IRAQI Academic Scientific Journals
Samarra Journal of Pure and Applied Science
SJPAS
www.sjpas.com
p ISSN: 2663-7405
e ISSN: 2789-6838

Comparison study of some physiology and immunological parameter in hypertension patients

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https://doi.org/10.54153/sjpas.2024.v6i2/2.759

Article Information
Received: 14/11/2023
Revised: 20/12/2023
Accepted: 25/12/2023
Published: 30/08/2024

Keywords:
Hypertension, interleukin 2, interleukin 1 beta, interleukin 17, irisin

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Abstract

High blood pressure is the most common chronic condition associated with a persistent increase in systolic blood pressure above 140 mm Hg and/or diastolic blood pressure above 90 mm Hg. This study aims to compare patients with recently diagnosed high blood pressure to healthy, disease-free individuals to ascertain the impact of the hormone irisin and the immunological response in these individuals This study was conducted on two groups: the first group consisted of 50 males and female patients suffering from high blood pressure as a primary pathology, and the second group consisted of 40 male and female control group, and their ages were between (20-50) years. The level of interleukins and the physiological hormone irisin were measured using ELISA device technology. The results of the study showed that there was a significant increase with statistical evidence ($P \geq 0.01$) in the level of interleukin (IL-2, IL-1β, and IL-17) and the hormone irisin compared to the control group. It was concluded that there was a direct relationship between the level of the hormone Irisin in high blood pressure patients compared to healthy people. Also, there was a direct relationship between immune variables and high blood pressure patients compared to healthy people.

Introduction:

High blood pressure is defined as persistently high blood pressure (systolic pressure > 140 mmHg and/or diastolic pressure > 90 mmHg), these are values of ABPM (130-80 mmHg) or HBPM (135-85 mmHg) Blood pressure values are used to diagnose the disease, and the same classification is used in younger, middle-aged, and elderly people. [1] t is the single largest contributor to the global burden of disease and is increasing annually, affecting an estimated 1.39 billion people worldwide and causing 10.4 million premature deaths annually due to this disease [2]. Globally, the prevalence of high blood pressure is increasing, and a substantial proportion of individuals go undiagnosed or struggle with insufficient blood pressure management. A 2017 multinational cross-sectional study revealed that 35% of individuals had high blood pressure [3], High blood pressure is a significant global health concern, impacting millions. The Global Burden of Disease study identifies it as a primary risk factor, causing numerous cases and deaths [4], Hypertension leads to serious health issues like stroke, heart attacks, and more, potentially causing long-term mortality [5], Lifestyle

changes can help control blood pressure, but pharmaceutical treatments are crucial when lifestyle adjustments fall short in managing hypertension. [6]. Blood pressure is regulated by various cardiovascular parameters, including blood volume, cardiac output (the heart's pumping capacity), and arterial tone influenced by intravascular volume and neuro humoral systems.[7] The likelihood of developing hypertension rises with age, primarily due to the gradual stiffening of arterial vessels attributed to factors such as changes in vascular collagen and increased atherosclerosis. [8], A comprehensive medical history should encompass the timing of the initial hypertension diagnosis, current and past blood pressure readings, and the use of antihypertensive medications.[9] ,The physical examination's objectives include diagnosing hypertension, assessing target organ damage, and identifying secondary causes. Blood pressure should be measured on both arms, and differences exceeding 20 mm Hg in systolic blood pressure or 10 mm Hg in diastolic pressure warrant further investigation for vascular abnormalities. An average of 2 to 3 blood pressure measurements on 2 to 3 separate occasions provides accurate estimates [10]. Primary hypertension is typically asymptomatic, necessitating regular blood pressure measurements for all adults during clinic visits. Since 2010, out-of-office blood pressure monitoring methods have gained prominence for hypertension diagnosis and treatment guidance. Diagnosis often relies on repeated measurements in clinical settings [11]. Home blood pressure monitoring (HBPM) and ambulatory blood pressure monitoring (ABPM) are non-clinical methods. HBPM involves individuals measuring their blood pressure at home, while ABPM records blood pressure regularly over a 24-hour period during daily activities, enhancing hypertension diagnosis and treatment guidance [12].

