
“NUTRITIONAL STATUS OF
PRECONCEPTION WOMEN IN RURAL
AREAS OF BELGAUM DISTRICT –
A CROSS SECTIONAL STUDY”

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LIST OF ABBREVIATIONS

ANM	-	Auxiliary nurse midwives
AJCN	-	American journal of clinical nutrition
ASHA	-	Accredited Social Health Activists
ATSDR	-	Agency for Toxic Substances and Disease Registry
AWW	-	Anganwadi workers
BMI	-	Body mass index
CePAWHS	-	Central Pennsylvania Women's Health Study
CC	-	Chest circumference
CDC	-	Centre for Disease Control and Prevention
CED	-	Chronic energy deficiency
CI	-	Confidence interval
CSSC	-	Centre for the Study of Social Change
DF	-	Degrees of freedom
DRI	-	Dietary reference intakes
FANTA	-	Food and Nutrition Technical Assistance
FCT	-	Food composition table
FRT	-	Food record table
GOI	-	Government of India
GPE	-	Government of India
Gm	-	General physical examination
Hb	-	Haemoglobin
HCL	-	Hydro chloric acid

HFIAS	-	House hold food insecurity access scale
HC	-	Hip circumference
Hg	-	Mercury
HVRA	-	Home visiting research Assistant
ICDS	-	Integrated child development services
ICMR	-	Indian council of medical of research
IEC	-	Information education and communication
IUGR	-	Intra uterine growth retardation
J.N.M.C.	-	Jawaharlal Nehru Medical college.
<i>K. Kcal</i>	-	Kilo calories
LBW	-	Low birth weight
L-t-C	-	Likely to conceive
M.F	-	Multiplication factor
ML	-	Mili litre
MNCH	-	Maternal Newborn Child Health
MNHR	-	Maternal Newborn Health Registry
MUAC	-	Mid upper arm circumference
MWRA	-	Married Women of Reproductive Age Group
NFHS	-	National Family Health Survey
NNMB	-	National Nutrition Monitoring Bureau
NIN	-	National Institute of Nutrition
NPNL	-	Non -pregnant and non -lactating
NPV	-	Negative predictive value

O.R.	-	Odds Ratio
PHC	-	Primary health centre
PPV	-	Positive predictive value
PUC	-	Pre university certificate
PRI	-	Panchayath Rajya institution
RDA	-	Recommended dietary allowances
RDI	-	Recommended Dietary Intake
SD	-	Standard deviation
SES	-	Socioeconomic status
SGA	-	Small for-gestational age
UP	-	Uttar Pradesh
USA	-	United states of America
USDA	-	US Department of Agriculture
USAID	-	United States Agency for International Development
VHND	-	Village health nutrition day
WC	-	Waist circumference
WHO	-	World Health Organization
W/H ratio	-	Waist Hip ratio
2	-	Chi- square

ABSTRACT

Background and Objectives

Preconception under nutrition is the most leading cause of health loss worldwide. Women bear the brunt of the disease burden associated with undernutrition. The prevalence of underweight (< 45 kg) women are roughly the same relative distributions as stunting, but the overall proportion of underweight women is very much higher - up to about 60% in South Asia. In India, women of the child-bearing age (15 to 49 years) constitute 22.2 percent of the total population. Mothers and children not only constitute large group, but also a vulnerable or special-risk group. Poor health of women has bad implications on self as well as on their families. Women of reproductive age living in resource-poor settings are at high risk of inadequate micronutrient intakes when diets lack diversity and are dominated by staple foods. Based on the dietary and anthropometric results some study showed that malnutrition is a common feature among low income rural women. Preconception health applies to women who have never been pregnant and also to women who could become pregnant again. In recent years preconception care and nutrition has become an important health issue in a many developing countries. With this background, as no study about preconception nutritional status was done in this area, a study to know the nutritional status of preconception women, proxy indicators for the micronutrient adequacy of diets and socio demographic factors associated with preconception maternal nutrition was taken up.

Methodology

A Community based Cross Sectional Study was undertaken over a period of one year, in 18 villages under 10 Primary Health Centres, in Belgaum District. This

study was done in One year from January 2014 to December 2014. A total of 770 reproductive age group women (15-49) who were Non pregnant-non lactating women (NPNL) and Parity 0-3 women who were not following any family planning method were enrolled in the study. Women of primary and secondary sterility,NPNL who were having Hb% less than 7gm/dl and women adopted permanent and temporary method of sterilization were excluded. Data collection was done after identification of women, on socio demographic and food insecurity, laboratory investigations, anthropometry and consumption of 24 hrs.dietary history in half of the women.

Results

The mean age was 22.5 (SD±3.19) years and the median age was 22 years. Majority of them, 64.8 % belonged to class V according to modified B G Prasad classification, followed by 24.0% to class IV and only 22 (0.8%) belonged to class I category of socio-economic status. The mean age of marriage was 18.2 years (SD ± 2.59) and the median age of marriage was 18 years. Amongst the total women 43.9% were having 1 child, 33.5% nulliparous women and 18.3% were having 2 children.

In this study, 40.4% had moderate anaemia and 38.2% had mild anaemia. One third of the study participants, 36.6% were of below BMI of 18.5 and 22.7% of women were MUAC below 22cm and about 72.1% were having W/H ratio less than 0.8.

Majority of women consumed energy less than 90% of RDA. The consumption of protein was below 50% of RDA in 41.8% of preconception women and 50-70% of RDA in 39.0% women. The median intake of total fat was 44gm more than RDA 20gms. The median intake of vitamin B₁ was 0.6933 less than RDA 1mg. The median intake of vitamin B₂ was 0.6364 less than RDA 1.1mg. The median intake of vitamin B₆ was 0.7042 less than RDA 2mg. The median intake of vitamin dietary folate was

104µg less than RDA. The median intake of vitamin C was 22 less than RDA 40mg. Majority women, 34.0% consumed calcium 50% of RDA and 24.7% consumed 50-70% of RDA. Most of the participants 70.9% were consuming iron less than 50% of RDA and 24.9% consumed 50-70% of RDA. The median intake of zinc was 4.4 less than RDA 10mg.

Conclusion

Preconception women staying in rural areas had less desired food stuffs which were containing inadequate micronutrients and macronutrients. Low BMI in women showed that food habits of rural women had low macro and micronutrients which could be due to lack of knowledge regarding importance of nutrition. Multiple reasons like poverty, food insecurity, high parity, traditional food habits and dietary diversification could be the cause of undernutrition in preconception women.

Key words: Preconception women, micronutrients, macronutrients

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INTRODUCTION

As per World Health Organization (WHO) and its partners, nutritional status of women of reproductive age group (15-49) is important, because their off-spring that the pernicious affects of malnutrition is propagated to future generations. Preconception under nutrition is the most leading cause of health loss worldwide. Women bear the brunt of the disease burden associated with malnutrition. The prevalence of underweight (< 45 kg) women are roughly the same relative distributions as stunting, but the overall proportion of underweight women is very much higher - up to about 60% in South Asia, around 45% in South East Asia, and about 20% in Sub-Saharan Africa. In Africa and south Asia, Many factors can cause malnutrition, most of which relate to poor diet or severe and repeated infections, particularly in underprivileged populations. Nearly 27–51% of women of reproductive age are underweight in developing countries¹

In India, women of the child-bearing age (15 to 49 years) constitute 22.2 percent of the total population. Mothers and children not only constitute large group, but also a vulnerable or special-risk group. Malnutrition is like an iceberg; most people in the developing countries live under the burden of malnutrition. The adverse effects of malnutrition have been well documented, which include maternal depletion, low birth weight, anemia, toxemias of pregnancy, postpartum hemorrhage etc leading to high morbidity and mortality.²

Poor health of women has bad implications on self as well as on their families. It affects children in a family and also brings down household economic status.

Because of prevailing culture and traditional practices in India, the health and nutritional status of woman is adversely affected.³

Women of reproductive age living in resource-poor settings are at high risk of inadequate micronutrient intakes when diets lack diversity and are dominated by staple foods. In resource-poor environments across the globe, low-quality, monotonous diets are the norm and the risk for a variety of micronutrient deficiencies is high. Women of reproductive age are among those most likely to suffer from deficiencies. However, in reproductive age women low micronutrient intakes remain a problem even in countries undergoing transition and a dominant problem in many of the poorest regions.⁴

Nutrition is important in reproduction age group women, including the safe delivery of infants. Nutritional assessment of women at reproductive age should identify factors that may affect fertility and preconception health. Maternal nutritional status is important for the health and quality of life of women and for the health of their newborn babies. Based on the dietary and anthropometric results some study showed that malnutrition is a common feature among low income rural women.⁵

Malnutrition is the outcome of many complex biological and social processes. The roots of malnutrition run deep into its social soil and it is a matter of thought that malnutrition has not been changed significantly during the last two decades.⁶

In reproductive age women low BMI can result in poor fetal development. Under nutrition (low BMI) in women of reproductive age group and iron-deficiency anemia increase the risk of maternal death, poor foetal development and also accounting for at least 20% of maternal mortality. Under nutrition in pre pregnancy is

the underlying cause of 3.5 million deaths annually, and 11% of total global disability-adjusted life-years.⁷

Women living in poor resource settings are often malnourished before pregnancy; they may be short as a result of early childhood malnutrition, and underweight and anemic due to inadequate food intakes and infections. In some settings, overweight and obesity are also emerging concerns due to poor diet.⁸

Preconception health care is the care given to a woman before pregnancy to manage conditions and behaviors which could be a risk to women and baby. Preconception health applies to women who have never been pregnant and also to women who could become pregnant again. Preconception health looks at factors that can affect a fetus or infant. These include factors such as nutrition, smoking, alcohol and work place hazards. The key to promote preconception health is to combine the best medical care, healthy behaviors, strong support, and safe environments at home and at work.⁹

As per WHO, the term ‘preconception care’ includes both the period before conception and the inter-conception period. Preconception women also termed as pre-pregnant women. Even where strong public health programmes across the life-course are in place, they do not guarantee that women enter pregnancy in good health. The reality is that many women in low- and middle-income countries do not have adequate access to the prenatal care they need. Preconception care can make a useful contribution to reducing maternal and childhood mortality and morbidity, and also to improve maternal and child health in both high- and low-income countries.¹⁰

Weight and micronutrient status during pregnancy is influenced by a number of factors such as food insecurity and birth spacing during preconception period. Maternal malnutrition remains a serious global health issue, particularly in low and middle income countries (LMIC).¹¹

BMI (overweight or obese) and vegetable consumption (at least one serving per day) had statistically significant independent and positive effects on birth weight and fetal growth. Maternal weight gain during pregnancy, a prenatal variable, was an additional independent predictor of birth weight and fetal growth. Sociodemographic variables were not significant predictors after controlling for preconception and prenatal maternal characteristics. The limited available evidence suggests improving preconception maternal nutritional status will improve MNCH outcomes, although there are emerging concerns of overweight and obesity.^{12, 8}

Nutritional anemia is the most common type of anemia worldwide; this mainly includes iron, folate and vitamin B12 deficiencies. Among different population groups, the greatest number of individuals affected by anemia belongs to non-pregnant women, 468.4 million^{13, 14}

Pre-pregnancy underweight significantly increases the risk of preterm birth by 32%. Pre-pregnancy underweight was also found to significantly increase the risk of small-for-gestational age babies. Although previous work has found a significant effect of pre-pregnancy underweight on the risk of having low birth weight babies.¹¹

In recent years preconception care and nutrition has become an important health issue in a many developed and developing countries. In developed countries obesity is the problem but in developing countries malnutrition is the major problem.

Most of the women in reproductive age groups (15-49) are under-nourished before they become pregnant.

In India because of social problem women are neglected more by self or by a family as per nutrition concerns. Women are vulnerable to malnutrition, for social and biological reasons, throughout their life-cycle. In some parts of the world, women are discriminated for access to health care, to food and education. The long hours and multiple roles of women create a “social vulnerability” to problems of malnutrition particularly during the reproductive years.

Hence, the preconception nutrition is not just an issue; it is a development issue as well. It is deep rooted in gender inequality, poverty, less duration in between pregnancy and lack of education. It’s often leads to chronic energy malnutrition in preconception period and in turn it leads to pregnancy complications in future. In view of negative socioeconomic status (SES), demographic and food insecurity in reproductive age women, it is important to have clear understanding about nutrition during preconception period of these vulnerable groups.

With this background, as no study about preconception nutritional status was done in this area, a study to know the nutritional status, proxy indicators for the micronutrient adequacy of diets and socio demographic factors associated with preconception maternal nutrition was taken up. The observations obtained from this study can be further used to curb the nutritional status of preconception women and thereby protect the health of women and in turn that of the country.

So, this study of assessment of nutritional status will enable in identification of strategies for initiating appropriate preconception supplementation programmes for improving health status of preconception women.

OBJECTIVES

The objectives of the present study were:

1. To assess the nutritional status of preconception women.
2. To know the socio-demographic factors affecting nutrition status of women.

REVIEW OF LITERATURE

A.PRECONCEPTION PHASE: A CRITICAL PHASE

The aim of preconception care is to promote the health of women before conception occurs in order to reduce preventable adverse pregnancy outcomes. In 2006, the CDC/ATSDR (Centre for disease control &prevention/Agency for Toxic Substances and Disease Registry) Preconception Care Work Group and the Select Panel on Preconception Care defined preconception care as ‘interventions that aim to identify and modify biomedical, behavioral, and social risks to a woman’s health or pregnancy outcome through prevention and management, emphasizing those factors which must be acted on before conception or early in pregnancy to have maximal impact’.¹⁵

Meeting report of WHO on preconception women concluded that, effective interventions need to address health problems, behaviors and risk factors in the preconception period. During preconception period Nutritional supplementation and food fortification need of the hour. Improved maternal nutrition, such as tackling obesity and related issues, under nutrition and micronutrient deficiencies will benefit the preconception women. The group suggested that initially it was important to focus on ‘low-hanging fruit’ interventions, such as: prevention and treatment of folic acid deficiency, prevention and management of anemia. The Western Pacific region group highlighted that the region is very diverse, with low-, middle- and high-income countries with varied needs and concerns related to preconception care and nutrition.

As per CDC, reproductive-aged women are at risk of iron deficiency anemia because of blood loss from menstruation, poor diet, and frequent pregnancies. Prior to conception, women should eat iron-rich foods (lean meat, poultry, and iron fortified cereals). Foods that inhibit iron absorption, such as whole-grain cereals, unleavened whole-grain breads, legumes, tea, and coffee, should be consumed separately from iron-fortified foods. This was the commonest practice found in low and middle income countries. The Center for Disease Control and Prevention (CDC) recommends 18 mg/day of iron for women in reproductive age group.¹⁶

A study from the Central Pennsylvania Women's Health Study (CePAWHS), which conducted a telephone survey of a representative sample of 2,002 women of reproductive aged between 18-45 years residing in largely rural central Pennsylvania. Women were classified according to reproductive stage i.e. preconception, interconceptional, and postconceptional on the basis of pregnancy history and reproductive capacity. Multiple indicators of health status and health risks were examined by reproductive stage, stratified by age group (ages 18-34 and ages 35-45). Results showed that many risk factors varied significantly by reproductive stage and by age group within reproductive stage. Preconception and interconceptional women exhibited several unhealthy behaviors .e.g., binge drinking, nutritional deficits, and physical inactivity. Among this the most important was nutritional deficits.¹⁷

A cross sectional study was conducted using purposive sampling at selected Mohakali slum known as Sat-tala Basti of Dhaka city with a view to assess the nutritional status of women reproductive age living in the slum. A total of 510 slum women were interviewed and their anthropometric measurements were taken. The mean weight of the respondents was 42.4(±5.7) Kg. and the mean height of the

respondents was 19.2(\pm 2.4) and about one third (30.8%) of the respondents were malnourished.⁶

A descriptive cross sectional was done in Aredibal, Iran, on 1906 women at reproductive age. The prevalence of food insecurity and nutritional status among women of reproductive age was evaluated using specific questionnaire. The mean iron and protein intakes of women were adequate. But mean fiber, folate, vitamin B2, B6, calcium, zinc, selenium and calorie intake were less than dietary reference intakes (DRI)⁵

A study conducted by National Nutrition Monitoring Bureau (NNMB) Hyderabad in rural areas of all the states in India showed that, the intake of cereals and millets was 402 gm and 365 gm respectively in tribal and rural NPNL women. Except for other vegetables and roots and tubers, the intake of all the other foods was lower than the suggested level in both the areas. The intakes of all the nutrients were lower than the recommended dietary allowances (RDA) suggested by ICMR in all the physiological groups. The deficit was more in respect to micronutrients such as iron, vitamin A, riboflavin and free folic acid. Distribution of women according to intake of nutrients less than 50% of RDA revealed that more than 70% of the women were not meeting even 50% of the requirement for iron and vitamin A in both areas. In general, the prevalence of chronic energy deficiency (CED) was significantly higher ($P < 0.001$) among tribal women than the rural women. The prevalence of CED was 56% among tribal NPNL women against 36% in rural NPNL women³.

As per National Family Health Survey (NFHS) -2(88-89) data, anemia in the age group of 15-49 reproductive age women was 51.8% but in NFHS-3(2005-06) it

was 56.2%. BMI was below 18.5 in preconception women i.e.36.2% in NFHS -2 and 33.0% in NFHS-3.¹⁸

A study of nutrition transition in India revealed that, most of the Indian particularly women population, consume less nutrients containing diet. Even though, most horticultural products are generally good sources of vitamins, minerals and fiber as well as bioactive compounds like phytochemicals. The area under cultivation and the horticultural outputs have increased dramatically over the years. India has a prominent share in the global production of fruits and vegetables. However, much of this does not seem to be reflected in increases in the consumption of fruits and vegetables – perhaps largely the result of their production as cash crops for export and sale. This can lead to a considerable loss of soil and micronutrients that are not beneficial to the local population. However, economic development seems to lead to improvements in intakes of legumes and vegetables (as well as animal products) and these changes may be beneficial. But these changes with socio-economic status are also often associated with reduced intakes of coarse cereal grains and increased reliance on highly polished varieties that may reduce the intakes of dietary fiber.¹⁹

According to National nutritional monitoring bureau (NNMB), data of 1998-99 and 2005-06 in nine states including Karnataka conducted on diet and nutritional status of tribal and rural population in non- pregnant and non-lactating women (NPNL) showed that rural women were vulnerable to under nutrition. NNMB has been carrying out regular survey on diet and nutritional status of different population groups since 1972. As per NNMB report the prevalence of anemia in 15-49 age group women was 51.0%.²⁰

B. CHRONIC ENERGY DEFICIENCY AND BMI LEVELS:

A Meta analysis was done by WHO in 1995, based on 25 studies that related maternal anthropometry to pregnancy outcomes (WHO, 1995b). The meta-analysis reported that a preconception body-mass index (BMI) found to be below 20 kg/m² was associated with a significantly greater risk for IUGR, relative to a BMI above 24 kg/m². In developing countries, it has been estimated that poor nutritional status in pre-pregnancy accounts for 14% of fetuses with IUGR, and maternal stunting may account for a further 18.5%. The attributable fractions were based on prevalence and risk estimates from published and unpublished sources. In this the important component was prevalence of underweight status among women of reproductive age group. Also IUGR associated with preconception underweight status. It was concluded that preconception under nutrition leads to many problems in women and affects in future after pregnancy.¹

A Meta analysis carried out by nutritional studies in women of reproductive age group in developing countries shown that, measures of body size such as height, weight and body mass index (BMI) were associated with adverse birth outcomes such as low birth weight (LBW) and small for-gestational age (SGA). Various nutrients may influence pregnancy outcomes by altering both maternal and fetal metabolism due to their roles in modulating oxidative stress, enzyme function, signal transduction and transcription pathways that occur in pre pregnancy i.e. during the critical periods of preconception and conception period. So pre pregnancy BMI was the deciding factor of nutritional status of women.⁸

As per National Family Health Survey (NFHS -3, 2005-06) in India, more than one-third (36.0 percent) of women aged 15-49 years in India have a Body Mass

Index (BMI) below 18.5kg/m^2 indicating chronic nutritional deficiency. Women who are undernourished themselves are also much more likely than other women to have children who are undernourished.²¹

Another study conducted in 49 villages of Varanasi block in India on 6130 non-pregnant and non-lactating rural women aged 18-45 years showed that around 50.0% rural UP women in pre-pregnancy state were undernourished. The distribution of women according to Body Mass Index (BMI) revealed that 39.5% women were below 18.5kg/m^2 .²²

One more study conducted in Bangladesh and Philippines showed that, higher mean BMI in the urban/peri-urban samples was accompanied by higher prevalence of overweight (BMI > 25, 28–33% compared to 2–7% in the 2 rural sites). Prevalence of low BMI (18.5) ranged from 9 to 17% except in rural Bangladesh, where nearly one-half the NPNL (Non pregnant and non lactating) women had low BMI. Energy intakes were similar across sites, with the exception of the Philippines.²³

As per NFHS-3, more than one-third (36 %) of women aged 15-49 in India have a BMI below 18.5 indicating chronic nutritional deficiency, including 16 percent who are moderately to severely thin. The proportion of women who are undernourished is highest in Bihar (45 %), Chhattisgarh (43%), Madhya Pradesh (42%), and Orissa (41%). It is lowest in Sikkim (11%) and Mizoram (14%). The highest proportion of undernourished women was in Madhya Pradesh and Rajasthan. Obesity, the other side of poor nutrition, is a substantial problem among several groups of women in India, particularly urban women, well-educated women, women from households with a high standard of living, and among Sikhs. Anemia is a major health problem in women of reproductive age group, affecting 55% of women. The

consumption of a wide variety of nutritious foods is important for women's health. In general, women's food consumption is less balanced than that of men. Ninety percent or more women consume dark green leafy vegetables and pulses or beans weekly; however 55% women consume milk or curd weekly. Consumption of fruits and other foods is less common among women. Only 40 percent of women consume fruits weekly; 32 percent of women consume eggs weekly; and 35 percent of women, consume fish or chicken/meat weekly.²⁴

The trial was done from January 2006 to May 2012 in the Bandra, Khar, Santa Cruz, and Andheri areas of the city of Mumbai, India, in slums covered by the health and social programs of the nongovernmental organization i.e. the Centre for the Study of Social Change (CSSC). A total of 6513 preconception women were eligible and participated. At recruitment, 32% of women were underweight (BMI, 18.5), and 14% of women were overweight or obese (BMI >25). One-third of women were nulliparous. Only 6 women smoked, and 10% of women chewed tobacco. Eighty-seven percent of women had completed at least secondary education. Food-frequency questionnaire data collected at enrollment showed that women's diets were monotonous, with low intakes of micronutrient-rich foods. One-half of the women had not consumed milk or milk products (e.g., yogurt) in the preceding week other than in tea, and one-quarter of women had not consumed any green leafy vegetables. The majority of women (85%) had eaten fruit, 1 time/day, and more than one-quarter of women had consumed no meat or fish in the preceding week. Based on the interpretation of the BMI interaction in this study it was concluded that it is the extra macronutrients, in addition to micronutrients, which may be needed for underweight women in low- and middle-income countries.²⁵

A study done in Mashed, Islamic Republic of Iran, 2000 healthy preconception women were recruited under age of 15-49 age groups to assess the validity of MUAC and Chest circumference(CC) as a screening tool in detecting under weight and overweight, sensitivity, specificity and positive and negative predictive values(PPV and NPV) were calculated at various cut-off points for MUAC and CC. Using an MUAC cut-off point of 24 cm for detecting underweight, the sensitivity, specificity, PPV and NPV were 93.6%,83.9% and 98.1% respectively. The Study demonstrated lower anthropometric lean BMIs in preconception women, especially those less than 25 years of age women indicating the need for nutritional education.²⁶

C.MICRONUTRIENT DEFFICIENCY IN PRECONCEPTION WOMEN:

As per WHO , 21 out of 41 countries with data, more than one third of women aged 15-49 years are anaemic. Iron-deficiency anaemia is the most common, increases the risk of haemorrhage and sepsis during childbirth. It causes cognitive and physical deficits and reduces productivity in women. Preconception women are most vulnerable to anaemia due to insufficient iron in their diets, menstrual blood loss and periods of rapid growth.²⁷

Another study in USA revealed that the United Nations has urged that priority be given to programs in developing countries for the prevention of micronutrient malnutrition—sometimes referred to as “hidden hunger”. The micronutrients that have been emphasized are iodine, vitamin A, iron and, more recently, zinc (United Nations 1997, Hotz and Brown, 2004). Deficiencies of these micronutrients are estimated to affect the health, mental and physical function, and survival of more than two billion people worldwide. Women of childbearing age, especially in preconception age women are most at risk of micronutrient

deficiency. Iron deficiency has the highest rate of prevalence among nutritional deficiencies. Nutritional deficiencies of iron and zinc are often widespread in developing countries, where staple diets are frequently plant-based and consumption of expensive flesh foods (i.e., red meat, poultry, and fish) is low.²⁸

