# SERUM LIPIDS AND PROTEIN-BOUND IODINE LEVELS OF GUATEMALAN PREGNANT WOMEN FROM TWO DIFFERENT SOCIOECONOMIC GROUPS

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# Serum lipids and protein-bound iodine levels of Guatemalan pregnant women from two different socioeconomic groups

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NONPREGNANT women of upper socioeconomic status in Guatemala have been shown to have higher serum cholesterol levels than those in lower socioeconomic groups.[1] Serum cholesterol levels increased during pregnancy so that at term no significant difference was found between the serum cholesterol levels of the two groups,[2] despite the marked differences in dietary intake and cultural patterns. A greater rise of serum cholesterol thus occurred in the women of lower income status during pregnancy than in their upper income counterparts. The present study extends these observations to the development of hyperlipemia during gestation in the two groups and investigates a possible difference between them in thyroid function, as measured by protein-bound iodine.

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## Materials and methods

For the study of lipemia a total of 219 blood samples were collected, 163 from women in the prenatal clinic and maternity ward of the Roosevelt Hospital, a large charity institution in Guatemala City. They represented a lower socioeconomic stratum as judged from income status and an interview by a social worker. Seventeen were in the first trimester of pregnancy, 52 in the second, and 69 in the third; 25 women were studied at the time of delivery. The upper socioeconomic sample was made up of 56 women who attended private clinics and were wives of business and professional men in Guatemala City. Six were in the first trimester of pregnancy, 12 in the second, and 10 in the third; 28 were studied at delivery.

Protein-bound iodine (PBI) was also determined in the blood samples from all of the women studied at the time of delivery. For comparison, PBI determinations were done on blood samples obtained from two additional groups, one from lower income and the other from upper income families, each composed of 12 randomly selected nonpregnant women. Patients with abnormal pregnancies or parturitions were excluded, as well as patients with obvious thyroid

gland disease or previous iodine therapy. All blood samples were taken in the fasting state and protected from contamination with iodine.

Serum cholesterol was measured by the method of Abell and associates.[3] Lipid phosphorus was determined by the method of Maclay[4] adapted to a micro scale, and total lipids by the dichromate oxidation of Bragdon[5] in 0.05 ml. of serum with use of lipid extraction with Bloor's solvent mixture. The method of Grossmann and Grossmann[6] for the assay of protein-bound iodine was modified by stopping at a standard time of 10 minutes the catalytic reaction carried out at 25° C. with brucine.

## Results

In Table I the serum lipids and protein-bound iodine of the nonpregnant and pregnant women at delivery are presented. No significant differences in total serum lipids and PBI levels were found between the nonpregnant women of the two socioeconomic groups. Upper income nonpregnant women, however, had far more serum lipid phosphorus than lower income ones. The difference in cholesterol levels between nonpregnant women in the two socioeconomic groups was also significant; the upper income group showed the higher average. In the pregnant women at delivery no significant difference was observed in total lipids, lipid phosphorus, cholesterol, and protein-bound iodine for the two socioeconomic groups. If values for women at delivery are compared with those for nonpregnant women, a highly significant increase is observed for all serum lipid fractions and PBI ($P<0.001$ in all cases).

Lipid phosphorus and cholesterol levels for each trimester of pregnancy in both socioeconomic groups are given in Table II. For women in the lower socioeconomic group, these levels are shown in Table III for each month of pregnancy. There is a steady increase in lipid fractions during the course of pregnancy.

As shown in Table IV, highly significant positive correlations were found between cholesterol and total lipids in all of the groups studied and between total lipids and lipid phosphorus for the pregnant women at delivery in both socioeconomic groups. A highly significant positive correlation was also obtained between cholesterol and lipid phosphorus in the pregnant women at delivery in the upper income group. In the case of the pregnant women of the lower income group at delivery this correlation was significant at the 5 per cent level of probability. Significant correlations were also found between PBI and cholesterol and PBI and lipid phosphorus in women of the lower income group at delivery.

