

# Relationship between Serum Leptin Values and Abdominal Circumference Assessed in the First Trimester of Pregnancy in Obese Women

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**ABSTRACT:** Higher serum leptin values have been correlated with several complications of pregnancy, while the abdominal circumference (AC) is an anthropometric measurement usually used to diagnose abdominal obesity. For this study we compared serum leptin levels between two groups of pregnant women: those with abdominal obesity (AC>88cm) and those without abdominal obesity (AC<88cm), diagnosed at the beginning of pregnancy. Serum leptin levels were obtained through measurements performed between 11-14 and 28-32 weeks of gestation. Higher serum leptin levels were found in the group of pregnant women with abdominal obesity comparing to the group without abdominal obesity, but a positive correlation between abdominal circumference and the leptin values was found only at 11-14 weeks of pregnancy. Our study showed that a simple measurement of AC performed at the beginning of pregnancy may predict the average serum levels of leptin throughout the gestation period. A better understanding of the role of leptin during development is needed to make us able to know how maternal-placental-fetal leptin exchange influence the fetal development.

**KEYWORDS:** *Leptin, abdominal circumference, obesity.*

## Introduction

Excessive fat deposition in the abdominal area it is known as abdominal obesity and it is associated with an increased risk of coronary events, type 2 diabetes and high blood pressure [1,2].

The anthropometric measurement usually used to diagnose abdominal obesity is the abdominal circumference (AC) or waist circumference, because it is a simple and practical parameter to assess the risk of obesity complications and is measured in every clinical practice, providing additional data to Body mass index (BMI) and also independent ones [3].

Leptin, which is also produced by the placenta during pregnancy, plays an important role in regulating energy metabolism and installing physiological insulin resistance [4,5].

Leptin levels higher than those observed during normal pregnancy have been correlated with gestational diabetes [6], preeclampsia and intrauterine growth restriction, increasing in proportion to the severity of the disease [7].

To verify this relationship, in this study we tried to find a correlation between the maternal AC measured before the 12th week of gestation

and the mean serum leptin levels during pregnancy.

## Materials and Methods

This prospective study included a group of 99 patients, studied between October 2016 and May 2020, in the Obstetrics and Gynecology Clinic of the Craiova Municipal Hospital Filantropia.

During the mentioned research period, the informed consent was obtained from the women who agreed to participate in this study, subjected to an investigation protocol establishing the set of quantifiable, specific, case-tracking parameters.

The study was conducted in full compliance with the ethical principles contained in the "Declaration of Human Rights" adopted in Helsinki, which are in accordance with the Rules of Good Practice in Clinical Trials and legal regulations and with the approval of the Ethics Committee of our institution.

The statistical analysis was performed in the Biostatistics department, University of Medicine and Pharmacy of Craiova.

The statistical assessment was carried out in part in Excel (Microsoft, USA) and in part in Matlab (Mathworks, USA).

The variables were presented as mean±standard deviation.

For this study we compared serum leptin levels between two groups of pregnant women: those with abdominal obesity (AC>88cm) and those without abdominal obesity (AC<=88cm), diagnosed at the beginning of pregnancy.

Serum leptin levels were obtained through measurements performed between 11-14 and 28-32 weeks of gestation.

Serum leptin values were interpreted according to the gestational age at which the samples were collected.

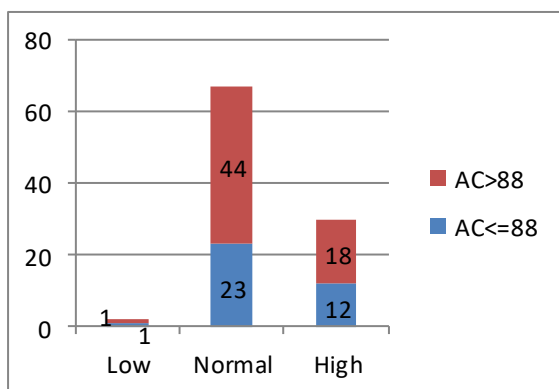
### Results

The mean value of AC for all the pregnant women analysed in this study was increased, 95.17±20.17 SD, a value measured at the beginning of pregnancy, at the record.

The percentage values were 63.6% cases with abdominal obesity and 36.3% cases without abdominal obesity.

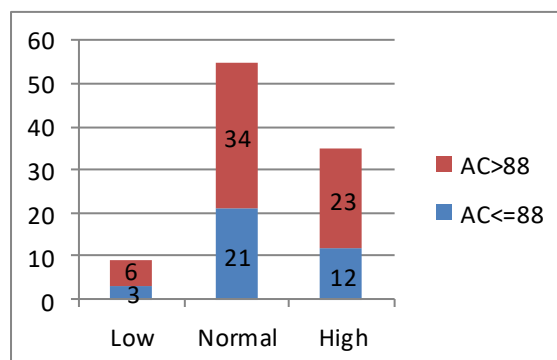
Leptin values at 11-14 weeks of pregnancy were higher in cases with AC>88cm, 18 cases, compared to those with AC<=88cm (12 cases).

