Original Research Article

Status of Prenatal Nutrition Knowledge and Fertility awareness in Women Seeking Treatment in a Tertiary Care Fertility Centre at Index Visit- An opportunity for Education andIntervention

ABSTRACT

Aims: Aim of the study is to evaluate prenatal nutrition knowledge and fertility awareness among womenreferred to tertiary care fertility centre.

Study design: Cross-sectional study design was employed for carrying out study.

Place and duration of study: Krishna Institute of Medical Sciences (KIMS) Fertility Centre, Secunderabadwas selected for carrying out study between December 2023 to April 2024.

Methodology: A total of 100 womenwho were previously taking fertility treatment with gynaecologists and other fertility centres in the community and have transitioned to tertiary care at KIMS fertility centre were selected. A standardized questionnaire including demographics, menstrual history, fertility history, understanding of prenatal nutrition, and fertility awareness was used to gather data.

Results: Couples seeking fertility treatment for some time can expect the conception at any given time. We wanted to evaluate their readiness in terms of prenatal nutrition and also awareness regarding fertility facts.The majority of participants (48%) were found to be between the ages of 31 and 40, and 97% of them lived in Hyderabad. Most of them had jobs (51%) and were well educated (79%). Although 79% of respondents agreed that diet plays a part in fertility, only 7% had received dietary guidance. Only 34% of participants knew the importance of including all the food groups, such as fruits, vegetables, whole grains, milk and dairy products, and animal products in their prenatal diet. The nutrition knowledge levels were found to be sub optimal as only 25% of subjects were aware of the suggested recommendations of protein, and only 49% of people knew importance of including foods high in omega-3 fatty acids in their diet. About 29% of women were aware of importance of taking preconception specific multivitamins to meet needs of micronutrients during this period, although there is fair knowledge about certain recommendations about green leafy vegetables, dairy intake, whole grain carbohydrates, and importance of incorporating iodized salt.Only 17% of respondents correctly identified the major drop in fertility between the ages of 33and 40, and 98% of participants were unaware that being older than 35 is the biggest risk factor for subfertility. However, a relatively high 90% of people were aware of Assisted Reproductive Technologies. All participants were aware of some or other methods for tracking ovulation and menstrual cycles.

Conclusion: This study reveals that there are knowledge gaps in both nutrition and fertility awareness in women who presented for further advanced fertility treatment at tertiary centre. It is important to reduce these gaps through enabling nutritionist's consultation,detailed dietary counselling and focused educational programs for improved fertility and health outcomes which can optimise the pregnancy outcomes and also minimise health risks for mother.

Keywords:Prenatal Nutrition, Fertility Awareness, Menstrual History, Assisted Reproductive Technologies

1. INTRODUCTION

Nutrition status at the time of conception has tremendous significant impact on the infant and maternal health outcomes during pregnancy and postpartum. Also underlying conditions such as PCOS, metabolic syndrome, diabetes, undernutrition, obesity impacting fertility in women require adherence to appropriate dietary management prenatally for optimal pregnancy out comes [1]. With India facing the huge burden of non-communicable disease on one hand and massive micronutrient deficiency disorders such as Anemia, B vitamins, Iron etc on the other hand it is pertinent to focus on prenatal nutrition status to address the foetal origin of adult diseases which also focuses on the micronutrient and dietary quality and quantity and nutritional status at the time of conception.

Weerasekara *et al.*, 2020 reported that women of reproductive age had less knowledge about nutrition related areas such as dietary fibre, micronutrients, fat, food and nutrition related diseases [2]. Another study of Papezová*et al.*, 2023 documented that merely 5% of female participants attained a nutritious score of 80% or above. The concepts of ideal energy intake, ideal weight gain, and the importance of micronutrients in a pregnant woman's diet had the lowest knowledge scores [3]. Furthermore, another cross-sectional study conducted by Lim *et al.,* 2018 reported that majority of women (63.6%) had a fair level of nutritional awareness which was observed to be still insufficient [4].

Nutritional intake of women during the preconception periods appear to be inadequate due to low socioeconomic status, unplanned pregnancies, ignorance about the importance of nutrition and other factors. The available evidence best supports a recommendation for a multivitamin-multimineral supplement containing folic acid at 0.4mg per daily dose to reduce the risk of first occurrence of anneurotubal defect. Preconception period continues to gain recognition as an ideal opportunity to optimize the health of women in their child bearing age.National Health Mission working under Ministry of Health and Family Welfare, Government of India launched Weekly Iron and Folic acid Supplementation (WIFS) to provide 100mg of iron and 500µg of folic acid in adolescent population to prevent onset of anemia in 2012 [5]. Also, Anemia Mukt Bharat programme is being carried out by Government of India since 2018 under which one iron and folic acid tablet containing 60mg iron and 500µg of folic acid is given to women in reproductive age, pregnant and lactating women [5]Van *et al*. (2018) reported that the women planning to conceive and becoming pregnant requires 4mg of folic acid daily, in order to meet this requirements it is suggested to start it's supplementation 5-6 months prior conception[6]. Pei *et al.* (2019) suggested taking folic acid supplements in order to reduce risk of neural tube defects in developing foetus and for reducing risk of preterm birth [7].