## Comment

One of the metabolic alterations of pregnancy is the increased activity of the thyroid gland as revealed by clinical studies showing

**Table I.** Serum lipid and protein-bound iodine concentration in nonpregnant and pregnant women in two socioeconomic groups in Guatemala City

| | *Total lipids (mg./100 ml.)* | | *Lipid phosphorus (mg./100 ml.)* | | *Cholesterol (mg./100 ml.)* | | *Protein-bound iodine (μg/100 ml.)* | |
|---|---|---|---|---|---|---|---|---|
| *Economic groups* | *Upper* | *Lower* | *Upper* | *Lower* | *Upper* | *Lower* | *Upper* | *Lower* |
| *Nonpregnant* | | | | | | | | |
| Number studied | 10 | 12 | 10 | 12 | 12 | 12 | 11 | 11 |
| Mean | 586 | 633 | 9.49 | 6.63 | 175 | 146 | 6.53 | 6.08 |
| Standard deviation | 89 | 97 | 1.96 | 1.47 | 41 | 20 | 1.13 | 0.63 |
| *At time of delivery* | | | | | | | | |
| Number studied | 28 | 24 | 28 | 24 | 28 | 26 | 26 | 24 |
| Mean | 991 | 1,023 | 13.90 | 13.88 | 232 | 230 | 8.91 | 8.82 |
| Standard deviation | 124 | 150 | 2.04 | 2.30 | 37 | 42 | 1.31 | 1.43 |

**Table II.** Serum lipid phosphorus and cholesterol levels of pregnant Guatemalan women of two different socioeconomic groups

| *Socioeconomic groups* | *Lipid phosphorus (mg./100 ml.)* | | | *Cholesterol (mg./100 ml.)* | | |
|---|---|---|---|---|---|---|
| | *No.* | *Mean* | *Standard deviation* | *No.* | *Mean* | *Standard deviation* |
| *First trimester* | | | | | | |
| Upper income | 7 | 9.53 | 1.29 | 6 | 206 | 32 |
| Lower income | 17 | 9.36 | 1.46 | 17 | 170 | 36 |
| *Second trimester* | | | | | | |
| Upper income | 12 | 10.97 | 1.83 | 12 | 208 | 44 |
| Lower income | 52 | 10.36 | 1.79 | 52 | 187 | 43 |
| *Third trimester* | | | | | | |
| Upper income | 11 | 13.01 | 1.27 | 10 | 248 | 44 |
| Lower income | 69 | 11.63 | 1.85 | 69 | 210 | 49 |

**Table III.** Serum lipid phosphorus and cholesterol during the course of pregnancy in lower income Guatemalan women

| *Month of pregnancy* | *Lipid phosphorus (mg./100 ml.)* | | | *Cholesterol (mg./100 ml.)* | |
|---|---|---|---|---|---|
| | *No.* | *Mean* | *Standard deviation* | *Mean* | *Standard deviation* |
| 1 | 1 | 6.98 | — | 145 | — |
| 2 | 2 | 8.56 | — | 144 | — |
| 3 | 14 | 9.65 | 1.38 | 176 | 37 |
| 4 | 19 | 9.86 | 1.74 | 185* | 33 |
| 5 | 11 | 10.40 | 1.85 | 190 | 35 |
| 6 | 23 | 10.76 | 1.78 | 196 | 35 |
| 7 | 24 | 11.22 | 0.95 | 197 | 27 |
| 8 | 16 | 11.69 | 2.66 | 222 | 66 |
| 9 | 29 | 11.94 | 1.89 | 215 | 51 |

*No. = 18.