Normal values were found both in cases with AC>88cm (44 cases) and in those with AC<=88cm (23 cases) (Figure1).



**Figure 1. Leptin values at 11-14 weeks of pregnancy in cases with AC>88cm compared to those with AC<=88cm.**

At 28-32 weeks of pregnancy, high values were present in 23 cases with AC>88cm, normal values were found in 34 cases with AC>88cm, and low values in 6 cases with abdominal obesity (Figure 2).

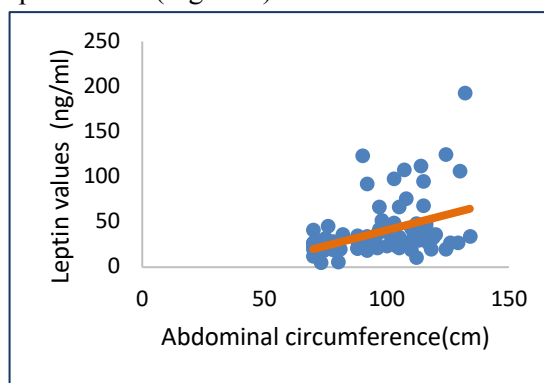


**Figure 2. Leptin values at 28-32 weeks of pregnancy in cases with AC>88cm compared to those with AC<=88cm.**

We observed that the mean serum leptin levels in the group of pregnant women with abdominal obesity (46.40±33.52ng/ml) identified at the beginning of pregnancy were significantly higher than those from the group of patients without abdominal obesity (24.12±8.50ng/ml).

We wanted to see what is the correlation between leptin values and abdominal circumference in all pregnant women, regardless of BMI classification, taking into account the gestational age, when the leptin was harvested.

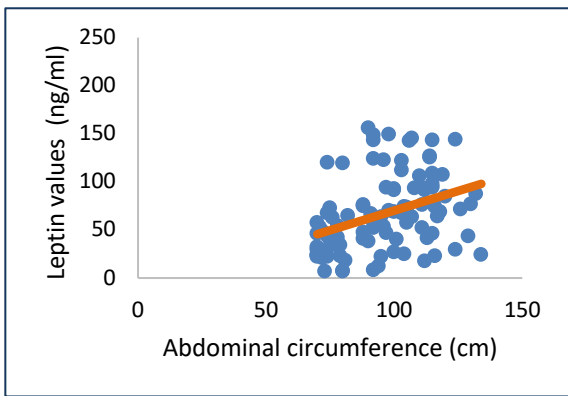
We found that at 11-14 weeks of gestation, we have a direct positive correlation with a high correlation coefficient, which suggests that pregnant women with high abdominal circumference values are likely to have high leptin values (Figure 3).



**Figure 3. The correlation between abdominal circumference and serum leptin values at 11-14 weeks of pregnancy.**

We had the same observation for the group at 28-32 weeks of gestation, with a high correlation coefficient, but lower than at 11-14 weeks.

This shows that in pregnant women with high values of abdominal circumference (AC>88cm) it is likely to have high levels of leptin at 28-32 weeks of gestation (Figure 4).

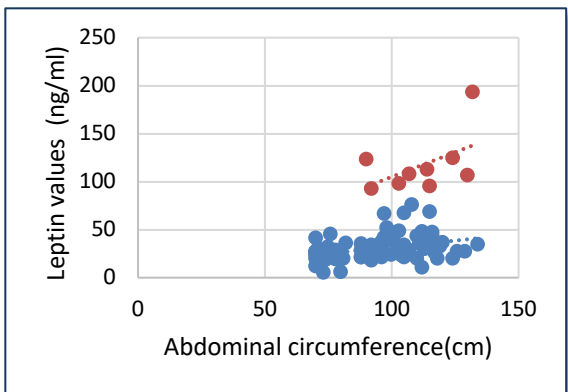


**Figure 4. The correlation between abdominal circumference and serum leptin values at 28-32 weeks of pregnancy.**

We then analyzed the correlation that exists between leptin values in the two groups, with abdominal circumference  $\leq 88$ cm and those with abdominal circumference  $> 88$ cm, at 11-14 weeks of gestation.

At 11-14 weeks, we found a positive correlation in the group with abdominal circumference  $> 88$ cm, with a strong correlation coefficient, so that when AC increases, the probability of increasing leptin values also increases.

