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Frequency of fetal iron deficiency anemia at the time of birth in obese mothers.

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ABSTRACT… Objectives: To determine frequency of fetal iron deficiency anemia at the time of birth in obese mothers. **Study Design:** Cross-sectional Descriptive study. **Setting:** Department of Obstetrics and Gynecology, Nishtar Hospital Multan. **Period:** September 2018 to February 2019. **Material & Methods:** A total of 368 obese pregnant women with singleton pregnancy between 37 -40 weeks of gestation were included in the study after informed consent. Cord blood was collected after delivery via syringe aspiration from the umbilical vein. Fetal Iron status in the form of serum iron, hemoglobin, transferrin saturation was measured with calorimetric endpoint assay. Obesity in pregnancy is defined as BMI equal and more than 30kg/m^2. Fetal iron deficiency anemia was defined as fetal hemoglobin less than 14.5g/dl, fetal iron 97.3micro gram/dl and transferrin saturation 39.6% at birth. **Results:** Among 368 cases, 87.8% of cases were having their BMI 30kg/m^2 to 34.9kg/m^2. BMI between35kg/m^2 to 39.9kg/m^2 was noted in 10% of cases and in 2.2% of cases BMI was equal to or more than 40kg/m^2. Frequency of neonatal iron deficiency anemia was 22.8%. **Conclusion:** There is a increase prevalence of obesity in women of childbearing age however maternal obesity has no significant correlation of fetal iron deficiency anemia.

Key words: BMI, Fetal Anemia, Maternal Obesity.

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INTRODUCTION

Obesity is the most common disorder in developed world.[1] It is defined as increase in body mass index (BMI) of more than 30 kg/m^2. Moreover, it is further classified into three main classes: Class I (30-34.9kg/m^2), Class II (35-39.9kg/m^2), and Class III (greater than 40kg/m^2). In recent past, obesity has significantly outburst in the developing world.[2] Frequency of obesity in pregnancy has enormously increased in last decade. It is reported to be more than 30% in Europe.[3]

Maternal obesity is associated with many adverse pregnancy outcomes including higher risk of maternal hypertension, gestational diabetes, difficult delivery, increased caesarean section rate and postpartum hemorrhage.[4] There is an increased risk of gross congenital defects, neural tube defects, large for gestational age babies, macrosomia, neonatal anemia and low apgar score in babies born to obese mothers.[5] It is indicated in recent studies that maternal obesity is also associated with childhood obesity, adverse neuro developmental outcomes like cerebral palsy, lower cognitive capabilities, autism, attention deficit hyperactivity disorder and developmental delay.[6]

Obesity is actually a state of low grade chronic inflammation.[7] Many inflammatory mediators are elevated in obesity like interleukin-6. It induces the expression of hepcidin.[8] It is an important regulator of iron homeostasis and it binds to the iron exporter; ferroportin on gut epithelium and surface of macrophages thus inhibiting iron trasnport.[9] Hepcidin correlates with low iron status in the obese mothers.[10] Hepcidin is expressed at a lowest level during pregnancy in order to provide maximum iron transfer to the fetus.[11,12] In obese mothers fetal iron transfer is decreased due to excessive hepcidin so

increase prevalence of iron deficiency anemia in newborns.[13]

There is scarce data regarding actual effect of maternal obesity on fetal iron deficiency anemia. A study done in the United States of America indicated that fetal anemia is more common in mothers with BMI 35kg/m^2.[14] In contrast to this, another study done in USA showed no impact of gestational weight gain and obesity on neonatal iron deficiency anemia.[15] In a Californian study, fetal iron status was adversely affected by maternal obesity. Transferrin saturation has also been shown to be reduced up to 39.6% in this study.[16] A study conducted in china in 2016 also showed negative association between maternal obesity and neonatal iron status.[5] Same effect is seen in the data from a prospective maternal-infant birth cohort in ireland.[17]

In Pakistan, very limited data regarding obesity in pregnancy related to fetal iron deficiency anemia is available. Data from national health survey of Pakistan showed prevalence of obesity in reproductive age was reported 14% in women from rural areas while 37% from urban areas.[10]

The results of this study could find correlation of maternal obesity and fetal iron deficiency anemia. The evidence from our study could help to devise interventional strategies to alleviate the potential adverse consequence of obesity in pregnancy on newborns.

