the fact that the women in the study were capable of altering their negative attitudes when they possessed an adequate level of knowledge.

The present findings are consistent with the research conducted by *Ramachandran, et al., (2023)* who demonstrated that there was no statistically significant difference in the attitude of women toward IFAS and nutritional management between the intervention group and the comparison group at the baseline. However, At the finish line, the intervention group's attitude differed significantly from the comparison groups. Also, the current study result was consistent with *Reshid, and Anato, (2024)* who conducted a comparison of the maternal attitude toward IFAS between the baseline and end line of the examined women and discovered that the proportion of women who had a favorable attitude toward IFAS

increased across the study groups during the study period. The intervention group experienced a 25.8 percentage point increase (from 37.1% to 62.9%), while the control group experienced a 0-percentage point increase (from 42.7% to 42.7%). Positive attitudes regarding IFAS increased by 25.8 percentage points (25.8-0.0) as a result of the intervention.

Additionally, the present study found that a substantial portion of the control group and approximately half of the study group had a favorable impression of IFAS prior to conception during the pre-interventionary phase. Nevertheless, more than one-third of the control group and less than three-quarters of the research group exhibited favorable attitudes one month after the intervention, respectively. According to the researchers, this can be explained as providing picture-based educational sessions aimed at increasing study group women's awareness and encouraging a positive attitude toward preconception IFAS through a focus on its effect on reducing maternal and fetal complications, which reinforces women's desire to adopt a more positive attitude.

These results are corroborated by the investigation conducted by *Abdulmalek, (2021)* which demonstrated that a mere quarter of the women under investigation possessed a positive attitude prior to the intervention, while over two-thirds of the women under investigation exhibited a positive attitude promptly after the intervention. Additionally, the majority of the women exhibited a positive attitude two months after the intervention. The need of adjusting attitudes to become more adherents to offered care is being recognized by more and more women as their knowledge and positive attitude continue to improve.

The results listed above validated the second study hypothesis, which claimed that women who will receive a preconception picture-based educational program will exhibit a more positive attitude than those who will not receive it.

The most recent research findings regarding women's conformance with IFAS suggest that three months following the

intervention, the total mean score of adherence with the preconception IFAS of women's, Women in the experimental group exhibited a considerably higher mean score than those in the control group ($P < 0.001$). Additionally, only a small proportion of women in the control group continued to adhere to preconception IFAS three months after the intervention, in stark contrast to the majority of women in the research group.

The results of the current investigation were in accordance with *Tegodan et al., (2021)* who demonstrated that the majority of women were consistent in their use of the IFAS and consumed it for a minimum of five days in the previous week following the implementation of educational guidelines. Furthermore, current research findings are substantiated by *Mengistu et al., (2023)* who revealed that three-months following intervention, the cumulative mean score of adherence to the preconception IFAS among women in the intervention group was significantly higher than that of women in the comparison group ($P < 0.001$). Three months following the intervention, less than one-fifth of the women in the comparison group were adherent to preconception IFAS, whereas more than three-quarters of the women in the intervention group were.

Concerning Hemoglobin level, during the pre-intervention phase, the results of the current study indicated that the mean hemoglobin levels of the two groups were not significantly different ($P > 0.05$). However, three months following the intervention, the study group's total mean hemoglobin level score was substantially higher than that of the control group ($P < 0.001$). That could be explained by the fact that adherence to IFAS increases Hb levels, indicating a favorable effect of picture-based instructional programs.

All of these results lined up with *Bumrungpert, et al., (2022)* who demonstrated that the two groups did not exhibit any significant differences in their baseline hemoglobin levels. A statistically significant increase in Hb was observed in the test group ($p < 0.001$), when contrasted with the control group at the three- and six-month time points subsequent to IFAS. Increasingly, *Nassejje, & Were, (2024)* illustrated that the total mean

score of Hemoglobin level did not differ statistically significantly between the counseling group and the comparison group during the pre-intervention phase ($P > 0.05$). However, compared to the comparison group, the mean hemoglobin level score was significantly lower three months after counseling ($P < 0.001$). In contrast, the counseling group achieved a significantly higher score.

The third study hypothesis, which asserted that women who participate in a preconception picture-based educational program will demonstrate greater adherence to IFAS and an enhanced hemoglobin level, was corroborated by the aforementioned results.

In terms of the obstacles to the adherence to preconception IFAS, as per the most recent research findings, there was a highly statistically significant distinction between the control and study groups in terms of all barriers IFAS. However, with regard to the item "A lack of health insurance that covers iron and folic acid," There was no discernible distinction between the control and study groups. This is attributable to the fact that the preponderance of women in the current study is caregivers, and as a result, they are not enrolled in the health insurance system.