Materials and Methods

The study was conducted in which (90) samples were collected from males and females in the morning, while they were fasting and had not eaten anything, and they were divided into two groups. The first group was (50) male and female patients who suffer from high blood pressure that is essentially pathological and not hereditary, newly diagnosed as a result of their unhealthy lifestyle, for example, they eat a large amount of fat and also take a percentage of their weight, and they do not suffer from other chronic diseases. They exercise infrequently and have never undergone surgery. The second group is the control group (40 individuals, male and female). Five milliliters of blood was drawn intravenously from hypertensive patients and healthy controls, and samples were collected from Salah al-Din General Hospital and some external medical laboratories. The ages of the patients ranged between (20-50) years. Interleukin 2 and interleukin 1 beta were measured and their relationship with high blood pressure was measured using measuring tools. A ready-made kit from the American company SUNLON based on ELISA technology using the Huma Reader device.

Body Mass Index (BMI)

Using a tape measure for height and a scale for weight, this measurement includes height and weight for both male and female patients as well as healthy individuals. It also includes the body mass index (BMI) and weight in kilograms divided by the square of height in meters (kg/m2), following the methodology described by [13 -14] The following law was used to compute the body mass.

$$\text{BMI} = \frac{Weight(kg^2)}{Height(m^2)}$$

Statistical analysis

In this study, the results of physiological and immunological blood pressure and ELISA tests were subjected to statistical analysis using the Minitab-17 statistical program. One-way analysis of variance (ANOVA) was used, and Duncan-test multiple comparisons test was used at the (0.01) probability level to compare significant differences between the means of the current study groups. Descriptive statistics were used to extract the mean and standard error. [15]

Results and discussion

Body Mass Index (B M I)

The results showed Table 1 that the value of underweight in patients with high blood pressure was higher by (23.9) kg/m2 compared to the control group (18) kg/m2, and the value of normal weight in patients with high blood pressure was (28.9) kg/m2, which is higher compared to the control group (24) kg/m2, and there was overweight in Hypertension patients reached (35) kg/m2, which was higher compared to the control group (29) kg/m2.

Table 1: The association between hypertension and BMI.

kg/m2	Control	Patients
G1 (Underweight)	18	23.9
G2 (normal weight)	24	28.9
G3 (Overweight)	29	35

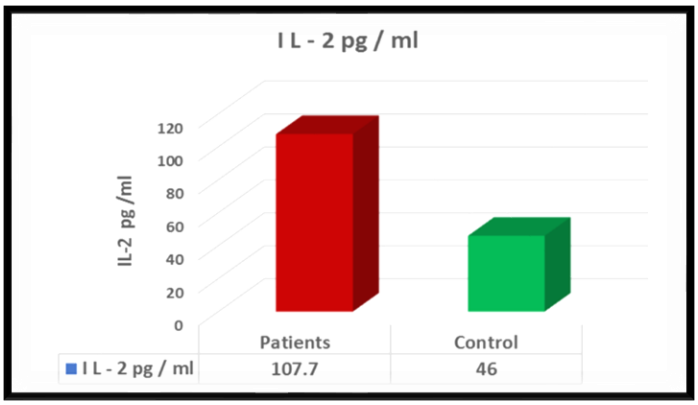


Fig. 1 Assessment Serum IL-2 (p g/ml) in Studied Groups.

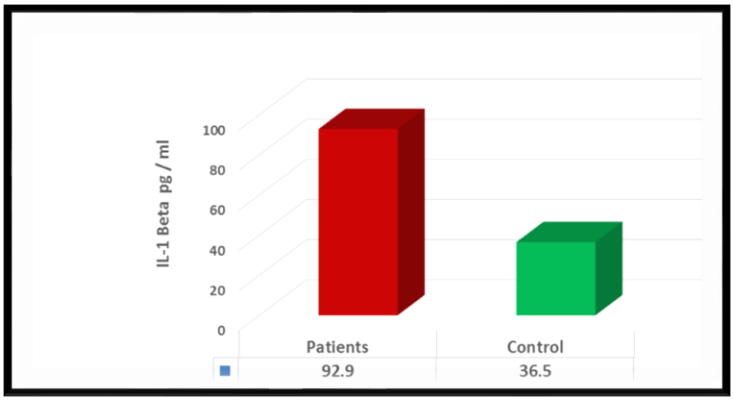


Fig. 2 Assessment Serum (Level of IL-1β pg/ml) in studied groups.