MATERIAL & METHODS

Study was conducted in the Department of Obstetrics and Gynecology, Nishtar Hospital Multan from September 2018 to February 2019. It was a Cross-sectional descriptive study. Non probability consecutive sampling was used. A total of 368 pregnant women aged 20-40 years were included in the study after informed consent. Both prim gravidas or multigravidas (up to 3), between 37-40 weeks of pregnancy were included. All women were having singleton pregnancy and Body Mass Index 30kg/m^2 or more. Cord blood was collected after delivery via syringe aspiration from the umbilical vein. Hemoglobin, serum iron, transferrin saturation were measured with calorimetric endpoint assay in Central Laboratory of Nishtar Hospital, Multan, to access fetal iron deficiency anemia The data was entered and analyzed by using computer software SPSS version18. Mean and SD was calculated for quantitative variables like age, gestational age of patient. Frequencies and percentages were calculated for categorical variables like fetal anemia, BMI and weight of baby. Effect modifiers like mode of delivery, age, gestational age and parity was controlled by stratification.

RESULTS

Among 368 patients, 323 were having their BMI 30kg/m^2 to 34.9kg/m^2. BMI between 35kg/m^2 to 39.9kg/m^2 was noted in 27 cases and in 8 of cases BMI was equal to or more than 40. Demographic findings in terms of age, parity and duration of gestation shown in Table-I Neonatal anemia was analyzed in 368 samples. It was found in 84 cases and in 284 cases, no neonatal anemia was observed at the time of delivery (Table-II). Among 368 cases, majority of the babies were having their birth weight less than 4000 gm i.e. 75.82% of babies. Birth weight equal to or more than 4000 gm was recorded in 24.18% of babies (Figure-1).

Age in years	**Number of cases**	**Percentage**
20-30	163	44.3
31-40	205	55.7
Total	368	100
Parity	**Number of cases**	**Percentage**
P1	71	19.29
P2	118	32.07
P3	179	48.64
Total	368	100
Gestational age	**Number of cases**	**Percentage**
37-38 weeks	154	41.85
39-40 weeks	214	58.15
Total	368	100
BMI	**Number of cases**	**Percentage**
30-34.9	323	87.8
35-39.9	37	10.0
≥40	8	2.2
Total	368	100

Table-I. Demographic features. (n=368)

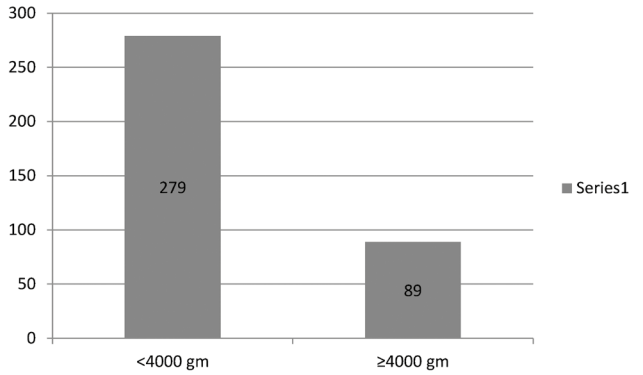

Figure-1. Weight of the neonates. (n=368).

Majority of the babies were having their birth weight less than 4000 gm i.e. 75.82% of babies.

Fetal Iron Deficiency Anemia	Number of Cases	Percentage
Present (hemoglobin <14.5g/dl) (transferrin saturation 39.6% or less)	84	22.83
Absent (hemoglobin >14.5g/dl) (Trasferrin saturation >39.6%)	284	77.17
Total	368	100

Table-II. Frequency of fetal Iron deficiency anemia. (n=368)

Frequency of fetal iron deficiency anemia was 22.83%.