The results of the current investigation were in accordance with *Tefera, et al., (2023)* The individual who exhibited a statistically significant difference between groups 1 and 2 in terms of the challenges associated with adhering to iron supplement and FA regimens one month after the intervention commenced, and that this difference was even more pronounced three months later. The disappearance of many barriers of adherence achieved by this research is due to the good effect of the educational program based on pictures that was implemented.

Increasingly, *Abidah, & Sumarmi, (2024)* found that both the iron folic acid group and the multiple micronutrient group had significantly different levels of difficulty adhering to taking their multivitamins and IFAS supplements right after the intervention. However, two months later, the two groups exhibited a highly significant difference.

Moreover, the current research suggests that the intervention was met with high levels of satisfaction by over two-thirds of the women in the study group following the implementation of preconception picture-based teaching. These results were in accordance with *Rezaie, et al., (2021)*, who clarified that, after implementation of program, three quarters of women in counseling group were highly satisfied with program. Increasingly *Masoud, et al., (2023)* revealed that over seventy percent of participants were exceedingly content with the lifestyle intervention's implementation.

This may be due to the reality that preconception picture-based education programs were very effective, resulting in great satisfaction as women were given the opportunity to ask questions, more attention was given to each woman's individual needs, and WhatsApp notifications were provided to refresh provided information and alert women regarding the daily dose of IFAS, so study group women were satisfied with the provided care.

The results listed above supported the fourth study hypothesis, which claimed that women who will receive a preconception picture-based educational program will exhibit higher satisfaction with the given program than those who will not receive it.

The current results indicate a highly statistically significant positive correlation between the total scores (attitude and adherence) and the overall knowledge score at both the pre- and post-intervention stages ($P \leq 0.001$). That can be explained as understanding of the benefit of IFAS was highly linked to a positive attitude and adherence to IFAS. The better the knowledge, the better the attitude and commitment or adherence.

Results from this study were in agreement with *Bashir, et al., (2023)* through the PCC program, exhibited a statistically significant positive correlation ($r = 0.18$, $P < 0.001$) between the comprehensive knowledge score and the total (attitude and adherence) ratings of ANC. Moreover, the current research findings are substantiated by *Mahmoud, et al., (2023)* who specified that there was a statistically significant positive correlation

between the total knowledge score and the total (attitude and adherence) scores regarding FA supplementation following the implementation of the educational program ($P < 0.01$).

Furthermore, as per the most recent research, the total adherence and attitude scores of both groups are positively correlated during the pre- and post-intervention periods ($P \leq 0.001$). This reflected the fact that as women's attitudes improved, their adherence to prescribed supplements increased. As they became more conscious of the importance of a positive attitude on their pregnancy results, a positive attitude was reflected by increased awareness of how supplements affected their fetal and health outcomes.

In accordance with the results of the current investigation *Magdy, et al., (2023)* To whom was it explained that the overall knowledge and attitude scores of expectant women regarding FA intake were positively correlated ($p \leq 0.001$). A positive attitude develops as women's knowledge expands.

Conclusion:

According to the results of this investigation, it was determined that the implementation of preconception picture-based educational program had desirable effect in enhancing women's awareness (knowledge and attitude), exhibiting better adherence to IFAS with lower barriers, improving Hemoglobin level, and attaining high satisfaction; with a highly statistically significant difference between the research group and the control group at the post-intervention phases ($p < 0.001$). In both groups, Statistically significant positive associations were observed between the total knowledge score and the total (attitude and adherence) scores at both the pre- and post-intervention phases ($P \leq 0.001$). So, the research objective was achieved, and the hypotheses were accepted.

Recommendations:

- Disseminate a preconception picture-based educational program in all maternity hospitals in order to raise knowledge, attitude,

and the adherence of women who attend outpatient clinics to preconception iron-folic acid.

- Disseminating brochures and posters at obstetrics and gynecological outpatient clinics to enhance women's comprehension of the significance and optimal timing and duration of preconception folic acid consumption.

Further researches:

- Incorporating of PCC in curriculum of undergraduate nursing students may be beneficial in building their knowledge and attitude; not only as future nurses but also as future mother.

- Re-applicability of the research at maternal and child health centers for identifying the real obstacles or barriers and work to overcome them.

- Conduct the generalizability of the results was ensured by conducting the investigation on a large, representative probability sample.

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