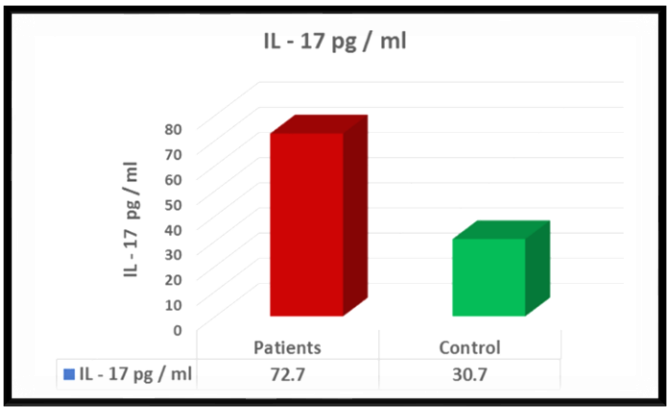


Fig. 3 Assessment of total irisin in studied groups.

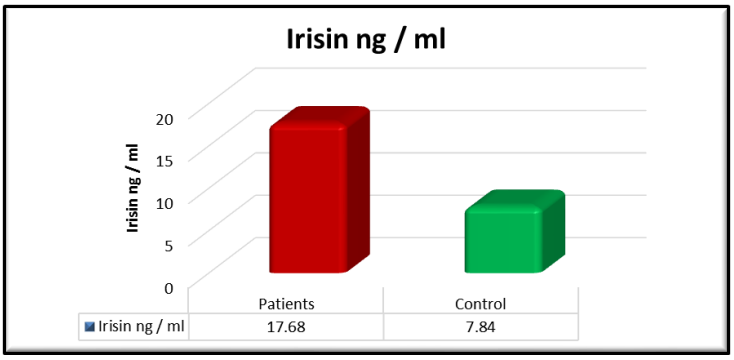


Fig. 4 Assessment of total irisin in studied groups.

The results of the study in Table 4 showed that there was a significant increase in the level (P ≥0.01) of immunological activity of interleukin- 2, interleukin- 1 beta, and interleukin-17 in people with high blood pressure compared to the control group.

interleukin 2

The table shows a significant increase in the concentration of interleukins in the serum of individuals diagnosed with high blood pressure, compared to the control group. The results showed an increase in the level of interleukin 2 in patients with high blood pressure, reaching (107.7±12.7) pg/ml, and the level of IL-2 was (46.0±10.9) pg/ml in the control group, with a statistically significant (P ≥0.01) and the strength of the significant difference between (T test = 9.25**).

interleukin-1 beta

The results showed an increase in the level of interleukin-1 beta in patients with high blood pressure, reaching (92.9±12.8) pg/ml compared to healthy people who do not suffer from high blood pressure, which is (36±6.52) pg/ml, with statistical significance (P ≥ 0.01 and the strength of the significant difference between (T test =6.76**).

IL-17

The results showed an increase in the level of IL-17 in patients with high blood pressure up to (72.7±10.3) pg/ml compared to healthy controls (30.7±5.71) pg/ml, with a statistically significant (P ≥0.01) and the strength of the significant difference between (T test =6.09**).

I R I S I N

The results of the analysis performed, as shown in (Figure 4.12) and Appendix (4), reveal a statistically significant increase in the levels of irisin (P ≥ 0.01) and the strength of the significant difference between (T-test = 6.05**) in individuals with high blood pressure. (17.68 ± 3.12) compared to individuals in the control group (7.84 ± 1.25) ng/m.

It showed in (Table 2) (a positive relationship between irisin and interleukin 1 beta, where the correlation amount was R = 0.170 ,0.029), while it showed (a negative relationship between irisin and interleukin 17, the amount of correlation R = -0.188-0.124). Also, (a negative relationship between irisin and interleukin 2 was the amount of correlation R = -0.092, -0.216).

There was in (Table 3) (a negative relationship between interleukin 17 and interleukin A, the extent of the correlation of the R value =-0.065, -0.062) and a (relationship between interleukin 17 and interleukin 2, the extent of the correlation of the R value =-0.115, -0.099)

Table 2: Correlation coefficient (r) between the hormone irisin with all variables in patients with high blood pressure compared to control.