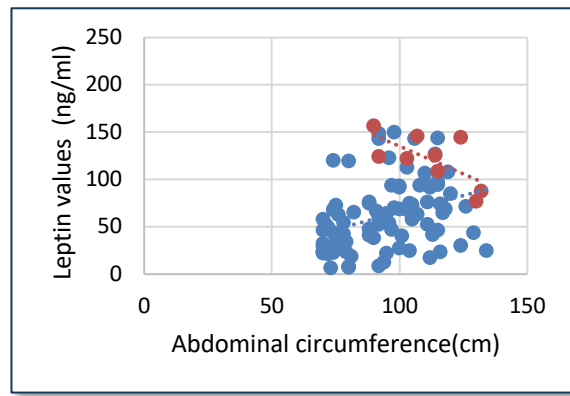
At AC values below 88cm, we encountered the same situation (Figure 5).



**Figure 5. The correlation between abdominal circumference and serum leptin values at 11-14 weeks of pregnancy differentiated on the two study groups: cases with AC  $> 88$ cm compared to those with AC  $\leq 88$ cm.**

Instead, at 28-32 weeks of gestation, we found a negative correlation between AC  $> 88$ cm and leptin values, high AC values correlating with lower or normal leptin values.

In cases with AC  $< 88$ cm, the correlation was positive, low AC values correlating with lower or normal leptin values (Figure 6).



**Figure 6. The correlation between abdominal circumference and serum leptin values at 28-32 weeks of pregnancy differentiated on the two study groups: cases with AC  $> 88$ cm compared to those with AC  $\leq 88$ cm.**

## Discussions

The relevance of our findings is due to the fact that, having a simple measurement of AC performed at the beginning of pregnancy, it is possible to predict the average serum levels of leptin throughout the gestation period.

Measurement of AC during early pregnancy is easy to perform, it is a valid and simple method, however, it is not yet part of the routine of anthropometric surveys performed in the prenatal period.

The main reasons why AC has not yet been included in prenatal propaedeutic may be related to the differences between the methods and measurement points used and to the increase in uterine volume, which may influence the accuracy of the method [8].

Therefore, these measurements should be made especially at the beginning of pregnancy to avoid affecting the results by the increased uterine volume.

In addition, measurements should be made by trained personnel to provide standardized data, and patient self-measurements should be avoided to minimize measurement errors [9].

Of the various ways of measuring waist circumference, the area of the minimum waist is the furthest from the uterus and therefore is least influenced by the increase in uterine volume [10].

In the present study, we decided to perform the AC measurement before the 12th week of gestation, at which point the uterus still does not intervene in the measurement results, because it is still inside the maternal pelvis.

Exceeding the threshold value of the abdominal circumference of 88cm is often correlated with various maternal and fetal

complications even for women with a normal BMI [11].

Leptin is a hormone produced by adipocytes, its serum value being high in obese people.

A number of studies have shown that there is a correlation between these values and fecundability [12], but also the occurrence of pregnancy complications, the women with increased initial precontraceptive values having an increased risk of developing complications such as gestational diabetes, and hypertensive disorders [13].

In our study we noticed higher serum leptin levels in the group of pregnant women with abdominal obesity.

Another study provided similar results in leptin values in the patient group with abdominal obesity [14], but also reported a positive correlation between leptin values and abdominal circumference for all periods analyzed while we found this correlation only for the period 11-14 weeks of gestation.

Moreover, another study found similar results to ours from this point of view by calculating an index of leptin concentration per unit body weight, which decreased for overweight patients, suggesting that there are also other factors other than fat mass which influence leptin concentrations in overweight pregnant patients [15].

Another study also found variations in the evolution of leptin values during different stages of pregnancy depending on the weight of the pregnant woman [16].

Moreover, maternal weight differences influence the effect of maternal serum leptin on fetal growth showing a metabolic and physiological heterogeneity between these groups that may have an echo related to the long-term physiological effects of the intrauterine environment.

Another interesting aspect is that the rate of change in maternal serum leptin in the second half of pregnancy may be also associated with a decrease in the gestational age at delivery [17].

If an increase in maternal plasma leptin levels is associated with maternal obesity, a decrease in these fetal values is correlated with intrauterine growth restriction, these fetuses featuring lower umbilical cord blood leptin concentrations comparing to normal fetuses, suggesting that fetal adipose tissue is a major source of leptin [18].

Variations in how maternal-placental-fetal leptin exchange occurs influence fetal development and may contribute to the

increased risk of developing certain diseases in adulthood.

Thus, these values correlate with the degree of restriction of fetal growth caused by altered placental function, which makes leptin can be considered a marker of the degree of impairment of fetal growth [19].

Therefore, a better understanding of the role of leptin during development is important as it could help the prevention and treatment of several disease conditions that may occur in adulthood [20].

## Conclusions

Measuring the abdominal circumference at 11-14 weeks of pregnancy is a simple method capable of predicting the average serum levels of leptin that is correlated with a series of pregnancy complications.

Higher serum leptin levels were found in the group of pregnant women with abdominal obesity comparing to the group without abdominal obesity, but a positive correlation between abdominal circumference and the leptin values was found only at 11-14 weeks of pregnancy.

## Conflict of interests

None to declare.

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