A Study done in low resource countries of Asia and Africa showed that, preconception and Periconceptional anemia may influence the synthesis of hormones and thus adversely affects infant growth. It was advised in many developed countries that, women were suggested to take vitamin and mineral supplements during preconception and periconceptional period to reduce the risk of adverse outcomes such as pre term delivery and low birth weight deliveries.⁸

One more cross sectional study showed that, for NPNL women, considering all micronutrients, the estimated prevalence of adequacy was below 50% for more than one-half, prevalence of adequacy was below 50% for 5 of 11 micronutrients, 6 in Mozambique, 7 in Burkina Faso and Bangladesh, and 9 in the Philippines. Considering results by micronutrient, prevalence of adequacy was below 50% for riboflavin, niacin, folate, vitamin B-12, calcium, and iron.^{29,30}

A cross sectional study was conducted in Shahajanpur District in 2006-07 of Uttar Pradesh, where 240 households were surveyed to know the level of nutrition and consumption of food items like cereals, vegetables, pulses, milk, meat, fish, eggs etc. It revealed the condition of food insecurity in selected villages; about 25 per cent of households were food insecure as the people did not get proper diet (which is far below to 2400 Kcal). An average of 6.67 per cent households by the category nutritional intake amounts to less than 1890 Kcal/day

calorie carbohydrate, proteins, fat, iron, and calcium deficiency affects growth and development of body and mental in adult women.³¹

According to NNMB survey in India, the intakes of micronutrients such as iron, vitamin A, riboflavin, vitamin C and folic acid were not even 50% of RDA in 51-83% of preconception women.. Among adults, the prevalence of chronic energy deficiency (CED i.e. BMI <18.5) was about 35% each in women. Similarly, the prevalence of overweight/obesity (BMI >25) was 13.5% among adult women. In reproductive age women, the median intakes of all the nutrients, barring thiamine were less than RDA. The median intake of energy was 1786Kcal as against RDA 2230Kcal, and ranged from a low 1346Kcal in Kerala to a maximum 2077Kcal in the State of Orissa. The intake of protein was 47g as against RDA 55g and ranged from a low 32g in West Bengal to a maximum 61g in Uttar Pradesh. The proportion of adult women consuming energy in amounts more than 70% of RDA ranged from a low 36% in Kerala to a high 95% in Orissa. Similarly, with respect to protein, the proportion ranged from 29% in West Bengal to 93% in Madhya Pradesh. The proportion of women consuming less than 50% of RDA of vitamins and minerals ranged from 41-72% for calcium, 75-92% for vitamin A, 23-81% for riboflavin, 17-58% for vitamin C, 18-76% for dietary folate and 31-92% for iron, with wide variations between the States.³²

As per 2006 NNMB survey, in India, the prevalence of anemia is high because of low dietary intake, poor iron (less than 20 mg /day) and folic acid intake (less than 70 micrograms/day) and poor bio-availability of iron (3-4 percent only) in phytate fibre-rich Indian diet.²⁰

In a study of women of reproductive age living in resource-poor settings showed that, prevalence of low BMI (18.5) ranged from 9 to 17% except in rural Bangladesh, where nearly one-half the NPNL women had low BMI. Preconception women, considering all micronutrients, the estimated prevalence of adequacy were below 50% for 5 of 11 micronutrients in Mozambique and 7 in Bangladesh. Adequacy was below 50% for riboflavin, niacin, folate, vitamin B-12, calcium, and iron. Also large gaps documented between intakes and requirements across a range of micronutrients.²³

A descriptive study conducted in Bangladesh revealed that, the staple food in women of reproductive age group were rice and bread with small amount of meat, fish, fruits, egg, milk and milk products. Also observed that calcium intake was low and 75% of participants consumed <600mg /day of calcium (RDA, ICMR). Again 13% of women consumed <200mg/day of calcium and 90% of women failed to meet RDA. The energy consumption was less than 69.5% of RDA. The dietary calcium intake correlated with protein intake($p < 0.05$) and was statistically significant.³³

According to National Institute of Nutrition(NIN) Hyderabad, recommended dietary allowances of nutrients for non-pregnant and non-lactating women as per 2012 , protein- 50gm, energy-1900kcal ,calcium- 400mg, iron- 21mg, vitamin A – 600ug, thiamine- 0.9mg, riboflavin- 1.1mg, niacin- 12mg, vitamin C- 40mg and dietary folate-100ug. Also recommended dietary intake(RDI) of food groups were, cereals and millets- 410gm/day, pulses and legumes- 40gm,green leafy vegetables- 100gm,other vegetables- 40,roots&tubers- 50gm,milk & products- 100,olis&fats-20gm, sugar jaggery- 35gm/day.³⁴

D.FOOD INSECURITY IN PRECONCEPTION WOMEN:

One more retrospective study done in Guatemala showed that, on an average preconception woman in the Western Highlands from households had a mean weight of 53.1 kg, height of 145.9 cm, and BMI of 24.9 kg/m². Weight and height of women of reproductive age were lower if they came from households with food insecurity, though there was not a significant difference in the weight of women from moderately vs. severely insecure households. Short stature among women (height < 145 cm) was associated with greater food insecurity in developing countries. Women of reproductive age from food secure or moderately food insecure households had greater hemoglobin concentration than women from severely food insecure households. The percentage of preconception women that were anemic was similar between food secure and moderately food insecure households (20.3% and 21.6%, respectively), but significantly less than the percentage of women from severely food insecure households experiencing anemia (29.4%).³⁵

A prevalence study done with the help of National Maternal –Infant Health Survey (ENSMI) during 2008-09 in Western Highlands of Guatemala, explored nutritional outcomes in women of reproductive age groups (15-49 years age). This study showed that three-quarters of women (71.3%) were worried of food and two-third (67.0%) had insufficient money to buy food in the past 30 days. Lesser percentage of women skipped meal (15.3 %) and complained of hunger (13.8%). Two-third of women in all house hold experienced either moderate or severe food insecurity during the last 30 days of study period. In those women of preconception age group, 16.5% had severe food insecurity, 40.4% were moderately food insecure and 43.1% were food secure. BMI was below normal (<18.5kg/m²) in more than 1.6

% of reproductive age group women which made it more difficult to detect significant associations in the regression model. In the multiple regression model results showed that women from moderately food insecure had a 0.83 lower odds of being overweight or obese compared to the odds of women from food secure households.³⁵

A base line survey was conducted in 2 districts of Mozambique in 2006-07. The survey was designed to measure the use of HFIAS (House hold food insecurity access scale) to assess the women's nutritional status through BMI in 15-49 age preconception women. A total of 20 clusters and 15 households in each cluster were taken for study and total households were 600. A tool of 9 questioners were used to assess HFIAS. Over the past 30 days were used to assess the frequency of occurrence of food insecurity. The themes covered in the tool were, a. Experiencing anxiety and uncertainty about household food supply b. Altering quality of the diet c. Reducing quantity of food consumed. Then based on reply, score was given from range 0-27. The higher score means poorer access to food and least score declared food secure. If the score ranges from 0-11 it indicates least food insecurity, 12-16 indicates medium food insecure and >17 indicates severe food insecure. The mean score was 2.08 in Chibabava district and 3.20 in Gondola district. The proportion of households in the lowest category in the Chibabava district was 43% and in Gondola district was 23%. Comparing both districts as HFIA scales, Chibabava district women were less food secure than Gondala district. The BMI of 15-49 age preconception women in both districts was 7-18% below normal values.³⁶

A study done in Shahajanpur district of Uttar Pradesh showed that, in preconception women level of consumption of energy was less than 1890 Kcal Exists in any individual, family, and household, it creates hunger and starvation that have

adverse effects on human health and growth in adult women. The damage caused by chronic undernourishment begins in preconception age and follows people throughout life. In Uttar Pradesh 8 per cent people consume less than 1890 Kcal while 42 per cent are below poverty line. Low income and non-availability work, unemployment and limited sources of income are the main causes of food insecurity inspite of availability and accessibility to food grains. Villages located in less fertile soil region and in interior locations have food insecurity which ranges in order of 13.33 per cent (as hungry) and 26.67 per cent (as insecure).³³

In a Cohort Follow-up Survey done in Sarlahi, Nepal, a total of 16,320 women were recruited. Among the year-round foods, cereal and cereal products were reportedly consumed a median of 14 (IQR 13-17) times per week, and, among individual items, rice was most frequently eaten [13 (7-13) times, followed by wheat [2 (0-6) times]. Among fats and edible oil eaten 13 (13-14) times per week, vegetable oil was most often consumed [13 (13-13) times], with <25% of the subjects reporting to have eaten local clarified butter (ghee) and hydrogenated oils [0 (0-0) times per week for both] in the previous week .Potatoes and pulses, legumes and nuts were often consumed with median intakes of 10 (5-13) and 6 (2-9) times respectively during the preceding week. On the other hand, foods of animal source, such as milk and milk products, were far less consumed [3 (0-9) times in the previous week], with one-fourth of the study population reporting eating none. Foods groups like, meat, egg, and fish products were eaten infrequently, 1 (0-2) time per week, with median intake of individual meats being zero. Year-round vegetables were reportedly eaten 4 (2-7) times per week, with green leafy vegetables accounting for half [2 (0-4)] of those consumed. Consumption of most seasonal fruits and vegetables was low, even

in season. Irrespective of wealth; intakes of vegetables, fruits, and animal products were far less frequent, especially among women of lower socioeconomic means.³⁷

A cross sectional study done in Asia and Africa showed that women of reproductive age group under nutrition (BMI <18.5 kg/m²) ranges from 10% to 19% in most developing countries. Low BMI, often combined with short stature (<145 cm), is particularly common among women in lower-income countries, where many families live in circumstances of chronic food insecurity.⁷

METHODOLOGY

Study area:

Study areas were 18 villages belonging to 10 Primary Health Centers (PHC) of 5 Talukas of Belgaum District in Karnataka state.

Showing the details of study area in Belgaum District:

Taluka	PHCs	Villages
Ramdurg	Sureban	Manihal, Sureban and Hampiholi
	Budnur	Budnur Chilamur
Saundatti	Murgod	Murgod
Bailhongal	Hunshikatti	Hunshikatti, Turamuri
	Naganur	Naganur
	Tigadi	Tigadi
	Deshnur	Deshnur
Hukkeri	Hulloli	Hulloli and H Hatti
Chikkodi	Khadaklat	Khadaklat
	Ankali	Ankali, Siddapurwadi Manjari and Manjriwadi

Map: Showing all the Primary Health Centers of study areas in Belgaum

District:



Study design:

A cross sectional study.

Study period:

One year – January 2014 to December 2014.

Source of data:

The study was conducted on preconception women of reproductive age (15-49) groups residing in rural areas of Belgaum district. Women of nulliparous and Para 1-3 who were non-pregnant and non-lactating were enrolled in the study.

Sample size:

Approximate eligible women were - 4235

Prevalence of anemia in Married Women of Reproductive Age Group (MWRA) - 51% .²⁰

Formula: $n=4pq/d^2$

By cluster random sampling method and assuming design effect '2'

So, $n=384 \times 2=768$

n=770

Women were selected by simple random technique from each PHC.

Inclusion Criteria:

1. Non pregnant-non lactating women (NPNL) of 15-49 age groups.
2. Parity 0-3 women who were not following any family planning method.

Exclusion Criteria:

1. Women of primary and secondary sterility.
2. NPNL who were having Hb% less than 7gm/dl.
3. Women adopted permanent and temporary method of sterilization.

Ethical clearance:

The present study was approved by J.N.M.C Institutional Ethics Committee on Human Subjects Research (Ref: MDC/DOME/189 dated 07/12/2013)

Method of collection of data:

Married women of Reproductive Age (MWRA) were identified through MNHR (Maternal Newborn Health Registry) of the JNMC Women's and Children's Health Research Unit identified Primary Health Centers (PHC) and villages of Belgaum District. MNHR has already been established in the above listed PHCs. Nulliparous and Para 1-3 women have been identified and enrolled in the study.

Eligible women were identified from the above mentioned areas of Belgaum District belongs to 18 villages of 10 PHCs of 5 Talukas were identified and enrolled.

Study area and sample from each PHC:

Taluka	PHCs	No. of women enrolled
Ramdurg	Sureban	85
	Budnur	92
Saundatti	Murgod	88
Bailhongal	Hunshikatti	79
	Naganur	80
	Tigadi	59
	Deshnur	60
Hukkeri	Hulloli	54
Chikkodi	Khadaklat	72
	Ankali	101
TOTAL	10	770

Maternal Newborn Health Registry (MNHR) in the Belgaum District:³⁸

Pregnancy related vital registration is important to reduce maternal, fetal and newborn mortality for capturing accurate data are available in low-middle income countries where the majority of the mortality occurs.

So MNHR established in the PHCs of the Belgaum District by JNMC Women's and Children's Health Research Unit Belgaum funded by U.S. Eunice Kennedy Shriver National Institute of Child Health and Human Development USA.

The MWRA (Married women of Reproductive age) register contains the information regarding couples eligible to receive contraception services, infertile women and there yet to reach menopause. It also identifies those couples wishing to and who are likely to conceive within the following year. The MWRA is updated every year by a house to house survey conducted by auxiliary nurse midwives (ANMs), Anganwadi workers (AWWs) and Accredited Social Health Activists (ASHAs). The data collection for the MNHR began in May 2008.

It contains the list of women who are likely to conceive in future year. This has helped in the study to identify the preconception women in the above mentioned PHCs with the help of MNHR all the women were identified randomly.

Collection of data:

Data collection was done after identification of women, on socio demographic and food insecurity, laboratory investigations, anthropometry and consumption of 24-hour dietary history.

1. Identification of women:

Through MNHR eligible women list has been prepared with help of medical officer, ANM and research assistants of particular area.

Women names were enrolled in study and list of nulliparous and Para 1-3 women who were non-pregnant and non-lactating were enrolled in the study area. Selection of women has been done through cluster sampling method.

Analysis of likely to conceive list (L-t-C) in study clusters as below:

Primary Health Centers	Population	MWRA (15-49 age.)	Presently pregnant	Using contraceptives	Likely to conceive
Sureban	11309	531	94	18	419
Budnur	6272	664	49	32	483
Murgod	10418	719	140	36	543
Hunshikatti	8720	470	104	24	342
Naganur	5313	290	49	10	231
Tigadi	5085	319	44	50	225
Deshnur	6773	364	65	28	271
Hulloli	10100	435	102	23	310
Khadaklat	12387	565	92	58	415
Ankali	24281	1248	195	57	996
Total	100666	5605	1034	336	4235

2. General information, Socio demographic and food insecurity data collection:

All the eligible women's residential address, general information, socio demographic information and food insecurity data were collected by visiting to women's house with the help of ASHAs and HVRAAs (Home visiting research Assistant). HVRAAs are working mainly for research activities of JNMC Women's and Children's Health Research Unit Belgaum. They were trained in quality management and follow-up of women. They were all trained in JNMC Women's and Children's Health Research Unit for 3 days. They are residing in the same place. As they were residing in same place and have good rapport with community and easy access to each home. They were helped in collecting data.

Eligible women of each village were selected randomly by visiting house to house. General information, Socio demographic information and food insecurity information were collected by individual house to house visit. This has helped to collect correct and accurate information.

Informed written consent was taken during house to house visit from each study participant.

3. Laboratory investigations:

All the eligible women were called to PHC on weekly basis for laboratory investigation for Hb.% and urine sugar and albumin. Women who were having Hb.% <7gm/dl were excluded. On the same day GPE (General physical examination) and systemic examination was conducted.

Hemoglobin estimation by Sahli's method: ³⁹

Hemoglobin estimation by Sahli's method was done for every participant in the study. Hemoglobin meter tube was filled with N/10 HCL up to its lower mark with a dropper. The finger of the participant was pricked with all aseptic precautions and the first drop of blood was discarded. The hemoglobinometer pipette was used to suck blood up to 20 cu mm mark. Blood was immediately transferred into tube containing HCL. The solution was left in the tube for about 10 minutes (for maximum conversion of hemoglobin to acid hematin). Then the acid hematin formed was diluted by adding distilled water drop by drop. The color of the solution was matched with the standard comparators and the reading of lower meniscus was noted as result.

Urine examination: Rapid urine test : ⁴⁰

This involved dipping a test strip with small square colored fields on it into the urine sample for a few seconds. After a little time the result will appear. Depending on the concentration of the particular substance testing for, the fields on the test strip change color. Then the resulting colors of the fields were compared with a color table which found on the urine test package. With this urine Albumin and Sugar were measured.

4. Anthropometry: ⁴¹

Anthropometry has been done in the respective PHCs.

Standing Height:

Measuring accurate height is a critical component of assessment. For this wall mounted adult stadiometer was used in all PHCs. Simple stadiometers accurate to 0.5

cm was available at each health center. The subject stood straight without footwear, with heels, buttocks and back touching the wall and arms hanging by side. The height was measured from head to heel. Height was recorded to nearest 0.1 cm. All women's height measurements obtained from the same calibrated instrument at the health center facility.

Women's weight:

Each woman's body weight was measured without any foot wear and with minimal clothing to the nearest 0.1 kilogram using a standard portable electronic weighing machine, which was standardized periodically during the study. Weight was measured by the standard weighing (electronic) machine which has been supplied to all the PHCs to maintain uniformity. The scale was adjusted to zero before each session and weight was recorded in kilogram. Weight was recorded to the nearest 0.1 kg.

Mid upper arm circumference (MUAC):

For measuring maternal MUAC, retractable tape was used. Reference range was 14.9 -30 cm. Measurement took on the upper left arm. It was measured by flexing elbow to 90⁰ and finds the midpoint between the end of the shoulder (acromion) and the tip of the elbow (olecranon); this midpoint was marked. Then the arm was allowed to hang freely, palm towards the thigh, and the measuring tape is placed snugly around the arm at the midpoint mark. Same tape was used in all PHCs to maintain uniformity. MUAC was recorded to the nearest 0.1 cm.

Waist and Hip Circumference:

It was taken in standing position and measured around her bare abdomen at her natural waist, usually just above the umbilicus. Tape was parallel to the floor and fit snugly but not compressed her skin. Waist circumference was recorded to the nearest 0.1cm

Hip Circumference:

While measuring hip circumference woman was standing with feet together and wearing light cloth. The tape was placed around the maximum extension of the buttocks (i.e. around the widest part of her buttocks). Hip circumference was recorded to the nearest 0.1cm. Same tape was used in all PHCs to maintain uniformity

Body Mass Index (BMI):⁴²

The BMI was calculated using the formula given below.

$$\text{BMI} = \text{Weight (Kg)} / \text{Height (Meter}^2\text{)}.$$

BMI is classified for Asians as:

BMI	Status
< 18.5	Under weight
18.5 -22.9	Normal
≥23	Over weight

5. Consumption of 24hour dietary history:

The mean of the proximate daily calorie (energy), protein, fat, dietary fiber and vitamins (Vitamin A&C, Folate, Vitamin B₁ B₂ B₆ B₁₂) and minerals (Iron, Calcium and Zinc) intake of the women who were in the study were assessed on the

basis of 24 hrs. dietary recall. Dietary intake was assessed in half of the study participants (385) selected on alternative basis. Given that the study population is a homogenous one with fairly similar dietary habits and consuming food prepared using mostly the same generic recipes, dietary assessment was restricted to half the study population. Additionally, in 30% of the study participants repeat dietary recall was performed to validate the nutritional intakes further increment in the number of dietary assessments will not provide additional information to the understanding of the nutritional deficiencies in the study population.

The second dietary recall conducted after 2 weeks of the 1st recall on the nonconsecutive days to avoid learning effect also enabled the estimation of the proportion of participants at risk of inadequate intakes of particular nutrients for e.g. Calcium, Iron, Zinc. For the repeat recall, 30% (119 women) of the participants who had undergone prior dietary assessment were randomly selected.⁴³

24 Hour Dietary recall in PHC as below:

PHCs	1st Dietary recall	2nd Dietary recall
Sureban	44	11
Budanur	47	12
Murgod	44	12
Hunasikatti	42	11
Naganur	39	12
Tigadi	27	12
Deshnur	40	12
Hulloli	28	12
Khadaklat	27	12
Ankali	47	13
Total	385	119

Dietary recall was done in women's home. An equal number of recalls conducted each day of the week to ensure equal representation in the final study. A repeat dietary recall conducted on a non-consecutive day after 2 weeks and within 1 month of the first dietary recall. E.g.: If first recall conducted on Tuesday the next recall was not conducted on Monday or Wednesday to avoid the learning effect i.e. when the participant may repeat the same information reported in the previous recall.

To calculate mean of the proximate daily calorie (energy), protein, fat, dietary fiber and vitamins (Vitamin A&C, Folate, Vitamin B₁ B₂ B₆ B₁₂) and minerals (Iron, Calcium and Zinc) intake, there were 4 steps involved.

STEP-1:

List of all the foods and drinks consumed:

Listing of all foods and drinks consumed sequentially during the preceding 24 hours, starting at the time of waking. On the day of the 24hr recall interview, the food and drinks consumed in previous day was asked. Interview was used to start with the following "I would like you to tell me what you had after you wake up yesterday morning. When did you get up in the morning? Did you eat or drink anything then? Did you eat that food at home or somewhere else? What did you have next and at what time? Direct questions about specific meals were avoided. Time and location of consumption of food were recorded in form.

STEP-2:

Describe the foods and drinks consumed:

Detailed description of each food and drink item was recorded in the form. Information was also recorded if different types of staple, whether refined or unrefined was used by the study participants. For each mixed dish or drink (A dish > 1 ingredient) form of consumption like raw, boiled, fried, grilled etc was also recorded.

STEP-3:

Estimation of portion sizes and conversion to weight equivalents:

A dietary kit was developed for the study purpose containing articles like, various sizes of cups and spoons purchased from local market. They were marked as C1 to C12 for cups and S1 to S5 for spoons. Measuring jars were used measure liquid items. All utensils were standardized.

Individual consumed portions size was estimated by direct weighing. The respondent was asked to visualize the amount of food or drink consumed. The bowl or plate was placed on the scale and adjusted to scale zero. Then asked the participant to measure the amount of taken into the weighed plate /bowl preferably using an actual food or salted replica. This method is highly preferred in order to decrease risk of estimation error.

In case, actual food was not available the food models or photo graphs were used to display and food consumed was recorded as large, medium and small. Liquids were recorded as volumes in ML by using graduated jug. Local calibrated spoons

were used for jam, sugar and salt. For commercial food in individual portions, the weight or size was recorded on the label and number of items eaten.

Conversion of portion sizes to weight equivalents:

Standardized model utensils and spoons were used to convert the consumed portion to gram weight equivalents. Volume of liquid food recorded was converted to gram weight equivalents by using specific gravity with the help of following formula:

$$\text{Weight} = \text{Specific gravity} \times \text{Volume.}^{44}$$

STEP-4:

Review:

24hrs dietary record form was reviewed to ensure all foods and drinks were mentioned completely. After feeling everything was correct asked to go home.

Preparatory work for 24hrs dietary recall:

For accurate 24hrs dietary recall, interviewer should have good interviewing skills. For this purpose the investigator underwent training in NIN (National Institute of Nutrition) Hyderabad for 15 days and training of 24 hour dietary recall assessment and food composition table by Rebecca Lander, Research nutritionist from University of Colorado Denver, in J.N.M.C.Belagavi for 5 days.

Generic recipes were constructed with the help of research nutritionist. A total of 96 generic recipes were identified across the Belgaum district for the study. For each dish, minimum 5 and maximum 10 recipes were collected and average of this was taken.

Then Nutrient values were derived from the existing food composition table (FCT) in India. (Gopalan et.01.1989), the US Dept of Agriculture (USDA) national Nutrient Database for standard reference (2013), the Bangladesh FCT (Shaheen et.01.2013) and the World Food Dietary Assessment System (Bunch and Murphy 1997) with appropriate moisture adjustments as required (Gibson and Ferguson 2008)^{43,45,46,47}

All calculations for the analysis of energy, protein, fat, vitamins and minerals intakes were calculated by using STATA statistical software package version 13.0 (Stata Corporation, college station, Tx USA)

Analysis:

Codes were prepared for each options of the questionnaire. Data was entered in excel sheet to prepare master chart. SPSS version 21.0 software was used for analysis of the data. The tables and graphs were prepared by using Microsoft office 2010 software.

Dietary details were entered in food record table (FRT). First and second dietary recalls were entered separately. Then this excel sheet was merged with food composition table (FCT) and all the nutrient values like calorie (energy), protein, fat, dietary fiber, vitamins (Vitamin. A&C, Folate, Vitamin B₁ B₂ B₆ B₁₂) and minerals (Iron, Calcium and Zinc) were calculated. For food analysis of the macronutrients, micronutrients and minerals intakes were calculated by using SPSS version 21.0. The values were tabulated as per National Nutrition Monitoring Bureau 2012 survey report, Hyderabad.