	P.Irisin	C.Irisin
IL-17	-0.188	-0.124
IL-2	-0.092	-0.216
IL-1 Beta	0.170	0.029

Table 3: Correlation coefficient (r) between the hormone IL-17 with all variables in patients with high blood pressure compared to control.

	P.IL-17	C.IL-17
IL-2	-0.115	-0.099
IL-1 Beta	-0.065	-0.062

Table 4: of the value of immune variables and the hormone irisin in patients with high blood pressure compared with the control group

IL-1β	Cases	N	Mean	Std. deviation	T test	P-Value
	Control	40	36.5	±6.52	6.76**	0.01
	Patients	50	92.9	±12.8		
IL-17	Control	40	30.7	±5.71	6.09**	0.01
	Patients	50	72.7	±10.3		
IL-2	Control	40	46.0	±10.9	9.25**	0.01
	Patients	50	107.7	±12.7		
IRISIN	Control	40	7.84	±1.25	6.05**	0.01
	Patients	50	17.68	±3.12		

The value represents the mean ± standard deviation
N=Number of samples
P= Patients
C= Control group

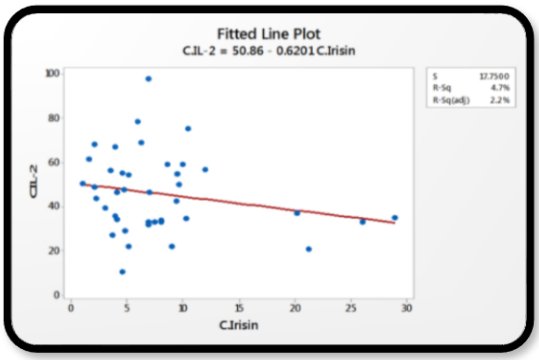


Fig. 5 Relationship between IL-2 and Irisin.

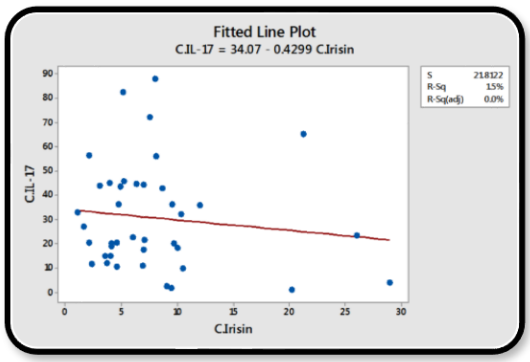


Fig. 6 Relationship between Irisin and IL-17.

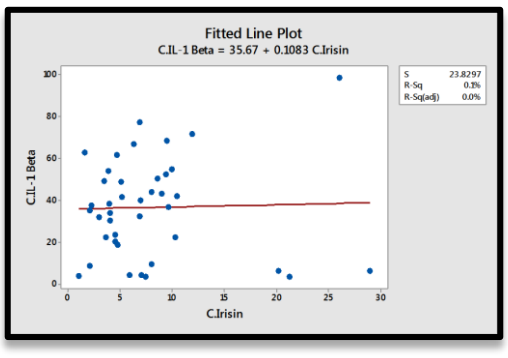


Fig. 7 Relationship between IL-1 Beta and Irisin.

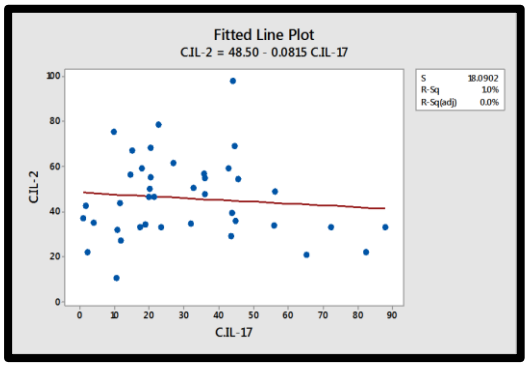


Fig. 8 Relationship between IL-2 and IL-17.