Age	Fetal Anaemia Yes	Fetal Anaemia No	P-Value
20-30	37	126	Chi-square value = 0.0026 d.f. = 1 p value = 0.9588
31-40	47	158	
Parity			
P1	16	55	Chi-square value = 0.2242 d.f. = 2 p value = 0.9978
P2	27	91	
P3	41	138	
Gestational age			
37-38 weeks	35	119	Chi-square value = 0.00146 d.f. = 1 p value = 0.9694
39-40 weeks	49	165	
BMI			
30-34.9	74	249	Chi-square value = 0.0532 d.f. = 2 p value = 0.9737
35-39.9	8	29	
≥40	2	6	

Table-III. Association of Fetal Iron deficiency Anemia with demographic features. (n=368)

DISCUSSION

According to WHO obesity is one of the most blatantly visible and most neglected, public health problems and it is a killer disease at par with HIV and malnutrition. It may result in a decrease in life expectancy in the future.[18] Prevalence of obesity is more in women than men making it a point of serious concern for obstetrician.[19]

In our study, neonatal anemia was a finding in 22.83% of cases at the time of delivery. While in another study done in America, anemia was found in 24% neonates of obese mothers.[15] The results of our study were comparable with the results of another International study in India in which prevalence of anemia in the BMI> 30kg/m^2 group was 16%.[20] The difference was statistically insignificant with a p value of 0.444.[20] Our results were comparable with the results of another study done in Spain where increased maternal BMI was having no significant effect on any of the hematological parameters of newborn.[13] The results generated by our study did not correspond with the results of another study in which frequency of fetal anemia was 39.6% in obese mothers.[16] Our results were also in contrast with another large cohort study done in china that was showing that increase maternal BMI was linked with infant anemia at 6 months (adjusted OR1.39,95%CI 1.02,1.88).[21] In a study done in china, 33% of neonates born to obese mothers had low serum ferritin and iron deficiency anemia.[5] Another study done in New York showed that serum ferritin was lowered by 29% in infants of obese mothers.[22] They also found that association between pre pregnancy body mass index and fetal anemia was more pronounced in male babies.[22]

In our study, among 368 cases, 55.70% were in age group 31 to 40 years and 44.3% of cases were in age group 20-30 years. The results generated by our study are comparable with another study in India.[20] In that study, 48% of the BMI greater than 30 category women was reported in more 26 years of age, but 28% of the BMI more than 30 group was reported in the <26 years category. The p value was 0.039 and it was statistically significant.[20] Our results were also comparable with another study

in Saudi Arabia, who reported that average age of obese patients was 25.2 years and that of non-obese was 24.1years, concluding that obesity was more common in women of higher age.[23]

Our study has some limitations that include relatively small size of sample and lack of data regarding pre pregnancy body mass index. Moreover we did not collect data about iron intake of obese pregnant women. We did not measure serum ferritin in cord blood sample which is more sensitive to rule out iron deficiency anemia.

CONCLUSION

Neonatal anemia was finding in about one third of cases in our study although a non-significant correlation is found with maternal obesity. More insight is needed regarding iron studies in cord blood to estimate the exact correlation between iron deficiency anemia in newborn and obese mothers.

There is increase prevalence of obesity in women of childbearing age and this finding is of prime importance for obstetricians. Maternal obesity has negative influence on fetal health so pre-pregnancy counseling is very important regarding detrimental effects associated with obesity.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

Sr. #	Author(s) Full Name	Contribution to the paper	Author(s) Signature
1	Amna Aziz	Conceived, designed and did statistical analysis and editing of manuscript.	
2	Hajra Sultana	Conceived, designed and did statistical analysis and editing of manuscript.	
3	Saima Qadir	Did review and final approval of manuscript.	
4	Saima Ashraf	Did data collection and manuscript writing.	
5	M. Sajjad Masood	Did data collection and manuscript writing.	