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Comparison of dietary iron intake with recommended dietary allowance among pregnant women belonging to different socio-economic strata

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Abstract

Iron deficiency is considered as one of the most common nutritional problem in both developed and developing countries. Anemia from iron deficiency affects almost two-third of pregnant women in developing countries. The study was conducted to compare the dietary iron intake with recommended dietary allowance among pregnant women belonging to different socioeconomic strata. The study was designed cross sectional. A total of 150 pregnant women aged 15-39 years were selected for three months study. The sample was selected from three different hospitals namely, Sheikh Zayed Hospital, National Hospital and Medical Centre and Hameed Latif Hospital, Lahore, Pakistan. The included parameters for this study are information about age, height, body weight, socioeconomic status and evaluation of hemoglobin level. A 24 hours dietary recall method was used for three days to compute the nutrient intake and iron intake. The participants were asked to recall three different days of food intake including two days from week and one from weekend. Statistical analysis was performed by using the Program Statistical Package for the Social Sciences (SPSS 22). According to socioeconomic data, 64% participants were belonged to upper class, 48% and 38% were belonged to middle class and lower class respectively. The descriptive statistics and analysis of variance (ANOVA) was applied. The mean dietary iron intake was 18.09±0.9 mg/day, 20.2±1.2 mg/day and 23.03±0.01 mg/day in lower, middle and upper classes respectively. There was a significant difference ($p < 0.05$) in nutrient intake among different socioeconomic strata. The level of hemoglobin has variation from 8.9 mg/dl to >11 mg/dl among different socioeconomic strata. The study concluded that the dietary iron consumption was lower than the recommended dietary allowance among participants of different socioeconomic strata.

Introduction

Iron is considered as a vital element for the normal development and function of all tissues in the body [1]. Iron is particularly critical during the pregnancy given the rapid cell and tissue development which is involved in fetal growth [2]. It is significant for almost all living organisms as it contributes in a wide variety of metabolic processes including oxygen transport, deoxyribonucleic acid synthesis and also plays key role in electron transport [3]. There is a remarkable increase in the amount of iron during pregnancy, which is required to increase the red cell mass, to expand the plasma volume as well as plays vital role for the growth of the fetal-placental unit [4]. Pregnant women are particularly vulnerable to iron deficiency and related to adverse pregnancy outcomes. During and immediately after pregnancy, women are most susceptible to iron deficiency. The iron requirements with each trimester during pregnancy can change [5]. The increase of iron depends on iron storage at the start of pregnancy and also on the dietary iron absorption during pregnancy [6]. The iron requirements increase from 0.8 mg/day in the first trimester to 7.5 mg/day in the third trimester. The iron deficiency is one of the leading causes for disability and death, affecting an estimated 2 billion people worldwide [7]. It is a condition in which iron is inadequate for the maintenance of normal physiological functions of the body. It results from insufficient iron absorption to accommodate an increase in requirements which are attributable to growth [8]. It is one of the most prevalent forms of malnutrition [9]. Almost 50% of women do not have sufficient iron stores for pregnancy [10].

Iron is vital for the neurologic development of infants and children [11]. Dietary iron is accessible in two forms: heme iron, which is found in meat; and non-heme iron, which is found in plant and dairy foods [12]. In Pakistan, 70-80% of pregnant population is suffering from iron deficiency anemia [13]. In pregnant women, the prevalence of iron deficiency in industrialized countries is 17.4% while in developing countries the incidence of iron deficiency increases significantly up to 56% [14].

According to previous studies in Pakistan, the prevalence of iron deficiency is very high among pregnant women. Therefore, the aim of the study was to determine the dietary iron intake in comparison to recommended dietary allowance among pregnant women belonging to different socio-economic strata. This study will help to make nutrition education policies and create awareness regarding proper dietary iron intake among pregnant women in order to reduce mortality and morbidity rate.

Materials and Methods

According to World Health Organization Anemia defined as a low blood hemoglobin concentration has been shown to be a public health problem that affects low, middle and high-income countries and has significant adverse health consequences. Approximately 50% of cases of anemia are due to iron deficiency. Recommended Dietary Allowances (RDAs) are the levels of intake of essential nutrients depends on the basis of scientific knowledge and Food and Nutrition Board to be adequate to meet the known nutrient needs of practically all healthy persons. The intake of iron is to fulfill the requirements of the body. The recommended dietary iron intake for normal women was 15-18 mg/day while for pregnant women was 27 mg/day [18]. This recommended amount of iron was used for comparison among participants. Hemoglobin level for middle age females is 11.7-13.8 g/ dL and for females more than 18 years 12.1-15.1 g/dL is normal. The normal hemoglobin level in pregnancy is considered at 10-14 g/dL [15].

