ABSTRACT

The objectives of the study “A Study on the Association Between Maternal Micronutrient Status and Birth Weight of Neonates” were to assess the maternal nutritional and micronutrient status during three trimesters of pregnancy and the nutritional and micronutrient status of neonates in the city of Khoy, Iran, using the longitudinal study and to find out the association among maternal nutritional, micronutrient status and other factors with reference to the birth weight of the neonates.

Nine health care centers and one hospital in Khoy city were selected based on their approval and cooperation. A total number of 450 healthy women, aged between 16-45 years, after pregnancy confirmation for prenatal care of pregnancy, were registered as the subjects for the present study. The tools used for the study were questionnaire, diet survey anthropometric measurement and biochemical analyses of maternal and cord blood.

The findings of study showed that the mean age of pregnant women was 26.1±5.8 years and the age range was 18-40 years. The mean age of the marriage was 21 to 25 years. Majority of them had high school level of education and obtained an income of 3-5 million Rials per month. The majority of the subjects were suffering from constipation (85%) followed by nausea and vomiting (68%).

Frequency of consumption of foods on daily basis revealed that wheat was consumed by 100% of women, whereas potato was used by 91%, egg and flesh foods by 39%, milk and yogurt were consumed by 36%, and oil was used by 89%. The major items of foods like pulses and green leafy vegetables and fruits were not consumed on daily basis by the majority of women but they were consumed by women on weekly and monthly basis.

The mean energy and protein intake per day by the pregnant women were 1697 kcal, 59.5g 2201 kcal, 77.8g and 2186 kcal, 74.5g during first, second and third trimesters respectively based on the findings of 24 hour recall method. The mean
intake of calcium and iron were 688mg, 19.0mg, 865mg, 23.1mg and 855mg, 22.9mg during first, second and third trimesters respectively, while the mean intake of zinc, copper and magnesium during first, second and third trimesters were 9.0mg, 1.39 mg, 236.3mg, 12.5mg, 1.60mg, 307.4mg and 12.3mg, 1.58mg, 295.6 mg respectively.

Percentage adequacy intake with reference to Recommended Daily Allowance (RDA) for energy and protein, in second and third trimester were nearer to adequacy (82-86%) but in the first trimester, it was significantly lower (77%). Percentage adequacy intake of calcium and iron were also inadequate but iron intake was adequate after including the iron supplements during the second and third trimesters. Percentage adequacy intake of zinc was inadequate whereas magnesium and copper intakes were adequate during pregnancy.

The mean height, weight, BMI and upper mid arm circumferences in the end of the first trimester of pregnancy were, 159.4 cm, 60.7 kg, 23.9 kg/m² and 24.9cm, respectively. All the somatic measurements at the third trimester showed increase in weight (72.0kg), upper mid arm circumferences (28.7 cm) and BMI (28.3 kg/m²).

The mean biochemical profile of maternal haemoglobin, serum calcium, iron, zinc, copper and magnesium in the first trimester was 12.3g/dl, 8.96 mg/dl, 76.0µg/dl, 79.0µg/dl, 130.9µg/dl and 2.10 mg/dl respectively. In the second trimester they were 10.8g/dl, 8.86 mg/dl, 63.5 µg/dl 74.5 µg/dl, 172.0µg/dl and 2.08mg/dl respectively. In the third trimester they were 11.4g/dl, 8.91 mg/dl, 70.1µg/dl, 65.3µg/dl, 193.2µg/dl and 2.09mg/dl respectively. Thirteen percent of pregnant women were hypocalcemic (calcium serum ≤8.7µg/dl). 40% of pregnant women had iron deficiency (iron serum <671µg/dl), 42% of the pregnant women were deficient in Zn (zinc serum<66µg/dl) and 13% magnesium deficiency (<1.8mg/dl). None of the pregnant women were found deficient in serum copper. In the cord blood the mean serum calcium, iron, zinc, copper and magnesium were 8.9 mg/dl, 106µg/dl, 85µg/dl, 57µg/dl and 1.98 mg/dl respectively.

