Original Research Article

Nutritional Profile of Pregnant Women from Rural Mysore, Karnataka

C. Anitha[1], Sushma B V[2]

[1]Department of Studies in Food and Nutrition, Karnataka State Open University, Muktagangothri, Mysore -570 006, Karnataka State, India
[2]Department of Studies in Food and Nutrition, University of Mysore, Manasagangothri, Mysore -570 006, Karnataka State, India

Corresponding Author: C. Anitha

ABSTRACT

Pregnancy is a dynamic process that is bestowed with active physiological adaptation. Fetal development notably is accompanied by various physiological, biochemical and hormonal changes. Often this influence demands for additional essential nutrients requirements to nurture a growing fetus. Maternal malnutrition is known to impair pregnancy outcomes. In India, anemia is estimated to contribute about 20% of all maternal deaths, 3 times greater risk of premature delivery and low birth weight babies, brain damage in infants born to severely anemic mothers.
Thereby the study was aimed to assess the nutrition status and morbidity factors in association with socioeconomic background and the prevalence of anemia among rural pregnant women. Evidently 45% of women in our investigation were indicated to be anemic. Our investigation reports that Poor Nutrient intake and increased morbidity level during pregnancy were noted to be major causative factors for low hemoglobin status among pregnant women. Consequently the clinical manifestations were more prevalent among pregnant women related to nutrient deficiency. Hence forth ensuring correct nutrient supply during pregnancy could bring out positive pregnancy outcomes.
Key words: Pre Pregnancy, Birth Weight, Hemoglobin Status, Anemic, Clinical Manifestations, Quality Of Life

INTRODUCTION

Pregnancy is a period of great physiological and psychological stress for the women as she nurtures a growing fetus in her body. The development of fetus accompanies with various physiological, biochemical and hormonal changes occurring in the maternal body. This in turn often influences the needs for nutrients and the efficacy with which the body uses them. Maternal pre pregnancy nutrition affects intrauterine growth and birth weight. [1-3]

Nutrition is not only important for the unborn but is also important for the health and quality of life of women and for the health of their newborn infants. Maternal malnutrition impairs pregnancy outcomes, increases maternal mortality, and retards early childhood development. [4-6] Eighteen million low-birth weight babies are born to undernourished mothers each year. This is one of the prime causes of infant mortality in developing countries. [7,8]

Anemia during pregnancy continues to be a common clinical problem with high rates of prevalence (35 to 75%) in many developing countries. [9-13] The major concern about the adverse effects of anemia on pregnant women is a great risk of prenatal mortality and morbidity for the population. [14-19]

Socioeconomic factors associated with adverse gestational events include social class, working conditions, life style, family status and psychosocial state. [20-23] There has been a positive association reported between the maternal education and utilization of health care services. [24-27] Socio cultural dimensions provide a frame work for examining cultural issues associated to prenatal weight gain. This often include belief structure related to appropriate food intake, food prescription etc during pregnancy. [28-30] There is a belief that diet influences ease of delivery; for example, some believe that animal protein foods and excessive weight gain during pregnancy cause deliveries that are more difficult. [31-33]

Nutrition is not only important for the unborn but is also important for the health and quality of life in women and for the health of their newborn infants. [34,35] Pre pregnancy nutrition status affects intrauterine growth and birth weight. Maternal malnutrition impairs pregnancy outcomes, increases maternal mortality, and retards early childhood development. [36,37] Eighteen million low-birth weight babies are born to undernourished mothers each year. This is one of the prime causes of infant mortality in developing countries. Maternal malnutrition increases the risk of future malnutrition in generations. [38]

The study was conducted to evaluate the nutritional status and incidence of anemia in pregnant women in relationship with socioeconomic background with following research objectives;

❖ The Demographic details of the study areas and socio-economic status of the pregnant women.
❖ The Nutritional and Hemoglobin Status in the pregnant women.
❖ Dietary Intake, Nutrition/Health knowledge during pregnancy among the subject.

