

# Iron Content of Intact Placentas and Cords

BONNIE A. MCCOY, M.S.,\* ROBERTA E. BLEILER, P.I.D.† AND MARGARET A. OHLSON, PH.D.‡

THE only significant iron loss during a normal pregnancy occurs at parturition. In addition to the loss of iron to the infant and as result of hemorrhage, iron contained in placental blood, and in placental and cord tissue, is lost. Values for the blood content of a total of 216 placentas were published by several investigators<sup>1-3</sup> and ranged from 9 to 33.4 per cent of the wet weight of the organs. In a study of 143 German women, Mischel<sup>4</sup> found that the total iron in the blood and tissue of the placentas averaged 11.1 and 4.2 mg., respectively, per 100 gm. of wet sample.

More information on the iron content of placentas is needed in the evaluation of the iron requirement during pregnancy. The majority of investigations of this problem have been completed outside the United States, and few details of such factors as diet, prenatal medications and delivery procedures are included, all of which may influence placental iron losses. It appeared worthwhile, therefore, to collect intact placentas and their cords from the delivery room of the State University of Iowa Hospitals in order to evaluate this material in maternal iron loss.

## DESCRIPTIONS OF SUBJECTS AND OFFSPRING

The forty-nine patients in this study were not preselected. The pregnancies were considered to be normal, and all resulted in vigorously viable offspring. One patient died of aneurysm four days after delivery although there was no earlier evidence of illness.

Thirty-nine of the patients were indigents who were given custodial care by the hospital for two weeks to one month before term; four patients had insurance which paid hospital

fees but not medical fees, and the remaining six were private cases. The subjects were predominantly of northwestern European extraction, but the group included two Negroes and one Mexican. Thirty-five of the women were married.

Pertinent data concerning the pregnant subjects, and their offspring are given in Table I. The mean age of the women was twenty-five years, and the average number of previous pregnancies was two. One obese, nineteen year old patient lost 24 pounds during pregnancy and a sixteen year old adolescent gained 57 pounds, but the group gained an average of 24 pounds. The mean maternal hemoglobin immediately prior to parturition was 11.2 gm. per 100 ml. of blood. Five women had had oral iron medication prescribed by their physicians; however, the regularity of intake throughout the gestation period remains unknown. Six women received intramuscular iron therapy prior to or after admission to the hospital, since their hemoglobin values were below 10 gm. per 100 ml. of blood. The average weight of the infants at birth was 3.1 kg.

## COLLECTION OF MATERIAL AND CHEMICAL METHODS

Fifty intact placentas and their cords were collected from the patients upon delivery and were frozen in waxed containers. The standard delivery procedure followed by physicians was to sever the umbilical cord following cessation of the pulsation, allowing the infant to receive as much blood as possible. Two samples from a set of double-ovum twins and two samples from two sets of single-ovum twins were included in this study (Table II).

Aliquots of each suspension of placenta plus cord, which had been partially digested in acid, were ashed and brought to known volumes. A modification of the Woiwod<sup>5</sup> method for

From the Department of Nutrition, State University of Iowa, Iowa City, Iowa.

\* Technical Assistant; † Assistant Professor; ‡ Professor and Director.

TABLE I  
Pertinent Data Concerning Pregnant Subjects and  
Their Offspring

Data	Mean	Range
Age (yr.)	25	15-42
Previous pregnancies (no.)	2	0-9
Prenatal weight change (lb.)	24	-24-57
Maternal hemoglobin (gm. per 100 ml. of blood)	11.2	8.2-14.0
Weight of fetus (kg.)	3.1	1.5-4.2

TABLE II  
Relationships among Numbers of Subjects, Infants and  
Placentas

Data	Subjects (no.)	Infants (no.)	Placentas (no.)
Single births	46	46	46
Single-ovum twins	2	4	2
Double-ovum twins	1	2	2
Totals	49	52	50

TABLE III  
Iron Content\* of Placentas and Cords

Data	Present Study	Mischel <sup>4</sup>
Wet weight of sample (kg.)	560 (385-880)	...
Total iron (mg.)	75.5 (34.5-170.0)	63.7
Placentas plus cord †		
Placenta		63.7
Iron concentration (mg. per 100 gm. of wet weight of sample)	13.6 (7.1-34.8)	11.1
Placentas plus cord †		
Placenta		11.1

\* Ranges are given in parentheses.