The social group that had monthly income of >20,000-100,000 pkr was classified as upper class, middle class had monthly income of 20,000-50,000 pkr while social group that had monthly income of 4,000-20,000 pkr were classified as lower class (**Fig. 1**) [25].

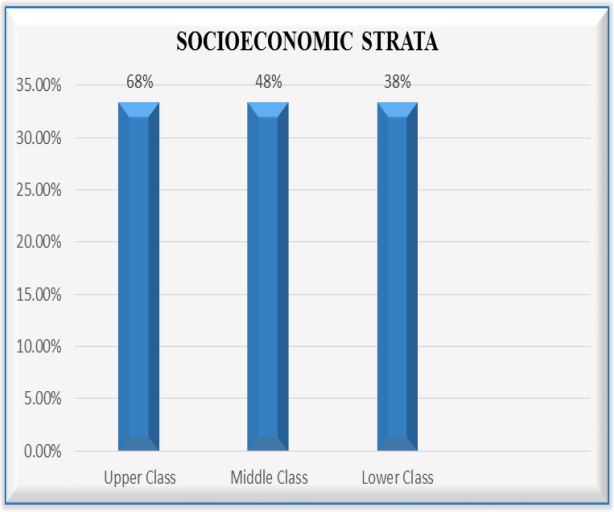

Fig. 1: Socioeconomic Strata. The 68% participants belonged to upper class, 48% were from middle class and 38% were belonged to lower class.

The present study was conducted to evaluate the dietary iron intake among pregnant women belonging to different socioeconomic strata. Institutional ethics review committee approved the study protocol and informed consent was taken from the participants after explaining the purpose of the study. The present study was cross sectional and conducted at the National Hospital and Medical Centre, Lahore, Sheikh Zayed Hospital, Lahore and Hameed Latif Hospital, Lahore. The sample size was calculated by using the formula: sample size = n = $\frac{z^2 qp}{d^2}$. The data was collected from 150 pregnant women with the age from 15-39 years (**Fig. 2**).

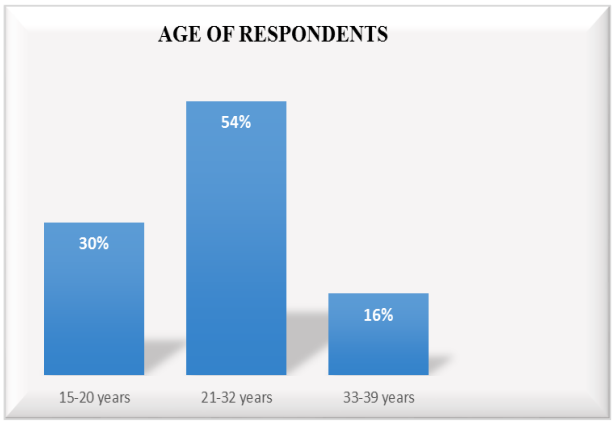

Fig. 2: Age of Respondents. The age of the respondents ranges from (15-20) 30%, (21-32) 54%, and (33-39) 16%.

Women who did not meet the study criteria and those who did not agree to follow the study protocols were excluded. The pregnant women who were suffering from health diseases and taking any supplements were also excluded. A questionnaire was prepared to collect the socio-economic data and dietary intake data. For 3 continues days, a 24-hour dietary recall method was used to compute nutrient intake among the participants. The participants were asked to recall the food intake of three different days including 2 weekdays and 1 day from weekend. The macro nutrient and dietary iron intake was computed by using food composition table [16]. The biochemical evaluation of the hemoglobin level was assessed. All the women were informed that the information will remain confidential and the obtained data will be used only for the research purpose.

Statistical Analysis

Statistical analysis was performed by using the Program Statistical Package for the Social Sciences (SPSS 22). The descriptive statistics and analysis of variance (ANOVA) was applied. Quantitative data was represented as mean and standard deviation. Percentages were computed for the qualitative variables. P <0.05 was considered as statistically significant.

Results

In present study, the participants were categorized into lower class, middle class and upper class based on their income level. The results showed that 64% of the participants belong to upper class, had monthly income of >20,000-100,000 pkr, 48% were from middle class had monthly income of 20,000-100,000 pkr while 38% were from lower class with monthly income of 4,000-20,000 pkr (**Fig. 1**) [25].

