

Study of the Relationship between Myeloperoxidase Enzyme, Ghrelin Hormone, and Relaxin Hormone Levels in Blood Serum During Late-Stage Pregnancy

Khalid Walid Rashid and Nadia Ahmed Saleh

*Chemistry Department, College of Education for Pure Sciences, Tikrit University, 34001 Tikrit, Salah Al-Din, Iraq
kw230037pep@st.tu.edu.iq , nadea.saleh@tu.edu.iq*

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Abstract: To study the effect of levels of amyeloperoxidase, ghrelin, and relaxin on the late stages of pregnancy in pregnant women, and to study the correlation between the study variables. To identify potential factors that may lead to oxidative stress in pregnant women during the late stages of pregnancy. Amyeloperoxidase is classified as an oxidoreductase enzyme, belongs to the peroxidase family, and contains a heme group. It is found primarily in neutrophils and lymphocytes, as well as in monocytes and macrophages. Approximately 30% of cellular amyeloperoxidase is secreted as an active enzyme into the extracellular fluid, along with several antimicrobial factors at the site of inflammation, through the lysis of neutrophils. The study included collecting 90 blood samples, from patients and healthy individuals, during the period from 14/1/2024 to 14/2/2024 from pregnant women in the final stages of pregnancy. The samples were collected from Al-Yarmouk Teaching Hospital, Department of Obstetrics and Gynecology, Baghdad. The samples included 60 patient samples and 30 healthy samples representing the control group. The results were analyzed using an ELISA device, which went through several steps, including preparing the ready-made measurement kit containing antigens for the variables under study. Then, the blood serum containing the antibodies was added, where the reaction process was carried out. The serum was then washed several times, and the results were placed in the device for the purpose of reading the absorbance at a wavelength of 450 nm. Research results: The research results showed a significant increase in the level of the enzyme amyeloperoxidase and a decrease in the levels of both relaxin and ghrelin hormones. The current results indicate that there is no correlation between the enzyme myeloperoxidase and both relaxin and ghrelin.

1 INTRODUCTION

The final stages of pregnancy include the third trimester. The mother's body and fetus undergo significant changes in preparation for childbirth. During this stage, [1]. the pregnant woman's weight increases, and she may feel more tired and exhausted. Oxidative stress may play an important role in the final stages of pregnancy, resulting in an imbalance between free radicals and antioxidants in the body [2]. The enzyme amyeloperoxidase is primarily found in white blood cells and plays an important role in the immune response by producing free radicals to fight infection. [3]. It also contributes to oxidative stress if it is present in excess. Its levels may rise in the final stages of pregnancy due to increased immune system activity in preparation for childbirth. Amyeloperoxidase is the only enzyme in the peroxide

family capable of reducing chloride ions to hypochlorous acid, an oxidizing agent that plays an important role in the immune system. However, excessive production of hypochlorous acid is a risk factor because it can oxidize many biological molecules. [4]. The hormone relaxin plays a prominent role in the final stages of pregnancy, as it contributes to preparing the body for childbirth by relaxing and stretching the pelvic ligaments and joints, which contributes to facilitating the process of dilating the birth canal during labor.

It also helps soften and gradually dilate the cervix in preparation for childbirth [5]. The hormone ghrelin plays an important role in stimulating appetite and regulating food consumption. It is a peptide hormone known as the hunger hormone, secreted by glandular cells in the stomach, as well as in smaller quantities from the small intestine and pancreas. It affects the mother's appetite and energy needs, as the mother's

energy needs are essential in the final stages of pregnancy to support fetal growth, and ghrelin levels may change in response [6]. Ghrelin has prokinetic effects in the gastrointestinal tract and is believed to play an important role as an anti-inflammatory [7].

2 MANUSCRIPT PREPARATION

The current project was approved by the Scientific Committee at Tikrit University, College of Education for Pure Sciences, Department of Chemistry, in coordination with the Baghdad Health Department and Yarmouk Teaching Hospital, and conducted from 14 January to 14 February 2024. Blood samples were collected from 60 participants, including 30 pregnant women in their third trimester (study group) and 30 non-pregnant women (control group). From each participant, 5 mL of venous blood was drawn into gel tubes. Serum was separated by centrifugation at 3000 rpm for 20 minutes and stored at -20°C until analysis. Serum levels of myeloperoxidase enzyme and other study variables were quantified using a sandwich ELISA kit (SUNLONG Biotech, China). The assay procedure involved antigen-antibody binding, enzyme-conjugated detection, and reaction termination with an acidic stop solution. Absorbance was measured at 450 nm, and analyte concentrations were calculated against standard curves.

All data were analyzed statistically using (SPSS Statistical) using a computer and through the digital data program described. Microsoft Excel 2013 program and using 21.0 and the arithmetic mean and standard deviation values were obtained as well as the correlation coefficients were obtained.