Socio-demographical variables were analyzed by means and standard deviations and food insecurity and anthropometric were summarized using percentages.

Chi-square test was used to find the association between various socio-demographic variables and food insecurity and nutrient intakes.

Variables:

Menarche:⁴⁸

The appearance of first menstrual flow in the life of a girl is called menarche. Normally it appears between 11-13 years of age.

Nullipara:⁴⁹

It is one who never completed a pregnancy to stage of viability.

Food security:³⁵

The United States Agency for International Development (USAID) defines food security as a state in which “all people at all times have both physical and economical access to sufficient food to meet their dietary needs for a productive and healthy life”

Food insecurity:

Food insecurity means below 3 elements were not fulfilled.

1. Adequate food availability.
2. Adequate access to food by all people.
3. Appropriate food utilization and consumption.

The household food insecurity access scale (HFIAS) was developed by USAID Food and Nutrition Technical Assistance to assess food insecurity in developing countries. Based on a 9 item questionnaire food insecurity was assessed in the present study.⁵⁰

It is categorized into 4 types:

- | | | |
|--------|---|--------------------------|
| HFIA 1 | - | Food secure |
| HFIA 2 | - | Mildly food insecure |
| HFIA 3 | - | Moderately food insecure |
| HFIA 4 | - | Severe food insecure |

It consists of 9 occurrence questions which represents increasing level of severity of food insecurity (access) and follow up “frequency of occurrence” questions to determine how often the condition occurred relating to 3 different domains of food insecurity (access), anxiety and uncertainty about the food supply, insufficient quality and insufficient food intake.

Age: Age was recorded to the nearest completed years.

Educational status:

- Illiterate - A person who cannot read and write.
- Primary school – Person who has studied from 1st to 7th standard.
- High school – Person who has studied 8th to 10th standard.
- Pre-university / Diploma – Person who has studied up to PUC 2nd year or a diploma course.

- Graduate– Person who has obtained any degree.

Occupation:

- Housewife – A woman who takes care of the household day to day duties.
- Agriculturist – A person who works in farm field.
- Daily wage worker – A person who makes living on daily wage basis
- Factory worker – A person who works in a small or large scale industry

Socio-economic status:

Information regarding per capita income (in Rupees / month) was collected and socio-economic status was classified using Modified B G Prasad’s classification for the study period (2014) and it was calculated by Multiplication factor with 1961 Prasad’s classification values.⁵¹

Average consumer price index for year 2014 = 1130^{52, 53}

Modification was done with the aid of multiplication factor (M.F), which was obtained as below:

Average consumer price index for the study period (2014)

$$\begin{aligned} \text{M.F.} &= \frac{\text{Average consumer price index for the study period (2014)}}{100} \times 4.93 \\ &= 1130 / 100 \times 4.93 = 55.71 \end{aligned}$$

Socio-economic status	Prasad's classification 1961 (per capita income in Rs/month)	Modified Prasad's classification In study period 2014 (per capita income in Rs/month)
I	≥ 100	≥ 5571
II	50—99	2786– 5570
III	30-49	1671 – 2785
IV	15-29	836 – 1670
V	≤ 15	≤ 836

Type of family:²

Nuclear family - Household, where married couple along with their dependent children live in the same house.

Joint family - Household, where many married couples and their children live in the same house. Males are blood relatives and females of the family are related by either marriage or blood relation.

Three generation family - Household, where representatives of three generations related to each other by direct descent live together.

Consanguineous Marriage: According to WHO, a consanguineous is defined as a marriage between people who are second cousins or more related.

Blood pressure measurement: During the study, blood pressure of each study participant was recorded using mercury sphygmomanometer. The average of two systolic blood pressure and diastolic blood pressure readings were considered to

describe the blood pressure of the participant. In cases where the two readings differed by over 10 mm Hg, a third reading was obtained and three measurements were averaged.²

Categorization of subjects by blood pressure levels: The subjects were divided into “Normotensives” or “Hypertensive” on the basis of their blood pressure levels.

Normotensives: Systolic blood pressure less than 140 mm Hg and Diastolic blood pressure less than 90 mm Hg.

Hypertensive: Systolic blood pressure 140 mm Hg or above; Diastolic blood pressure 90 mm Hg or above

Anemia:

A hemoglobin level of <7gm/dl is suggestive of underlying systemic pathology including severe nutritional deficiency and is not representative of the general population. Therefore, women with hemoglobin<7gm/dl. at screening were excluded from the study and were advised to undergo further evaluation of their anemic status and seek appropriate medical care.²¹

Grading of anemia in women according to WHO criteria:⁵⁴

Hemoglobin (g %)	Anemia
≥11.0	No Anemia
10.0-10.9	Mild Anemia
7.0-9.9	Moderate Anemia
<7.0	Severe Anemia

RESULTS

The present study was conducted in the rural area of Primary Health Centers of Belgaum District. A total of 770 women were enrolled and in that 392 women's 24hours dietary recall has been done, during the period of January 2014 to December 2014.

The data obtained was tabulated and analyzed under following headings:

- I. Socio-demographic profile**
- II. Gynecology and Obstetrics History**
- III. Personal information**
- IV. Hematological profile**
- V. Nutritional status of preconception women :**
 - 1. Anthropometry**
 - 2. Macronutrient intake**
 - 3. Vitamins intake**
 - 4. Mineral intake**
 - 5. Prevalence of food insecurity**

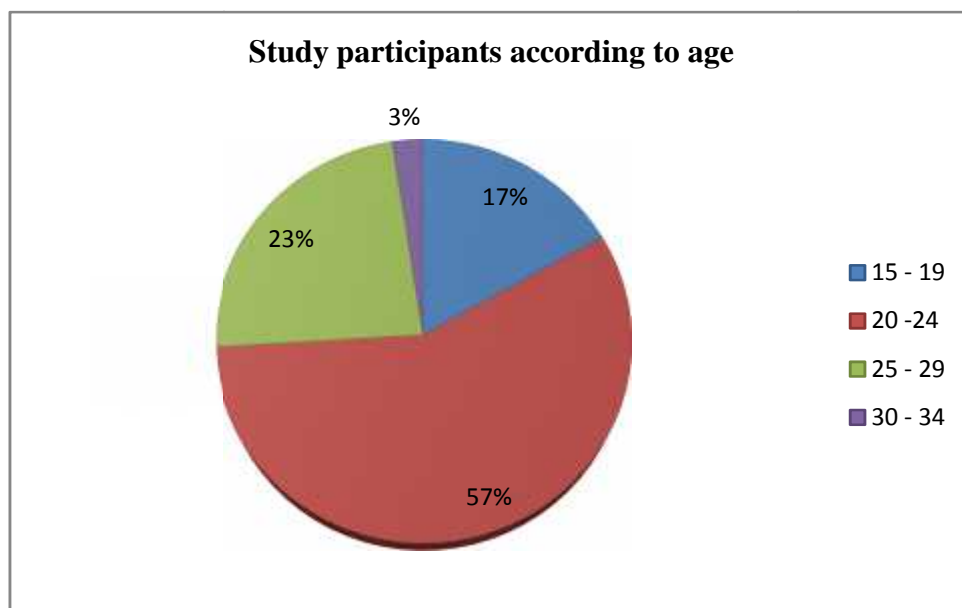
I) Socio-demographic profile:

A. Age:

Table 1. Distribution of the study participants according to their age:

Age (Years)	Study participants (n=770)	
	Number	Percentage
15 - 19	129	16.8
20 -24	441	57.2
25 - 29	181	23.5
30 - 34	19	2.5
Total	770	100.0

Graph 1.



In the present study, out of 770 study participants, 129 (16.8%) were in 15-19 years of age, 441 (57.2%) in 20-24 years, 181 (23.5%) in of 25-29 years and 19 (2.5%) belonged to 30-34 years of age. The mean age was 22.5 (SD±3.19) years and the median age was 22 years.

B. Religion:**Table 2. Distribution of the study participants according to their religion:**

Religion	Study participants (n=770)	
	Number	Percentage
Hindu	648	84.2
Muslim	119	15.4
Others	3	0.4
Total	770	100.0

A major number of participants, 648 (84.2%) were Hindus and Muslims constituted 119(15.4%).

C. Occupation:**Table 3. Distribution of the study participants according to their occupation:**

Occupation	Study participants (n=770)	
	Number	Percentage
Housewife	638	82.9
Labor	55	7.1
Others	42	5.5
Agriculturist	35	4.5
Total	770	100.0

As many as 638 (82.9%) participants of the study were housewives, 55(7.1%) were laborers, 35 (4.5%) were agricultural workers and 42 (5.5%) were others. (Factory workers, school teacher etc.)

D. Husbands' Occupation:**Table 4. Distribution of the study participants according to their husbands' occupation:**

Husbands' Occupation	Study participants (n=770)	
	Number	Percentage
Agriculturist	248	32.2
Others	413	53.6
Laborer	67	8.7
Factory Worker	42	4.5
Total	770	100.0

A large number of participants' husbands, 248(32.2%) were agriculturists followed by 67 (8.7%) were laborers, 42(4.5%) factory workers and 413(53.6%) belonged to other category such as daily wagers, tailors, school teachers, business etc.

E. Education:**Table 5. Distribution of the study participants according to their education:**

Education	Study participants (n=770)	
	Number	Percentage
Illiterate	51	6.6
Primary School	228	29.6
High School	331	43.0
PUC/Diploma	123	16.0
Graduate	33	4.3
Post graduate	4	0.5
Total	770	100.0

A large majority of study participants, 331 (43.0%) educated up to high school, 228 (29.6%) completed primary education, 123 (16%) studied up to PUC and 33(4.3%) and 4 (0.5%) studied graduate and post graduate course respectively. In this study 51(6.6%) women were illiterate.

F. Husbands' Education:**Table 6. Distribution of the study participants according to their husbands' education:**

Husbands' Education	Study participants (n=770)	
	Number	Percentage
Illiterate	54	7.0
Primary School	234	30.4
High School	236	30.7
PUC/Diploma	163	21.1
Graduate	80	10.4
Post graduate	3	0.4
Total	770	100.0

Among the husbands of the study participants, almost equal percentage 236(30.7%) and 234(30.4%) had studied up to primary and high school respectively followed by 163(21.1%) up to PUC, 80(10.45) were graduate, 3 (0.4%) were post graduate and only 54(7.0%) of them were illiterate.

G. Type of Family:**Table 7. Distribution of the study participants according to type of family:**

Type of family	Study participants (n=770)	
	Number	Percentage
Nuclear	181	23.5
Joint	579	75.2
Three Generation	10	1.3
Total	770	100.0

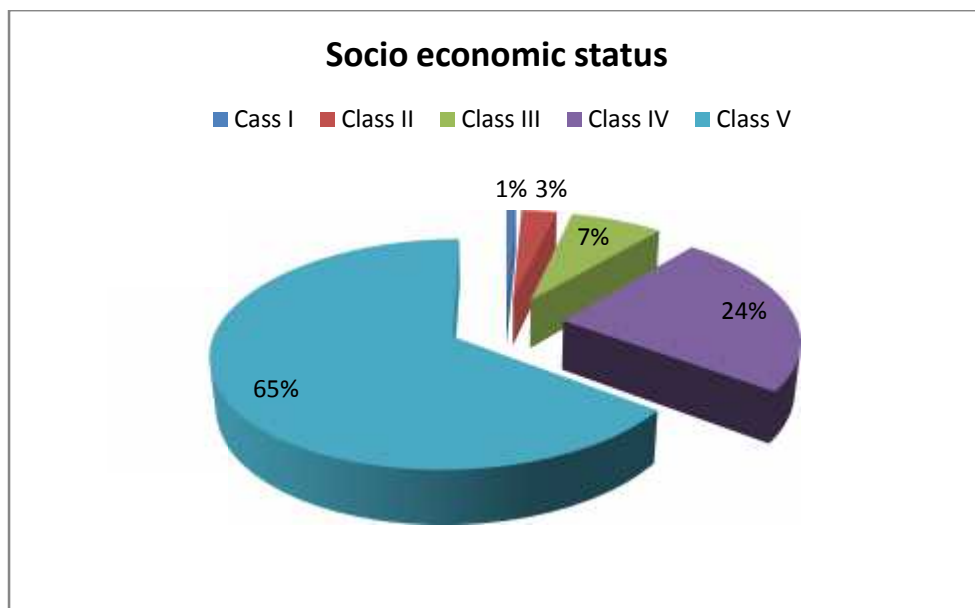
A great number of women 579 (75.2%) were living in a joint family, 181 (23.5%) in nuclear family and only 10 (1.3%) were living in three generation family.

H. Socio-Economic Status:

Table 8. Distribution of the study participants according to their socio-economic status:

Socio-Economic Status	Study participants (n=770)	
	Number	Percentage
Class I	6	0.8
Class II	22	2.9
Class III	58	7.5
Class IV	185	24.0
Class V	499	64.8
Total	770	100.0

Graph 2.



In the present study, majority of them, 499 (64.8 %) belonged to class V according to modified B G Prasad classification, followed by 185 (24.0%) to class IV, 58 (7.5%) to class III, 22(2.9%) to class II and only 6 (0.8%) belonged to class I socio-economic status.

II. Gynecology and Obstetrics History: a. Age at menarche:

Table 9. Distribution of study women according to their age at menarche:

Age at menarche (Years)	Study participants (n=770)	
	Number	Percentage
10 – 12	139	18.1
13 – 15	568	73.8
16 – 19	63	8.1
Total	770	100.0

Most of the women 568(73.8%) got their first menstrual period at the age of 13-15 years, 139 (18.1%) at the age of 10-12 years and 63 (8.1%) at the age of 16-19 years.

b. Age at Marriage:

Table 10. Distribution of the study participants according to their age at marriage:

Age at marriage (Years)	Study participants (n=770)	
	Number	Percentage
<18	295	38.3
>18	475	61.7
Total	770	100.0

Most of them 475 (61.7%) married after 18 years and 295 (38.3%) married before 18 years of age. The mean age of marriage was 18.2 years (SD \pm 2.59) and the median age of marriage was 18 years.

c. Consanguineous Marriage:

Out of the total 770 preconception women, 390 (37.7%) had consanguineous marriage

d. Parity:**Table 11. Distribution of women according to parity:**

Parity	Study participants (n=770)	
	Number	Percentage
Nulliparous	258	33.5
1 Child	338	43.9
2 Children	141	18.3
3+Children	33	4.3
Total	770	100

Amongst the total women, 338 (43.9%) were having 1 child, 141 (18.3%) 2 children and 33 (4.3%) had 3 or more children. About 258(33.5%) women were nulliparous.

III. Personal information:

a. Type of food consumed:

Among the total participants, half of them 374 (48.6%) were vegetarian and 396 (51.4%) were consuming mixed diet.

b. Habit of tobacco chewing:

Table 12. Distribution of study participants according to their habit of tobacco chewing:

Tobacco Chewing	Study participants (n=770)	
	Number	Percentage
Yes	16	2.1
No	754	97.9
Total	770	100.0

Among the total participants only 16 (2.1%) were used to chew tobacco and 754 (97.9%) had no habit of tobacco chewing.

c. Blood pressure :

Among the participants mean systolic blood pressure was 112.9mmHg. (SD 112.9±10) and median was 110mm Hg. Similarly, the mean & median diastolic blood pressure was 74.6mmHg (SD 74.6±7.91) and 74mmHg respectively

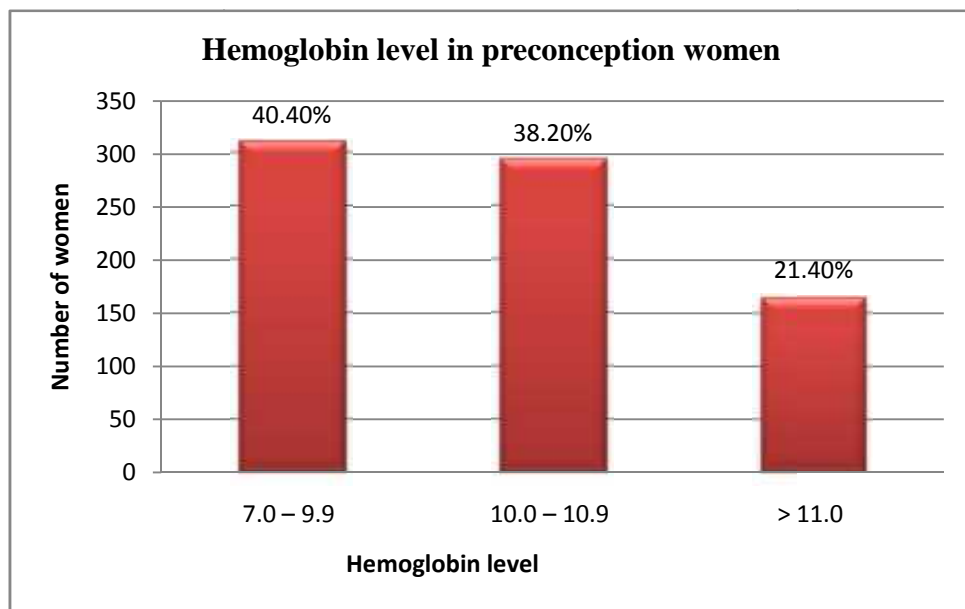
IV. Hematological and biochemical profile:

d. Hemoglobin:

Table13. Distribution of the study participants according to hemoglobin level:

Hemoglobin (gm/dl)	Study participants (n=770)	
	Number	Percentage
7.0 – 9.9	311	40.4
10.0 – 10.9	294	38.2
≥ 11.0	165	21.4
Total	770	100.0

Graph 3.



Of the total 770 participants, 311 (40.4%) had hemoglobin between 7.0 – 9.99 gm/dl, 294 (38.2%) women were with hemoglobin level between 10.0 - 10.99 gm/dl and only 165 (21.4%) women had a normal hemoglobin of ≥ 11.0 gm/dl.

a. Urine albumin and sugar :

In all the participants' urine for albumin and sugar was not detected.

V .Nutritional status of preconception women:

1. Anthropometry:

a. Height:

The heights of the participants ranged from 134.6cms to 167.2cms with a mean height of 151.4 cm (SD 151.4± 5.59). The median height was 151cms.

b. Weight:

The weights of the participants ranged from 30kg to 85kg with a mean 46.2kg (SD 46.2± 8.46). The median weight was 45kgs.

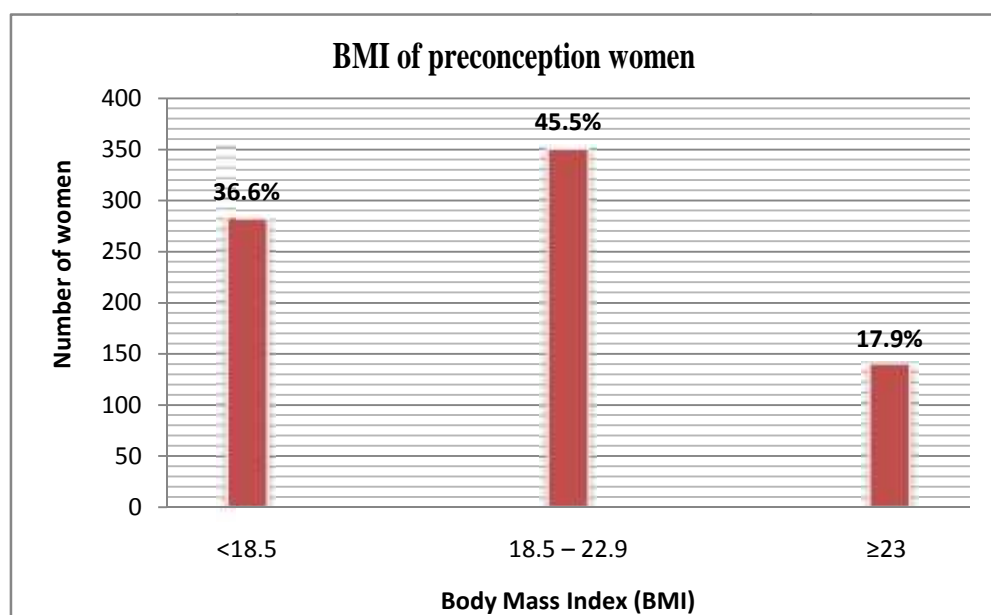
c. Body Mass Index:

Table 14. Distribution of the study participants according to BMI:

Body mass index(BMI)	Study participants (n=770)	
	Number	Percentage
<18.5 (Chronic Energy Deficiency)	282	36.6
18.5 – 22.9 (Normal)	350	45.5
≥23 (Over weight)	138	17.9
Total	770	100.0

One third of the study participants, 282 (36.6%) were of below BMI (Undernourished), 350 (45.5%) were normal BMI and 138 (17.9%) of them were overweight.

Graph 4.



d. Mid upper arm circumference (MUAC):

Table 15. Distribution of MUAC among study participants:

MUAC	Study participants (n=770)	
	Number	Percentage
Under Nourished (<22.0 cm)	190	24.7
Normal (≥ 22.0 cm)	580	75.3
Total	770	100.0

The MUAC of the participants ranged from 18cm. to 38.1cm with a mean 24.1cm and SD of 3.07. The median MUAC was 23.5cm. Among participants 190(24.7%) were having less than 22.0 cm of MUAC and 580 (75.3%) were having MUAC more or equal to 22.0cm.

a. Waist circumference (WC):

The WC of the participants ranged from 50cm to 106cm with a mean 65.2(SD 65.2 \pm 8.46). The median WC was 63.7cm.

b. Hip circumference (HC):

The HC of the participants ranged from 56cm to 113cm with a mean 85.2cm. (SD 85.2 \pm 7.17).The median HC was 84.6cm.

c. Waist – Hip ratio :**Table16. Distribution of Waist/Hip ratio among study participants:**

Waist/Hip Ratio	Study participants (n=770)	
	Number	Percentage
<0 .8 WH Ratio	555	72.1
0.8 WH Ratio	215	27.9
Total	770	100.0

Total of 555(72.1%) were having W/H ratio less than 0.8 and 215 (27.9%) were having W/H ratio more than or equal to 0.8.

Table 17. Distribution of undernourished participants according to BMI, MUAC and W/H ratio:

Parameters	Study participants (n=770)	
	Normal No. (%)	Undernourished No. (%)
BMI	488(63.4)	282(36.6)
MUAC	580(75.3)	190(24.7)
W/H Ratio	215(27.9)	555(72.1)

Among total participants, 282 (36.6%) were of below BMI (undernourished) and 488 (63.4%) normal BMI or overweight. The MUAC of the participants 190(24.7%) were having less than 22.0cm. and 580 (75.3%) were having more or equal to 22.0cm. So also 555(72.1%) were having W/H ratio less than 0.8 and 215 (27.9%) were having W/H ratio more than or equal to 0.8.

Nutritional status of preconception women according to dietary recall:

Among 770 study participants, dietary intake was assessed in half of the participants (385) selected on alternative basis, as the study population is a homogenous one with fairly similar dietary habits and consuming food prepared using mostly the same generic recipes as per Gibson and Ferguson an interactive 24-hour recall method.²⁸

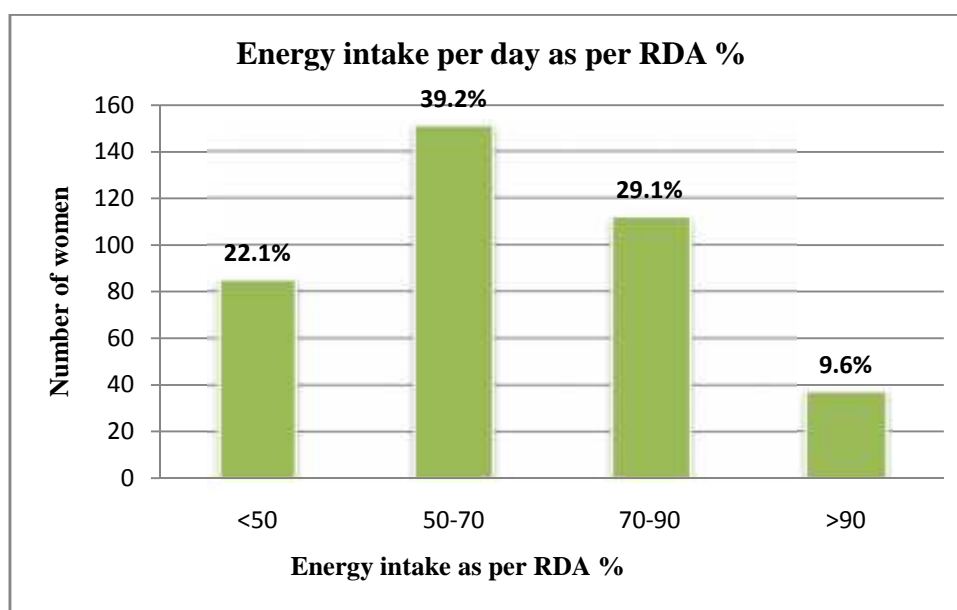
1. Macronutrient levels:

A. Energy intake:

Table 18: Distribution of participants according to energy intake per day³²:

Energy intake as per RDA (RDA-1900kcal/day) - %	Study participants (n=385)	
	Number	Percentage
<50	85	22.1
50-70	151	39.2
70-90	112	29.1
>90	37	9.6
Total	385	100.0

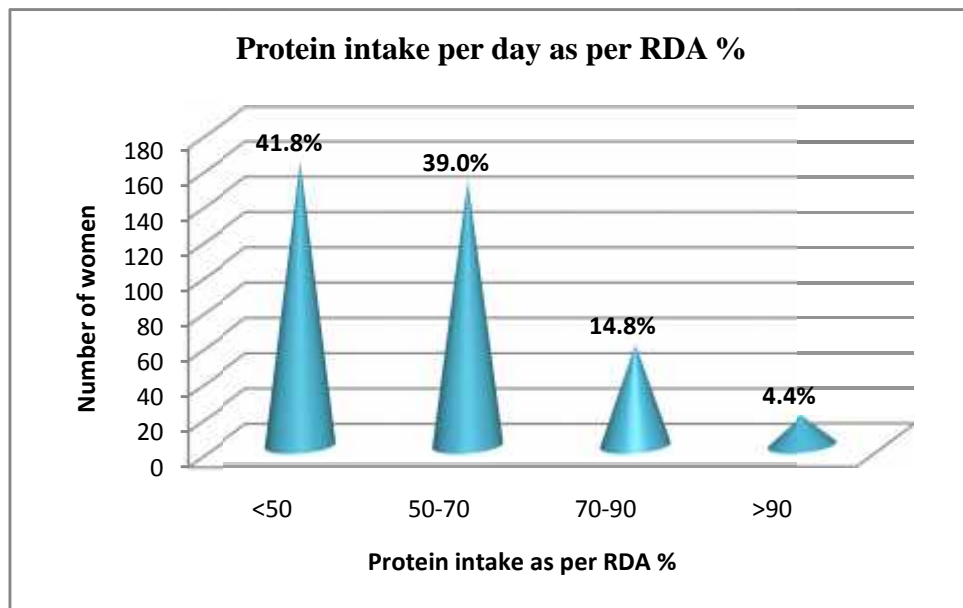
Graph 5.