Subfertility is a significant health concern at global level and is defined as the inability to conceive following a year of consistent, unprotected sexual activity [8]. As per data from National Family Health Survey (NFHS) overall subfertility prevalence in India has increased from 22.4% in 1992-93 to 25.3% in 2005-06 and then has increased to 30.7 % in 2015-16 [9]. The increasing prevalence of Subfertility in India has made it the most important issue in terms of reproductive health.

Studies have also demonstrated the need of fertility-related knowledge for fertility self-care, for understanding once own fertility potential, and for starting treatment when necessary. Therefore, in order to avoid fear and unnecessary delay in seeking treatment when faced with subfertility concerns, knowledge of reproductive issues is essential [10]. There is a reasonable level of general information on fertility (e.g., age of fertility decrease, definition of subfertility, etc.) and a low level of knowledge regarding identifying the fertile window in the menstrual cycle to optimize pregnancy among women [11].

In the study conducted on 108 total women by Malik *et al*., 2022 [12] the participants' levels of fertility awareness were found to be low in 27.8%, moderate in 44.4%, and high in 27.8%. Most subjects were not able give right answers when asked about the fertile period (60%) and regarding age-related decrease in fertility (55.6%). Mahey *et al*., 2018 [13] reported that low levels of knowledge existed regarding reproduction and fertility in women, 85% did not know about the menstrual cycle's ovulatory period, only 8% thought that being older than 35 was the biggest risk factor for subfertility, and most did not know when to seek treatment for subfertility after trying for a child. Less than half of the women knew that donor oocytes and assisted reproductive treatment were essential for older adult's conception. Hammarberg *et al*., 2016 [14] studied fertility knowledge and information-seeking behaviour among people of reproductive age. The majority of participants reported having "low" to "average" levels of knowledge regarding fertility and many of them were ignorant about the menstrual cycle's "fertile window" and overestimated the longevity of women as reproductive agents.

Since subfertility has an immense negative influence on a couple's social and psychological well-being, treating it is an essential task. Even if the rate of subfertility is high, previous research indicates that a lack of knowledge about fertility among those in the reproductive age range may contribute to the reason that many couples do not achieve their goals of becoming parents [12].

The number of women seeking medical help to conceive is growing, however apart from prescribing Folic acid supplements, whether any institutional support exists to educate and address nutrition challenges has to be studied. In Indianscenario, where majority of women face the malnourishment challenges particularly of micronutrients, anemia, compounding with obesity and underweight itis pertinent to address prenatal nutrition to break the vicious cycle of multigenerational impact of malnourishment and foetal origin of adult diseases. In present study we choose to evaluate the awareness of prenatal nutrition and fertility among women undergoing treatment for subfertility at index visit in tertiary care fertility centre, because they can conceive at any given point.

2. MATERIALS AND METHODS

2.1 Study design and setting

This study used qualitative research approach with cross sectional study design. The study was carried out at KIMS Fertility Centre at Krishna Institute of Medical Sciences, Secunderabad, Hyderabad, Telangana, India.

2.2 Study participants and sampling

The subjects comprised of hundred (n=100) women who had challenges with conception and were referred to fertility centre for advanced fertility treatments such as In vitro Fertilization (IVF), Intra Uterine Insemination (IUI), Intracytoplasmic Sperm Injection (ICSI), Frozen embryo transfer, Egg donation, ovarian Stimulation, Hysteroscopy or laparoscopic surgery. Purposive random sampling technique was used for selecting these 100 women.

2.2.1 Inclusion criteria: Womeninagegroupof18-45activelyseekingprimaryorsecondaryfertilitytreatment, BMI above 18.5 to 39.9 kg/m^2, free of underlying medical disorders were included in the study. Those women who voluntarily have given consent after reading the patient information sheet were recruited for the study.

2.2.2 Exclusion criteria: Womenwhoaretakingfertilitytreatmentwithunderlyinginfectious diseases i,e typhoid,T.B, Human Immunodeficiency Virus (HIV), and other health conditions such as arthritis, inflammatory diseases etc, and also subjects who were diagnosed for nutritional deficiencies and already on nutrition supplementation were excludedfrom thestudy. Also, BMI of women < 18.5kg/m^2 and > 40 kg/m^2 were not considered.