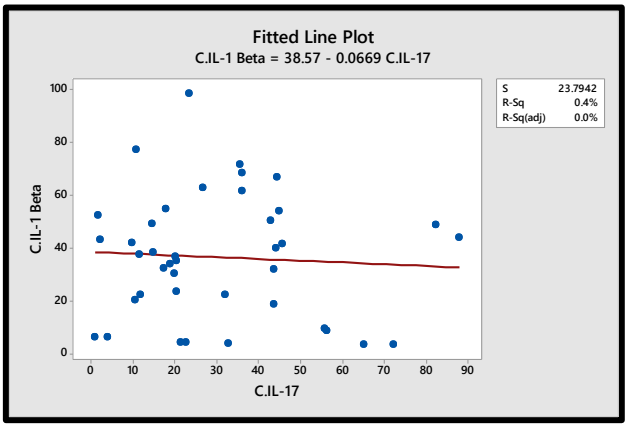


Fig. 9 Relationship between IL-1 Beta and IL-17.

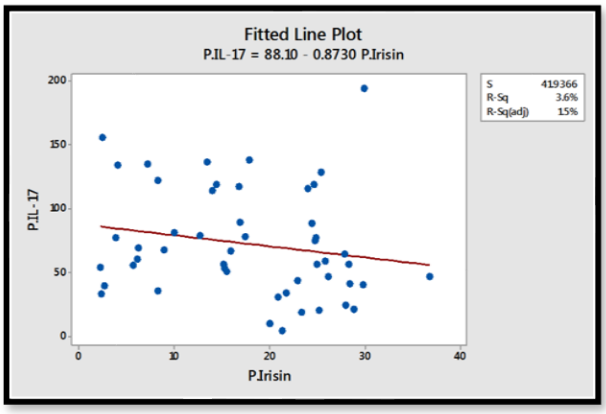


Fig. 10 Relationship between Irisin and IL-17

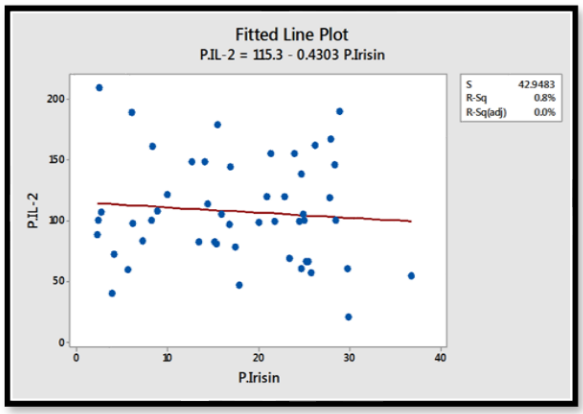


Fig. 11 Relationship between Irisin and IL-2.

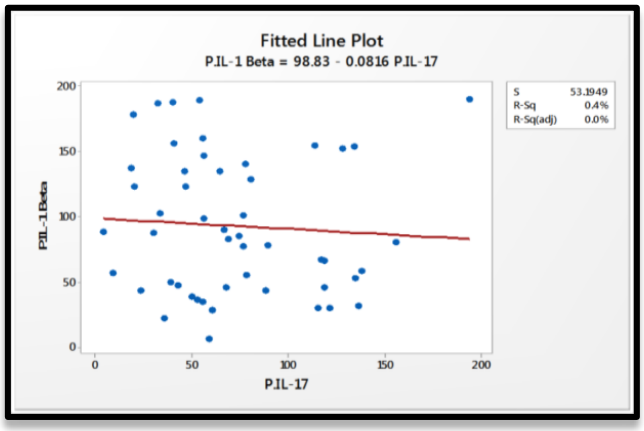
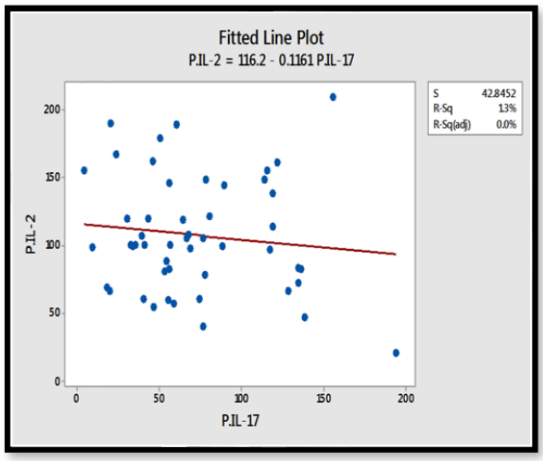


Fig. 12 Relationship between IL-17 Beta and IL-1β.