MATERIALS AND METHODS

Maternal mortality is currently an issue of much concern on the global health agenda. The health status of a woman could affect the likelihood that she will develop complications during pregnancy and also her ability to survive these complications. Viewing women's health across the life cycle, it is clear that the health status of pregnant women is affected by many factors; particularly significant is the nutritional anemia during pregnancy continues to be a common clinical problem with high rates of prevalence (35 to 75%) in many developing countries. The major concern about the adverse effects of anemia on pregnant women is a great risk of prenatal mortality and morbidity for the population. Poor socio-economical and educational statuses are the principal reasons for a high prevalence of anemia in our population. Multifactorial situations in a community tend to influence mother status, as well as in new born as a result of poor nutrition, which could lead deleterious effects.

Research Design:

The investigation is a descriptive population based Study and conducted using suitable pre-tested questionnaires to study Nutrition, Biochemical and Clinical status in rural pregnant women.

The study was carried out in two phases:
❖ DEMOGRAPHIC ASSSSMENT : Demographic characteristics, Socio-Economic Status, Family Type, Education and occupation status

❖ NUTRITIONAL ASSESSMENT: i. Nutritional anthropometry, ii. Dietary assessment using food frequency method, dietary behavior and nutrition and health knowledge evaluation using pretested questionnaires. iii. Clinical investigation: maternal history, health problems related to nutrition, clinical signs & symptoms for anemia and iv. biochemical analysis using cyanometh hemoglobin method.

Study Population:
Pregnant women aged 18 to 32 years were assessed for nutritional and health status. The mean age of study participants was 21.6 ± 2.79. Out of 176 registered pregnant women; 100 women who voluntarily agreed for nutritional evaluation and biochemical analysis were subjected for the study by using a Purposive random sampling technique.

Study Area:
The situational study was conducted in the PHC of Ratnapuri Village, Hunsur taluk, Mysore district, Karnataka, India.

Statistical Analysis:
The obtained data were analyzed by using XLSTAT-7.5.2 version at alpha =0.05 significance level, chi-square tests, percentage, Mean and Standard Deviation. Statistically results were illustrated based on the level of significance

RESULTS AND DISCUSSION
Fetal development is accompanied by many physiological, biochemical and hormonal changes occurring in the body, which influence the needs for nutrients and efficacy with which the body use them. Nutritional status of woman is also influenced by her socio-economic backgrounds while certain demographic factors influence the physiological problems. Therefore a set of such variables are considered and problems during pregnancy are analyzed against these variables for a better understanding. In India, anemia is estimated to contribute to 20% of all maternal deaths, 3 times greater risk of premature delivery and low birth weight babies and 9 times higher risk of prenatal mortality and higher risk of brain damage in infants born to severely anemic mothers. Hence it was proposed to investigate factors influencing the nutritional status among the rural pregnant women.

Demographic profile of the women:
The women included for the study were between 18 to 32 years age. A perusal of the table indicates the distribution of selected women, into different age groups. Women aged 18 -20 years 46 percent of the study group, while a major percentage of women was in the most fertile period i.e., 20-29 years (63 %) in the group. Small percentages were above 29 years.

Other information of subjects such as religion followed by type of family economic status and education level. A higher percentage of the women belonged to Hinduism (71 %) followed by Muslim (28%). Joint family was predominated (79%). Only 21% were from small or nuclear family. It is noteworthy that most of the women had educational qualification above 7th standard (44%) and 45 %were below 7th, while illiterates were only 11%.