The descriptive statistics have been used to find out the relationship between variables. The analysis of variance (ANOVA) was applied to compute difference in macro nutrient intake and iron intake among different economic strata. The consumption of iron among respondents was much below than the recommended level of iron intake. It was observed that women from lower class were highly deficient in iron intake as compared to middle class and upper class. A significant decrease in dietary iron intake was observed in lower class which was mean value of 18.09±0.9 mg/day. The mean iron intake among middle class was 20.2±1.2 mg/day. The majority of the participants was from upper class and was consuming iron 23.03±0.01 mg/day. The actual values of the total energy, carbohydrate, protein and fat were calculated from 3 continues day of 24-hour dietary recall. A significant difference (p=0.002) was observed in kcal intake among participants. The mean actual value for energy was 1800±2.3 kcal/day among lower class, 2000.2±1.0 kcal/day among middle class and 2400.05±0.2 kcal/day among upper class. There was a significant difference in carbohydrate intake (p=0.01) among different socio-economic strata as compare to the recommended dietary allowance. The mean value for carbohydrate consumption of lower class was 60.05±0.2, 58.01±0.01 for middle class and 52.01±3.0 for upper class. There was no significant difference found in protein intake among all the socio-economic strata (p=0.75). The mean value of protein consumption of lower class was 15.1±0.03, 16.3±1.1 for middle class and 22.16±0.23 for upper class. The mean value of fat intake was 18.09±1.1 of lower class, 27.02±0.9 of middle class and 30.03±1.2 of upper class with a significance difference (p=0.000) among different socio-economic strata (**Table 1**).

Table 1: Comparison of Macronutrients and Iron Intake among Pregnant Women Belonging to Different Socioeconomic Strata

Nutrient Intake	RDA	Lower Class	Middle Class	Upper Class	p-value
Energy (Kcal)	+300	1800±2.3	2000.1±1.0	2400.05±0.2	0.002
CHO (Energy %)	45-64	60.05±0.2	58.01±0.01	52.01±3.0	0.01
Protein (Energy %)	15-25	15.1±0.03	16.3±1.1	22.16±0.23	0.75
Fat (Energy %)	20-35	18.09±1.1	27.02±0.9	30.03±1.2	0.000
Iron intake (mg/day)	27	18.09±0.9	20.2±1.2	23.03±0.01	0.01

**Note: ***CHO; Carbohydrate, *RDA; Recommended Dietary Allowance, A significant difference was observed in iron intake p = 0.01 in comparison to recommended dietary allowance among pregnant women belonging to different socioeconomic strata.

The hemoglobin level of all the participants were analyzed, the minimum level was found 8.9g/dl while the maximum level was 11.2 g/dl (**Fig. 3**).

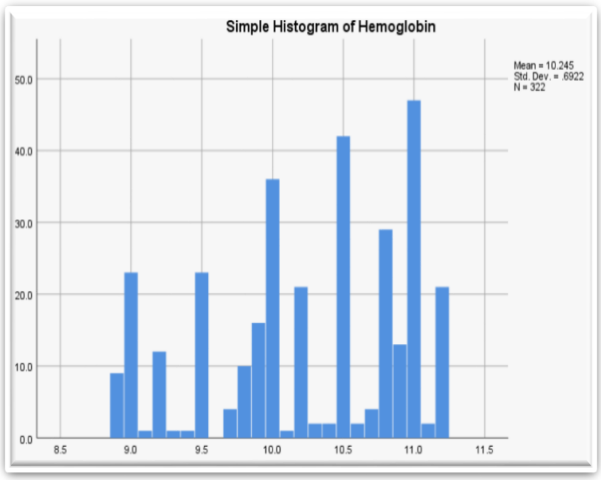

Fig. 3: Hemoglobin Level among Participents Belonging to Different Socioeconomic Strata. The minimum level of hemoglobin was 8.9 g/dl while maximum level was observed 11.2 g/dl.