The mean anthropometric measurements of neonates, namely, weight, height, head and chest circumferences were 3.2 kg, 49.4cm, 34.7cm, 33.1cm. The male neonates were heavier, taller and their head and chest circumferences were higher
than females. Our findings showed that a majority (89%) of neonates had normal birth weight and only 11% of them were considered as low birth weight.

Analyses of the findings with reference to the association between birth weight and maternal nutritional status and other attributes revealed that as the energy and protein intake increased, the birth weight of neonates increased. Pregnant women (in third trimester) who consumed 60-79% of RDA per day gave birth to neonates with 2.6 kg weight, while the pregnant women with 80-99% of RDA gave birth to neonates with 3.3 kg and with >100% RDA of energy per day gave birth to neonates with 3.6 kg. In the case of protein intake with 60-79% RDA gave birth to neonates with 2.5 kg while the pregnant women with higher intake of protein (80-100% RDA) gave birth to neonates with 2.9 kg and protein intake >100% RDA gave birth to neonates with 3.4 kg.

Pregnant women who consumed calcium less than <80% of RDA gave birth to lighter neonates with 3.0 kg (still in normal weight range), while the pregnant women with 80-100% of RDA gave birth to heavier babies -3.3 and 3.5 kg. The pregnant women with iron intake of <80% of RDA gave birth to neonates with 2.8 kg, while the pregnant women with 80-100% of RDA gave birth to heavier neonates- 3.4 to 3.6 kg. The pregnant women who consumed zinc <80% of RDA gave birth to neonates 2.9 kg when compared to the women who consumed 80-100% of RDA gave birth to heavier neonates (3.4 kg). There was no association between maternal consumption of copper and magnesium and birth weight of infants.

The taller pregnant women (more than 162 cm) gave birth to heavier babies (3.6 kg) than shorter women (2.6 kg). Pregnant women with weight less than 65 kg gave birth to neonates with 2.7 kg, while subjects with more than 75 kg gave birth to heavier neonates (3.6 kg). Overweight and obese women gave birth to heavier neonates (3.4 kg), comparing with underweight women (2.7 kg). Pregnant women who had gestational weight gain below recommended range gave birth to neonates with birth weight of 2.5 kg, while women within normal recommended range gave birth to heavier neonates (3.3 kg).
Association between birth weight and maternal biochemical parameters revealed that the pregnant women with anaemia (9 g/dl), gave birth to neonates with lower birth weight (2.6kg), when compared to the pregnant women with normal haemoglobin level (>11 g/dl), gave birth to heavier and normal babies (3.5 kg). Our findings showed that as the haemoglobin level of pregnant women increased the birth weight of the neonates also increased.

As the age of the women increased from 20-36 years, the birth weight increased from 3.3 to 3.4 kg. Age at marriage also influenced the birth weight of neonates. Women who married at younger age (18-20 years) gave birth to babies with lower birth weight(2.8kg) when compared to women who married at later age of 26-32 years (3.5 kg). It was also revealed that women who were pregnant for second and third time gave birth to neonates with higher birth weight (3.5kg) when compared to the first born. There was no difference between birth weight and mother’s occupation and educational level. Total income of family of pregnant women in different levels showed significant influence on birth weight of babies. The pregnant women who had less than 3 million in Rials per month gave birth to neonates with birth weight with 2.9kg, while pregnant women with >5 million in Rials per month gave birth to neonates with 3.6kg.

The findings of binary logistic regression analyses showed that among the maternal nutritional factors, the most significant predicting factors for birth weight of the neonates were fundal height, total iron intake, haemoglobin levels. The other important factors in the order were calcium intake, family income, protein intake, abdominal circumference, energy intake, upper mid arm circumference, and gestational weight gain of women could be considered as "Prediction factors" for birth weight of neonates. It may be recommended that these known prediction factors may be considered by government, non government agencies and health care centres to concentrate on education of women on the importance of maternal nutritional status on the outcome of pregnancy namely the birth weight of neonates.