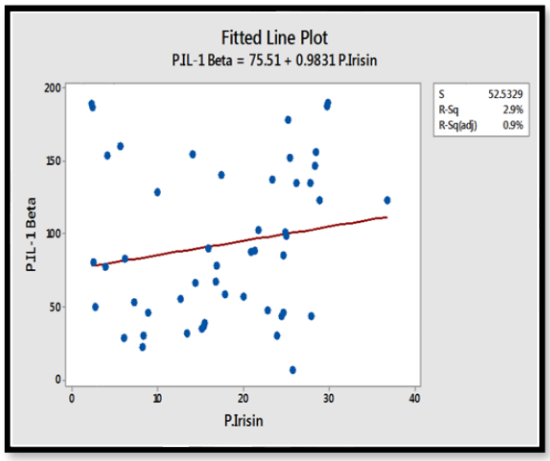


Fig. 13 Relationship between IL-17 and IL-2. **Fig. 14** Relationship between Irisin Beta and IL-1β

Discussion

The results of the current study agreed that there is an association between BMI and blood pressure [16], and increases in BMI have been associated with increased blood pressure and cardiovascular events, highlighting the need for improved preventive strategies as well as medications and treatments. Lifestyle modifications to prevent high blood pressure. Body mass index (BMI) is positively associated with blood pressure (BP); This association has critical implications as hypertension becomes more prevalent and obesity increases. A greater understanding of the association between BMI and BP is required to determine its impact and develop strategies to mitigate it [17].

As mentioned in the study conducted by [18], the role that IL-2 plays in hypertension is still not directly known. IL-2 is a series of cytokines produced by activated T cells and plays a critical role in maintaining immune tolerance. However, IL-2 production leads to high blood pressure. compared to hypertensive individuals through the survival and proliferation of regulatory T cells. This physiological study shows that IL-2 has a high ability to promote T-cell proliferation and differentiation, as it was originally called T-cell growth factor (TCGF). IL-2 has a crucial role in antigen activation of T cells. Since IL-2 is produced primarily by activated T cells, it occurs through the interaction of activated CD4 T helper cells, as well as the activation of CD8 T cells. An immune response occurs [18].

Through a study in which I clarified the physiology of interleukin-2, there is a study that showed a relationship between the CD4T helper cell and an important role in the pathophysiological mechanisms underlying high blood pressure resulting from T cells [19].

This study agreed that IL-1β levels, both circulating and intravascular, are elevated in individuals with hypertension [20].

Interleukin-1 beta, a cytokine inside the IL-1 family, has received attention in the context of high blood pressure. It is produced mainly by immune cells, including monocytes, T cells, and neutrophils. (IL-1β) plays a role in promoting inflammation and is linked with pro-inflammatory genes, contributing to tissue damage and events such as hypertension and myocardial infarction. Recent research has identified elevated levels of IL-1β in the serum of individuals with primary hypertension, suggesting its involvement in blood pressure raising.

Furthermore, (IL-1β) not only triggers direct inflammatory responses but also influences vascular smooth muscle cells, leading to vascular remodeling. Through both inflammatory-dependent and independent mechanisms. Studies investigating IL-1β inhibitors, like Anakinra, have demonstrated their ability to reduce systolic blood pressure and peripheral vascular resistance, underscoring IL-1β's impact on hypertension progression [21].

The present study established an association between IL-17 and hypertension, suggesting that pro-inflammatory immune responses may begin to increase even when blood pressure (BP) is below the hypertensive range. This finding suggests that assessing serum IL-17 level in individuals with hypertension could enhance predictive and prognostic value in the context of hypertension. The study results underscore the importance of further research in this area, as high levels of IL-17 are significantly associated with blood pressure and immune function, which may provide insights into the early stages of hypertensive conditions.

The immune system plays a crucial role in regulating inflammation, and this has major implications for high blood pressure [22].