Table 1: General Information Regarding The Pregnant Women

Characteristics		Percentage (%)
Age	18-20	46
	>20	64
Caste	HINDU	71
	MUSLIM	28
	CHRISTIAN	1
Education level	<= 7th	45
	>7th < 10th	44
	NIL	11
Type of family	JOINT	79
	NUCLEAR	21
Economic status	BPL	78
	APL	22

Maternal history:

Details regarding married life, age at marriage, number of pregnancy and mode of delivery during the previous pregnancy were also noted. It is noteworthy that only a small percentage of women reported to experience abortions (12%) and only 4.2% of women had still birth. Likewise it is striking to note that they had normal deliveries than caesarian section.
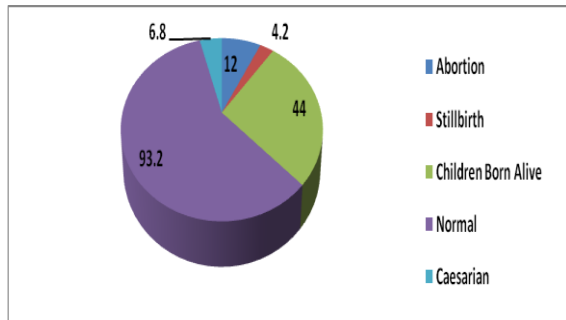

Figure.1: Percentage Distribution Of Selected Women According To The Maternal History

Morning sickness is symptomatic of pregnancy among the participants of the study, considerable percentage expressed to have experienced this. About 18 to 24% women experienced nausea and vomiting. More than 50% women expressed to have pica. Chalk, tamarind and mango were found to predominate among the group. Most mothers are malnourished, anemic and had short pregnancy interval.
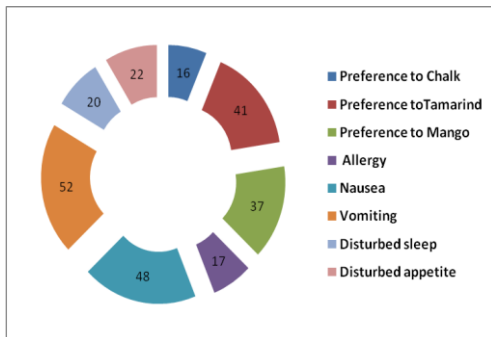

Figure.2: Pregnancy Induced Clinical Features Experienced By The Subjects (%)

The physiological adaptation that ensures during pregnancy is known to influence the normal behavior. Appetite and sleep pattern are altered during pregnancy. It was observed that 46% of the women experienced disturbed sleep and more than 55% with loss of appetite. The reason for such observation is not clear.

Clinical Manifestation Related To The Nutrient Deficiencies

It is evident that occurrence of symptoms for nutrient deficiency was in the group with pale and flat nails in higher percentages. Oral ulcer and pale tongue was seen in only 5% of the women, pale and dull eyes were observed in 30% of the women, while decayed and pigmented tooth was observed in nearly 43%.

This could be apparently due to poor oral hygiene. Edema of the feet was observed in one of the subject. None of the women complained of night blindness.
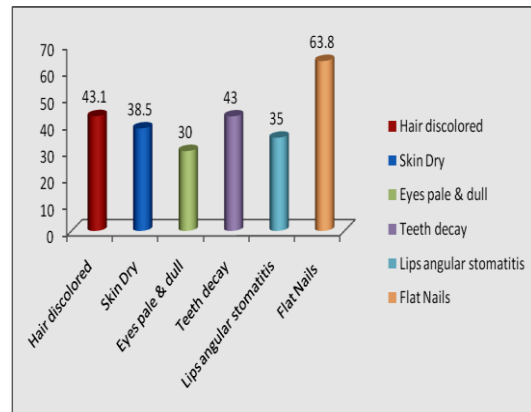

Figure.3: clinical manifestation of nutritional deficiencies prevalent among pregnant women (%).