Majority of participants were consuming calories less than 90%. Out of 385 participants 85 (22.1%) were consuming <50% of RDA, 151 (39.2%) were consuming 50-70% of RDA, 112 (29.1%) were consuming 70-90% RDA and only 37 (9.6%) were consuming >90% of RDA of energy. The median intake of energy was 1228, less than RDA 1900kcal and ranged from 350kcal to 2531kcal.

B. Protein intake :**Table 19: Distribution of participants according to protein intake per day³²:**

Protein intake as per RDA (RDA-55gms/day) - %	Study participants (n=385)	
	Number	Percentage
<50	161	41.8
50-70	150	39.0
70-90	57	14.8
>90	17	4.4
Total	385	100.0

Graph 6.

The consumption of protein was below 50% of RDA in 161(41.8%) of preconception women, 50-70% of RDA in 150(39.0%) women, 70-90% of RDA in 57(14.8%) and only 17(4.4 %) women were consuming protein >90% of RDA. The median intake of protein was 30 less than RDA 55gm and ranged from 7 to 75gm.

C. Lipid intake:**Table 20. Distribution of participants according to total fat (Lipid) intake per day³²:**

Total fat (Lipid) intake as per RDA (RDA-20gms/day) - %	Study participants (n=385)	
	Number	Percentage
<50	1	0.3
50-70	2	0.5
>90	382	99.2
Total	385	100.0

Most of the women consumed fat more than 90% of RDA ie.382 (99.2%), about 2(0.5%) were consumed 50-70% of RDA and 1(0.3%) was consumed less than 50% of RDA. The median intake of total fat was 44gm, more than RDA 20gm and ranged from 7 to 124gm.

D. Dietary fiber intake:**Table 21. Distribution of participants according to dietary fiber intake per day³²:**

Dietary Fiber intake as per RDA (RDA-30gm/day) - %	Study participants (n=385)	
	Number	Percentage
<50	345	89.6
50-70	36	9.4
70-90	4	1.0
Total	385	100.0

Dietary fiber consumption of participants 345(89.6%) which was <50% of RDA in that 36(9.4%) were consuming 50-70% of RDA, 4(1.0%) were consuming 70-90% of RDA and none was consumed more than 90% of RDA. The median intake of dietary fiber was 9 which was less than RDA 30gm and ranged from 1.7gm to 23.6gm.

2. Vitamins intake:

Table 22. Distribution of participants according to Vitamin B₁ (Thiamine) intake per day³²:

Vitamin B ₁ (Thiamine) intake as per RDA (RDA-1.0mg/day - %	Study participants (n=385)	
	Number	Percentage
<50	60	15.6
50-70	145	37.7
70-90	97	25.2
>90	83	21.5
Total	385	100.0

In this study about 145(37.7%) participants consumed Vitamin B₁ which was of 50-70% of RDA, 97(25.2%) consumed 70-90% of RDA, 83(21.6%) were consuming more than 90% of RDA and only 60 (15.6%) consumed less than 50% Of RDA. The median intake of vitamin B₁ was 0.6933 and was less than RDA 1mg and ranged from 0.2317 to 1.6489mg.

Table 23. Distribution of participants according to Vitamin B₂ (Riboflavin) intake per day³²:

VitaminB ₂ (Riboflavin)intake as per (RDA-1.1mg/day) –%	Study participants (n=385)	
	Number	Percentage
<50	83	21.6
50-70	184	47.8
70-90	62	16.1
>90	56	14.5
Total	385	100.0

Vitamin B₂ consumption of participants 50-70% of RDA were 184(47.8%), about 83 (21.6%) consumed < 50% of RDA, 62(16.1%) were consuming 70-90% Of RDA and only 56(14.5%) consumed more than 90% of RDA.

The median intake of vitamin B₂ was 0.6364mg less than RDA 1.1mg and ranged from 0.1297mg to 1.7822mg.

Table 24. Distribution of participants according to Vitamin B₆ (pyridoxine phosphate) intake per day³²:

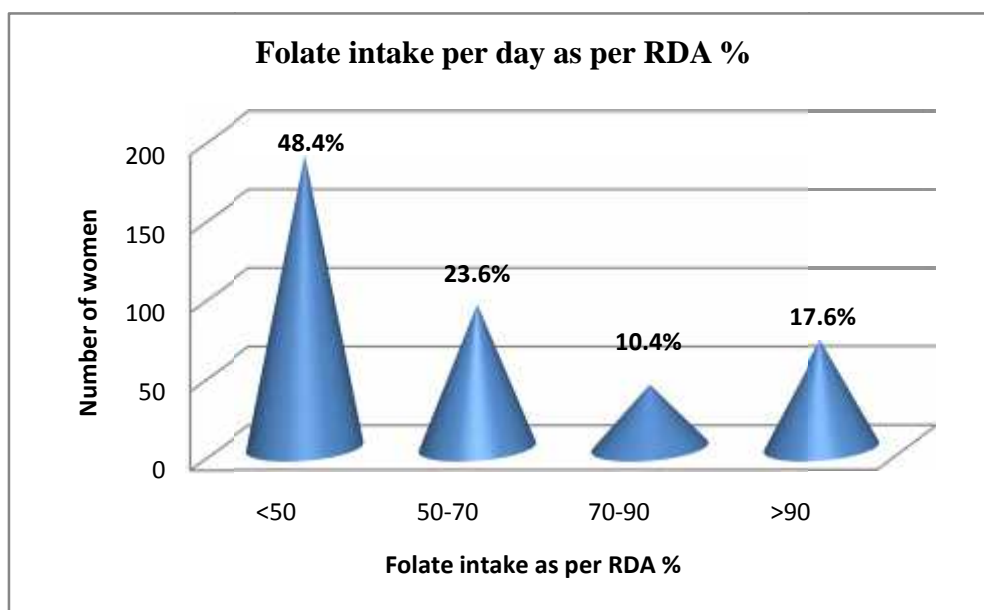
VitaminB ₆ (pyridoxine phosphate intake as per RDA (RDA-2.0mg/day) -%	Study participants (n=385)	
	Number	Percentage
<50	299	77.7
50-70	63	16.4
70-90	15	3.8
>90	8	2.1
Total	385	100.0

The participants consuming vitamin B₆ were 299 (77.7%) which was less than 50% of RDA, in that 63 (16.4%) consumed 50-70% of RDA, 15(3.8%) were consuming 70-90% Of RDA and only 8(2.1%) were consuming more than 90% of RDA. The median intake of vitamin B₆ was 0.7042mg less than RDA 2mg and ranged from 0.1578mg to 2.2274mg.

Table 25. Distribution of participants according to dietary folate intake per day³²:

Folate intake as per RDA (RDA-200ug/day) - %	Study participants (n=385)	
	Number	Percentage
<50	186	48.4
50-70	91	23.6
70-90	40	10.4
>90	68	17.6
Total	385	100.0

Graph 7.



Majority of participants consuming folate <50% of RDA were 186(48.4%) and only 68 (17.6%) study participants were consuming more than 90% of RDA.

The median intake of vitamin dietary folate was 104µg, less than RDA of 200µg and ranged from 23 to 500µg.

Table 26. Distribution of participants according to Vitamin B₁₂ (Cobalamine) intake per day³²:

Vitamin B ₁₂ (cobalamine) intake as per RDA (RDA- 1.0ugm/day) - %	Study participants (n=385)	
	Number	Percentage
<50	127	33.0
50-70	70	18.1
70-90	36	9.4
>90	152	39.5
Total	385	100.0

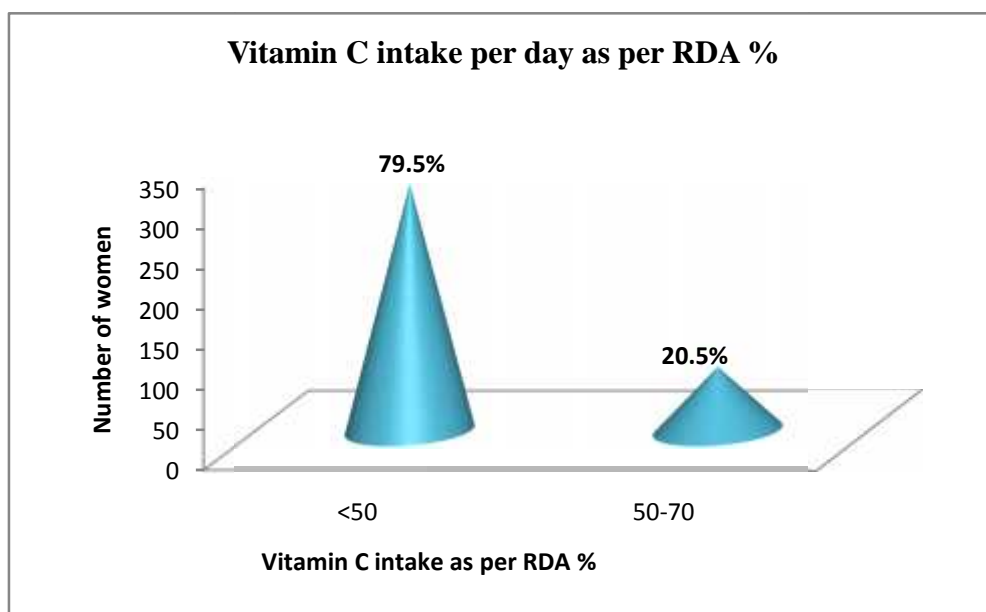
Vitamin B₁₂ consumption more than 90% of RDA was observed in 152(39.5%) of the study participants where as 127 (33.0%) were consuming < 50% of RDA.

The median intake of vitamin B₁₂ per day was 0.6753µg less than RDA 1µg and ranged from 0.0000 to 3.5327µg.

Table 27. Distribution of participants according to Vitamin C intake per day³²:

Vitamin C intake as per RDA (RDA-40mg/day) - %	Study participants (n=385)	
	Number	Percentage
<50	306	79.5
50-70	79	20.5
Total	385	100.0

Graph 8.

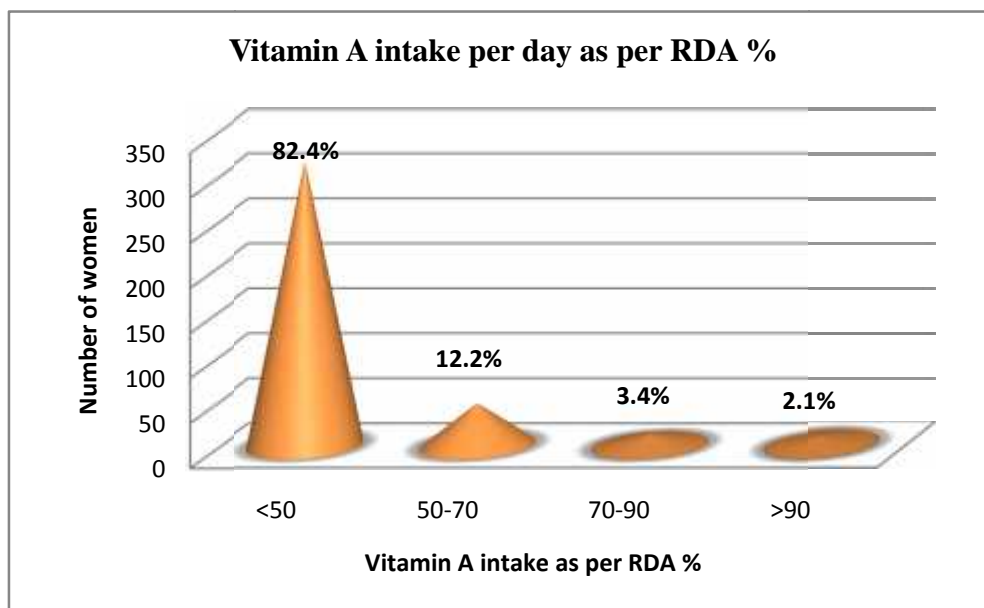


Majority of participants consumed vitamin C i.e. 306(79.5%) less than 50% of RDA, 79 (20.5%) consumed of 50-70% of RDA and no one consumed more than 90% of RDA of vitamin C. The median intake of vitamin C was 22mg less than RDA 40mg and ranged from 1.9 to 223mg.

Table 28. Distribution of participants according to Vitamin A (Retinol) intake per day³²:

Vitamin A intake as per (RDA-600ug/day) - %	Study participants (n=385)	
	Number	Percentage
<50	317	82.3
50-70	47	12.2
70-90	13	3.4
>90	8	2.1
Total	385	100.0

Graph.9



Vitamin A consumption was less than 50% of RDA in 317(82.3%) of participants and only 8(2.1%) consumed more than 90% of RDA of vitamin A.

The median intake of vitamin A was 195ug less than RDA 600μg and it ranged from 37 to 924μg.

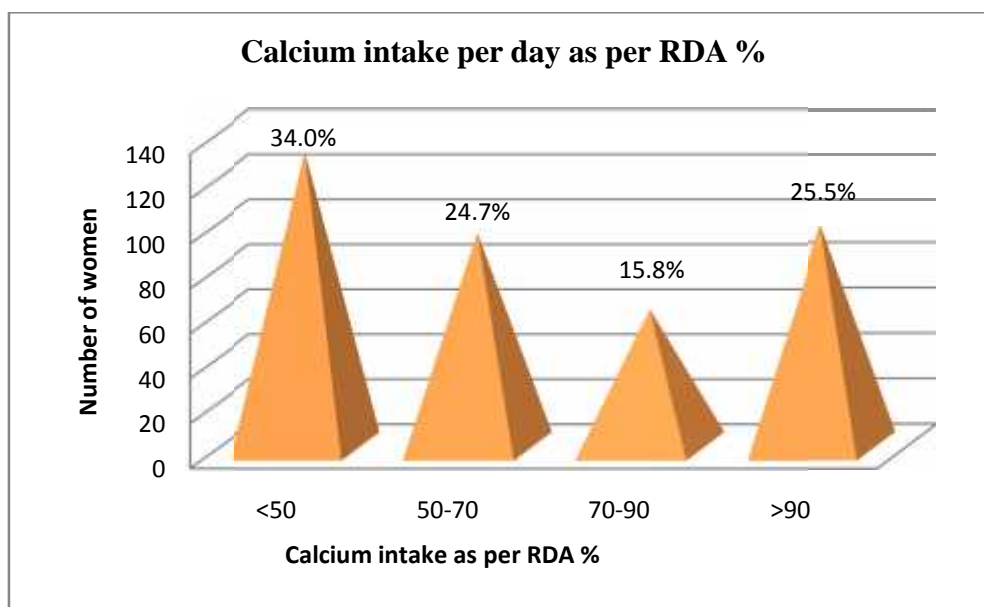
3. Minerals intake:

a. Calcium intake:

Table 29. Distribution of participants according to Calcium intake per day³²:

Calcium intake as per RDA (RDA-600mg/day) - %	Study participants (n=385)	
	Number	Percentage
<50	131	34.0
50-70	95	24.7
70-90	61	15.8
>90	98	25.5
Total	385	100.0

Graph 10.



In the present study as many as 131(34.0%) participants consumed calcium less than 50% of RDA and only 98(25.5%) consumed more than 90% of RDA.

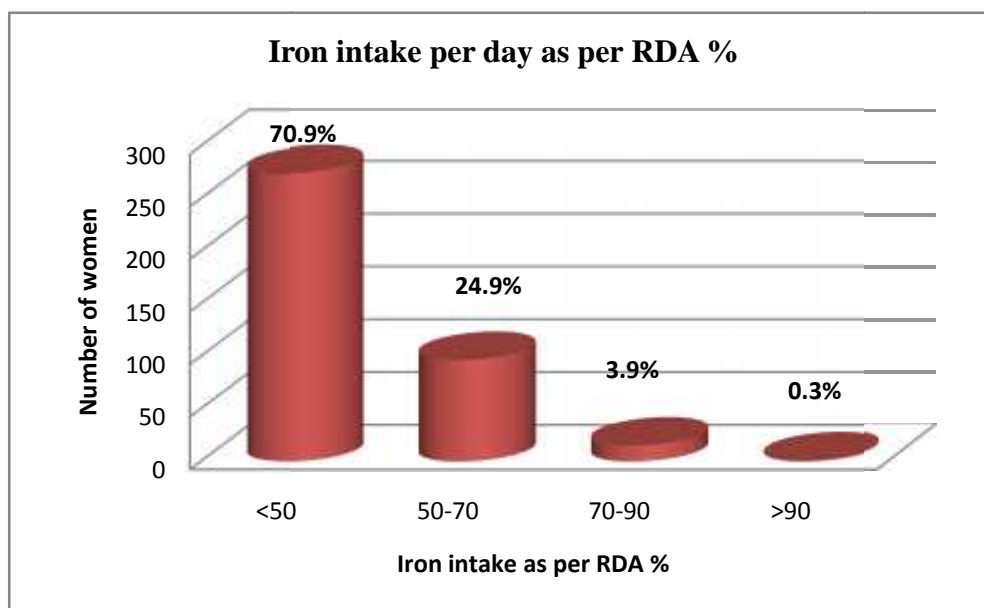
The median intake of calcium was 375mg less than RDA of 600mg and ranged from 53gm to 1350gm.

b. Iron intake:

Table 30: Distribution of participants according to Iron intake per day³²:

Iron intake as per RDA (RDA-21mg/day) - %	Study participants (n=385)	
	Number	Percentage
<50	273	70.9
50-70	96	24.9
70-90	15	3.9
>90	1	0.3
Total	385	100.0

Graph.11



Majority of participants 273(70.9%) consumed iron less than 50% of RDA and only 1(0.3%) consumed more than 90% of RDA of iron.

The median intake of iron was 8.9mg less than RDA 21mg and ranged from 2.4 to 19mg per day.

c. Zinc intake:

Table 31: Distribution of participants according to Zinc intake per day³²:

Zinc intake as per RDA (RDA-10mg/day) - %	Study participants (n=385)	
	Number	Percentage
<50	253	65.6
50-70	113	29.4
70-90	18	4.7
>90	1	0.3
Total	385	100.0

This study revealed that, 253(65.6%) participants consumed zinc less than 50% of RDA, 113 (29.4%) consumed 50-70% of RDA where as only 7(1.8%) were consuming more than 90% of RDA. The median intake of zinc was 4.4mg less than RDA 10mg and ranged from 1.2 to 10.5mg.

Food groups' consumption:**Table 32: Distribution of study participants according to food groups intake per day:**

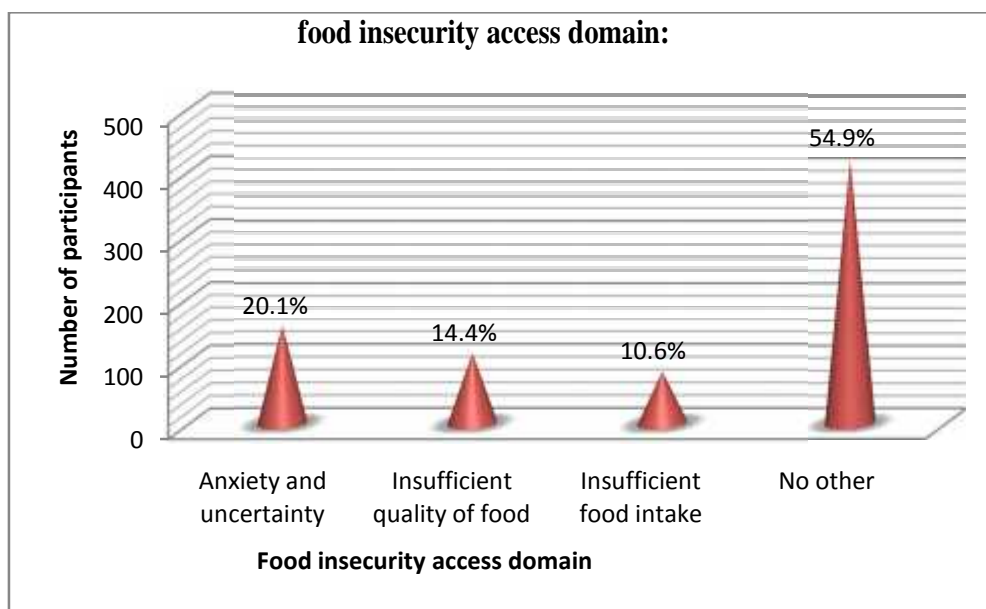
Food Groups	Grams consumed/Day (Mean)	RDI Gm/Day	Percentage of consumption	Deficit (%)
Starch staples	124.24	410	30.3	69.7
Legumes&Nuts	75.86	40	189.65	+89.65
Milk & dairy products	96.27	100	96.3	3.7
Vit.A rich GLV & fruits	71.60	100	71.6	28.4
Other veg. & fruits	59.13	40	147.8	+47.8
Fats & oils	5.57	20	27.8	72.2
Sweets & sugar	21.78	35	62.2	37.8

It was observed in this study that, average intake of starch staples was 124.24gm/day, and was lower than RDI of 410gm. The mean daily intake of milk and milk products was 96.27gm/day as against RDI of 100gm. The mean daily intake of green leafy vegetable was 71.60gm/day and was lower than RDI 100gm/day. The mean daily intake of fats and oils was 5.57gm/day as against RDI of 20gm/day. The mean daily intake of sweets and sugar was 21.78gm/day and was lower than RDI of 35gm/day.

Table 33. Distribution of participants according to food insecurity access domain³⁵:

Food insecurity access domain	Study participants (n=770)	
	Number	Percentage
Anxiety and uncertainty	154	20.1
Insufficient quality of food	111	14.4
Insufficient food intake	82	10.6
No other	423	54.9
Total	770	100

Graph 12.



A total of 154(20.1%) preconception women felt anxiety and uncertainty about food,111(14.4%) faced insufficient quality of food and 82(10.6%) were had insufficient food intake.