The study participants were recruited and information gathered by personal interview method at tertiary fertility centre at Index visit only.

2.3 Data collection tools

A well structured questionnaire was developed comprising of four sections. The first section of questionnaire consisted of questions related to demographic information [13, 15]. The second section of questionnaire consisted of questions related to menstrual and fertility history. The third section of questionnaire consisted of questions on Prenatal Nutrition Knowledge [16]. And the fourth section had fertility awareness questions to evaluate level of understanding on fertility related aspects [13]. The generated questionnaire was validated by pilot testing on 10 subjects and then was utilized for data collection by making all necessary changes.

2.4 Statistical Analysis

Descriptive statistics – frequency and percentage was used for summarizing demographic characteristics, menstrual and fertility history, prenatal nutritional knowledge, and fertility awareness levels of women.

3. RESULTS AND DISCUSSION

3.1 Demographic Characteristics

The demographic characteristics of 100 women participants is presented in **Table 1.**Majority of women were in the age group of 31 to 40 years (48%) followed by 21 to 30 years (44%) and only 8% of women belonged to age group of 41 to 50 years. Majority of women were from Hyderabad (97%) and only 3% were from other places. More than half of the participants were found to be employed (51%) with 79% of being them graduates. Majority of participant's partner's age also belonged in

group of 31 to 40 years (68%) followed by (20%) in 41 to 50 years and only 12 % being in the age group of 21 to 30 years. About 62 % of men were into profession, 41% were into semi profession and only 6 % and 1% were into clerical/shop owner and semi-skilled owner respectively.

Majority of participants belonged to nuclear family (75%) whereas 23% were belonging to joint family with only 2% who belonged to extended family. On the other hand it was analysed that nearly half (52%) had 3 or less than 3 family members, 40% had 4 to 6 family members and it was found that 7% of them belonged to family having 7 to 9 members and only 1% had family members more than 10. The study population was distributed into various socio economic status group based on modified Kuppuswamy scale [13] through which it was observed that socio economic status of 54% women participants was upper middle class and 46% belonged to upper lower class. 55 % of women had monthly income of more than 41,430 rupees while 44% of them had monthly salary in range of rupees 20,715-41,429.

Table 1: Demographic Characteristics of Study Population (n=100)

Variables	n	%
Age		
21 – 30 years	44	44
31 – 40 years	48	48
41 – 50 years	8	8
Place		
Hyderabad	97	97
Other than Hyderabad	3	3
Profession		
Employed	51	51
Domestic partner/ Housewife	49	49
Educational Background		
Illiterate	0	0
Upto Primary	0	0
Upto matriculation	1	1
Above matriculation	20	20
Graduate	79	79
Partner's age		
21 – 30 years	12	12
31 – 40 years	68	68
41 – 50 years	20	20
Partner's Occupation		
Profession	62	62
Semi Profession	41	41
Clerical, shop owner	6	6
Skilled owner	0	0
Semi skilled owner	1	1
Unemployed	0	0
Type of Family		
Joint	23	23
Extended	2	2
Nuclear	75	75
Size of family		
≤ 3	52	52
4 -6	40	40
7 -9	7	7
≥ 10	1	1
Monthly income of the family		

More than 41,430	55	55
20715- 41429	44	44
15536- 20714	1	1
10357-15535	0	0
6214- 10356	0	0
Less than 6214	0	0
Socioeconomic Status		
Upper	0	0
Upper middle	54	54
Lower middle	46	46
Upper lower	0	0
Lower	0	0

3.2 Menstrual and Fertility History of Women

Participant's age at menarche ranged from 11 to 15 years, with the majority (48%) reaching menarche at 13 years old. Additionally, according to the distribution, 26% of women attained menarche at age 12 and 15% at age 14 **[Figure 1]**. Bennett *et al*., 2015 reported that women who are subfertile frequently have a poor understanding of the biological processes involved in human reproduction in developing countries [17].On the other hand in our study women were able to report their menstrual and fertility history**.** Bennett *et al*, 2015 have stated that 78% of the participants were able to recall how long the menstrual cycle typically lasted [17]. This finding is similar to present study as all women were able to recall length of menstrual cycle. From our results, it was observed that majority (74%) had cycles that last between 28 and 35 days, which is within the typical range. Nonetheless, 16% of women have periods that are longer than 35 to 60 days, and 4% have cycles that are longer than 60 to 90 days. Furthermore, 6% reported withdrawal bleeding **[Figure 2].**Sharma *et al,* 2023 reported that nearly 56.4% had abnormal menstruation with only 19.6%having normal menstrual flow and 20% didn't responded to this [18]. Whereas,The majority of participants (90%) reported normal menstrual flow. On the other hand, 1% report heavy menstrual flow and 9% experience scanty flow **[Figure 3].** Regular menstrual cycles are reported by a significant percentage of individuals (72%) and is a sign of ovulation with good chances of getting pregnant. 28% of women have reported having irregular periods in, which could be due to a number of underlying medical conditions such polycystic ovarian syndrome (PCOS) and other medical causes[17] **[Figure 4].** A very small percentage (3%) of women had reported recurrent abortion **[Figure 4].** 79% of the participants are in the category of primary infertility, conversely, 21% experience secondary subfertility **[Figure 5].**