3 RESULTS

3.1 Amyloperoxidase

This study assessed the relationship between pregnant women and the control group and their amyloperoxidase activity levels. Statistical analysis was then conducted on samples from the pregnant and control groups. The results of our study indicated a significant increase in amyloperoxidase activity in the pregnant group compared to non-pregnant women, as shown in Figure 1, Table 1.

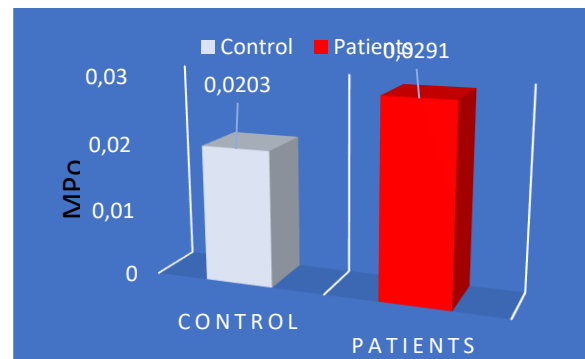


Figure 1: The activity of the enzyme amyloperoxidase in the blood serum of healthy and sick pregnant women.

Table 1: The levels of study variables in the serum of pregnant and non-pregnant women.

Group Parameters	Control	Patients	P-Value
Amyloperoxidis	0.02±0.01	0.029±0.021	p<0.05
Relaxin	0.08±0.03	0.091±0.035	p>0.05
Ghrelin	225.26±25.10	226.40±27.27	p>0.05

3.2 Relaxin

When conducting a study on the level of relaxin hormone in pregnant and non-pregnant women, it was found that there were no significant differences in the relaxin hormone in pregnant women compared to non-pregnant women, as shown in Figure 2 and Table 1.

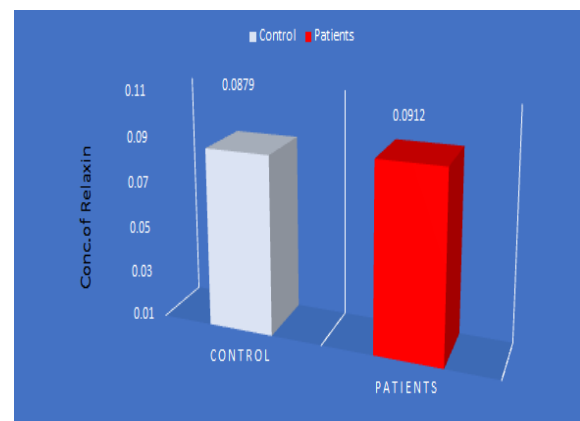


Figure 2: Level of relaxin hormone in the blood serum of healthy and sick pregnant women.

3.3 Ghrelin

The results of our current study indicated that there was no change in the level of the ghrelin hormone in pregnant women and non-pregnant women, as the results showed no significant differences in the ghrelin hormone in pregnant women compared to non-pregnant women, as shown in Figure 3 and Table 1.

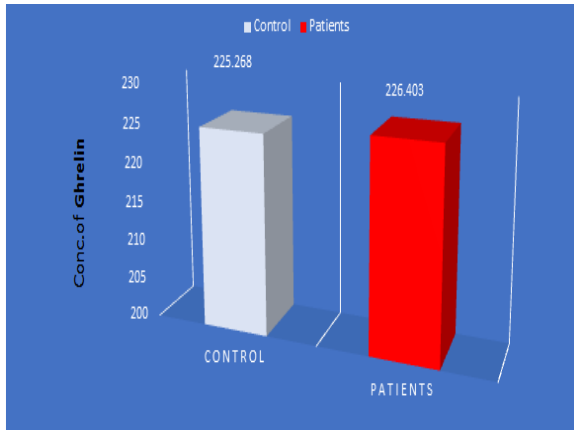


Figure 3: The level of ghrelin hormone in the blood serum of healthy and sick pregnant women.

3.4 Correlation Relationships

When studying the correlation relationships between the two enzymes, amyloperoxidase, our results showed that there were no significant correlation relationships between the enzyme amyloperoxidase and the hormone relaxin, as shown in Figure 4.

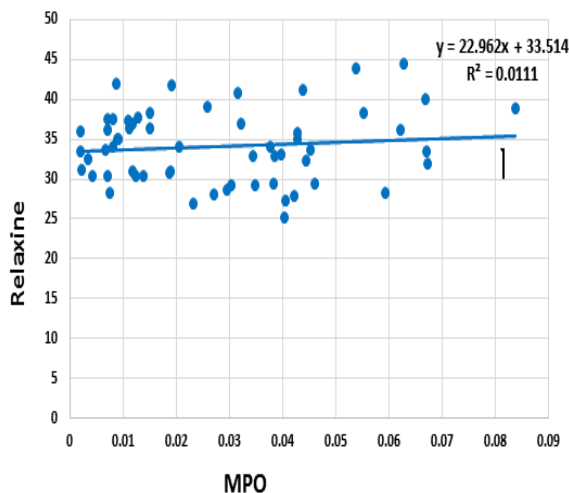


Figure 4: The relationship between the activity of amyloperoxidase and the hormone relaxin.