Table 34. Distribution of participants according to specific food insecurity related conditions³⁵:

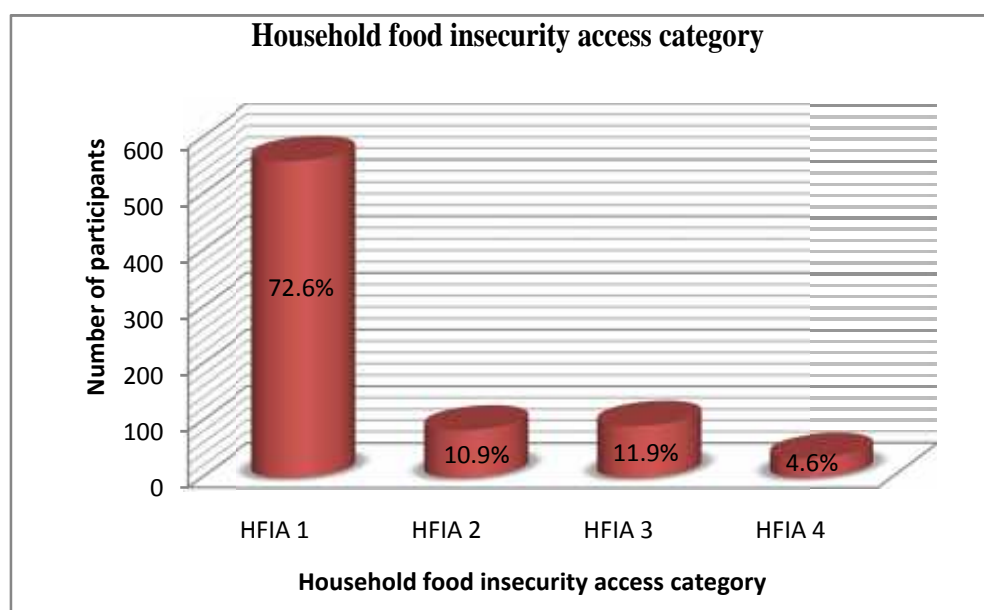
Specific Food insecurity related conditions	Study participants (n=770)	
	Number	Percentage
Worry about food	73	9.5
Not ate preferred food	111	14.4
Lack of resources	134	17.5
Ran out of food	29	3.6

In this study, a total of 134(17.5%) preconception women had lack of resources for food, 111(14.4%) not ate preferred food, 73(9.5%) worried about food and 29(3.6%) had to ran out of food.

Table 35. Distribution of household food insecurity access category⁵⁰:

Household food insecurity access category	Study participants (n=770)	
	Number	Percentage
Food secure-HFIA 1	559	72.6
Mild food insecurity-HFIA 2	84	10.9
Moderate food insecurity-HFIA 3	92	11.9
Severe food insecurity-HFIA 4	35	4.6
Total	770	100.0

Graph 13.

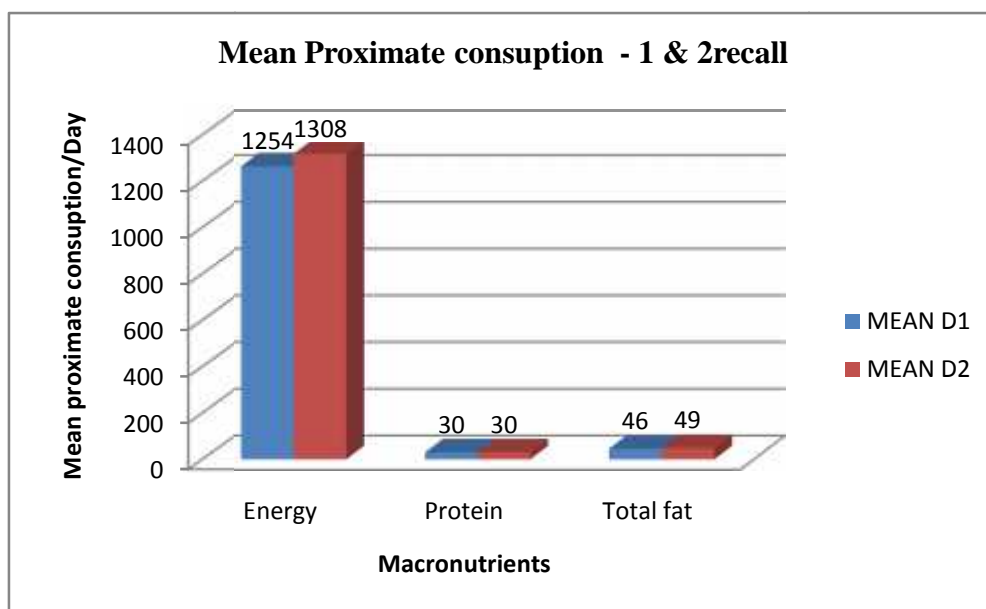


Majority participants in this study, 559(72.6%) had food secure,92(11.9%) women had moderate food insecurity category ,84(10.9%) and 35(4.5%) women had mild and severe food insecurity category respectively.The prevalence of food insecurity was 4.6%.

Table 36. Comparison of 1st and 2nd dietary recall the mean of the proximate consumption:

Dietary recall	Mean and S.D.	ENERGY Kcal/day	PROTEIN Gm/day	TOT.FAT Gm/day
1	Mean	1254.96	30.24	46.69
	Number	385	385	385
	Std. Deviation	345.31	10.35	16.55
2	Mean	1308.01	30.79	49.78
	Number	119	119	119
	Std. Deviation	354.18	9.91	17.20

Graph 14.



In first and second dietary recall, the mean of dietary intake of proximate of energy, protein and total fat was almost same. There was no much difference found.

Table 37. Comparison of 1st and 2nd dietary recall the mean of the vitamins:

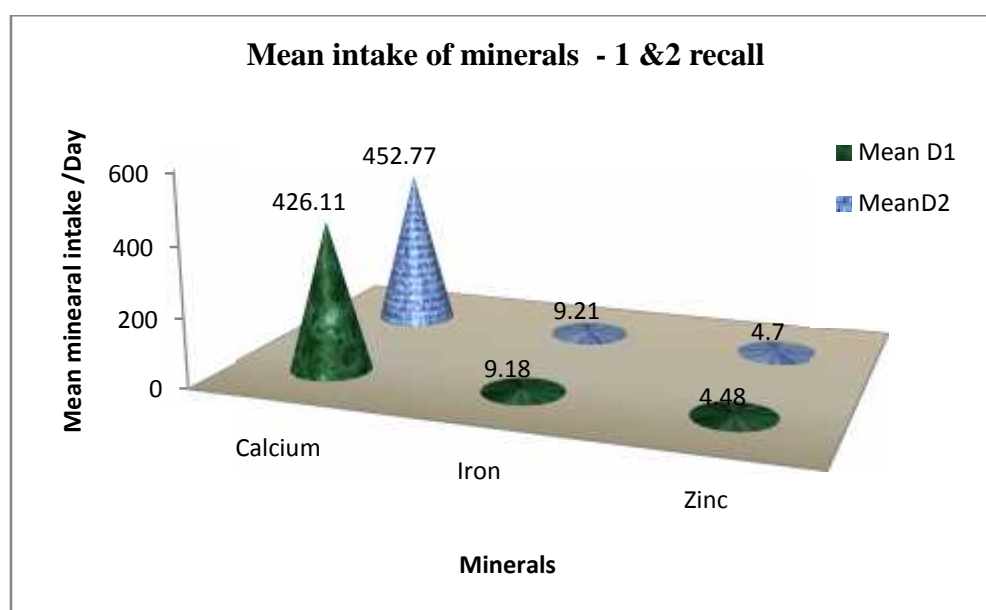
Dietary recall	Mean and S.D.	Vitamin B ₁ .mg/day	Vitamin B ₂ .mg/day	Vitamin B ₆ .mg/day	Dietary Folate µg/day	Vitamin B ₁₂ µg/day	Vitamin C mg/day	Vitamin A µg/day
1	Mean	0.7266	0.6802	0.7887	123.86	0.8895	27.47	218.77
	Number	385	385	385	385	385	385	385
	Std. Deviation	0.2279	0.2780	0.3625	72.59	0.6490	21.42	111.79
2	Mean	0.7487	0.7312	0.7988	121.45	0.9921	26.55	228.36
	Number	119	119	119	119	119	119	119
	Std. Deviation	0.2402	0.3101	0.3754	68.7913	0.6844	17.33	104.14

In the present study, first and second dietary recall, mean of dietary intake of vitamins i.e. vitamin B1, B2, B6, B12, folate, vitamin C and Vitamin A was almost same. There was no much difference found.

Table 38. Comparison of 1st and 2nd dietary recall the mean of the minerals:

Dietary recall	Mean and S.D.	Calcium mg/day	Iron mg/day	Zinc mg/day
1	Mean	426.11	9.18	4.48
	Number	385	385	385
	Std. Deviation	221.61	2.79	1.43
2	Mean	452.77	9.21	4.70
	Number	119	119	119
	Std. Deviation	227.73	3.17	1.53

Graph 15.

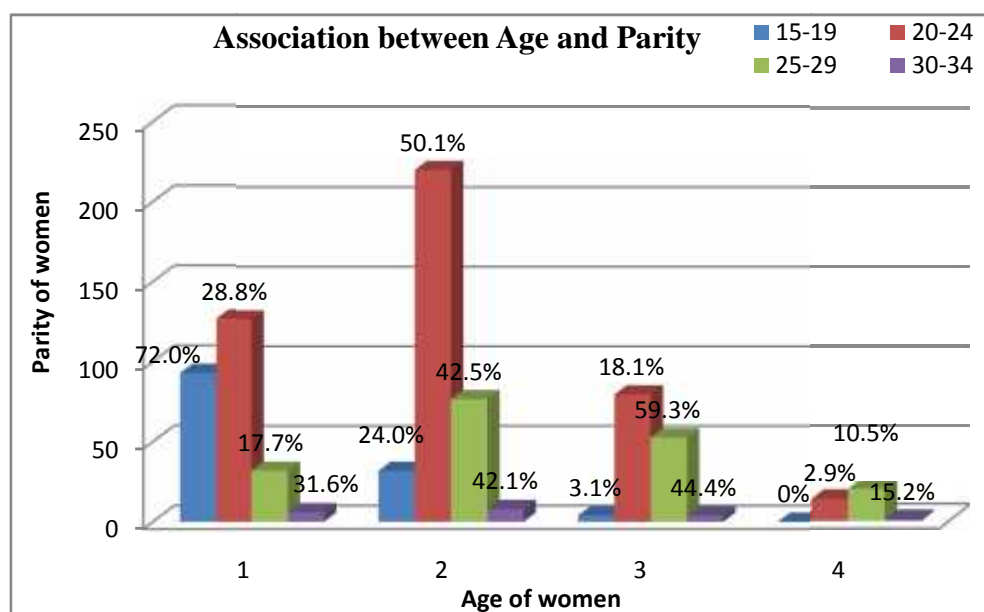


In our study it showed that, first and second dietary recall, mean of dietary intake of minerals i.e. calcium, iron and zinc was almost same. There was no much difference found. Association between various socio-demographic factors and nutritional status of preconception women:

Table 39. Association between age and parity:

Age In years	Parity				Total
	Nulliparous No. (%)	1Child No. (%)	2Children No. (%)	3+Children No. (%)	
15-19	93(72.0)	32(24.0)	4(3.1)	0(0)	129
20-24	127(28.8)	221(50.1)	80(18.1)	13(2.9)	441
25-29	32(17.7)	77(42.5)	53(29.3)	19(10.5)	181
30-34	6(31.6)	8(42.1)	4(44.4)	1(5.2)	19
Total	258	338	141	33	770
$\chi^2 = 13.736, \quad DF = 6, \quad p = 0.001$					

Graph 16.



Amongst the total 15-19 years age group preconception women, 93 (72.0%) were nulliparous, 32(24.0%) were having 1 child, 4 (3.1%) had 2children and no one had 3 children. This association between age and parity was statistically significant (p=0.001)

Table 40. Association between age and Hemoglobin:

Age in years	Hemoglobin			Total
	Normal No. (%)	Mild Anemia No. (%)	Moderate Anemia	
15-19	22(17.0)	48(37.2)	59(45.7)	129
20-24	103(23.4)	169(38.3)	169(38.3)	441
25-29	34(18.8))	71(39.2)	76(41.9)	181
30-34	6(31.6)	6(32.6)	7(36.8)	19
Total	165	294	311	770
$\chi^2 = 5.277, \quad DF = 6, \quad p = 0.509$				

As many as, 169 (38.3%) and 169 (38.3%) of the participants had, moderate and mild anemia in 20 - 24 years age group. In 25 -29 age group women were having mild anemia in 71(39.2%) and moderate anemia in 76(41.9%). However, this association was found to be statistically not significant ($p < 0.509$).

Table 41. Association between Religion and BMI:

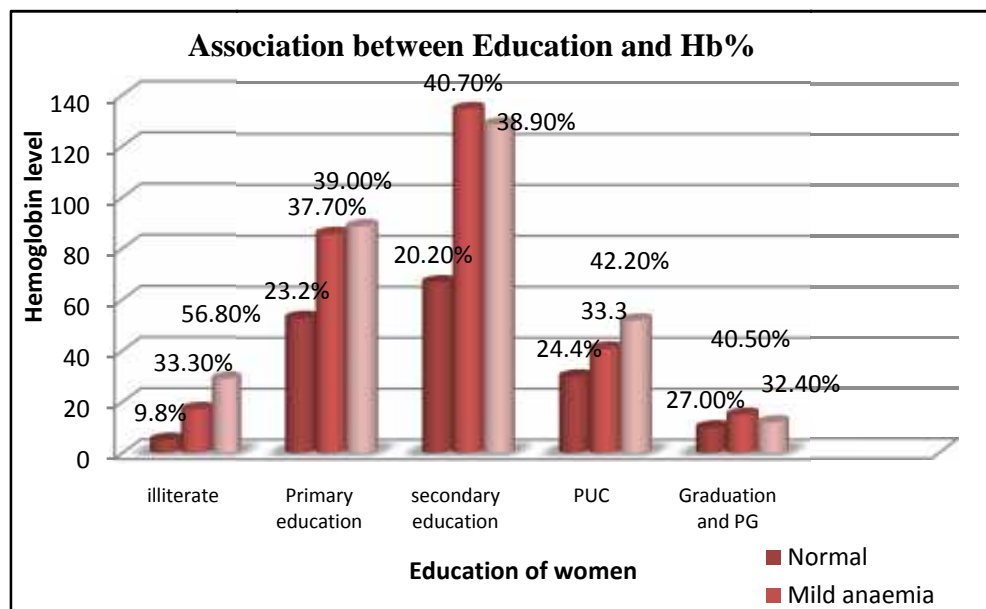
Religion	Body Mass Index(BMI)			Total
	Overweight No. (%)	Normal No. (%)	Underweight No. (%)	
Hindu	108(16.8)	292(45.0)	248(38.2)	648
Muslim	31(25.4))	58(47.5)	33(27.1)	122
Total	139	350	281	770
$\chi^2 = 8.030$, $DF = 2$, $p = 0.018$				

In our study, 248(38.2%) participants who were Hindu belonged to undernourished, about 292(45.0%) normal and only 108(16.8%) belonged to overweight category of BMI. Whereas, majority 58(47.5%) Muslim women belonged to normal BMI, 33(27.1%) undernourished and 31(25.4%) belonged to overweight category. This association between religion and BMI was statistically significant ($p=0.018$).

Table 42. Association between education and Hemoglobin:

Education	Hemoglobin			Total
	Normal No. (%)	Mild Anemia No. (%)	Moderate Anemia No. (%)	
Illiterate	5(9.8%)	17(33.3%)	29(56.9%)	51
Primary School	53(23.2%)	86(37.7%)	89(39.1%)	228
Secondary School	67(20.3%)	135(40.8%)	129(38.9%)	331
PUC	30(24.5%)	41(33.3%)	52(42.2%)	123
Graduate & post graduate	10(27.1%)	15(40.5%)	12(32.4%)	37
	165	294	311	770
$\chi^2 = 10.938, \quad DF = 8, \quad p = 0.205$				

Graph 17.



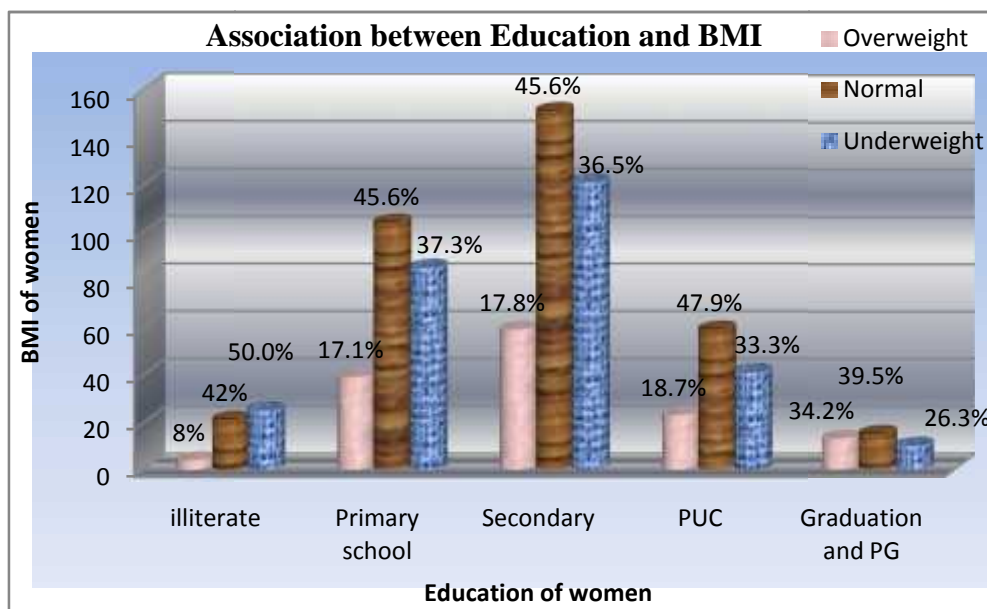
Among the illiterates, 29 (56.9%) were moderately anemic and 17 (33.3%) were suffering from mild anemia. Of the preconception women who had studied up to primary school, 89 (39.1%) had moderate anemia and 86 (37.7%) had mild anemia. In the women, who had studied up to high school, 129 (38.9%) had moderate anemia and 135 (40.7%) suffered from mild anemia. Women who studied up to PUC, 52(42.2%) had moderate anemia and 41(33.3%) had mild anemia. Also women who studied up to graduate and beyond, 15(40.5%) had mild anemia and 12(32.4%) had suffered from moderate anemia. This association between education and anemia was statistically not significant ($p=0.205$).

Table 43. Association between education and BMI:

Education	Body Mass Index(BMI)			Total
	Overweight No. (%)	Normal No. (%)	Underweight No. (%)	
Illiterate	4(8.0)	21(42.0)	25(50.0)	50
Primary School	39(17.1)	104(45.6)	85(37.3)	228
Secondary School	59(17.8)	151(45.6)	121(36.6)	331
PUC	23(18.7)	59(47.9)	41(33.4)	123
Graduate & post graduate	13(34.2)	15(39.5)	10(26.3)	38
Total	138	350	281	770

$\chi^2 = 13.851, \quad DF = 8, \quad p = 0.085$

Graph 18.



Women who were illiterates, 25(50%) undernourished, 21(42%) normal and only 4(8%) overweight. Among women completed primary school, 104(45.6%) were had normal BMI, 85(37.3%) undernourished and 39(17.1%) overweight. Also women who completed secondary school, 59(17.8%) belonged to overweight, 151(45.6%) normal and 121(36.6%) undernourished category. Women who completed PUC, 59(47.9%) had normal BMI, 41(33.3%) underweight category and 23(18.7%) belonged to overweight category of BMI. Women who completed degree and above, 15(39.5%) belonged to BMI of normal category, 13(34.2%) to overweight category and only 10 (26.3%) belonged to underweight category of BMI. But this association between education and BMI was statistically not significant ($p=0.086$).

Table 44 . Association between Types of family and BMI:

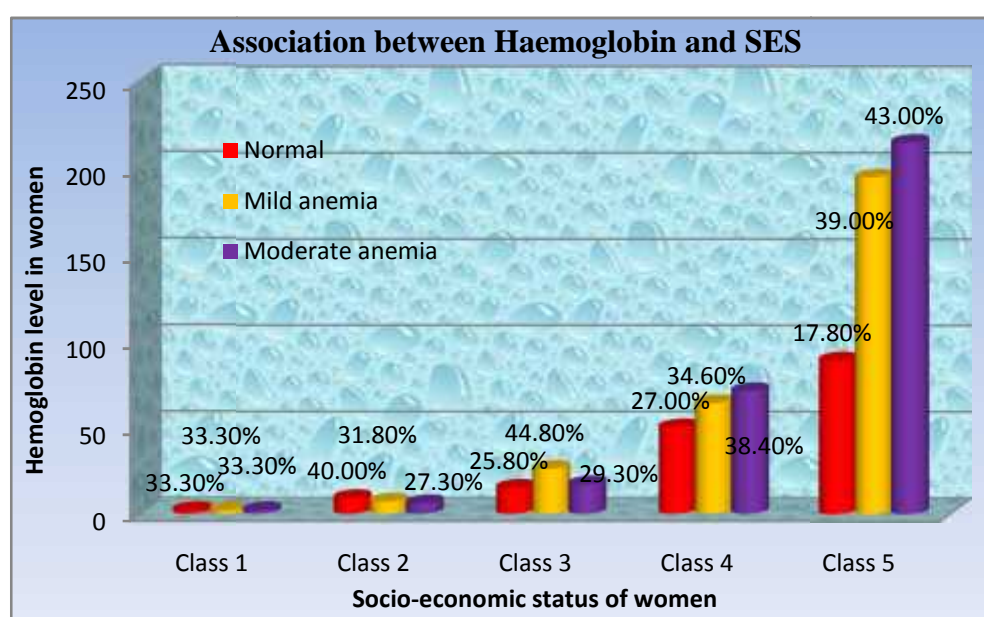
Types of family	Body Mass Index(BMI)			Total
	Overweight No. (%)	Normal No. (%)	Underweigh t No. (%)	
Nuclear	36(19.9)	85(46.9)	60(33.2)	181
Joint	102(17.6)	259(44.7)	218(37.7)	579
Three Generation	1(10)	6(60)	3(30)	10
Total	139	350	281	770
$\chi^2 = 2.254, \quad DF = 4, \quad p = 0.687$				

In our study women who were staying in nuclear family, 60(33.2%) undernourished, 85(46.9 %) normal and only 36(19.9%) overweight. Among women were staying in joint family, 259(44.7%) normal, 218(37.7%) undernourished and 102(17.6%) overweight. Also women who stayed in three generation family, 6(60%) belonged to normal category of BMI, 3(30%) undernourished and 1(10%) overweight category of BMI. But this association between type of family and BMI was statistically not significant ($p=0.687$).

Table 45. Association between socio economic status (SES) and Hemoglobin:

Socio economic status (SES)	Hemoglobin level			Total
	Normal No. (%)	Mild Anemia No. (%)	Moderate Anemia No. (%)	
Class I	2(33.3)	2(33.3)	2(33.3)	6
Class II	9(40)	7(31.8)	6(27.2)	22
Class III	15(25.8)	26(44.8)	17(29.4)	58
Class IV	50(27.0)	64(34.6)	71(38.4)	185
Class V	89(17.8)	195(39.0)	215(43.2)	499
Total	165	294	311	770
$\chi^2 = 16.064$, $DF = 8$, $p = 0.041$				

Graph 19.



Among participants class I of SES, 2 (33.3%) women belonged to normal, mild and moderate category of anemia equally. But women belonged to class V, 215(43.2%) had moderate anemia, 195(39.0%) mild anemia and 89(17.8%) had normal hemoglobin. This association between SES and Hemoglobin was statistically significant ($p=0.041$).

Table 46. Association between HFIA and BMI:

House hold food insecurity access scale (HFIA)	BMI			Total
	Overweight No. (%)	Normal No. (%)	Underweight No. (%)	
Food Secure HFAI-1	97(17.3)	265(47.4)	197(35.3)	559
Mild Food Insecure HFAI-2	16(19.1)	38(45.2)	30(35.7)	84
Moderate Food Insecure HFAI-3	19(20.7)	36(39.1)	37(40.2)	92
Severe Food Insecure HFAI-4	6(17.2)	11(31.4)	18(51.4)	35
Total	138	350	282	770
$\chi^2 = 6.158, \quad DF = 6, \quad p = 0.406$				

Women who had food secure, 97(17.3%) overweight, 265(47.4%) were having normal BMI and 197(35.4%) underweight. Participants who had mild insecurity, 38(45.2%) normal BMI, 30(35.7%) undernourished and 16(19.1%) were in overweight category of BMI. Women who had moderate food insecurity, 37(40.2%) underweight, 36(39.1%) normal BMI and 19(20.7%) were under overweight category. Women who had severe food insecurity, 18(51.4%) underweight, 11(31.4%) were normal BMI and 6(17.2%) overweight. This association between HFIA and BMI was statistically not significant ($p=0.406$).