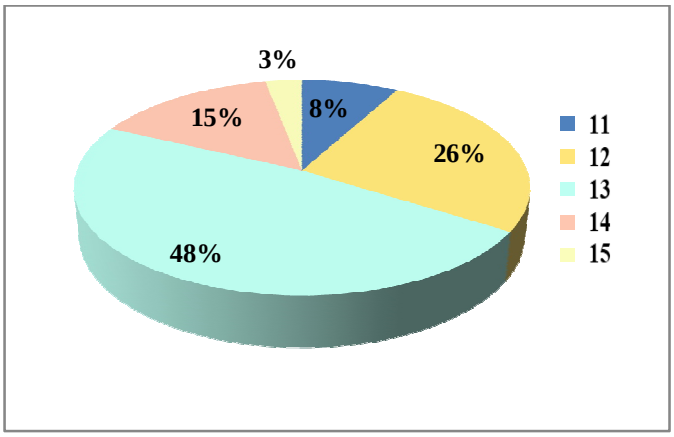

Figure 1: Age of Menarche among respondences (n =100)

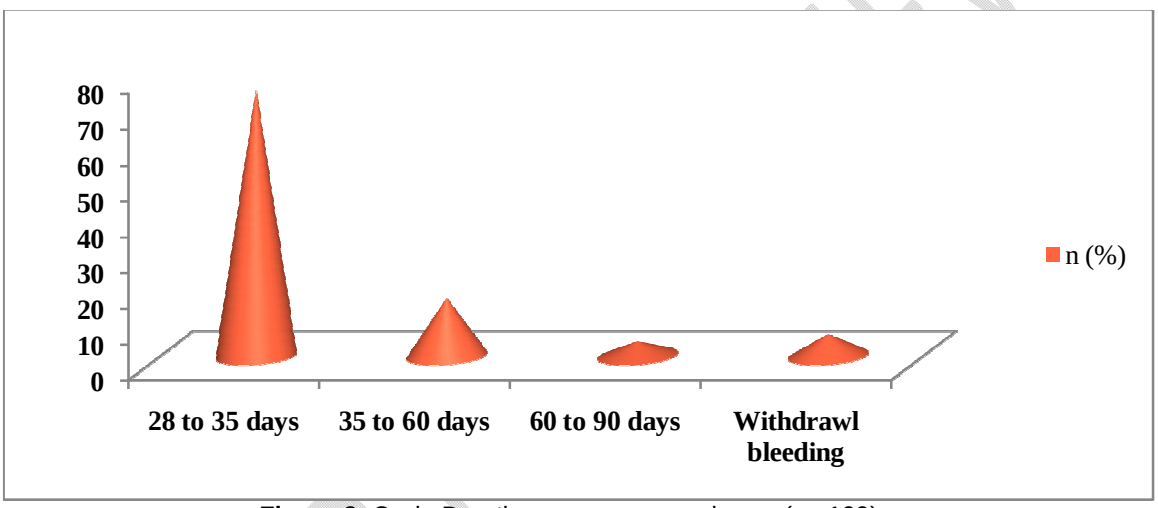

Figure 2: Cycle Duration among respondences(n =100)

