

Leptin level in pregnant mothers at term and cord blood and the effect of newborns gender

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ABSTRACT

Objectives: To evaluate the leptin level in healthy pregnant mothers at term and in their newborns and its relationship to their body mass index (BMI) and gender of the newborn.

Methods: The leptin level was measured in serum of 187 pregnant women at term delivering at the King Khalid University Hospital, Riyadh, Kingdom of Saudi Arabia in July 2001 and their newborns. Correlation studies were made between leptin level and their growth parameters, and gender of the newborns.

Results: Leptin level of the mothers was significantly higher compared to their newborns. There was a significant correlation between leptin level in the

pregnant women and their weight, BMI, and the newborns leptin level and weight, but not their height or BMI. A statistically significant difference was found between male and female newborns plasma leptin level. A significant correlation was found between male newborns leptin level and all their growth parameters, while in the female newborns there was no correlation between their leptin level and BMI.

Conclusion: Leptin plays an important role in providing a growth promoting signal during pregnancy, but the fat mass does not seem to be the most important predictor of cord leptin level.

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Several changes take place in the physiological, biochemical and hormonal parameters during pregnancy with a significant effect on the health and growth of the fetus and newborn. Certain genetic variations and environmental changes also play an important role in the development of the fetus.¹

Leptin, the adipocyte hormone, is implicated in the increasing number of neuro-endocrine regulations including adiposity, satiety, puberty and fertility.^{1,2} Several studies suggested that leptin plays an important role in the growth and development of the fetus.^{3,4} Recently, it has been shown that leptin level is influenced in the pregnant state,⁵ however, controversy still continues regarding the source of elevated leptin level in

pregnancy and the newborns and its effect on both of them.

This study was carried out to evaluate the relationship between maternal leptin level at term in healthy pregnant women and their newborns and its relationship to body mass index (BMI), in addition to its relationship to the gender of the newborns.

Method. Healthy pregnant women at term with an uncomplicated pregnancy, delivering at King Khalid University Hospital (KKUH), Riyadh, Kingdom of Saudi Arabia, in July 2001 were included in the study after an informed consent. Five to 10 ml of blood was extracted by vene-

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puncture in heparinized or ethylenediaminetetraacetic acid tubes at the time of delivery from those women. Cord blood samples were collected immediately after delivery from the placental end of the umbilical cord (discarding the first 2 mls) after early ligation of the cord and after raising the newborn to the level of the placenta to avoid fetoplacental transfusion and vice versa. Blood samples were stored at 40°C for not more than one week before analysis.

Age, body weight (wt), height (ht) and BMI (wt/ht²) were recorded for all the pregnant women. The sex, body weight, height, and BMI were recorded for the newborns. Leptin level was measured by radioimmunoassay (RIA). Within batch coefficient of variation (CV) ranged from 1.6-13% while between batch CV was 3.9%.

Statistical analysis was carried out using statistical package for social sciences version 10. Descriptive analysis in addition to regression analysis was carried out for variables. Mann Whitney U and Student t-tests were used to compare the statistical significance of the differences between the mothers and newborns parameters. The Pearson correlation coefficient was used to correlate between mothers and newborns parameters. *P*-value of 0.05 was considered to be statistically significant.

Results. A total of 187 pregnant women and their newborns were included in the study. The mean body weight, mean height and BMI for the pregnant women is summarized in **Table 1**. The mean leptin level for the pregnant women was 19.91ng/ml ± 13.95 and for the newborns was 10.14 ng/ml ± 9.57. The difference between them was statistically significant (*p*=0.0001). The mean leptin level in the female newborns was 11.62 ± 10.96 and in the male newborns was 8.23 ± 7.55 while the mean BMI for the female newborns was 13.15 ± 2.17 and in the male newborns was 13.74 ± 1.81, and the differences between both were statistically significant (**Table 2**). There was a statistically significant correlation between the pregnant women leptin level and their body weight (*p*=0.002) and BMI (*p*=0.031). The correlation between the newborns leptin level was statistically significant with their body weight (*p*=0.0001), height (*p*=0.017) and BMI (*p*=0.0001) (**Table 3**).