Table 47. Association between household food insecurity access scale (HFIA) and Socio-economic status) SES:

House hold food insecurity access scale (HFIA)	Socio-economic status				Total
	Class I& II No. (%)	Class III No. (%)	Class IV No. (%)	Class V No. (%)	
HFAI-1	16(2.8)	41(7.3)	133(23.8)	369(66.1)	559
HFAI-2	4(4.7)	6(7.2)	22(26.2)	52(61.9)	84
HFAI-3	4(4.3)	8(8.7)	22(23.9)	58(63.1)	92
HFAI-4	4(11.4)	3(8.8)	8(22.8)	20(57.0)	35
Total	28	58	185	499	770
$\chi^2 = 8.240$, $DF = 9$, $p = 0.510$					

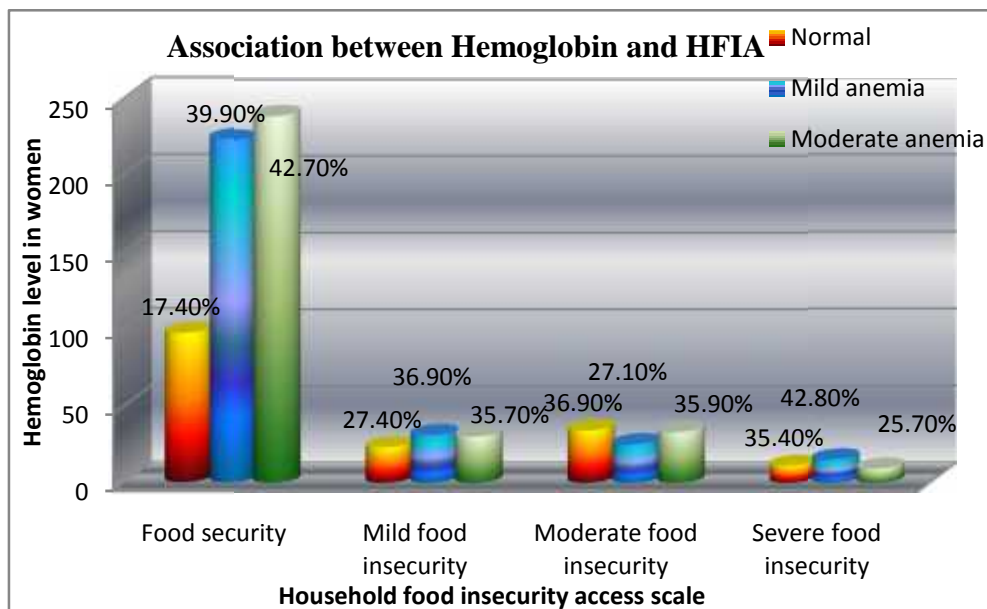
A total of 369(66.1%) food security were in SES class-V, 133(23.8%) in class IV, 41(7.3%) in class III and only 16(2.8%) study subjects were in class I&II. Women who had mild food insecurity 52(61.9%) were in SES class-V, 22(26.2%) in class IV, 6(7.2%) in class III and only 4(4.7%) belonged to class I&II. The study participants who had moderate food security 58(63.1%) were in SES class-V, 22(23.9%) in class IV, 8(8.7%) in class III and only 4(4.3%) belonged to in class I&II. Similarly women who had severe food insecurity 20(57.0%) were in SES class-V, 8(22.8%) in class IV, 3(8.8%) in class III and only 4(11.4%) were belonging to class I&II. However this association between HFIA and SES was statistically not significant ($p=0.510$).

Table 48. Association between HFIA and Hemoglobin:

House hold food insecurity access scale (HFIA)	Hemoglobin			Total
	Normal No. (%)	Mild Anemia No. (%)	Moderate Anemia No. (%)	
HFAI-1	97(17.4)	223(39.9)	239(42.7)	559
HFAI-2	23(27.4)	31(36.9)	30(35.7)	84
HFAI-3	34(36.9)	25(27.2)	33(35.9)	92
HFAI-4	11(35.5)	15(42.8)	9(25.7)	35
Total	165	294	311	770

$\chi^2 = 24.854$, 5 DF = 6, p = 0.000

Graph 20.



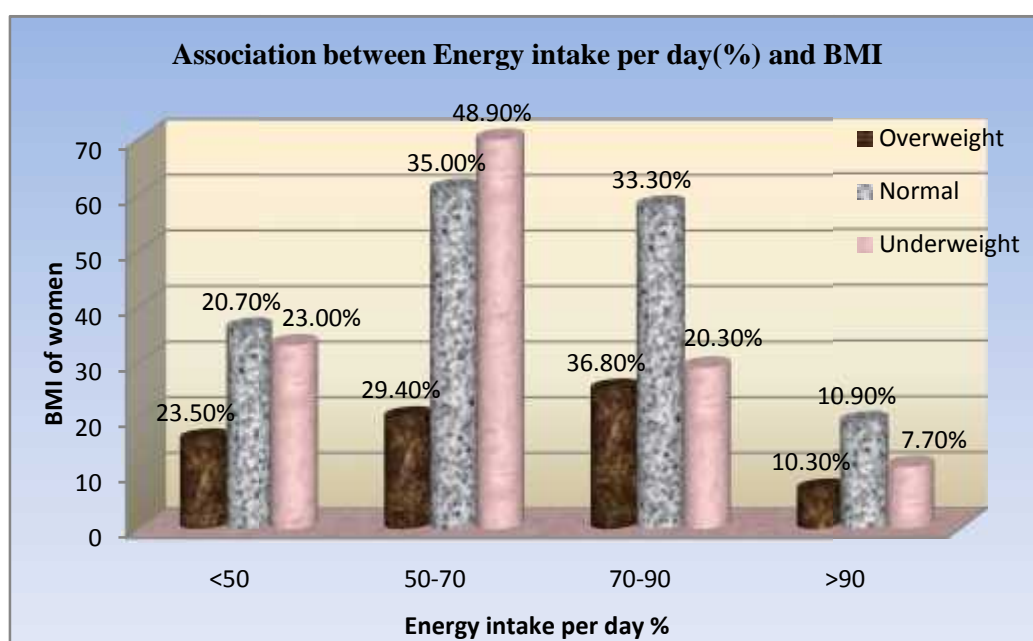
In the present study, 239(42.7%) women who had food security were moderately anemic, 223(39.9%) had mild anemia and 97(17.4%) were not anemic. Whereas, participants who had mild insecurity, 30(35.7%) were moderate anemic, 31(36.9%) were mild anemic and 23(27.4%) had no anemia. Women who had moderate food insecurity, 33(35.9%) were moderately anemic, 25(27.2%) had mild anemic and 34(36.9%) were not suffering from anemia. Participants who had severe food insecurity 9(25.7%) were moderate anemic, 15(42.8%) mild anemic and 11(35.5%) had no anemia. This association between HFIA and hemoglobin was statistically significant ($p=0.000$).

Table 49. Association between Body mass index (BMI) and Energy intake:

Body Mass Index (BMI)	ENERGY %				Total
	<50 No. (%)	50 – 70 No. (%)	70 – 90 No. (%)	>90 No. (%)	
Overweight	16(23.5)	20(29.4)	25(36.8)	7(10.3)	68
Normal	36(20.7)	61(35.1)	58(33.3)	19(10.9)	174
Underweight	33(23.1)	70(48.9)	29(20.3)	11(7.7)	143
Total	85	151	112	37	385

$\chi^2 = 13.331$, $DF = 6$, $p = 0.038$

Graph 21.



In our study, participants who had BMI category of overweight, 16(23.5%) were consuming energy <50% of RDA, 20(29.4%) consumed 50-70% of RDA, 25(36.8%) consumed 70-9-0% of RDA and only 7(10.3%) were consuming >90% of RDA. Women belonging to BMI category of normal 36(20.7%) were consuming

energy <50% of RDA, 61(35.1%) participants consumed 50-70% of RDA, 58(33.3%) consumed 70-90% of RDA and only 19(10.9%) were consuming >90% of RDA.

Also women were having BMI category of underweight 33(23.1%) consumed energy <50% of RDA, 70(48.9%) consumed 50-70% of RDA, 29(20.3%) consumed 70-90% of RDA and only 11(7.7%) were consuming >90% of RDA. This association between BMI and energy consumption of preconception women was statistically significant (p=0.038).

Table 50. Association between BMI and Protein intake:

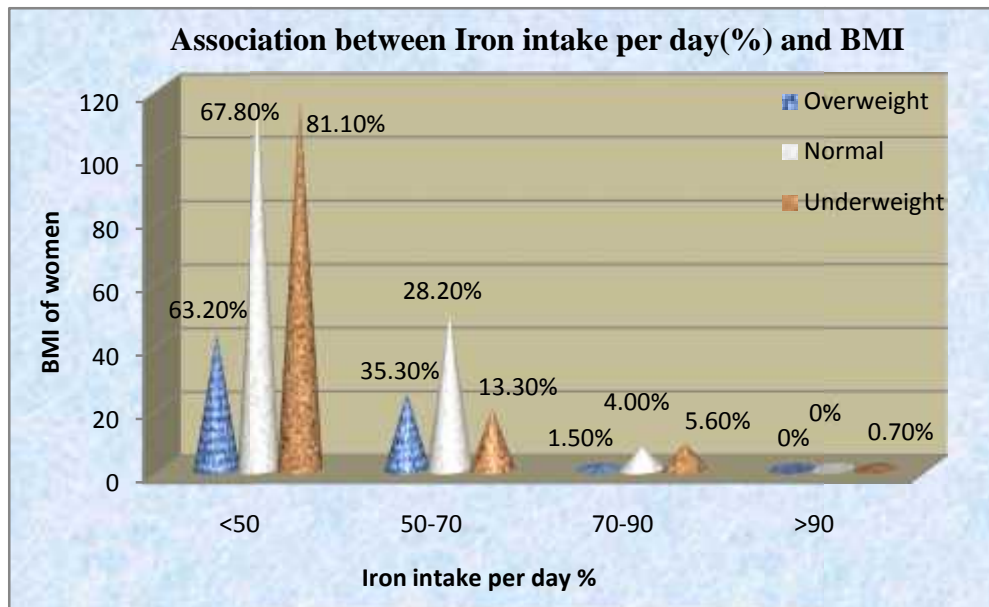
Body Mass Index (BMI)	Protein %				Total
	<50 No. (%)	50 – 70 No. (%)	70 – 90 No. (%)	>90 No. (%)	
Overweight	27(39.7)	27(39.7)	12(17.6)	2(2.9)	68
Normal	65(37.6)	68(39.1)	31(17.8)	10(5.5)	174
Underweight	69(48.2)	55(38.5)	14(9.8)	5(3.5)	143
Total	161	150	57	17	385
$\chi^2 = 7.508$, $DF = 6$, $p = 0.276$					

Among the study participants who had BMI category of overweight, 27(39.7%) were consuming protein <50% of RDA, 27(39.7%) consumed 50-70% of RDA, 12(17.6%) consumed 70-90% of RDA and only 2(2.9%) were consuming >90% of RDA. At the same time, 65(37.6%) women with normal BMI consumed energy <50% of RDA, 68(39.1%) consumed 50-70% of RDA, 31(17.8%) consumed 70-90% of RDA and only 10(5.5%) were consuming >90% of RDA. Similarly, women who had BMI category of underweight 69(48.2%) were consuming protein <50% of RDA, 55(38.5%) consumed 50-70% of RDA, 14(9.8%) consumed 70-90% of RDA and hardly 5(3.5%) were consuming >90% of RDA. However this association between BMI and protein consumption of preconception women was statistically not significant ($p=0.276$).

Table 51. Association between BMI and Iron intake:

Body Mass Index (BMI)	Iron %				Total
	<50 No. (%)	50 – 70 No. (%)	70 – 90 No. (%)	>90 No. (%)	
Overweight	43(63.2)	24(35.3)	1(1.5)	0(0)	68
Normal	118(67.8)	49(28.2)	7(4.0)	0(0)	174
Underweight	116(81.3)	19(13.4)	8(5.6)	1(0.7)	143
Total	277	92	16	1	385
$\chi^2 = 16.458, \quad DF = 4, \quad p = 0.002$					

Graph 22.



In this study, participants who had BMI category of overweight 43(63.2%) were consuming iron <50% of RDA, 24(35.3%) consumed 50-70% of RDA, 1(1.5%) consumed 70-90% of RDA and no one was consuming >90% of RDA. At the same time, 116(67.8%) women consumed iron <50% of RDA, 49(28.2%) consumed 50-70% of RDA, 7(4.0%) consumed 70-90% of RDA and no one was consuming >90% of RDA. Women who had BMI category of underweight, 116(81.3%) were consuming iron <50% of RDA, 19(13.4%) consumed 50-70% of RDA, 8(5.6%) consumed 70-9-0% of RDA and only 1(0.7%) was consuming >90% of RDA. For Chi-Square analysis both 70-90% and >90% were clubbed together. This association between BMI and iron consumption of preconception women was statistically significant (p=0.002).

Table 52. Association between BMI and Vitamin C intake:

Body Mass Index (BMI)	Vitamin C %		Total
	<50 No. (%)	50 – 70 No. (%)	
Overweight	50(73.5)	18(6.5)	68
Normal	131(75.3)	43(24.7)	174
Underweight	125(87.1)	18(12.9)	143
Total	306	79	385
$\chi^2 = 8.869, \quad DF = 2, \quad p = 0.012$			

In our study, participants who had BMI category of overweight 50(73.5%) consumed vitamin C <50% of RDA, 18(6.5%) consumed 50-70% of RDA and no one consumed more than 70% of RDA. Whereas participants who had BMI category of normal 131(75.3%) were consuming vitamin C <50% of RDA, 43(24.7%) consumed 50-70% of RDA and no one was consuming more than 70% of RDA. At the same time, participants who had BMI category of underweight, 125(87.1%) consumed vitamin C <50% of RDA, 18(12.9%) consumed 50-70% of RDA and no one was consuming more than 70% of RDA. This association between BMI and vitamin C consumption of preconception women was statistically significant ($p=0.012$).

Table 53. Association between BMI and Riboflavin intake:

Body Mass Index (BMI)	Riboflavin %				Total
	<50 No. (%)	50 – 70 No. (%)	70 – 90 No. (%)	>90 No. (%)	
Overweight	16(23.5)	30(44.1)	13(19.2)	9(13.2)	68
Normal	32(18.4)	83(47.7)	32(18.4)	27(15.5)	174
Underweight	35(24.5)	73(51.0)	18(12.6)	17(11.9)	143
Total	83	186	63	53	385
$\chi^2 = 4.746, \quad DF = 6, \quad p = 0.577$					

In the present study, participants who had BMI category of overweight, 16(23.5%) were consuming riboflavin <50% of RDA, 30(44.1%) consumed 50-70% of RDA, 13(19.1%) consumed 70-90% of RDA and 9(13.2%) were consuming >90% of RDA. Similarly, women who had BMI category of normal 32(18.4%) consumed riboflavin <50% of RDA, 83(47.7%) consumed 50-70% of RDA, 32(18.4%) consumed 70-90% of RDA and 27(15.5%) were consuming >90% of RDA. At the same time, women who had BMI category of underweight, 35(24.5%) consumed riboflavin <50% of RDA, 73(51.0%) consumed 50-70% of RDA, 18(12.6%) consumed 70-9-0% of RDA and 17(11.9%) were consuming >90% of RDA. However, this association between BMI and riboflavin consumption of preconception women was statistically not significant ($p=0.577$).

DISCUSSION

I. Socio demographic data :

Table1. Age distribution of study participants:

In the present study, out of 770 study participants, 16.8% between 15-19 years of age, 57.2% in 20-24 years, 23.5% between 25-29 years and 2.5% between 30-34 years of age. The mean age was 22.5 (SD±3.19) years and the median age was 22 years.

Similar study was conducted in Bangladesh, Dhaka by Hague et al.⁶ on the women of reproductive age groups, where 41.2%, 31.0% and 27.8% were in the age groups of 15 - 24 years, 25 - 34 years and 35 - 44 years respectively. The mean age was 28(SD ± 8.1).

Table2. Distribution of the study participants according to their religion:

In this study, 84.2% were Hindus by religion and the rest 15.4% were Muslims. There were no Christian participants in the study.

Similar type of a study conducted by Potadar et al. in Mumbai²⁵ comprised 69.7% Hindus and 25.6% Muslims.

Table3. Distribution of study participants according to occupation:

In the present study, 82.9% participants were housewives and 17.1% belonged to other occupations like agriculture, labor and daily wages.

A study conducted in Mumbai ²⁵, showed that 79.2% women were housewives.

Table4. Distribution of study participants according to husbands' occupation:

In the current study, a majority (33.2%) of husbands' of the participants was agriculturists followed by 8.7% labors and others were all daily wage workers, self employed and factory workers.

In the Shahajanpur, Uttar Pradesh study³¹, 52.8% husbands of participants were agriculturists and in Hydearabad ³study 70.0% husbands were cultivators.

The present study area was rural hence their income was from agriculture or labor in other agriculture lands.

Table5. Distribution of study participants according to educational level:

Majority (43.0%) of the participants in the present study had studied up to high school, 29.6% up to primary school and 6.6% women were illiterate.

Similarly, a study conducted at mumbai²⁵ showed that 81.4% of the women completed secondary school education. Yet, another study in Dhaka⁶ showed that 62.7% participants were illiterate and only13.9% completed primary education.

This may be due to women were not given preference for education after high school level.

Table6. Distribution of study participants according to husbands' educational level:

This study showed that majority, 30.7% of participants' husbands had studied up to high school, 30.4% up to primary school and 7.0% were illiterate.

The study conducted in Mumbai²⁵ revealed that 84.2% husbands of the participants had studied up to secondary school education and 12.9% up to primary. A study in Dhaka⁶ showed that 67.0% of husbands were illiterate.

In rural areas, the main occupation was agriculture so not given importance to education.

Table7. Distribution of the study participants according to type of family:

In our study, majority (75.2%) belonged to joint family and 23.5% to nuclear family.

A study done in Hyderabad³ showed that 79.2% belonged to nuclear family and 9.6% to joint family.

Concept of staying in joint family was still common in rural areas compared to urban.

Table8. Distribution of study participants according to socio-economic status:

In the present study, a majority (64.8%) of the participants belonged to Class V socio-economic status and 24.0% to class IV of socio-economic status.

A study done in rural areas of Belgaum⁵⁵ showed that, 62.5% participants belonged to Class V and 23% to class IV of socio-economic status. Similar observations found in both the studies

II. Obstetric information:

Table9. Distribution of study women according to their age at menarche:

In the present study, majority (73.8%) women attained menarche at the age between 13-15 years and 18.1% attained at the age between 10-12 years.

A study done in rural areas of Belgaum⁵⁵ showed that, majority (51%) attained menarche by the age of 11 years and the mean age of menarche was 13(SD±2) years.

Table10. Distribution of study participants according to age at marriage:

In this study, 61.7% women got married after 18 years and the mean age of marriage was 18.2±2.5 years and median age was 18 years.

A study done in Nigeria⁵⁶ showed that the mean age of marriage was 16.5±3.0 years. According to the NFHS-3²¹, the median age of marriage in India was 17.7 years. The reason could be early marriages in the rural areas.

Table11. Distribution of women according to parity:

In the present study, 43.9% preconception women were nulliparous and 33.5% had 1 child.

A study in Mumbai²⁵ showed that, 31% nulliparous, 43.7% had 1 child and 25.0% were with more than 1 child.

Consanguineous Marriage:

In this study 37.7% had consanguineous marriage. A study done in Mangalore⁶⁰ showed that 6.53% had consanguineous marriage.

III. Personal information:

Type of food consumed:

In the present study 48.6% women were vegetarian in diet and 51.4% were consuming mixed diet.

Whereas a study done by Choudhari et al. in Varanasi⁵⁸ showed that 28.9% were vegetarian in diet and 71.1% were consuming mixed diet.

Table 12. Distribution of study participants according to their habit of tobacco chewing:

In our study, 2.1% of women had habit of chewing tobacco. As per NNMB - 2012³² report, chewing of tobacco by women in Tamil Nadu was 1.8% and In Karnataka it was 2.3%.

IV. Hematological profile:

Table 13. Distribution of the study participants according to hemoglobin level:

In the present study, 40.4% of preconception women had moderate anemia and 38.2% were suffering from mild anemia.

A study done in Madhya Pradesh⁵⁹, Chambal division showed that 48.0% had moderate anemia and 42.1% had mild anemia. As per NNMB 2006,²⁰ India contributes 51% of anemia in 15-49 reproductive age group women.

In preconception women, this large gap could be due to low socio-economic status and less nutritious diet pattern in rural area.

V. Nutritional status of preconception women:

Table14. Distribution of the study participants according to BMI:

In the present study, 36.6% of preconception women undernourished (BMI <18.5) and 45.5% had normal BMI (18.5-22.9).

A study done in Kerala⁶⁰ showed that 31.3% preconception women undernourished (BMI <18.5). Another study in Dhaka⁶ showed that, 25.6% preconception women were undernourished and 28.7% had normal BMI.

This low BMI could be due to majority women belonged to low socioeconomic status in our study.

Table 15. Distribution of MUAC among study participants:

In the present study, 24.7% preconception women had MUAC of <22.0cm and 74.3% had MUAC ≥ 22.0cm.

In a study by Mashed et al. of Iran¹³ showed that 60.6% women had MUAC less than 22.0cm and were undernourished. But as per NNMB–2012³² report in Karnataka 25.1% of women had MUAC <22.0cms.

Table 16. Distribution of study participants according to waist/Hip ratio:

In the present study, 72.1% women had W/H ratio <0.8 and 27.9% women had W/H ratio 0.8. This measurement almost coincides with BMI this study.

As per NNMB–2012³² report India, 63.8% women had W/H ratio >0.8.

Table 17. Distribution of the study participants according to BMI, MUAC and W/H ratio:

In our study it revealed that, 36.6% of below BMI (undernourished) and 63.4% normal BMI or overweight. The MUAC of the participants 24.7% were having less than 22.0cm and 75.3% had more or equal to 22.0cm. So also 72.1% women had W/H ratio less than 0.8 and 27.9% were having W/H ratio more than or equal to 0.8.

It revealed that women who had less MUAC also had less W/H ratio.

In studies of Iran¹³ and NNMB-2012³² report had the almost same results as of our study.

Table 18. Distribution of participants according to energy intake per day:

In the present study, 22.1% preconception women consumed energy less than 50% of RDA, 39.2% consumed energy between 50-70% of RDA and only 9.6% of women consumed >90% of RDA. The median intake of energy was 1228kcal, less than RDA 1900kcal.

A study done in Iran by Nemati⁵, showed that average energy intake in women was 1707kcal. Another study done by NNMB-2012³² showed that, 7.7% non- pregnant non -lactating women consumed energy <50% of RDA, 19.1% consumed 50-70% and

37.3% consumed >70 of RDA of energy. The energy consumption in our study probably because of Jowar was staple food.

Table19. Distribution of participants according to protein intake per day:

It revealed in this study that, 41.8% preconception women consumed protein less than 50% of RDA, 39.0% consumed energy 50-70% of RDA and only 4.4% of women consumed >90% of RDA. The median intake of protein was 30gm which was less than RDA 55gms. Due to gap in dietary pattern in our women, protein consumption was as per RDA.

A study done in Iran by Nemati⁵, showed that average protein intake in women was 56gm. Another study carried out by NNMB-2012³² showed that 15.1% non pregnant non lactating women consumed protein <50% of RDA, 22.6% consumed 50-70% and 62.3% consumed protein >70 of RDA.

Table20. Distribution of participants according to total fat (Lipid) intake per day:

In our study, 99.2% preconception women consumed lipids >90% of RDA, 0.5% consumed energy 50-70% of RDA and only 0.3% of women consumed <50% of RDA. The median intake of lipids was 44gm more than RDA of 20gm.

A study conducted in Iran by Nemati⁵, showed that average lipids intake in women was 50gm. Another study done by NNMB-2012³² showed that 77.5% non pregnant non lactating women consumed lipids >70% of RDA, 10% consumed 50-70% and 12.1% consumed <50% of RDA of lipids. . In our study lipid consumption was more due to more usage of oils.

Table21. Distribution of participants according to dietary fiber intake per day:

In this study, among preconception women, 89.6% consumed fiber <50% of RDA, 9.4% consumed fiber 50-70% of RDA and only 1.0% of women consumed 70-90% of RDA. The median intake of fiber was 9 less than RDA 30gms.

A study done in Canada by Sara et al.⁶¹, showed that median fiber intake in women was 14.1gm. One more study by Nemati⁵ in Iran revealed that average intake of fiber was 10.0gm. Again in our study women were used less fiber containing food.

Table22. Distribution of participants according to Vitamin B₁ (Thiamine) intake per day:

The majority preconception women 37.7% in the present study, consumed vitamin B₁ >50-70% of RDA, 25.2% consumed 70-90% of RDA and only 15.6% of women consumed <50% of RDA. The median intake of vitamin B₁ was 0.6933mg less than RDA of 1mg.

A study done in Canada by Sara⁶¹, showed that median vitamin B₁ intake in women was 2.2mg. Another study done by NNMB-2012³² showed that 77.8% non-pregnant non -lactating women consumed vitamin B₁ >70% of RDA, 12.6% consumed 50-70% and 9.6% consumed <50% of RDA of vitamin B₁

In our study vitamin B₁ consumption was less due to non usage of variety of food stuffs and more were vegetarian.

Table23. Distribution of participants according to Vitamin B₂ (Riboflavin) intake per day:

Among the preconception women in the present study, 47.8% consumed vitamin B₂ >50-70% of RDA, 21.6% consumed <50% of RDA and only 14.5% of women consumed >90% of RDA. The median intake of vitamin B₂ was 0.6364mg which was less than RDA of 1.1mg.