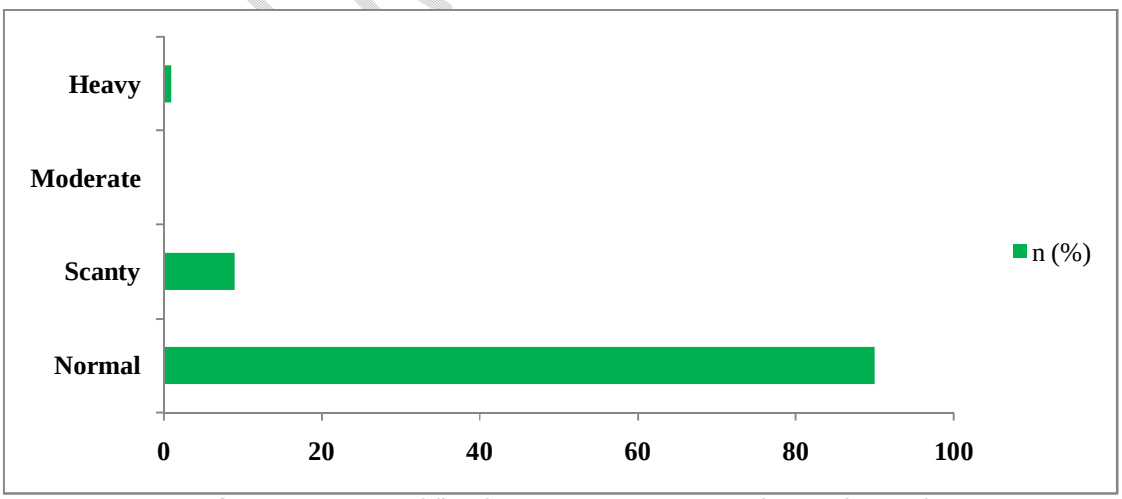

Figure 3: Menstrual flow in womenamong respondences (n =100)

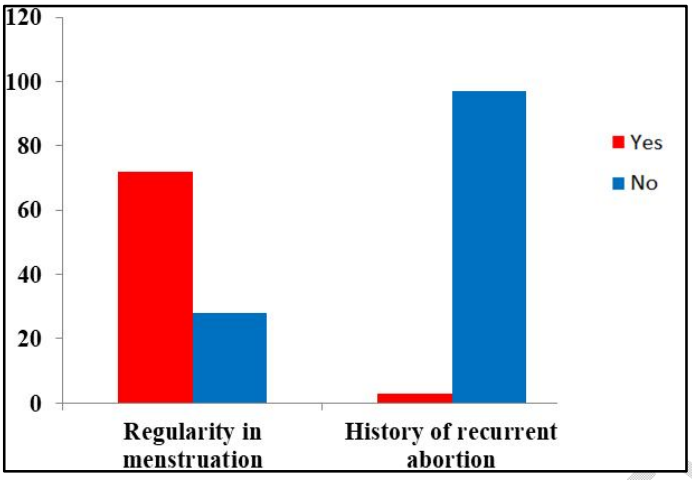

Figure 4: Menstrual and Fertility History among respondences(n =100)

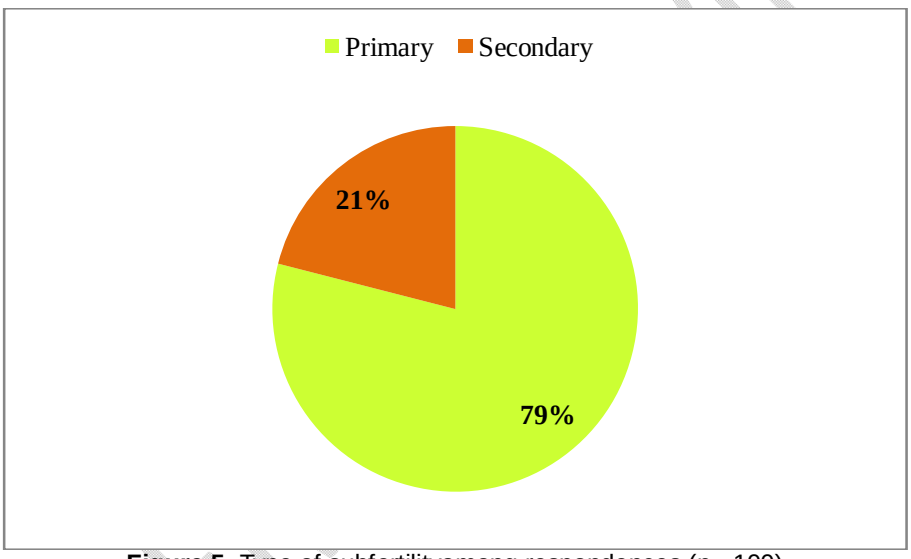

Figure 5: Type of subfertilityamong respondences (n =100)