**Table IV.** Calculated correlations of the different variables

| | *Lower income women* | | | | *Upper income women* | | | |
|---|---|---|---|---|---|---|---|---|
| | *Nonpregnant* | | *Pregnant (at delivery)* | | *Nonpregnant* | | *Pregnant (at delivery)* | |
| | *Degrees of freedom* | *Correlation coefficient* | *Degrees of freedom* | *Correlation coefficient* | *Degrees of freedom* | *Correlation coefficient* | *Degrees of freedom* | *Correlation coefficient* |
| Total lipids–lipid phosphorus | 10 | 0.379 | 22 | 0.699* | 8 | 0.617 | 26 | 0.637* |
| Cholesterol–total lipids | 10 | 0.787* | 21 | 0.661* | 8 | 0.862* | 25 | 0.771* |
| Cholesterol–lipid phosphorus | 10 | 0.473 | 21 | 0.506† | 8 | 0.360 | 25 | 0.509* |
| Cholesterol–PBI | 9 | –0.170 | 19 | 0.437† | 9 | 0.358 | 24 | 0.069 |
| PBI–lipid phosphorus | 9 | –0.494 | 17 | 0.497† | 7 | 0.190 | 23 | 0.284 |
| PBI–total lipids | 9 | –0.272 | 17 | 0.349 | 7 | –0.330 | 23 | 0.022 |

*Significant at the 1 per cent level.

†Significant at the 5 per cent level.

progressive thyroid enlargement during gestation,[7] laboratory investigations demonstrating elevated levels of serum protein-bound iodine and thyroxine,[8] greater uptake of radioactive iodine,[9] and histological evidence.[8] It is also known that proper thyroid function is dependent on the diet of the individual, particularly the intake of iodine. In pregnancy the demand for thyroxine is increased, and it is well established that goiters may appear or enlarge during gestation[10] in areas of low environmental iodine. With the increased thyroid function in pregnancy, a low availability of iodine places a double stress on the thyroid. If this is too great for its compensating capacity, hypothyroidism may result.

Hyperthyroid states are reported to produce a lowering of the serum cholesterol level while hypothyroid states lead to an increase, occasionally quite marked.[11] Nevertheless, Peters and Man[12] concluded that serum cholesterol determinations are not consistently useful in the detection of overactivity of the thyroid gland. The present data provide no evidence to suggest that the quantitatively greater elevation of serum cholesterol levels observed in lower economic as compared to upper economic Guatemalan women may be attributed to a relatively lower thyroid function during pregnancy in the former group. In spite of the marked differences in dietary habits and socioeconomic status, the PBI values for both groups were within normal limits and the PBI levels of nonpregnant women of the two groups did not differ significantly. The possible exception is the positive correlation between PBI and cholesterol and between PBI and lipid phosphorus obtained at the time of delivery of the lower income women.

A substantial elevation in PBI, serum lipid concentrations, and lipid phosphorus was observed in both groups during pregnancy. The previously reported phenomenon[2] of the relatively greater elevation of serum cholesterol during pregnancy in women of the lower economic status was also confirmed. As repeatedly described for cholesterol in both children and adults[1, 13] lipid phosphorus levels were found to differ in nonpregnant women of the two socioeconomic groups; the higher income group had higher phosphorus and cholesterol levels. Like serum cholesterol, lipid phosphorus also rose more during pregnancy in the women of the lower socioeconomic status. On the other hand, total lipids did not differ between the two socioeconomic groups either in nonpregnant women or at delivery, although a significant rise during pregnancy was observed.

## Summary

Total lipids, cholesterol, lipid phosphorus, and protein-bound iodine (PBI) concentrations were determined in nonpregnant and pregnant women at the time of delivery in two widely different socioeconomic groups in Guatemala City. Upper income nonpregnant women had higher serum levels of lipid phosphorus and cholesterol than those of lower income, but the difference in total serum lipids and in PBI levels were not significant. All serum constituents measured increased markedly during pregnancy. At the time of delivery, no significant differences were found between the two socioeconomic groups, since quantitatively greater increases in cholesterol and lipid phosphorus occurred during pregnancy in the lower socioeconomic group. Although it had been suspected that the combined stress of pregnancy and iodine deficiency might have been producing a relative thyroid hypofunction in the lower income women, which was in turn responsible for the relatively greater increase of serum cholesterol and lipid phosphorus during pregnancy in this group, the PBI data did not support this hypothesis.

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