A study carried out in rural area of Nigeria⁵⁶ showed that, median vitamin B₂ intake in women was 0.3400mg. Another study done by NNMB-2012³² revealed that 42.5% non-pregnant non-lactating women consumed vitamin B₂ >70% of RDA, 26.0% consumed 50-70% and 31.5% consumed <50% of RDA of vitamin B₂

In our study vitamin B₂ consumption was less due to non usage of variety of food stuffs and moreover majority were vegetarian.

Table24. Distribution of participants according to Vitamin B₆ (pyridoxine phosphate) intake per day:

In the present study, 77.7% consumed vitamin B₆ <50% of RDA, 16.4% consumed 50-70% of RDA and only 2.1% of women consumed >90% of RDA. The median intake of vitamin B₆ was 0.7042mg less than RDA of 2.0mg.

A study in Canada by Sara et al.⁶¹, showed that the median vitamin B₆ intake in women was 2.0mg/day. Another study conducted by Nemati⁵ in Iran revealed that, median vitamin B₆ intake in women was 0.9100mg. Less consumption of vitamin B₆ in our study may be due to less usage of other food stuffs containing pyridoxine.

Table25. Distribution of participants according to dietary folate intake per day:

Among the participants in the present study, 48.4% consumed folate <50% of RDA, 23.6% consumed folate 50-70% of RDA and only 17.6% of women consumed >90% of RDA. The median intake of folate was 104µg less than RDA 200µg .

It was revealed by a study done in Canada⁶¹, that the median folate intake in women was 398.6µg. Another study done by NNMB-2012³² showed that 46.4% non-pregnant non-lactating women consumed folate >50% of RDA, 32.1% consumed >70% and 21.5% consumed 50-70% of RDA of folate.

This could be due to high food gap in women staying in rural areas.

Table26. Distribution of participants according to Vitamin B₁₂ (Cobalamine) intake per day:

In the present study, 39.5% of preconception women consumed Vitamin B₁₂ >90% of RDA, 18.1% consumed 50-70% of RDA but only 33.0% of women consumed <50% of RDA. The median intake of vitamin B₁₂ was 0.6753µg less than RDA 1µg.

A study carried out in Canada⁶¹ showed that median vitamin B₁₂ intake in women was 12.9 µg.

Table27. Distribution of participants according to Vitamin C intake per day:

In the present study of preconception women, 79.5% of women consumed vitamin C <50% of RDA, 20.5% consumed vitamin C 50-70% of RDA and no one consumed >70% of RDA of vitamin C. The median intake of vitamin C was 22mg/day which was less than RDA 40mg.

A study done in Sahariya of Madhya Pradesh⁵⁹ showed that, median vitamin C intake in women was 6mg. Another study carried out by NNMB-2012³² showed that 53.7% non-pregnant non-lactating women consumed vitamin C >70% of RDA, 32.8% consumed <50% and 13.7% consumed 50-70% of RDA of vitamin C. In our study consumption was less probably due to food gap i.e. in less consumption of fruits.

Table28. Distribution of participants according to Vitamin A (Retinol) intake per day:

Majority of the participants in the present study, 82.3% consumed vitamin A <50% of RDA, 12.2% consumed vitamin A 50-70% of RDA and only 2.1% of women consumed >90% of RDA. The median intake of vitamin A was 195µg less than RDA of 600µg.

A study done in Sahariya of Madhya Pradesh⁵⁹ showed that, median vitamin A intake in women was 45µg. Another study conducted by Mallikarjun Rao et al³. of Hyderabad revealed that average intake of vitamin A was 109µg in non -pregnant non- lactating women. This large gap in our study could be due to less consumption of fruits and vegetables.

Table29. Distribution of participants according to Calcium intake per day:

In the present study, 34.0% women consumed calcium <50% of RDA, 24.7% consumed 50-70% of RDA and 25.5% of women were consuming >90% of RDA of calcium. The median intake of calcium was 375mg less than RDA 600mg.

A study conducted by Md. Zahirul Islam et.al in Bangladesh³³ showed that, average daily consumption of calcium was <75% of daily requirement 600mg/day and more than 13% of the women consumed calcium <200mg/day. We observed in our

study that most of the participants were used less amount of milk and milk products and also animal meat. Even consumption of fruits and vegetables were also less.

Table30. Distribution of participants according to Iron intake per day:

In the present study on preconception women, 70.9% of women consumed iron <50% of RDA, 24.9% consumed 50-70% of RDA and only 0.3% of women were consuming >90% of RDA of iron. The median intake of iron was 8.9mg which was less than RDA 21mg.

A study conducted by Nemati et al. in Iran⁵ showed that, average daily consumption of iron was 11.4mg. Another study done by NNMB-2012³² revealed that 68.3% non-pregnant non-lactating women consumed iron >50% of RDA, 16.5% consumed 50-70% and 15.2% consumed >70% of RDA of iron. In our study most of the participants were using fewer amounts of milk and milk products, eggs and also animal meat. Even consumption of fruits and green leafy vegetables were also less. This had pooled many participants to suffer from anemia of mild to moderate.

Table31. Distribution of participants according to Zinc intake per day:

Majority of the participants in the present study, 65.6% consumed zinc <50% of RDA, 29.4% consumed 50-70% of RDA and only 0.3% of women consumed >90% of RDA. The median intake of zinc was 4.4mg less than RDA 10mg.

A study done in Iran⁵ showed that, mean zinc intake in women was 3.40mg. Another study conducted in Canada⁶¹, median intake of zinc was 19.9mg in women of reproductive age group. This may be due to high food gap in women staying in rural areas.

Table32. Distribution of food groups intake per day:

In this study of preconception women, mean intake of starch staples was 124.24gm/day, milk and milk products was 96.27gm/day, green leafy vegetable was 71.60gm/day, fats and oils was 59.13gm/day and sweets and sugar was 21.78gm/day which all were less than RDI. But consumption of legumes and nuts were 75.86gm/day and was more than RDI.

A study conducted by Mallikarjun et al. Hyderabad³ showed that, mean intake of cereal and millets was 365gm/day, milk and milk products was 80gm/day, green leafy vegetable was 18gm/day, fats and oils was 13gm/day and sweets and sugar was 14gm/day.

In our study the staple food was legumes and other leafy vegetables which had created a large gap of variety of food type. This was also main cause of undernutrition in preconception women.

Table 33, 34 and 35. Distribution of households according to food insecurity access domain, related conditions and access category:

Our study on preconception women showed that, 20.1% preconception women had anxiety and uncertainty about food, 14.4% faced insufficient quality of food and 10.6% had insufficient food intake.

As for as food insecurity related conditions concernd, 17.5% preconception women had lack of resources for food,14.4% were not eating preferred food, 9.5% worried about food and 3.6% had to ran out of food.

Also in this study, 72.6% of women had food secure, 11.9% had moderate food insecurity, 10.9% faced mild food insecurity and only 4.6% women were facing severe food insecurity. The prevalence of food insecurity was 4.6%.

A study conducted in Tanzania⁶² showed that, 59.8% household women had anxiety and uncertainty about food, 67.9% faced insufficient quality of food and 50.9% had insufficient food intake.

Another study done by FANTA (Food and nutrition technical assistance, USAID) 2008 in Western High land of Guatemala³⁵ revealed that, about 67.0% women had lack of resources for food, 39.8% were not eating preferred food, 71.3% worried about food and 16.4% had to run out of food. This study also concluded that 35.9% women had food secure, 46.1% had moderate food insecurity and 18% women had severe food insecurity.

In our study most of the women had food security and some percentage women had mild to severe food insecurity that inhibited consumption of desired and nutrient food stuffs that might have led to more undernutrition in preconception women.

Table 36, 37 and 38. Comparison of 1st and 2nd dietary recall the mean of the proximate principles, vitamins and minerals consumption:⁶³

The mean of the 1st and 2nd dietary recalls in this study revealed that, dietary intake of proximate of energy; protein and lipids were nearly equal. The mean intake of energy was 1254.96 kcal/day in 1st dietary recall and 1308.01 kcal/day in 2nd dietary recall. The mean intake of protein was 30.24 gm/day in 1st dietary recall and 30.79 gm was in 2nd dietary recall.

In first and second dietary recall, mean of dietary intake of vitamins i.e. vitamin B₁ (0.7266mg/day and 0.7487mg/day), folate(123.86 µg/day and 121.45 µg/day), and Vitamin A(218.77 µg/day and 228.36 µg/day) were almost same. There was no much difference found.

In first and second dietary recall, mean of dietary intake of minerals i.e. calcium (426.11mg/day and 452.77mg /day) and iron (9.18mg/day and 9.21/day) were also same. There was no much difference found.

Association between various socio-demographic factors and nutritional status of preconception women:

Table 39 and 40. Association between age& parity and age &hemoglobin:

The parity and hemoglobin were compared with ages of preconception women. In the age groups 15-19 years, 72.0% nulliparous, 24.0% had 1 child and 3.1% had 2 children. In 30-34 years age groups, 31.6% nulliparous, 42.1% had 1 child and 44.4% had 2 or more children. Similarly in the age group 20-24 years, 50.1% women had 2 children. This revealed that inter conception period was less. This association between age and parity was statistically significant (p=0.001).

As many as in 20-24 year age group, 38.3% of the participants had moderate and mild anemia. In 25 -29 age group, 41.9% participants had moderate anemia. Because of more number of pregnancies and due to loss of blood in each pregnancy, anemia rate also increases. However, this association was found to be statistically not significant (p=0.509).

In a study conducted by Majid et al in Tehran, Iran¹³, converse to this study, in the age between 25-29 years and anemia odds ratio was (O.R.) 0.62 (CI 95%). Also

women with more than 2 pregnancies had higher rate of anemia with odds ratio of 2.32(95% CI:1.21-4.41). In the age group 35-39years and anemia the O.R.was 1.47(CI 95%: 0.53 -4.01) which was statistically significant.

Table 41. Association between Religion and BMI:

In our study, 38.2% participants who were Hindu belonged to undernourished and only 16.8% belonged to overweight category of BMI. Whereas, majority 47.5% Muslim women belonged to normal BMI and only 27.1% undernourished. This association between religion and BMI was statistically significant ($p=0.018$). This may be due to cultural habits of daily food consumption by women different in both religion.

In a study conducted by Ramesh in Kerala ⁶⁰ showed that, 21.8% Hindu women belonged to underweight and only 17.4% Muslim women were belonging to underweight category of BMI.

Table 42 and 43. Association between Education and Hemoglobin & BMI:

In this study, among the illiterates, 56.9% moderately anemic and 33.3% were suffering from mild anemia. Of the preconception women who had studied up to primary school, 39.1% had moderate anemia and 37.7% had mild anemia. In the women, who had studied up to high school, 38.9% had moderate anemia and 40.8% suffered from mild anemia. Women who studied up to PUC, 42.2% had moderate anemia and 33.3% had mild anemia. Also women who studied up to graduate and beyond, 40.5% had mild anemia and 32.4% had suffered from moderate anemia. There were inconsistency in number of women with education level .Hence

this association between education and anemia was statistically not significant ($p=0.205$).

In a study conducted by Majid et al. in Tehran, Iran¹³, the odds ratio between illiterates and anemia was 1.81 (CI 95%:0.33-9.92). Between primary education and anemia odds ratio was 1.17 (CI 95%:0.20-4.87) so it was found to be significant.

Women who were illiterates, 50.0% were undernourished, 42.0% were normal and only 8% were overweight. Among women completed primary school, 45.6% had normal BMI, 37.3% undernourished and 17.1% had overweight. Also women who were completed secondary school 17.8% were overweight, 45.6% were normal and 36.6% were undernourished. Those who completed PUC, 47.9% had normal BMI, 33.4% were belonging to underweight category and 18.7% to overweight category of BMI. Women who completed degree and above 39.5% belonged to BMI of normal category, 34.2% to overweight category and only 26.3% were belonging to underweight category of BMI. There was decrease in undernutrition as education increases but difference, so this association between education and BMI was statistically not significant ($p=0.085$).

However, in contrast similar study done in Burkina faso and Congo democratic republic⁶⁴, revealed that, 14.9% and 18.15% of women with no formal education were undernourished and women who completed secondary education fewer proportion were of undernourished (4.5% and 10.8%) respectively (p value=0.001).

Table44. Association between Types of family and BMI:

In our study women who were staying in nuclear family, 33.2% undernourished 46.9 % normal and only 19.9% overweight. Among women were staying in joint family, 44.7% normal, 37.7% undernourished and 17.6% overweight. Also women who stayed in three generation family, 60% belonged to normal category of BMI, 30% undernourished and 10% overweight category of BMI. But this association between type of family and BMI was statistically not significant ($p=0.687$).

Table45. Association between socio economic status (SES) and Hemoglobin:

In this study, participants who were class I of SES had 33.3% equal distribution as normal, mild and moderate anemia. But women belonging to class V had 43.2% moderate anemia and 39.0% were suffering from mild anemia. High prevalence of anemia in our study might be due to low socioeconomic status and nutritional deficiency among preconception women. This association between SES and Hemoglobin was statistically significant ($p=0.041$).

In a study conducted by Majid et al. in Tehran, Iran¹³, the lowest mean hemoglobin was found in women who belonged to low socioeconomic status group (12.56 ± 1.46) and highest mean of hemoglobin was found in the highest socioeconomic group (13.26 ± 1.44). There was significant association between Hb% and SES ($p < 0.05$).

Table 46, 47 and 48. Association between HFIA and BMI, SES and Hemoglobin:

In the present study, women who had food secure 17.3% were overweight and 35.3% were underweight. Among the study participants who had mild insecurity,

35.7% undernourished and 19.1% belonged to overweight category of BMI. Women who had moderate food insecurity, 40.2% underweight and 20.7% were belonging to overweight. Women who had severe food insecurity, 51.4% underweight, and 17.2% overweight. This association between HFIA and BMI was statistically not significant ($p=0.406$).

Participants having 66.1% food secure were in SES-class V, 23.8% in class IV, 7.3% in class III and only 2.8% in class I&II. Women who had mild food insecurity, 61.9% in SES –class V, 26.2% in class IV and 7.2% in class III. Women who had moderate food security, 63.1% belonged to SES V, 23.9% to class IV and 8.7% were in class III. Nearly 57.0% women who had severe food insecurity were in SES V, 22.8% were in class IV and only 11.4% were in class I&II. Some proportion of participants had low socioeconomic status had one or the other form of food insecurity but, however this association between HFIA and SES was statistically not significant ($p=0.510$).

In this study, women who had food security, 42.7% moderately anemic, 39.9% had mild anemia and 17.4% not anemic. Participants who had mild insecurity, 35.7% moderate anemic and 36.9% mild anemic. Among women who had moderate food insecurity, 35.9% moderately anemic and 27.2% had mild anemia. Participants who had severe food insecurity, 25.7% were moderate anemic and 42.8% were mild anemic. Food insecurity of any type had direct impact on the nutritional status and on anemia. This association between HFIA and hemoglobin was statistically significant ($p=0.000$).

A study conducted by FANTA³⁵(Food and nutrition technical assistance-USAID)2008 in Western High land of Guatemala, women of reproductive age group

who had moderately food insecurity had 21.6% anemia and who had severe food insecurity were with anemia 29.4%($p<0.05$). This study also revealed that, association between BMI and food insecurity showed that, 1.6% undernourished women belonged to moderately food insecure group and 1.6% to severely food insecurity group. However, this association was statistically significant ($p<0.05$).

Another study done in Mozambique³⁶, lower socioeconomic groups had higher food insecurity ranging from moderate (44%) to severe (26%) and it was statistically significant ($p=0.001$).

Table 49 and 50. Association between BMI and Energy and protein intake:

In the present study, women who had BMI category of overweight 23.5% consumed energy <50% of RDA, 29.4% consumed 50-70% of RDA, 36.8% consumed 70-90% of RDA and only 10.3% consumed >90% of RDA.

Women who had BMI category of underweight, 23.1% consumed energy <50% of RDA, 48.9% consumed 50-70% of RDA, 20.3% consumed 70-90% of RDA and only 7.7% were consuming >90% of RDA. This association between BMI and energy consumption of preconception women was statistically significant ($p=0.038$) Consumption of energy was always associated with BMI. In the present study women's staple food were legumes and nuts that could be reason for low BMI.

Participants who had BMI category of overweight, 39.7% consumed protein <50% of RDA, 39.7% consumed 50-70% of RDA, 17.6% consumed 70-90% of RDA and only 2.9% were consuming >90% of RDA. Women who had BMI category of underweight, 48.2% were consuming protein <50% of RDA, 38.5% were consuming 50-70% of RDA, 9.8% were consuming 70-90% of RDA and only 3.5%

had consumed >90% of RDA. Women were consuming less protein containing food and had direct effect on weight, but still this association between BMI and protein consumption of preconception women was statistically not significant ($p=0.276$).

A study conducted by NNMB-2012³² showed that, there was direct association between BMI and protein and was statistically significant ($p=0.001$). Whereas no statistical association was found between BMI and energy intake ($p>0.005$).

Table 51. Association between BMI and Iron intake:

In this study, Participants who had BMI category of overweight, 63.2% were consuming iron <50% of RDA, 35.3% consumed 50-70% of RDA, 1.5% were consuming 70-90% of RDA and no one consumed >90% of RDA. Women who had BMI category of underweight, 81.3% consumed iron <50% of RDA, 13.4% consumed 50-70% of RDA, 5.6% consumed 70-9-0% of RDA and only 0.7% were consuming >90% of RDA. For Chi-Square analysis both 70-90% and >90% were clubbed together. This association between BMI and iron consumption by preconception women was statistically significant ($p=0.002$). In our study we observed that most of the women were vegetarian and were consuming less amount of meat, egg and green leafy vegetables. This type of food gap could have lead to inadequate iron consumption in preconception women.

A study done in Nigeria⁵⁶, showed that, there was positive correlation between BMI and iron and was statistically significant ($p<0.05$).

Table 52. Association between BMI and Vitamin C intake:

In this study, Participants who had BMI category of overweight, 73.5% were consuming vitamin C <50% of RDA, 6.5% consumed 50-70% of RDA and no one consumed more than 70% of RDA. Participants who had BMI category of underweight, 87.1% were consuming vitamin C <50% of RDA, 12.9% consumed 50-70% of RDA and no one was consuming more than 70% of RDA. This association between BMI and vitamin C consumption by preconception women was statistically significant ($p=0.012$). This also led to less consumption of fruits and vegetables and there was long food gap in the daily dietary intake.

A study done in Nigeria⁵⁶, found that there was positive correlation with BMI and vitamin C and which was statistically significant ($p<0.05$).

Table 53. Association between BMI and Riboflavin intake:

In this study, women who had BMI category of overweight, 23.5% consumed riboflavin <50% of RDA, 44.1% were consuming 50-70% of RDA, 19.2% consumed 70-90% of RDA and 13.2% were consuming >90% of RDA. Women who had BMI category of underweight, 24.5% were consuming riboflavin <50% of RDA, 51.0% consumed 50-70% of RDA, 12.6% were consuming 70-90% of RDA and 11.9% consumed >90% of RDA. Women in this study consumed inadequate vitamin riboflavin probably due to food gap in daily diet. This association between BMI and riboflavin consumption of preconception women was statistically not significant ($p=0.577$).

A study done in Nigeria⁵⁶, found that there was positive correlation with BMI and riboflavin and it was statistically significant ($p<0.05$).

CONCLUSION

The current study revealed that preconception women staying in rural areas had less desired food stuffs which were containing inadequate micronutrients and macronutrients. Low BMI in women pronounced that food habits of rural women (staple food was jowar and rice) had low macro and micronutrients which could be due to lack of knowledge regarding importance of nutrition. Poverty was related to poor nutrition status usually due to factors limiting food access. There was no balanced diet served daily as less consumption of pulses, milk, eggs and green leafy vegetables. Adequate amount of pulses, selected nuts or seeds could have made diet complete even though they were vegetarian but it did not happen.

Multiple reasons like poverty, food insecurity, high parity, traditional food habits and dietary diversification in this study lead to undernutrition in preconception women. The key intervention would be suggestion of dietary diversification to improve macro and micro nutrient intake of preconception women living in rural area.

LIMITATIONS

The limitations of the study are:

- Dietary assessment was based on women's own statement and memory which might over or under estimate the actual consumption of food due to many reasons
- In this study seasonal variations were not reflected due to the cross sectional study design.
- Biochemical assessment of nutritional status such as serum albumin, vitamin and minerals level were not assessed due to highly expensive or not feasible for community based studies.

SUMMARY

The present study – “Nutritional status of preconception women in rural areas of Belgaum District-A cross sectional study”, was undertaken to know the nutritional status and socio demographic factors affecting the nutritional status of preconception women.

This community based cross sectional study was carried out in 10 rural PHC areas comprising of 18 villages of 5 talukas in Belgaum district. A total of 770 preconception women, aged between 15-49 years were selected for the study and the duration of the study was for one year from 1st January 2014 to 31st December 2014. Data collection was done after identification of women, on socio demographic and food insecurity, laboratory investigations, anthropometry and consumption of 24 hrs.dietary history in half (385) of the women.

In the current study, majority 57.2% participants belonged to 20-25 years age group and 84.2% were Hindus by religion. As many as 82.9% women were housewives and 32.2% of their husbands were Agriculturists. A large number of women (43.0%) and their husbands (30.7%) had studied up to high school. Most of them, 64.8% belonged to class V socio-economic status as per modified B G Prasad classification and 75.2% were living in joint families.

A great number of study participants, 61.7% had married after 18 years and the mean age of marriage was 18.2 years. A total of 37.7% had consanguineous marriage and 43.9% of them had 1 child. As many as 48.6% women were vegetarians and 2.1% women had habit of tobacco chewing. About 45.5% had a normal BMI and 36.6% belonged to underweight category. MUAC was <22cm in 24.7% of the women

and >22cm in 75.3% of the women in the study. Similarly, about 72.1% of women were having W/H ratio <0.8 and 27.9% of women were having W/H ratio >0.8 indicating more undernourished. Whereas, 40.4% of the study women were suffering from moderate anemia and 38.2% were suffering from mild anemia.

Majority of the participants were consuming energy less than 90% of RDA. Out of 385 women, 22.1% consumed energy <50% of RDA and 39.2% consumed 50-70% of RDA. About 41.8% preconception women consumed protein less than 50% of RDA. But 99.2% preconception women consumed lipids >90% of RDA. Among preconception women, 89.6% consumed fiber <50% of RDA.

The majority of the preconception women 37.7% consumed vitamin B₁ >50-70% of RDA. About 47.6% of the preconception women consumed vitamin B₂ >50-70% of RDA. Among study participants 77.7% consumed vitamin B₆ <50% of RDA. About 48.6% of the participants consumed folate <50% of RDA.

In the present study, 39.5% of preconception women consumed Vitamin B₁₂ >90% of RDA. Majority of preconception women, 79.5% of women consumed vitamin C <50% of RDA. Most of the women (82.3%) in this study consumed vitamin A <50% of RDA.

Majority of the preconception women, 34.0% consumed calcium <50% of RDA. About 70.9% of the preconception women consumed iron <50% of RDA. Among the participants 65.6% consumed zinc <50% of RDA.

In this study on preconception women, the mean intake of starch staples was 124.24gm/day, milk and milk products 96.27gm/day, green leafy vegetable

71.60gm/day, fats and oils 59.13gm/day and sweets and sugar was 21.78gm/day which were all less than RDI.

In this study, 20.1% preconception women had anxiety and uncertainty about food, 14.4% faced insufficient quality of food and 10.6% had insufficient food intake. Also in this study, 11.9% of the women had moderate food insecurity and 4.5% had severe food insecurity. The prevalence of food insecurity was 4.54%.

Various socio-demographic variables had influence over preconception nutritional status of women. Significant associations were found between age and parity ($p=0.001$), religion and BMI ($p=0.018$), socio-economic status and Hemoglobin ($p=0.041$), HFIA and Hemoglobin ($p=0.000$), BMI and Energy ($p=0.038$), BMI and Iron ($p=0.002$) and BMI and Vitamin C ($p<0.012$).

Nevertheless, no statistically significant associations were observed between age and hemoglobin, education and BMI, HFIA and BMI, HFIA and SES, BMI and protein, BMI and riboflavin.

Hence, the present study recommends that in order to improve the nutritional status of preconception women, periodic IEC activities have to be held at villages regarding knowledge about good nutrition and consequence of poor nutrition leads to ill effects during pregnancy, during child birth and on new born.

RECOMMENDATIONS

On the basis of this study, the following recommendations have been made for the improvement of nutritional status of preconception women in the community.