The current study agreed that the mechanisms of action of IL-17 in human vascular diseases are the subject of ongoing research. However, increased production of interleukin 17 has been found in vascular diseases in humans. Regulatory T cells produce interleukin 17, which is the mechanism by which inflammation and autoimmunity, or auto inflammation, lead to the development of hypertension [23].

One study agreed with our current study that increased circulating irisin was associated with higher blood pressure [24].

As mentioned in the study conducted by [25-26], since hypertension is a recognized systemic inflammatory condition. Previous studies have indicated a relationship between irisin levels and inflammatory markers [27, 28]. Moreover, irisin acts as an endogenous anti-inflammatory hormone, protecting against lung and heart injury [29, 30]. Thus, increased irisin levels in individuals with hypertension could be a response to the inflammation associated with hypertension, providing insight into maintaining homeostasis [31].

Studies have also indicated a relationship between the level of irisin and the level of inflammatory factors, suggesting its anti-inflammatory properties. Therefore, there is a special need for research into the mechanisms of action of irisin. Macrophages, as important cells in the first line of our immune defense, play an important role in eliminating pathogens and recruiting other cells to the site of persistent inflammation. However, in some pathological conditions, such as obesity, for example, their excessive activation can lead to mild inflammation and thus associated disease development [31].

(Anti-inflammatory hormone) (In vitro studies in macrophages have shown that iresin regulates the activation of immune cells. It enhances the activity and reproduction of phagocytes, improves their phagocytic ability [32].

Conclusion

1 - There was a very significant increase in the concentration of interleukin beta 1 in hypertensive patients compared to the control group

2- The level of interleukin 2 in the serum was significantly higher in patients with high blood pressure

3- There is a relationship between them in terms of the immune response in patients with high blood pressure

4- The level of interleukin 17 immune response was very high compared to healthy people

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IRAQI Academic Scientific Journals
Samarra Journal of Pure and Applied Science
SJPAS
مجلة سامراء للعلوم البحتة والتطبيقية
www.sjpas.com
p ISSN: 2663-7405
e ISSN: 2789-6838

دراسة مقارنة لبعض العوامل الفسيولوجية والمناعية لدى مرضى ارتفاع ضغط الدم

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معلومات البحث:
تأريخ الاستلام: 2023/11/14
تاريخ التعديل: 2023/12/20
تأريخ القبــول: 2023/12/25
تاريخ الـنشر: 2024/08/30
الكلمات المفتاحية:
ارتفاع ضغط الدم، انترلوكين 2، انترلوكين 1 بيتا،انترلوكين 17 ,هرمون الايريسين

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الخلاصة:
ارتفاع ضغط الدم هو الحالة المزمنة الأكثر شيوعًا المرتبطة بالزيادة المستمرة في ضغط الدم الانقباضي فوق 140 ملم زئبق و/أو ضغط الدم الانبساطي فوق 90 ملم زئبق. تهدف هذه الدراسة إلى مقارنة المرضى الذين تم تشخيصهم حديثا بارتفاع ضغط الدم بأفراد أصحاء وخاليين من الأمراض للتأكد من تأثير هرمون الإيريسين والاستجابة المناعية لدى هؤلاء الأفراد. أجريت هذه الدراسة على مجموعتين: المجموعة الأولى تكونت من 50 ذكرا والمرضى الإناث الذين يعانون من ارتفاع ضغط الدم كمرض أولي، وتكونت المجموعة الثانية من 40 مجموعة ضابطة من الذكور والإناث، وتراوحت أعمارهم بين (20-50) سنة. تم قياس مستوى الإنترلوكينات وهرمون الإيريسين الفسيولوجي باستخدام تقنية جهاز ELISA. أظهرت نتائج الدراسة وجود ارتفاع معنوي بالدلالة الإحصائية ($P \geq 0.01$) في مستوى الإنترلوكين (IL-2، βIL-1، وIL-17) وهرمون الإيريسين مقارنة بمجموعة السيطرة. وقد تم التوصل إلى وجود علاقة مباشرة بين مستوى هرمون الإيريسين لدى مرضى ارتفاع ضغط الدم مقارنة بالأصحاء. كما أن هناك علاقة مباشرة بين المتغيرات المناعية ومرضى ارتفاع ضغط الدم مقارنة بالأصحاء.