Table.2: Mean Blood Heamoglobin Status Of Selected Pregnant Women

Cut-off levels indicative of anemia	2nd trimester	3rd trimester
	<11 HB(g/dl)	<11 HB (g/dl)
Mean	10.6	10.7
+SD	2.06	0.9

The mean hemoglobin status of women is presented in the table. It can be seen that mean hemoglobin in women was 10.6± 2.06 and 10.7± 0.9 hemodilution, a normal physiological phenomena known to occur in the second trimester. In fact this

could the reason for a drop in the hemoglobin levels in the two groups. The mean hemoglobin levels among the women were similar in 2nd and 3rd trimester.

Classification of subjects into grades of anemia, when hemoglobin concentration defined by WHO reference standard was used as criterion, 6.0, 15.0, 23.0 percent of women were in severe, moderate, and mild grades respectively.
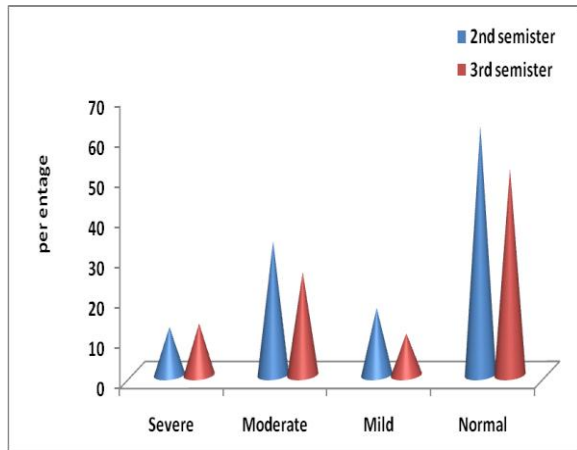

Figure.4: classification of women into grades of anemia (%).

There was no statistically significant association between age and marital status (p > 0.05). The association of anemia with social class was statistically significant (p = 0.000). A direct relationship was found to exist between the prevalence of anemia and socio-economic class at the primary health centre. This relationship was statistically significant. Severe anemia was significantly associated with educational status (p = 0.02) and socio-economic status (p = 0.03).

Anthropometric Assessment

Weight is an indicator of the nutritional status among adults. The mean weight among the pregnant women in different trimesters was between 40.5 to 48.5 kg. More than 24 BMI in pregnant women has been considered as normal due to the obligatory increase in body weight which is equal to 120 percent of BMI (22±2).

Table 3: mean heights and weights of pregnant women and their body mass index (BMI).

Trimester	Height	Weight	BMI	
			>24	18-24
First	149.5±0.6	42.5±7.2	18	82
Second	152±5.4	40.5±5.9	37	63
Third	152±6.0	48.5±6.4	24	76

Women especially in the third trimester exhibited chronic energy deficiency (48.5+6.4 kgs). The lower body weights in the third trimester are suggestive of a low weight gain during pregnancy as well as lower pre-pregnancy body weights. Hence the comparison of BMI suggests 63 to 82 percent of women in different trimesters had chronic energy deficiency while 18 to 37 percent were normal.

A perusal of the table provides information about the women selected with normal and below normal parameters. All the parameters were found to be significantly different and lower among the women.

Table.4: anthropometric profile of pregnant women included for the study.

Measurements	2nd trimester Mean ± SD	3rd trimester Mean ± SD
Weight(kg)	40.5±5.924	48.5±6.426
Fundal height(cm)	19.3±1.783	25.8±2.888
MUAC(cm)	21.1±1.905	22.1±1.569
Abdominal circumference(cm)	75.6±3.310	87.3±7.363
BMI (kg/m2)	17±0.762	17.3±0.580

Women exhibited considerably lower measurements. BMI was found to be very much low when compared to the normal range. Abdominal circumference and fundal height have been frequently referred to as indicative parameters about the fetal development. Initial measurement as indicated in other reports is more than 100 cm, for abdominal circumference and 32-33 cm for fundal height. In the present investigation it can be seen that the measurement in the abdominal circumferences was not desirable. Fundal height was 19.3 and 25.8 in 2nd and 3rd trimester respectively which was again not

as desired. This indicates that study population was under risk of pregnancy.