† Values exclude one sample; see text for explanation.

total iron was employed in which iron in the ashed samples was reduced to the ferrous state and the concentration of the mineral determined colorimetrically with alpha, alpha dipirydil. Blanks were prepared with the exclusion of the ashed material. Special care

was taken in cleaning all equipment to prevent contamination with iron; the pyrex ashing crucibles were treated with 48 per cent hydro-fluoric acid.

#### RESULTS

Data obtained on the fifty placentas and cords were expressed as milligrams of total iron and milligrams per 100 grams of the wet weight of the sample. The results are summarized in Table III.

The total iron content of the samples averaged 75.5 mg. and ranged from 34.5 to 170 mg., excluding one value, 396.7 mg., which was 6 standard deviations from the mean. The latter total iron value was also omitted in the calculation of the iron concentrations in placentas plus cords which ranged from 7.1 to 34.8 mg. with a mean of 13.6 mg. per 100 gm. of the wet weight of the sample.

The weights of the placentas and cords averaged 560 gm. but varied from 385 to 880 gm.

#### COMMENTS

The data from the current study and that published by Mischel,<sup>4</sup> presented in Table III, agree quite well on the total iron contents of placentas even though the values by the former investigators include iron in the cord. The average placental iron loss of 75.5 mg. was 8.4 per cent of the 900 mg. dietary increment, which has been suggested for pregnancy,<sup>6</sup> while the range extended from 3.5 to 18 per cent, exclusive of the percentage calculation from the single, extreme iron value of 397.7 mg.

Several factors seemed to affect the iron content of the placentas. The wet weights of the placentas appeared to be related to the amounts of blood present in the organs at the time of collection. Salhanick and associates<sup>1</sup> found that the blood contents of nine placentas ranged from 10.6 to 33.4 per cent of the wet weights of the organs. Even though the delivery room procedure was standard in the current investigation, the blood contents of the placentas may be expected to vary considerably. These volumes were not determined, nor was the blood adhering to the sides of the organs after collection separated from samples analyzed for iron.

It is possible that the intramuscular administration of iron-dextran complex preparation to six patients prior to delivery introduced variation in the amount of iron and its concentration in the placentas. The total iron value for one patient who received this iron preparation was 6 standard deviations from the mean. On the other hand, the corresponding value for iron in the placenta plus cord for another patient who received the same dose of iron-dextran complex preparation within a similar time interval before delivery was 1 standard deviation below the mean for the group.

Four of the six patients receiving intramuscularly administered iron were unmarried, which may suggest that social or economic factors influenced the nutritional status of the woman and her offspring. Relationships between the various chemical values or case history information and the oral administration of iron were not apparent. The woman who died of an aneurysm following delivery received no iron supplementation, but the concentration of iron in the placenta plus cord was 34.8 mg. per 100 gm. of the wet weight of the sample, the second highest value found (Table III).

Four placentas were associated with multiple births. The two from one set of double-ovum twins effected a maternal iron loss of 145 mg. The placenta and cord from one of the two sets of single-ovum twins contained 85.5 mg. of iron, while the other represented a loss of only 49 mg.

The twenty-two year old and fifteen year old Negro subjects lost 84.4 and 62 mg. of iron, respectively, due to expulsion of the placenta.

Race did not appear to contribute to variations in the iron content of the placentas studied, nor did hospital classification, age, weight change during pregnancy, the number of previous pregnancies, fetal weight and maternal hemoglobin prior to delivery.

#### SUMMARY

Iron content was determined in fifty intact placentas plus cords, but one value, 6 standard deviations from the mean total iron content was omitted from subsequent calculations. Total iron content ranged from 34.5 to 170 mg. and averaged 75.5 mg., while the mean concentration of the mineral was 13.6 mg. and the range 7.1 to 34.8 mg. per 100 gm. of the wet weight of the samples. This loss of iron represented an average of 8.4 per cent, from a 3.5 to 18 percentage range, of a 900 mg. total dietary increment suggested for pregnant women.

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