Discussion

In Pakistan, there are few studies that focused on nutrient intake among pregnant women. The present study evaluated the nutrient intake and hemoglobin level among pregnant women belonging to different socio-economic strata. The aim of the study was to compare the dietary iron intake with recommended dietary allowance among pregnant women belonging to different socio-economic strata. Pregnancy is a critical period in the life of a woman. In this stage, if proper health status cannot be monitored, it can lead to several health complications including birth defects, miscarriage, maternal and infant mortality. There is almost 50% increase of blood amount than normal during pregnancy. During pregnancy, more iron intake is required [17]. The results revealed that the participants were not taking iron according to their recommended amounts. There was a significant difference of iron intake among pregnant women belonging to different socio-economic strata as compare to the recommended dietary iron intake p=0.01. Women from lower class were highly deficient in iron intake. The lowest dietary iron intake was observed in lower class with a mean value of 18.09±0.9 mg/day, while middle class was consumed 20.2±1.2 mg of iron daily. The majority of the participants was from upper class and consumed 23.03±0.01 mg of iron daily (**Table 1**). All the groups were not taking dietary iron according to the recommended dietary allowance which is almost 27-30 mg/day. The previous two studies also showed that the participants were not taking dietary iron intake according to their recommended dietary allowance [18, 19].

Socio-economic status plays a vital role in the nutritional status of the pregnant women. According to socio-economic status, there were 38% participants belong to lower class, 48% belong to middle class and 64% were lying in the upper class. In the present study, there was no significant difference in protein intake among pregnant women belonging to different socio-economic strata and p=0.075 was observed. The mean value for carbohydrate consumption was 60.05±0.2, 58.01±0.01 and 52.01±3.0 with a significant difference among lower, middle and upper class respectively as compare to their recommended dietary allowance (p=0.01). A significant difference (p=0.000) in mean value of fat intake among different socio-economic strata in comparison to recommended dietary allowance was seen. The mean fat intake was 18.09±1.1 in lower class, 27.02±0.9 in middle class and 30.03±1.2 in upper class (**Table 1**). The minimum level of hemoglobin was found 8.9 g/dl while maximum level was 11.2 g/dl (**Fig. 3**).

The nutrient intake in all groups was not according to recommended dietary allowance, which showed that the pregnant women were not aware about importance of balanced nutrient intake during the pregnancy. In a previous study, it was also observed that the pregnant women were unaware about nutritional needs during the pregnancy [18].

Another study was designed to assess the nutritional status of the pregnant women residing in rural areas

and 133 pregnant women were selected. Their hemoglobin level was also examined, and the mean energy intake was 2472±0.2 kcal/day. The percentages of carbohydrate, protein and fat intake were 61.5%, 12.2% and 26.3%, respectively. The effective nutrition intervention should be given to pregnant women for the improvement of their maternal nutritional status [19]. The 24 hours of dietary recall is a quantitative research system utilized as a part of dietary intake assessment. The participants were categorized into three socio-economic classes. The study results showed that the consumption of iron among respondents was much below than the recommended level of the intake prescribed [15, 20]. The previous study results were compatible to the present research. During pregnancy consumption of iron, did not reach to the daily recommended amount and it was significantly lower than the recommended amount [21]. Another study was conducted among the pregnant women belong to rural and urban areas in order to assess their dietary practices and nutrient intake. A significant difference in consumption of macronutrients among the participants was observed. There was a remarkable difference in energy and the nutrient intake among rural and urban groups [22]. A study was conducted in Nigeria that the iron intake according to recommended dietary allowance is necessary for both the mother and the baby. In conclusion, the study showed that the iron deficiency was higher among pregnant women in the rural communities when compared to those women who were in the urban areas [23]. Another similar study was conducted in India; all the participants were selected from three different social groups. One group was from slum population, second was from lower/middle class and the third was from middle/upper class. This study was conducted on poor pregnant women to determine the persistent anemia in an urban population of Chandigarh. At the end of the study, researchers concluded that there was a significant difference in prevalence of iron deficiency among the different social groups [24].

Nutrition plays a significant role in improving the health quality of the population. The present study provides the insight data to explore the iron status and other nutrients intake among pregnant women belonging to different socio-economic strata. Many iron rich foods are available, but people do not have enough knowledge to select and use those foods. Other risk factors identified in the present study such as low hemoglobin and the absence of iron rich foods in the diet of pregnant women can be helpful for planning more intervention programs to prevent iron deficiency among the future mothers. Nutritional education and health promotion can be used as a tool to improve the health status. Longitudinal studies should be conducted to evaluate the nutritional status of the pregnant women.

Conclusion

The overall study concluded that the effective nutrition intervention included; awareness regarding adequate nutrient intake especially iron according to recommended dietary allowance and consumption of iron rich foods should be directed towards pregnant women to improve maternal nutritional status. The dietary iron consumption was lower than the recommended dietary allowance among participants of different socio-economic strata. During pregnancy, women of all socio-economic strata were not aware about the importance of macronutrients, especially iron.

Conflict of Interest

The authors declare no conflict of interest.

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