Clinical signs of deficiency of iron were uniformly distributed among the pregnant women (p> 0.01), Where as indicators like BMI and caloric intake showed significant difference (P<0.01). Highest percentage of women having deficient caloric intakes were found to be illiterate and belonging to lower socio-economic status while least number of salaried mothers were found to consume deficient diets.

Dietary Pattern

Dietary patterns are sensitive to differences across socio-economic strata or cultural habits and may have impact on the outcome of pregnancy. A general practice of diet observed among the selected women is presented in the table. As can be observed most of the pregnant women who participated were non-vegetarians. It was proposed to investigate the pattern of use of spices by the subjects. Majority of women mentioned the use more spicy food. However a considerable percentage of women mentioned the use of less spicy food. During pregnancy women is access to foods even more restricted in the traditional Indian household through taboos and ritual observances, which are widely documented in both rural and tribal population.

Beverages especially tea and coffee is most relished in South India. Majority of the families consumed them more frequently. Consumption of coffee during pregnancy is contraindicated, since this is known to affect fetal growth and development. A perusal of the table suggests that the most popular beverages were tea and coffee. About 48 % of the subjects consumed tea and 46% of them consumed coffee.
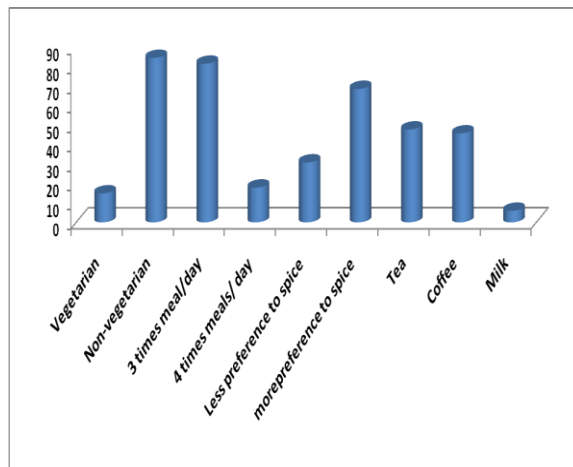

Table.5: dietary pattern followed by selected pregnant women.

There was no considerable difference in the percentage. However, only 6 percent consumed milk. One of the reasons could be low income. Meal pattern is more or less similar in given region. The common practice is to include three meals a day. About 82 percent of the women followed this pattern, while 18 percent of the women had four meals a day.

Food beliefs are commonly practiced all over the world. It unfortunately revolves around those physiological conditions which require more nutritional care. Hence, variety of food is restricted during pregnancy. It is often referred to hot foods like papaya, sesame seeds, meat, egg etc.

They are feared to induce abortions or cause vayu in people. However there is no scientific evidence to support such beliefs.

The dietary behaviors were associated with a variety of socio-demographic characteristics, but no single factor was associated with all the dietary behaviors.

The belief about food practices by the selected subjects was obtained and is presented in the table shown above. (45%) of them preferred to consume leafy vegetables and grams as they are good for health and 6% of them consumed Milk and saffron which is considered to give

complexion to the baby. Foods that were avoided during pregnancy were Papaya, sesame seeds, egg, chicken and fish as they had a notion that the above-mentioned foods were heat inducing which in turn might result in abortion.

Table.6: belief regarding food and reasons.

Foods especially given	Percentage	Reason	Foods avoided	Percentage	Reasons
Leafy vegetables, pulses	45	Good for health	Papaya, sesame seeds, egg, chicken, fish	62	Heat inducing
Milk and saffron	6	Gives complexion			

Frequency of consumption of various food items by the pregnant women is presented in the table. Information about food preference was obtained, however, it is worthwhile to mention, that none of the women included for the study expressed that food available at home was not consumed by them. Cereals and pulses were consumed every day. Among the cereals rice was consumed by everyone, while ragi was consumed daily by 65 percent of them. Wheat was frequently used. Similarly red gram dhal and green gram was used by 19% of the women daily, while majority used it alternate days. Other legumes were used less frequently.