3.3 Responses of Fertility Awareness Questionnaire

The fertility awareness questionnaire was used to assess the fertility knowledge levels among women. Accordingly, the responses obtained were identified into correct and incorrect responses and presented in **Figure 7**. In a study conducted by Swift *et al.*, 2014, it was observed that half of the study participants accurately identified the age range by which women's fertility decreases while other participants of same study did not knew exact age range where fertility decreases [19]. Similarly, in the study conducted by singh*et al*., 2023, sufficient knowledge of more than 50% was found regarding age when fertility decreases [20].Whereas, we observed a notable lack of awareness among participants about the ideal age to conceive and the age-related decrease in fertility. Among all participants, only 17% correctly answered the significant decline in a woman's chances of getting pregnant between the ages of 36 and 40 (Q1). While, just 12% of respondents were aware that the easiest age range to become pregnant is between twenty and thirty (Q3). This highlights the need to increase awareness about role of biological age's influence on fertility. Singh *et al.,* 2023 reported that least knowledge (30.8%) was seen in women regardingmost fertile time to conceive during menstrual

cycle[20]. Similarly, none of participants correctly answered that the optimal time to conceive is between two periods (Q2). Furthermore, just 7% of participants correctly recognized the correct timeframe (Q6) for a woman under 35 to see a fertility specialist following a year of unprotected intercourse, whereas 69% of individuals correctly identified the same timeframe (Q7) for women over 35. A striking 98% of participants were unaware that being older than 35 is the biggest risk factor for subfertility (Q4).

Only 3% of respondents correctly answered the question (Q8) about whether a woman of advanced age desiring a child should use donor eggs to get pregnant; nevertheless, 62% of respondents correctly answered (Q9) about surrogacy. All participants (100%) were aware of methods for tracking ovulation and menstrual cycles (Q10). Majority of women (90%) were aware about success rates of fertility treatments like - In Vitro Fertilization (IVF) and Intra Uterine Insemination (IUI) (Q13). Similar results were reported by Yu *et al.,* 2020 that 76.4 % of the subjects overestimated the likelihood that IVF would be successful in treating subfertility [21]. 76% women had not undergone any fertility related surgeries or treatments previously. 95% of women were unaware about normal ovulation symptoms (Q11). Hammerberg *et al*., 2023 reported that only 32% among 385 Australian women correctly identified the fertility window during the menstrual cycle [22]. In our study 86% women didn't have the ability to compute fertile window (Q12) this indicates that overall there is insufficient fertility awareness among women and there is need for more precise communication and education. Bunting *et al.,* 2013 also concluded that only 56.9% of patients with reproductive disorders in 79 countries had accurate understanding about fertility, indicating the need for further education [23]. In our study, only 24% of women had undergone fertility related surgeries and treatments previously while 76% of them have not underdone any fertility related surgeries or treatments (Q14).

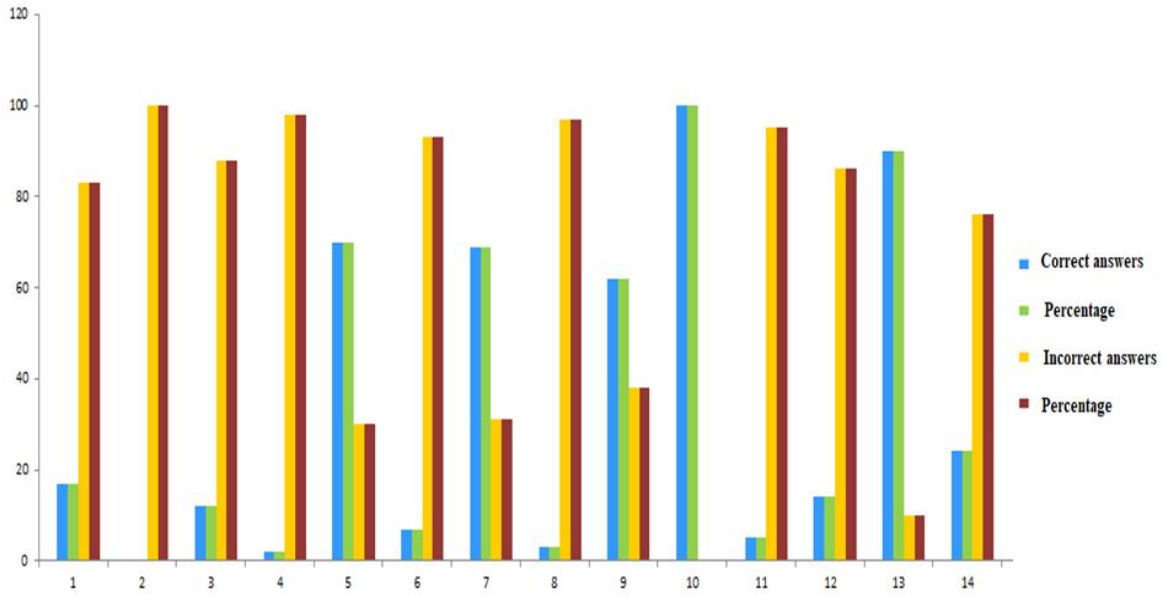

Figure 7: Responses ofFertility Awareness Questionnaire among respondences(n =100) at index visit in a tertiary care fertility centre