When studying the correlation relationships between amyloperoxidase enzymes, our results showed that there were no significant correlation relationships between the amyloperoxidase enzyme and the hormone ghrelin, as shown in Figure 5.

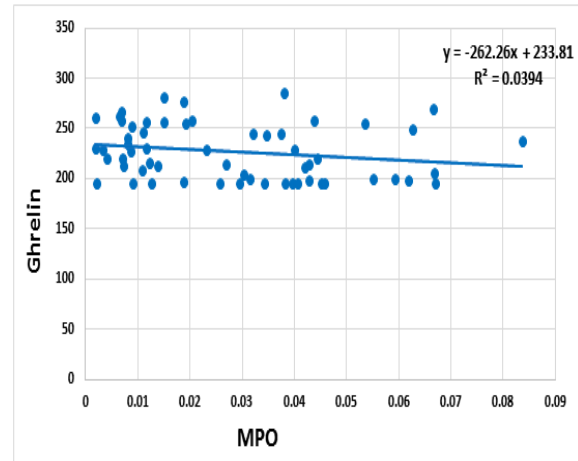


Figure 5: The relationship between the activity of amyloperoxidase and the hormone ghrelin.

The relationship between amyloperoxidase, an enzyme produced primarily by immune cells and acting as an antioxidant, and the hormone ghrelin, which regulates energy expenditure, and the hormone relaxin, which controls relaxation levels, has been studied. A study by Tsakonas [8] and Goodge et al. showed an increase in amyloperoxidase levels, which is consistent with our current study. The results showed that amyloperoxidase levels increase in pregnant women during the later stages of pregnancy and decrease in non-pregnant women. This is attributed to amyloperoxidase activity, which is under the influence of estrogen [9]. Amyloperoxidase is released outside the cells as an active enzyme into the fluids at inflamed sites. The hormone ghrelin is a peptide growth hormone and has been released. It has the nickname "hunger" [10]. Apart from its effect on growth hormone, it has many important biological actions such as regulating the autonomic nervous system Gupta et al. noted a decrease in ghrelin levels in pregnant women and suggested that there are factors controlling beta-glucose hyperplasia of the pancreas, and that changes in insulin and glucose sensitivity are responsible for the decrease in ghrelin. This study is inconsistent with our current study. A study by Jesse et al. indicated that relaxin levels increase in pregnant women in the seventh week of pregnancy and peak in the later stages of pregnancy and during labor. This is due to an increase in the corpus luteum, which is secreted in the final days of

pregnancy and helps relax the cervix and uterine ligaments during labor. This study does not resemble the results of our study [10].

A study by Duan et al. reported a significant increase in relaxin levels in the serum of pregnant women compared to the control group. There is evidence that maternal vasodilation persists after delivery and also reduces the risk of hypertension relaxin hormone in the serum of (patients) pregnant women compared to the control group. There is evidence that the expansion of the mothers' blood vessels continues after birth and also reduces the risk of developing high blood pressure in the next pregnancy and reduces the risk of developing cardiovascular diseases later in life. This study differs from our current study. There is a significant increase in the activity of the myeloperoxidase enzyme and a decrease in the hormone ghrelin and the hormone relaxin in the sera of pregnant women patients in the last stages of pregnancy compared to healthy people.

A study by Duan et al. reported a significant increase in relaxin levels in the serum of pregnant women compared to the control group. There is evidence that maternal vasodilation persists after delivery and also reduces the risk of hypertension [11]. in subsequent pregnancies and cardiovascular disease later in life. This study differs from our current study [12]. Gupta and others pointed out that there is a decrease in the hormone ghrelin in pregnant women and explained that there are factors that control the enlargement of the beta pancreas and changes [13] in insulin and glucose sensitivity that are responsible for the decrease in the hormone ghrelin. This study does not agree with our current study [14].

4 CONCLUSIONS

This study provides important insights into the biochemical changes that occur in the blood serum of women during the late stages of pregnancy. Specifically, the focus was placed on investigating the activity of myeloperoxidase (MPO), an enzyme associated with oxidative stress and immune activation, as well as two important regulatory hormones - ghrelin and relaxin - which are involved in metabolic balance and reproductive physiology, respectively. Through the clinical study of a number of vital variables that were conducted on the sera of pregnant women patients in the last stages of pregnancy, with partial purification of the MPO enzyme and a study of some of its kinetic properties,

the following conclusions were reached in this myeloperoxidase. Oxidative stress in pregnant women in the late stages of pregnancy leads to an increase in the level of the enzyme Amyeloperoxidase. increases oxidative stress when elevated Ghrelin may have an antioxidant role, but its effect depends on the mother's metabolic state Relaxin may reduce oxidative stress, but its impact depends on its balance in the body.

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