Table.7: food frequency consumption pattern of the subjects.

Food stuffs	Daily	Alternative days	Weekly	Fortnightly
Cereals: Rice	100		---	---
Ragi	65	10	17	8
Wheat	---	10	40	50
Legumes: Red gram dhal	19	47	5	---
Greengram dhal	---	17	73	10
Others	---	22	58	20
Vegetables	30	58	9	3
Green leafy vegetables	---	29	47	24
Roots and tubers	16	37	39	8
Milk	10	---	---	---
Curds	6	36	---	---
Oil	100	---	---	---
Meat	---	---	79	21
Fish	---	---	---	80
Egg	---	---	---	82
Fruits	---	17	34	49
Bakery items	---	---	23	77

Vegetables especially brinjal and gourds formed a popular item daily as they were readily available in their backyard.

Non-vegetarian foods like meat, fish and egg were consumed fortnightly.
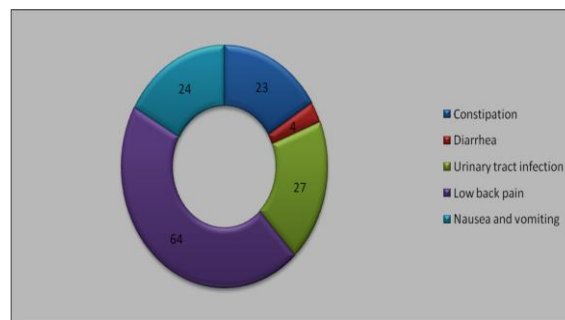
Morbidity profile:

Morbidity during pregnancy is known to be prone for sickness during pregnancy. The sickness varies with the environment and her activity pattern. Most commonly expressed health problems were constipation, diarrhea, low back pain, urinary tract infection, nausea and vomiting. Among these problems urinary tract infection is considered to be serious, since it affects the fetal development. The major problems confronted by the selected women were constipation urinary tract infection low back pain nausea and vomiting

Figure.5: Medical Problems Encountered By The Subjects

Health and nutrition knowledge acquired by the pregnant women were assessed using a pre tested questionnaire and their knowledge was found to be unsatisfactory.

Inquiry regarding the changes in the diet intake during pregnancy revealed that majority of them had not altered their diet pattern while few reported to consume less quantity due to nausea and vomiting.

SUMMARY AND CONCLUSION

Health and nutritional status of women in the society is neither a new issues not a fully settled one. The physiological state where a woman becomes vulnerable is pregnancy; successful pregnancy requires a continuum, of adjustment in maternal body composition, metabolism and function of various physiological systems. Adequate nutrient intake supports growth of both maternal and fetal tissues.

It could be hypothesized from our investigation that, consumption of all the nutrients was lower than required level. The clinical manifestations for nutrient deficiency also supported the fact that 45% of women were anemic. As a result of symptoms like pale and dull nails, eyes and tongue. Morbidity like urinary tract infection and low back pain indicated poor resistance to infection. Income was found to be the single most important factor influencing the events and course of pregnancy. Fundal height and abdominal circumference was not as desired indicating the risk of pregnancy. Education also played a major role in the selection of food, and improving health and nutritional knowledge.

Thus it can be concluded that the major contributory factors that has influenced hemoglobin status among selected pregnant women were poor intake of essential nutrients including iron, calcium. As well there was as increase in clinical problems related to nutritional deprivation due poor nutrition and health status, nutritional knowledge, educational qualification, and family economic status. Dietary advice and interventions to prevent adverse health consequences need to be tailored to meet the demands of pregnant women from low socio-economic status in order to improve their own healthy eating behaviors and health outcomes.