3.4Prenatal Nutrition Knowledge in Women

The results [Figure 6, Table 2] indicate knowledge gap among women undergoing fertility treatment regarding prenatal nutrition. Similarly, in the cross sectional survey conducted by Wang *et al.,* 2023 it was observed that infertile women interviewed knew very little about nutrition [24]. Significant majority of participants (79%) are aware that prenatal diet plays a major role in fertility, which is positive finding which indicates good baseline awareness. However, only 7% have received advice or instruction regarding prenatal nutrition at community level medical centres before they were referred to tertiary care medical fertility management, highlighting a significant gap. Wang *et al*, 2023 reported that most women had less knowledge of nutritional dietary guidelines [24]. Also, in the study of Papezová*et al*., 2023 the evaluation of women's nutritional knowledge revealed that women were ignorant in important areas of food recommendations[3]. Study done by Sangwan *et al.*, 2022 showed that nearly 40(40.26%) of participants had knowledge about different food groups [25]. The findings were similar in present study, as just 34% of participants knew how important it is to include in their prenatal diet all the key food groups, such as fruits, vegetables, whole grains, milk and dairy products, and animal products. There is also significant lack of knowledge regarding the daily recommended intake of fruits and vegetables. Merely 47% of women are aware of the daily recommendation of 300g of vegetables, while 48% are aware of the recommendation of at least 150g of fruits. There is a somewhat better understanding on the consumption of green leafy vegetables; 72% of respondents are aware that 75g should be consumed daily.Study of Gupta *et al*., 2016 showed that only 36% of women had knowledge regarding protein, carbohydrates and iron [26]However, Only 25% of respondents recognize the importance of consuming serving of animal or vegetarian protein sources at least twice or thrice in a week. The benefits of omega-3 fatty acids are acknowledged by around half of the participants (49%) only. It is generally well-understood that two to three servings of dairy should be consumed each day; 80% of people are aware of this guideline. 60% of them regularly consume whole grain carbohydrates. The majority (83%) are aware of including iodized or double fortified salt in diet during prenatal period. While it is advised to consume sufficient amounts of at least fifteen essential micronutrients, participants seemed to be focusing on specific micronutrients, such calcium and iron. Kraemer *et al*., 2023 studied the behaviour of 402 women regarding knowledge levels on prenatal multivitamin pills and have reported that 202 women did not knew about multivitamin pills [27]. Similarly in another study of Le *et al*., 2023 more than half of respondents said they were aware of importance of taking a preconception multivitamin with or without inclusion of folic acid [28]Similarly study of Sangwan *et al*., 2022 reported that out of selected 94 women 81 were having optimal knowledge regarding iron and folic acid supplementation[25]. However in current study, at index visit, just 29% of women were aware of importance of taking preconception multivitamins including folic acid and vitamin D and only 9% of participants knew about other vitamins and mineral supplements in contradiction to this Furness *et al,* 2024 from study results in three countries of Australia, China and Vietnamobserved that majority of respondents (Australia: 63%, China: 82%, Vietnam: 94%)considered supplements to be beneficial [29] As opposed to this a study conducted in Romania by Avram *et al*., 2022 found that 69.58% of subjects were not taking any folic

acid and vitamin supplements prior to pregnancy [30]. Das et al., 2024 in their study focused on the folic acid and iron administration in women during prenatal period to prevent reproductive health problems in them. The intake folic acid and iron tablet for 90 days was useful in preventing reproductive healthin women [31].Thus, overall knowledge of a well-balanced diet is sub optimal among women referred to tertiary care fertility centre at index visit although there is fair knowledge about certain recommendations for green leafy vegetables, dairy intake, whole grain carbohydrates, and importance of incorporating iodized salt .

Table 2: Prenatal Nutrition Knowledge levels in women at index visit at a tertiary care fertility centre (n =100)

