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Origin of the *Trans* Fatty Acids in Human Tissue.* (24483)

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We have previously reported(1,2) that *trans* fatty acids were deposited in the tissue of female rats which had been fed *trans* fatty acids and that these acids did not seem to pass through the placenta, as the progeny from these rats did not contain *trans* fatty acids unless they had been allowed to suckle the maternal milk. Since rat and human placentae may differ in ability to transfer nutrients, it is not possible to conclude from these results whether the human baby receives *trans* fatty acids *via* the placenta. In the present study samples of fat from human placental, maternal, fetal, and baby tissue were examined for the presence of *trans* fatty acids to determine whether those in human tissues originate(3) solely from dietary fat.

Methods. The placenta was washed free of superficial blood with cold water, the umbilical cord removed; the placenta was cut into small pieces, ground in Waring Blendor in the presence of ethanol, and allowed to remain in contact with solvent for 12 hours. The remaining lipid was removed by successive extractions with acetone, petroleum ether (Skellysolve F) and ethyl ether. Extracts were combined, dried over sodium sulfate and freed from solvent. Since these lipids contained a large amount of unsaponifiable material which interfered with absorption at 10.36 μ in the infrared region, analyses for *trans* fatty acids were carried out on the methyl esters. The combined lipids were saponified with 4% alcoholic potassium hydroxide at room temperature. We found that *trans* isomers are not formed under these conditions. The unsaponifiable material was removed in a separatory funnel by shaking with Skellysolve F, the soaps were acidified with hydrochloric acid, fatty acids removed by extraction with Skellysolve F, free from solvent, and the methyl esters prepared from residue by esterification with cold methanol saturated with hydrogen chloride gas. All extractions were done quantitatively and solvents were removed by use of a Rinco rotating evaporator. Lipids from samples of maternal, baby and fetal tissue were extracted by use of Soxhlet apparatus and after drying, the solvent (acetone followed by Skellysolve F) was removed as described above. The % *trans* double bond was determined at 10.36 μ by use of Beckman IR2A spectrophotometer and the Jackson and Callen baseline method(4). All analyses were done in carbon disulfide solution at 5% concentration. Methyl esters were compared with methyl elaidate standard and all other samples with a trielaidin standard.

Results. Methyl esters obtained from placental lipids contained little or no *trans* double bonds. In 3 samples a slight absorption

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TABLE I. Percentage of *Trans* Fatty Acids in 6 Samples of Placental and Maternal Fat from Same Individual.

Placental fat,* % *trans*	Maternal depot fat, % *trans*	Age of mother
0	6.4	16
.5	6.8	20
0	6.1	19
0	1.5	26
.5	1.8	37
0	5.2	22

* Six other samples of placental fat were collected from which maternal fat had not been available, none contained *trans* fatty acids.

at 10.36 μ was observed, but this was too slight for measurement and is reported as a trace or less than 0.5% (Table I).

In 6 cases of Caesarean section, it was possible to obtain samples of the maternal depot fat in addition to the placenta. Analyses of these samples showed that the depot fat of the mother contained from 1.5-6.8% of *trans* fatty acids, whereas methyl esters of the placental lipids from these mothers contained little or no *trans* double bonds (Table I).

The lipid extracted from 5 samples of fetal liver (5 to 8 months gestation) contained no appreciable amounts of *trans* double bonds. In 4 cases there was no absorption at 10.36 μ and slight absorption was noted in the fifth case but was not measurable. Furthermore, the fat extracted from 2 pooled lots of new born baby tissue† representing a total of 22 samples showed little or no *trans* fatty acids were present in this tissue.

While it has been shown that polyunsaturated fatty acids(5) and other lipids do pass the placental barrier, the amounts are apparently small(6). It is therefore improbable that any appreciable amount of *trans* fatty acids would be detected in the placental fat or be passed on to the fetus unless the maternal depot fat and blood contained large quantities of *trans* fatty acids. We have found a maximum of 14% *trans* in human tissue(3) and traces only in the fatty acids of human blood and human milk fat. No correlation was noted between age of the mother and percentage *trans* fatty acid content of her depot fat (Table I).

The results of our study indicate that the *trans* fatty acids present in human tissue apparently arise solely from dietary fat, and as in other non-ruminants(7), they do not normally appear in the tissues unless a source of *trans* fatty acids is included in the diet.

Summary. Samples of fat from human placental, maternal, fetal, and baby tissue were examined for presence of *trans* fatty acids. While the maternal tissue contained considerable amounts of *trans* fatty acids, these lipids were not found to any measurable extent in placental, fetal, or baby fat. The results indicate that *trans* fatty acids found in human tissue must originate solely from dietary fat.

† Prepuce tissue from male babies.

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