NUTRITION ACTION PLAN

- A stage play and self understanding informative nutrition models implementation supported pregnant women in understanding the consequence of nutritional problems and anemia.
- Promotion of Nutrition awareness program notably supported pregnant women in gaining nutritional knowledge towards iron rich food intake as well its importance on pregnancy outcome.
- Promotion of Dietary advice importantly brought out a possible improvement on nutritional knowledge and management of anemia among pregnant women.

REFERENCES

1. WHO.1968. Nutritional anemia. Report of a WHO Scientific Group. Geneva, *World Health Organization.*
2. Ramachandran P. 2002. Maternal nutrition effect on fetal growth and outcome of pregnancy. *Nutrition Reviews*. 60(5), 26-34.
3. Kamal raj. 2006. A study of nutritional status of pregnant women of some villages in Balasore District, Orissa, *Journal of Human Ecology*. 20(3): 227-232.
4. Hichey C A. 2000. Socio cultural and behavioral influence on weight gain during pregnancy. American Journal of Clinical Nutrition. 71; 1364-1370.
5. Sherman P.W.Flaxmen S.N. 2002. Nausea and vomiting of pregnant in an evolutionary perspective. *American Journal of Obstetrician Gynecology*. 185(5); 190-7.
6. Herrera E, Ortega H, Alvino G, Giovannini N, Amusquivar E, Cetin I. 2004. Relationship between plasma fatty acid profile and antioxidant vitamins during normal pregnancy. Eur J Clin Nutr 58:1231–1238.

7. O'Brien KM, Zavaleta N, Abrams SA, Caulfield LE. 2003. Maternal iron status influences iron transfer to the fetus during the third trimester of pregnancy. Am J Clin Nutr 77(4):924–930.

8. Knudsen VK, Orozova-Bekkevold IM, Mikkelsen TB, Wolff S, Olsen SF. 2008. Major dietary patterns in pregnancy and fetal growth. Eur J Clin Nutr 62(4):463-70.

9. Neggers Y, Goldenberg RL. 2003. Some thoughts on body mass index, micronutrient intakes and pregnancy outcome. J Nutr 133(5 Suppl 2):1737-40.

10. Luke B. 2005. The evidence linking maternal nutrition and prematurity. J Perinat Med 33(6):500-5.

11. Mehta SH. 2008. Nutrition and pregnancy. Clinical Obstetrics and Gynecology 51(2):409-418.

12. Jood S, Bishnoi S, Khelarpaul N. 2002.Nutritional status of rural pregnant women of Haryana State, NorthIndia. Nutritional Health, 16: 121-131

13. Linda H A. 2002. Biologic mechanism that might underlie iron effect on featal growth and preterm birth. Journal of Nutrition, 132; 2215-2221.

14. Barbarino Monnier P. 1994. Anemia of pregnancy: mechanisms and prevention. From theory to practice. The *Gazette of the Transfusion,* (104) : 11-19.13.

15. King JC. 2000. Physiology of pregnancy and nutrient metabolism. Am J Clin Nutr 71(5 Suppl):1218-25.

16. Stephenson T, Symonds ME. 2002. Maternal nutrition as a determinant of birth weight. Arch Dis Child Fetal Neonatal Ed; 86(1):F4-6.

17. Rainville A J. 1998. Pica practices of pregnant women are associated with lower maternal heamoglobin level at delivery. *Journal American Dietetics Association*. 98(3); 293-6.

18. Kirchengast J.E. et al. 2003. Impact of maternal age and maternal somatic characteristic on new born size. *The American Journal of Clinical Nutrition*. 15(2) ; 220-8.

19. Freisling H, Elmadfa I, Gall I. 2006. The effect of socioeconomic status on dietary intake, physical activity and body mass index in Austrian pregnant women. J Hum Nutr Diet, 19:437–445.