A separate analysis was carried out for male and female newborns parameters. There was a significant correlation between the male newborns leptin level and their height (*p*=0.045), body weight (*p*=0.0001) and BMI (*p*=0.018). There was only a significant correlation between the female newborns leptin level and their body weight (*p*=0.005), while

Table 1 - Demographic data of the pregnant ladies and their newborns.

Parameter	Mother Mean ± SD	Newborn Mean ± SD
Height (cm)	156.9 ± 10.3	48.5 ± 4.23
Weight (kg)	72.5 ± 17.2	3.2 ± 0.52
BMI (kg/m ²)	31.0 ± 11.9	13.52 ± 1.83
BMI - body mass index		

Table 2 - Leptin level and body mass index according to the gender of the newborn.

Parameter	Female newborn Mean ± SD	Male newborn Mean ± SD	95% CI	<i>p</i> value
Leptin (ng/ml)	11.62 ± 10.96	8.23 ± 7.55	0.024 -6.75	0.001
BMI (kg/m ²)	13.15 ± 2.17	13.74 ± 1.81	0.001-1.179	
BMI - body mass index, CI - confidence interval				

Table 3 - The correlation between the mother and newborns own leptin and growth parameters.

Parameter	Mothers <i>p</i> value	Newborns (general) <i>p</i> value	Male newborns <i>p</i> value	Female newborns <i>p</i> value
Height (cm)	0.089	0.017*	0.045*	0.667
Weight (kg)	0.002*	0.000*	0.000*	0.005
BMI (kg/m ²)	0.031	0.000*	0.018*	0.844
* statistically significant, BMI - body mass index				

no significant correlation with their height ($p=0.667$) and BMI ($p=0.844$), as shown in **Table 3**. Correlation between the pregnant women leptin level was significant with the newborns leptin ($P=0.003$) and body weight ($p=0.075$), but it was not significant with the newborns height ($p=0.630$) or BMI ($p=0.378$).

Discussion. Most of the studies reported during recent years on cord blood leptin level and its role in fetal growth and development were small and on complicated pregnancies. All studies showed that leptin level in cord blood varied depending on several factors including fetal body weight, ponderal index, BMI, gender and maternal illness.⁵⁻⁸ Our study is the second largest study reporting leptin level in uncomplicated pregnancies. It has confirmed the presence of leptin in cord blood in a wide range. This study also showed that leptin level in cord blood is significantly lower than maternal leptin level as shown in the majority of the reported studies.^{5,9,10} There was a significant correlation between maternal and cord blood leptin level and all the growth parameters of the newborns (body weight, height, BMI). This confirms that leptin plays an important role in providing a growth promoting signal for growth and fetal fat mass during pregnancy and support the suggestion of existence of an adipo-insular axis regulating growth of the fetus. The strong correlation seen in our study between maternal and cord blood leptin level contradicts the suggested hypothesis of a non communicating 2 compartment model of fetoplacental leptin regulation and this could be due to the larger sample size in our study. In addition, Sarandakou et al,⁵ showed in their study that leptin level decreases significantly on day 5 after birth in the serum of the newborn and this confirms that the placenta is one of the major sources of leptin production.

Our study confirms also that a sexual dimorphism in adipose tissue exists in utero as, there was a significant difference between leptin level and BMI in male and female newborns (**Table 2**). This is in agreement with most of the other studies that reported a higher leptin level in female newborns.⁷⁻¹⁰ The most interesting finding in our study was that leptin level in the female newborns correlated only with their body weight but not their height or BMI, while in the male newborns, leptin level correlated with all their parameters (**Table 3**).

This finding suggests that in the female fetuses other factors affect their growth, which could be maternal hormones effect on their tissue or the sex chromosome effect. This suggestion is supported by the finding that although leptin level was higher in the cord blood of the female newborns than males, their BMI was significantly lower than the male newborns (**Table 3**).

In conclusion, it is important to note that the specific factors of leptin production and action have yet to be completely elucidated as fat mass does not seem to be the most important predictor of cord leptin concentration. The implications of these results require additional research, specifically, whether the leptin levels are the result or the effect of gender and fat mass.

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