Sr. No	Questions	Yes N (%)	No N (%)
1	Do you know that prenatal diet plays a major role in fertility?	79	21
2	Have you been given any advice or instruction regarding prenatal nutrition?	7	93
3	Do you have knowledge to include all major dietary groups such whole grains (or other kinds of carbohydrates), milk and dairy products, animal products, fruits, or vegetables in your diet during prenatal period?	34	66
4	Do you know it is recommended to consume 300g of vegetables each day by women in prenatal stage?	47	53
5	Do you know it is recommended to consume at least 100 g of fruits each day by women in prenatal stage?	48	52
6	Do you know it is recommended to consume 100 g of green leafy vegetables every day by women in prenatal stage?	72	28
7	Do you know consuming animal protein (Chicken, Meat, Fish and egg) or vegetarian protein (Dhals, Soyabean and Paneer) at least twice or thrice a day is recommended during prenatal period?	25	75
8	Do you know that incorporating omega 3 fatty acid rich sources like Flaxseeds, Walnuts, Black gram whole, Bajra, Rajmah, etc in diet is beneficial during prenatal period?	49	51
9	Do you know that eating two to three servings a day of dairy products (yogurt, cheese, milk, ghee and curd) or fortified plant-based milk is recommended in prenatal stage?	80	20
10	Do you know importance of regularly consuming whole grain carbohydrates such as brown rice, jowar, ragi, and bajra in your diet during prenatal period?	60	40
11	Do you know benefits of including iodized or double fortified salt in your diet during prenatal period?	83	17
12	Do you know importance of regularly taking preconception-specific multivitamins (including folic acid and vitamin D) or the recommended supplementation of 400 mcg folic acid + 10 mcg vitamin D (winter months) for women trying to conceive?	29	71
13	Do you know any other vitamin or minerals other than folic acid and vitamin D useful for increasing fertility in women?	9	91

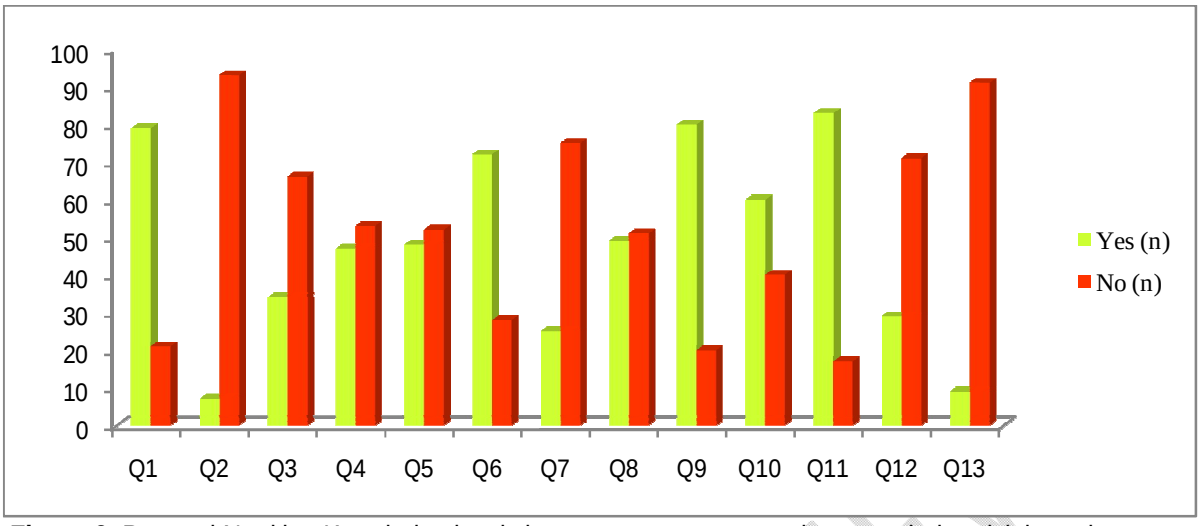

Figure 6: Prenatal Nutrition Knowledge levels in womenamong respondences at index visit in tertiary care fertility centre (n =100)

3.5 Practical Applications of the Research

The research findings will be useful for provision of nutrition and diet advice to all couples intending to start treatment for conception. It will help to sensitise administrators to provide targeted nutrition education programs and fertility awareness related programs at fertility centres as a part of treatment process. Also, it will be useful reduce morbidity and mortality in babies and mothers due to nutrient deficiencies and pave way to seek fertility treatment at appropriate times to reduce psychological burden and medical expenditure.

4. CONCLUSION

Our study revealed that at index visit in a tertiary care fertility centre, most women had sub optimal knowledge regarding consumption of well-balanced diet. Substantial number of women were not aware about recommended dietary intake of nutrients and food groups. Also, fertility awareness was found to be limited. Providing dietary counselling by qualified dietician, nutritional educational intervention and nutrition counselling for women/couples seeking fertility management is important and helpful for bridging diet –fertility knowledge gaps which will improve reproductive health in women/couples.

Ethical Approval

The ethical committee of Krishna Institute of Medical Sciences (KIMS) and Institutional Ethical committee, Professor Jayashankar Telangana State Agricultural University, Hyderabad have given ethical clearance for the research work.

Consent

As per international standards or university standards, Participants' written consent has been collected and preserved by the author(s).

Disclaimer (Artificial intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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