20. O'Brien KM, Zavaleta N, Abrams SA, Caulfield LE. 2003. Maternal iron status influences iron transfer to the fetus during the third trimester of pregnancy. Am J Clin Nutr 77(4):924–930

21. Sacco LM, Caulfield LE, Zavaleta N, Retamozo L. 2003. Dietary pattern and usual nutrient intakes of Peruvian women during pregnancy. Eur J Clin Nutr 57:1492–1497.

22. Peacock S L. Anderson H.R. 2002. Preterm delivery effect of socio economic factors physiological stress. Br. *Med. J.* 311; 531-535(14).

23. Allard C.L. et al. 2002. The burden of illness of severe nausea and vomiting of pregnancy in the United States. *American Journal of Clinical Nutrition.* 185; 220-7,

24. Coulibaly M, Costagliola D, Zittoun J, Et Mary J.Y. 1987. Assessment of nutritional status of pregnant women from hematobiologiques parameters, following a displacement of populations in northern Cameroon. IIIeme International Scientific Days of GERM. p 46.

25. Wickens D, Wilkins M, Lyne C: Free radical oxidation (peroxidation) products in plasma in normal and abnormal pregnancy. Ann Clin Biochem 1981, 18:158–162.

26. King JC. Physiology of pregnancy and nutrient metabolism. Am J Clin Nutr 2000; 71(5 Suppl):1218-25.

27. Scholl T O. 2005. Iron status during pregnancy: Setting the stage for mother and infant. Am J Clin Nutr, 81(suppl):1218-1222.

28. Worsley A, Blasche R, Ball K, Crawford D 2003. The relationship between education and food consumption in the 1995 Australian National Nutrition Survey. Public Health Nutrition, 7(5):649-663.

29. Northstone K, Emmett P, Rogers I. 2008. Dietary patterns in pregnancy and associations with socio-demographic and lifestyle factors. European Journal of Clinical Nutrition, 62:471-479.
30. Sherman P.W.Flaxmen S.N. 2002. Nausea and vomiting of pregnant in an evolutionary perspective. *American Journal of Obstetrician Gynecology*. 185(5); 190-7,
31. Kirchengast J.E. et al., Impact of maternal age and maternal somatic characteristic on new born size. *The American Journal of Clinical Nutrition*. 15(2) ; 220-8, 2003.
32. Luke B. Nutritional influences on fetal growth. Clin Obstet Gynecol 1994; 37(3):538-49.
33. Bloomfield FH, Oliver MH, Harding JE. 2006. The late effects of fetal growth patterns. Arch Dis.Child Fetal Neonatal, 91(4):F299-304.
34. Dyck J.L, Blot C, Dop M.C, Schneider D, Hodonou A.F.K, and DOH A. 1987. Anemia, iron deficiency and pregnancy in pregnant women lomeenne. IIIeme International Scientific Days of GERM. p 43.
35. Wickens D, Wilkins M, Lyne C 1981. Free radical oxidation (peroxidation) products in plasma in normal and abnormal pregnancy. Ann Clin Biochem 18:158–162.
36. Herrera E, Ortega H, Alvino G, Giovannini N, Amusquivar E, Cetin I. 2004. Relationship between plasma fatty acid profile and antioxidant vitamins during normal pregnancy. Eur J Clin Nutr, 58:1231–1238.
37. Picone TA, Allen LH, Olsen PN, Ferris ME. 1982. Pregnancy outcome in North American women.II. Effects of diet, cigarette smoking, stress, and weight gain on placentas, and on neonatal physical and behavioral characteristics. Am J Clin Nutr; 36(6):1214-24.
38. Huges, A. (1991) Anaemia in Pregnancy. Maternal Health and Safe Motherhood. Division of family Health, WHO.

How to cite this article: Anitha C, Sushma BV. Nutritional profile of pregnant women from rural Mysore, Karnataka. Int J Health Sci Res. 2015; 5(1):260-269.

****