- Preconception women less likely to see a physician, so periodic health check up and health education regarding nutrition has to be done in all primary health centers (PHC).
- Nutritional screening programmes in PHC will help in early identification of anemia and low BMI in women, so that interventions could be started at the earliest before she conceives.
- Effective observation of village health nutrition day (VHND) in all villages with involvement of ASHA, AWW, ANM and panchayath leaders.
- Effective and quality PDS (public distribution system) to include all food stuffs.
- Nutritional intervention programmes (Anna Bhagya) should be combined with health programmes. This could help in uplifting the nutritionally vulnerable people.
- Awareness regarding health and nutrition activities with involving other departments such as Health, ICDS, Revenue, Education and Panchayat Rajya Institutions (PRI).

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ANNEXURE II

INFORMED CONSENT

**NUTRITIONAL STATUS OF PRECONCEPTION WOMEN IN RURAL AREAS
OF BELGAUM DISTRICT-A CROSS SECTIONAL STUDY**

INVESTIGATORS: _____

Introduction:

I am _____ post graduate student of Dept of Community Medicine, JNMC, KLE University, Belgaum. I am conducting a study in Rural areas of Belgaum district under the guidance of _____ Professor of Community Medicine, JNMC, KLE University, Belgaum. I am conducting a study of “Nutritional status of preconception women in Rural areas of Belgaum District”

Nutrition is important in reproduction age group women; including the safe delivery of infants. Nutritional assessment of women at reproductive age should identify factors that may affect fertility and preconception health. Maternal nutritional status is important for the health and quality of life of women and for the health of their newborn infants.

So this study will help in identification of strategies for initiating appropriate preconception supplementation programmes for improving health status of preconception women.

Methodology:

I will be interviewing eligible preconception women to know about their nutritional status and examine them. Laboratory investigations with blood and urine

samples will be done. No treatment will be provided if any illness is found during the study.

Possible benefits:

You will not be eligible for any kind of monetary benefits or free services by virtue of your participation in the study. You will be benefited by the health education given during the study regarding the problems associated with nutritional factor.

Possible risks:

Methods applied to do the study are safe. No risk is involved in the study.

Cost of participation:

The cost of the study will be borne by the researcher. You will not have any costs attached to your participation.

Legal rights:

By signing this consent form you are not waiving any of your legal rights.

Privacy and Confidentiality:

The results of the study may be published for scientific purposes. However your identity will not be revealed. All information collected will be coded so that no one other than the investigator will know your identity.

Withdrawal from the study:

You can withdraw from the study at any time if you wish to do so.

Authorization to publish the results:

The researcher may use the information gathered from this study for presentation in scientific journals. However your identity will not be revealed.

Questions:

If you have any queries regarding the study, you can contact Dr.Ganga S.Pilli, Chairman, J. N. M. C Institutional Ethics Committee on human subjects' research on 0831-2471350.

Consent statement:

“I volunteer and consent to participate in the study. I have read (or it has been read to me in the language known to me) the information sheet thoroughly. Full opportunity was given to me to ask questions. I am fully satisfied with the answers to the questions I wanted to ask. I hereby voluntarily agree to participate in this research project”.

Name of the Participant/guardian

Name of Investigator

Name of Witness

Date: _____

Sign of the participant/Guardian

Signature of investigator

Signature of Witness

Place: _____

ಅನುಬಂಧ III

ಸಮ್ಮತಿ ಪತ್ರ

ಬೆಳಗಾವಿ ಜಿಲ್ಲೆಯ ಗ್ರಾಮೀಣ ಭಾಗದಲ್ಲಿಯ ಗರ್ಭಪೂರ್ವ ಹೆಣ್ಣುಮಕ್ಕಳ ಪೋಷಣೆ ಮಟ್ಟ - ಕ್ರಾಸ್ ಸೆಕ್ಷನ್ ಅಭ್ಯಾಸ

ಸಂಶೋಧಕರು:

ಪರಿಚಯ:

ಡಾ|| ಎಂಬ ನಾನು ಕೆ.ಎಲ್.ಇ ವಿಶ್ವವಿದ್ಯಾಲಯದ ಜವಾಹರಲಾಲ್ ನೆಹರು ವೈದ್ಯಕೀಯ ಮಹಾವಿದ್ಯಾಲಯದ ಸಮುದಾಯ ಆರೋಗ್ಯ ಶಾಸ್ತ್ರ ವಿಭಾಗದಲ್ಲಿ ಸ್ನಾತಕೋತ್ತರ ವಿದ್ಯಾರ್ಥಿಯಾಗಿದ್ದೇನೆ. ಇದೇ ವಿಭಾಗದ ಪ್ರೊಫೆಸರ್ ಡಾ|| ಎಸ್.ಎಮ್.ಕಟ್ಟಿ ಅವರ ಮಾರ್ಗದರ್ಶನದಲ್ಲಿ ಬೆಳಗಾವಿ ಜಿಲ್ಲೆಯ ಗ್ರಾಮೀಣ ಭಾಗದ ಹೆಣ್ಣು ಮಕ್ಕಳ ಪೋಷಣೆ ಮಟ್ಟ ಕುರಿತು ಅಭ್ಯಾಸ ಮಾಡುತ್ತಿದ್ದೇನೆ.

ಗರ್ಭಧರಿಸುವ ಹೆಣ್ಣುಮಕ್ಕಳಲ್ಲಿ (15-49 ವರ್ಷ) ಪೋಷಣೆಯ ಒಂದು ಮುಖ್ಯವಾದ ಅಂಶವಾಗಿದೆ. ಪೋಷಣೆಯ ಅಧ್ಯಯನದಿಂದ ಈ ವಯಸ್ಸಿನ ಹೆಣ್ಣು ಮಕ್ಕಳಲ್ಲಿ ಗರ್ಭಧರಿಸುವಿಕೆಯ ಬಗ್ಗೆ ಹಾಗೂ ಗರ್ಭಧರಿಸುವ ಮುಂಚೆಯ ಆರೋಗ್ಯ ಸ್ಥಿತಿ ಬಗ್ಗೆ ತಿಳಿಯಬಹುದಾಗಿದೆ. ಪೋಷಣೆಯ ಹೆಣ್ಣು ಮಕ್ಕಳ ಆರೋಗ್ಯ ಮತ್ತು ಜನ್ಮ ಧರಿಸುವ ಮಕ್ಕಳ ಮೇಲೆ ಕೂಡ ಒಂದು ಪ್ರಮುಖ ಪಾತ್ರ ವಹಿಸುತ್ತದೆ.

ಅದರಿಂದ ಈ ಅಭ್ಯಾಸ ಕೈಗೊಂಡು, ಇದರಿಂದ ಮುಂದೆ ಪೋಷಣೆಗೆ ಬಗ್ಗೆ ಯೋಜನೆಗಳನ್ನು ಕೈಗೊಳ್ಳಲು ಅನುಕೂಲವಾಗಲು ಸಹಾಯವಾಗುತ್ತದೆ.

ಅಭ್ಯಾಸಕ್ರಮ:

ಅರ್ಹ ಗರ್ಭಪೂರ್ವ ಹೆಣ್ಣುಮಕ್ಕಳ ಪೋಷಣೆಯನ್ನು ಅರಿಯುವ ಸಲುವಾಗಿ, ಅವರ ಸಂದರ್ಶನವನ್ನು ಮಾಡುತ್ತೇನೆ ಮತ್ತು ಪರೀಕ್ಷಿಸುತ್ತೇನೆ. ಇದರಲ್ಲಿ ಕೆಲವು ರಕ್ತ ಪರೀಕ್ಷೆ, ಮೂತ್ರ ಪರೀಕ್ಷೆ ಮಾಡಲಾಗುತ್ತದೆ. ಯಾವುದೇ ರೀತಿಯ ಚಿಕಿತ್ಸೆಯನ್ನು ಕೊಡಲಾಗುವುದಿಲ್ಲ.

ಸಾಧಿಸಬಹುದಾದ ಲಾಭಗಳು:

ಈ ಅಭ್ಯಾಸಕ್ರಮದಲ್ಲಿ ಭಾಗವಹಿಸುವ ಮೂಲಕ ನೀವು ಯಾವುದೇ ಆರ್ಥಿಕ ಸಹಾಯಕ್ಕೆ ಹಕ್ಕುದಾರರಾಗುವುದಿಲ್ಲ. ಈ ಆರೋಗ್ಯ ಶಿಕ್ಷಣ ಪಡೆಯುವ ಮೂಲಕ ನಿಮ್ಮ ಪೋಷಣೆಯಲ್ಲಿ ಉಂಟಾಗಿರುವ ಸಮಸ್ಯೆಗಳಿಗೆ ಪರಿಹಾರ ಕಂಡುಕೊಳ್ಳಬಹುದು.

ಅಡಚಣೆಗಳು:

ಈ ಅಭ್ಯಾಸಕ್ರಮ ಸುರಕ್ಷಿತವಿದ್ದು ಯಾವುದೇ ತರಹದ ಅಡಚಣೆಯಿಲ್ಲ.

ಭಾಗವಹಿಸುವ ವೆಚ್ಚ:

ಸಂಶೋಧಕರೇ ಈ ಅಭ್ಯಾಸದ ವೆಚ್ಚ ಭರಿಸುತ್ತಾರೆ. ಭಾಗವಹಿಸುವ ಕಾರಣಕ್ಕಾಗಿ ನೀವು ಯಾವುದೇ ವೆಚ್ಚವನ್ನು ಭರಿಸಬೇಕಿಲ್ಲ.

ಕಾನೂನಿನ ಹಕ್ಕು:

ಈ ಒಪ್ಪಿಗೆ ಪತ್ರ ನೀಡುವ ಮೂಲಕ ನೀವು ಯಾವುದೇ ಕಾನೂನಿನ ಹಕ್ಕಿನಿಂದ ವಂಚಿತರಾಗುವುದಿಲ್ಲ.

ಒಕತೆ ಮತ್ತು ಗೌಪ್ಯತೆ:

ವೈಜ್ಞಾನಿಕ ಉದ್ದೇಶಗಳಿಗಾಗಿ ಈ ಅಭ್ಯಾಸದ ಪರಿಣಾಮಗಳನ್ನು ಪ್ರಕಟಿಸಬಹುದು. ಸಂಗ್ರಹಿಸಲ್ಪಟ್ಟ ಎಲ್ಲ ಮಾಹಿತಿಯನ್ನು ಕೋಡ್ ಮಾಡಲಾಗಿದ್ದು, ಈ ಸಂಶೋಧಕರ ಹೊರತಾಗಿ ಬೇರಾರಿಗೂ ನಿಮ್ಮ ಪರಿಚಯದ ಸಾಧ್ಯತೆ ಇಲ್ಲ.

ಅಭ್ಯಾಸಕ್ರಮದಿಂದ ಹಿಂದೆಗಡೆ:

ನಿಮಗೆ ಬೇಕೆನಿಸಿದಾಗ ಈ ಅಭ್ಯಾಸಕ್ರಮದಿಂದ ನೀವು ಹಿಂದೆ ಸರಿಯಬಹುದು.

ಪುಣ್ಯಾಚರಣೆ ಪ್ರಕಟಿಸಲು ಒಪ್ಪಿಗೆ:

ಈ ಅಭ್ಯಾಸಕ್ರಮದಲ್ಲಿ ಸಂಗ್ರಹಿಸಿದ ಮಾಹಿತಿಯನ್ನು ಸಂಶೋಧಕರು ವೈಜ್ಞಾನಿಕ ನಿಯತಕಾಲಿಕಗಳಲ್ಲಿ ಪ್ರಕಟಿಸಲು ಬಳಸಬಹುದು, ಆದರೆ ನಿಮ್ಮ ಗುರುತನ್ನು ಯಾವುದೇ ಕಾಲಕ್ಕೆ ಬಹಿರಂಗಗೊಳಿಸುವುದಿಲ್ಲ.

ಮಾಹಿತಿ ಪ್ರಶ್ನೆಗಳು:

ಅಭ್ಯಾಸದ ಬಗ್ಗೆ ಪ್ರಶ್ನಿಸುವುದಿದ್ದರೆ,

ಈ ನಂಬರಿನ ಮೂಲಕ ಅಥವಾ ಡಾ||

0831- 2444065

ನಂಬರಿನ ಮೂಲಕ ಸಂಪರ್ಕಿಸಬಹುದು. ಆದರೆ ಸಂಶೋಧನಾ ಭಾಗವಾಗಿ

ಪ್ರಶ್ನಿಸುವುದಿದ್ದರೆ, ಡಾ|| ಗಂಗಾ ಎಸ್. ಪಿಳ್ಳೆ, ಬೇರಮನ, ಜಿ.ಎನ್.ಮೇಡಿಕಲ್ ಮಾನವೀಯ ವಿಷಯಗಳ ಸಂಶೋಧನಾ ಸಾಂಸ್ಕೃತಿಕ ಸಮಿತಿ, ಇವರನ್ನು 0831-2471350 ಈ ನಂಬರಿನ ಮೂಲಕ ಸಂಪರ್ಕಿಸಬಹುದು.

ಒಪ್ಪಿಗೆ ಸಾರಾಂಶ:

ಈ ಒಪ್ಪಿಗೆ ನಮೂನೆಯ ಎಲ್ಲ ವಿಷಯವನ್ನು ನನ್ನ ಸ್ಥಾನಿಕ ಭಾಷೆಯಲ್ಲಿ ತಿಳಿಸಲಾಗಿದೆ. ಈ ಅಭ್ಯಾಸಕ್ರಮವನ್ನು ಅರ್ಥ ಮಾಡಿಕೊಂಡಿದ್ದೇನೆ ಹಾಗೂ ನನಗೆ ತಿಳಿದಮಟ್ಟಿಗೆ, ನನಗಿದ್ದ ಸಂದೇಹಗಳನ್ನು ನಿವಾರಿಸಿಕೊಂಡಿದ್ದೇನೆ. ಈ ಅಭ್ಯಾಸ ವರ್ಗದಲ್ಲಿ ಭಾಗವಹಿಸಲು ನಾನು ಸ್ವತಃ ಒಪ್ಪಿಗೆ ನೀಡುತ್ತೇನೆ. ನನಗೆ ಪರಿಚಿತರಾದ ಸಾಕ್ಷಿದಾರರ ಸಮಕ್ಷಮ ಈ ಒಪ್ಪಿಗೆ ನಮೂನೆಗೆ ನಾನು ರುಜು ಹಾಕುತ್ತೇನೆ.

ಭಾಗವಹಿಸುವವರ ಹೆಸರು :

ಭಾಗವಹಿಸುವವರ ಸಹಿ / ಎಡ ಹೆಬ್ಬರಳಿನ ಗುರುತು :

ಸಂಶೋಧಕರ ಹೆಸರು :

ಸಂಶೋಧಕರ ಸಹಿ:

ಸಾಕ್ಷಿದಾರರ ಹೆಸರು :

ಸಾಕ್ಷಿದಾರರ ಸಹಿ / ಎಡ ಹೆಬ್ಬರಳಿನ ಗುರುತು :

ದಿನಾಂಕ :

ANNEXURE-III

PROFORMA

**NUTRITIONAL STATUS OF PRECONCEPTION WOMEN IN RURAL AREAS
OF BELGAUM DISTRICT-A CROSS SECTIONAL STUDY**

Section A. GENERAL INFORMATION:

S.No:

A) Name:

B) Age: _____years

C) Address & Phone No:

D) Religion:

1. Hindu 2. Muslim 3. Christian 4. Others

E) Occupation:

1. Housewife 2. Agriculture 3. Labourer 4. Others (Specify)

F) Husband's occupation:

1. Agriculture 2. Labourer 3. Factory Worker 4. Others

(Specify)

G) Education:

1. Illiterate 2. Primary School 3. Secondary School 4. PUC
5. Graduate 6. Post Graduate

H) Husband's Education:

1. Illiterate 2. Primary School 3. Secondary School 4. PUC

5. Graduate 6. Post Graduate

I) Type of Family:

1. Nuclear 2. Joint 3. Three Generation

J) Income of Family:

K) Total Number of Family Members:

L) Per Capita Income:

M) Obstetric Information:

1. Age of Menarche: _____ years
2. Age of marriage: _____ years
3. Duration of Married Life: _____ years
4. Previous pregnancy ;History

Previous pregnancy	Out come	Sex of child	Age of child
1			
2			
3			
4			

5. Consanguineous Marriage: a) Yes

- b) No

N) History of Chronic Diseases:

1. None
2. Hypertension
3. Diabetes Mellitus
4. Tuberculosis
5. Congenital Heart Diseases
6. Jaundice
7. Malaria
8. HIV
9. Cancer
10. Respiratory disease
11. Others. (Specify).....

Personal Information:

1. Type of Diet: a) Vegetarian b) Mixed

2. Habits:

- i) None
- ii) Chewing Tobacco
- iii) Smoking
- iv) Alcohol consumption
- v) Others (please specify)

If yes, Duration Frequency

If stopped, since:.....

3. Are you taking Iron /Folic acid tablets Y/N

If yes since when.....

Section B. FOOD INSECURITY:

Please think about past 4 weeks in answering the following 9 questions ;

Codes for the below 9 questions;

1 = Rarely (1-2 times in the past four weeks)

2 = Sometimes (3-10 times in the past four weeks)

3 = Often (>10 times in the past four weeks)

1. Did you worry that you would not have enough food Y/N
If yes, how often did this happen a. Rarely b. Some times c. Often
2. Were you not able to eat the kinds of foods you preferred because of a lack of money or goods for food purchases? Y/N
If yes, how often did this happen a. Rarely b. Some times c. Often
3. Did you have to eat a limited variety of foods due to a lack of resources? Y/N
If yes, how often did this happens a. Rarely b. Some times c. Often
4. Did you have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food? Y/N
If yes, how often did this happens a. Rarely b. Some times c. Often
5. Did you have to eat a smaller meal than you felt you needed because there was not enough food? Y/ N
If yes, how often this did happens a. Rarely b. Some times c. Often
6. Did you have to eat fewer meals in a day because there was not enough food?
Y/N
If yes, how often did this happens a. Rarely b. Some times c. Often

7. Was there ever no food to eat of any kind in your household because of a lack of resources to get food? Y/N
If yes, how often this did happens a. Rarely b. Some times c. Often
8. Did you go to sleep at night hungry because there was not enough food? Y/N
If yes, how often this did happens a. Rarely b. Some times c. Often
9. Did you go a whole day and night without eating anything because there was not enough food? Y/N
If yes, how often did this happens a. Rarely b. Some times c. Often
10. How many meals per day do you usually eat? 1/2/3/4

Section C: MATERNAL ANTHROPOMETRY:

1. HEIGHT (cms):
2. WEIGHT (Kgs):
3. BMI (Kg/m²):
4. MUAC (cms):
5. WAIST CIRCUMFERENCE (cms):
6. HIP CIRCUMFERNCE (cms):

Section D: General Physical Examination

Pallor	a) Present	b) Absent
Nail Changes	a) Present	b) Absent
Knuckle Pigmentation	a) Present	b) Absent
Edema	a) Present	b) Absent
Skin Changes	a) Present	b) Absent
Any other (specify)..... Present/ Absent		

Vitals:

1. Pulse Rate: _____/ min
2. Blood Pressure:
Systolic Blood pressure_____ mm Hg
Diastolic Blood Pressure _____ mm Hg
3. Respiratory Rate: _____/ min
4. Temperature: a) Febrile b) Afebrile

Investigations:

1. Haemoglobin:
2. Urine:
a) Sugar: Present Absent
b) Albumin: Present Absent

ANNEXURE-IV**KEY TO MASTER CHART**

A	Sl No	Serial No
B	Age	Years
C	Religion	1. Hindu 2. Muslim 3. Christian 4. Others
D	Occupation	1. Housewife 2. Agriculture 3. Labourer 4. Others (Specify)
E	Husband's occupation	1. Agriculture 2. Labourer 3. Factory Worker 4. Others (Specify)
F	Education	1. Illiterate 2. Primary School 3. Secondary School 4. PUC 5. Graduate 6. Post Graduate
G	Husband's Education	1. Illiterate 2. Primary School 3. Secondary School 4. PUC 5. Graduate 6. Post Graduate
H	Type of Family	1. Nuclear 2. Joint 3. Three Generation
I	Per Capita Income	Rs./month

J	Age of Menarche	Years
K	Age of marriage	Years
L	Duration of Married Life	Years
M	Outcome 1	Live birth, Vaginal delivery, LSCS ,Neonatal death
N	Sex of child 1	Male/female/Nil
O	Age of child 1	years
P	Outcome 2	Male/female/Nil
Q	Sex of child 2	Male/Female/Nil
R	Age of child 2	years
S	Outcome 3	Live birth, Vaginal delivery, LSCS ,Neonatal death
T	Sex of child3	Male/Female/Nil
U	Age of child 3	Years
V	Outcome 4	Live birth, Vaginal delivery, LSCS ,Neonatal death
W	Sex of child 4	Male/female/Nil
X	Age of child 4	Years
Y	Consanguineous Marriage	a) Yes b) No
Z	History of Chronic Diseases	1. None 2. Hypertension 3. Diabètes Mellites 4. Tuberculoses

		5. Congenital Heart Diseases 6. Jaundice 7.Malaria 8. HIV 9. Cancer 10.Respiratory disease 11. Others. (Specify).....
AA	Type of Diet	a) Vegetarian b) Mixed
AB	Habits -Chewing of tobacco	Yes/No
AC	Habits	iii) Smoking
AD	Are you taking Iron /Folic acid tablets	a) Yes b) No
AE	Socio Economic Status	1-classI, 2-classII, 3-classIII, 4-classIV, 5-class-V
AF	Age of last child	Years
AG	If left yes since when	years
AH	Parity	1-Nulliparous,2-1children,3-2-child,4- 3+children
AI	Did you worry that you would not have enough food	1) Yes 2) No
AJ	Were you not able to eat the kinds of foods you preferred because of a lack of money or goods for food purchases	1) Yes 2) No
AK	Did you have to eat a limited variety of foods due to a lack of resources	1) Yes 2) No
AL	Did you have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food	1) Yes 2) No

AM	Did you have to eat a smaller meal than you felt you needed because there was not enough food	1) Yes 2) No
AN	Did you have to eat fewer meals in a day because there was not enough food	1) Yes 2) No
AO	Was there ever no food to eat of any kind in your household because of a lack of resources to get food	1) Yes 2) No
AP	Did you go to sleep at night hungry because there was not enough food	1) Yes 2) No
AQ	Did you go a whole day and night without eating anything because there was not enough food	1) Yes 2) No
AR	How many meals per day do you usually eat	1) Yes 2) No
AS	HEIGHT	Cms
AT	WEIGHT	Kgs.
AU	BMI	M ²
AV	MUAC	Cms
AW	WAIST CIRCUMFERENCE	Cms
AX	HIP CIRCUMFERENCE	Cms
AY	Pallor	a) Present b) Absent
AZ	Nail Changes	a) Present b) Absent
BA	Knuckle Pigmentation	a) Present b) Absent

BB	Edema	a) Present b) Absent
BC	Skin Changes	a) Present b) Absent
BD	Any other (specify)	a) Present b) Absent
BE	Pulse Rate	Per/Min.
BF	Blood Pressure(Systolic/ Diastolic)	Systolic/Diastolic
BG	Respiratory Rate	Per/Min
BH	Temperature	Febrile
BI	Haemoglobin	Gm/Dl
BJ	UrineSugar	a) Present b) Absent
BK	UrineAlbumin	a) Present b) Absent
BL	MUAC	1-<22CM,2->22CM
BM	Energy	kcal
BN	Protein	Gms.
BO	Total Fat	Gms.
BP	Dietary Fibre	Gms.
BQ	Calcium	mg
BR	Iron	mg
BS	Zink	mg
BT	Vitamin B1	mg
BU	Vitamin B2	mg

BV	Vitamin B6	mg
BW	Dietary Folate	μg
BX	Vitamin B12	μg
BY	Vitamin C	mg
BZ	Vitamin A	μg

ANNEXURE I – ETHICAL CLEARANCE LETTER



K.L.E.SOCIETY'S
JAWAHARLAL NEHRU MEDICAL COLLEGE,
NEHRU NAGAR, BELGAUM-590010 (KARNATAKA-INDIA)
(Affiliated to KLE University, Belgaum)

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: jnmc@sancharnet.in

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Principal: 2471701
Fax No. +91 (0)831 – 2470759

Ref: MDC/DOME/ 89

Date: 07/12/2013

To,

PG student in MD. Community Medicine,
J.N.Medical College,
BELGAUM.

Sub: Institutional Ethical Clearance for the study.

With reference to the above, we wish to inform you that your proposed research project titled "NUTRITIONAL STATUS OF PRECONCEPTION WOMEN IN RURAL AREAS OF BELGAUM DISTRICT- A CROSS SECTIONAL STUDY," is ethical and justifiable. The proposed research project has been cleared by the JNMC Institutional Ethics Committee on Human Subjects Research.

(Dr.Hema Dhumale)
Member Secretary

JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belgaum.

(Dr.Ganga Pilli)
Chairman,

JNMC Institutional Ethics Committee
on Human Subjects Research,
J.N.Medical College, Belgaum.