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Study Interplay Between Asprosin with Vitamin D in Metabolic Syndrome

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Abstract

Objective: The study aims to in investigating the role of the asprosin hormone and its relationship with Vitamin D in patients with metabolic syndrome and clinical parameters.

Methods: The study included measurement asprosin hormone, Vitamin D, and some biochemical variable levels in metabolic syndrome patients with age matching to the control group (35–65 years). The study includes (95) samples of metabolic syndrome patients [49 female, 46 males] who were attending the abdominal consultation unit at the Ibn Sina Teaching Hospital in Mosul, Iraq. MetS were diagnosed in compliance with the criteria of the NCEP (ATP III) and AHA/NHLB. Samples were collected during the period from January 2021 to December 2021. Also, the study was carried out on 76 samples of apparently healthy (40 female, 36 male) as a control group.

Results: The findings revealed a significant increase in the concertation of the asprosin hormone in metabolic syndrome patients compared to the control group. Also, it has been found that was a significant increase in the concertation of fasting glucose, insulin, homeostasis model for insulin resistance (HOMA-IR), Triglycerides, low-density lipoprotein-cholesterol, very low-density lipoprotein-cholesterol, total cholesterol and urea. In addition to a decline in high-density lipoprotein cholesterol, non-high-density lipoprotein cholesterol (Non-HDL), (HOMA-B), Vitamin D and Calcium among metabolic syndrome patients. There is also a significant inverse correlation between asprosin hormone with the Vitamin D.

Conclusion: The study concluded that the hormone asprosin is a good indicator that reflects the status of metabolic syndrome patients and Vitamin D appeared to be associated with MetS, as well as the Insulin resistance (IR) and lipid profile.

Keywords: Asprosin, Vitamin D, metabolic syndrome, obesity, insulin resistance

Introduction

The simple concept of 'metabolic syndrome' (MetS) is a clustering of risk factors for diabetes and cardiovascular disease.[1] The metabolic syndrome is a collection of linked risk factors with metabolic origins that seem to actively encourage the onset of atherosclerotic cardiovascular disease (ASCVD), diabetes mellitus type 2 and dyslipidemia, which includes increased plasma glucose and apolipoprotein B (apoB) and serum triglyceride levels, are the most generally acknowledged metabolic risk factors.[2-3]

Another studies on metabolic syndrome persons show elevated blood pressure and a reduced level of High-density lipoprotein-cholesterol (HDL-C), prothrombotic, and proinflammatory states.[4] Indeed, of the metabolic risk factors–elevated triglyceride, low HDL-C, and hypertension or elevated glucose are well-known, significant risk factors[5,3] Even when just slightly aberrant, as is frequently seen in metabolic syndrome, each increases the risk.[6]

Asprosin is associated with metabolic syndrome through its relationship with insulin resistance, obesity, inflammation, glucose and lipid metabolism, as well as in other diseases such as diabetic retinopathy, polycystic ovary syndrome, and anorexia nervosa.[7-8]

Asprosin is a fasting-responsive orexigenic protein hormone that increases the liver's ability to release glucose and stimulate the hypothalamus to appetite, it was originally discovered in patients with newborn progeroid syndrome by Romere et al.[9]

These patients do not have asprosin, they discovered. As a result, scientists came to the conclusion that asprosin could affect how lipids and carbohydrates are metabolized.[10]

Also, It has been shown that a major level of Vitamin D (Vit. D) is associated to a lower extent with metabolic syndrome, hyperglycemia, abdomen obesity and dyslipidemia.[11]

Vitamin D (Vit. D) is important for regulating osteoarticular homeostasis.[12] HypoVitaminosis D, a risk factor for reducing both bone mass and the atherosclerotic process which increases with age, It is a potential link between low Vitamin D levels and an increased risk of cardiovascular disease also, showed a correlation between obesity, arterial hypertension, glucose intolerance, and dyslipidemia are all linked to low Vitamin D levels.[13-14]

This study aimed to measure asprosin level, Vitamin D, and relationship with clinical parameters in serum of metabolic syndrome patients participating in this study.

Materials and Methods

Ethical Approval

This study was approved by the ethical committee of the Nineveh health direction training center and human development, ministry of health and environment, Iraq. Informed written consent was obtained from all the participants before sample collection.

Research Objects

This study included (95) samples of metabolic syndrome patients [49 female, 46 males] aged between 35 and 65 years, the Samples were collected during the time period from the beginning of August 2021 to the end of December 2021.

All the samples were randomly selected from MetS patients who were attending the abdominal consultation unit

at the Ibn Sina Teaching Hospital in Mosul. MetS were diagnosed in compliance with the criteria of the NCEP (ATP III) = National Cholesterol Education Program (Adult Treatment Panel III) and AHA/NHLB = American Heart association/ National Heart, Lung and Blood Institute (has been in compliance with the criteria that included waist circumference, blood lipids, blood pressure(BP) and fasting glucose).[15]

Also, the study was carried out on the control group consisting of samples [76] healthy group [40 female, 36 male], whom they did not have (MetS), diabetes, or high blood pressure, as well as no taking any medication, they were carefully selected after a complete physical examination and laboratory tests and who match the age and body mass index with the patients.

The data collected included age, gender, family medical history. Using an automated blood pressure measuring system, systolic and diastolic pressures were measured twice, with average results used.and the subject's blood pressure was taken after they had been sat for at least 5 minutes.[16] The body mass index (BMI) was calculated using the formula (weight in kg/ height in m^2).

After overnight fasting [12 hours] five milliliters of venous blood were obtained from the participants, and the serum was isolated by centrifuged for 10–15 minutes at 4000 (rpm) to get the serum that was separated and frozen in aliquots at –20°C until used.

Laboratory Analysis

The serum **Asprosin hormone:** was measured by using an ELISA kit from SUN LONG Biological Technology Co., Ltd kit (China).[17]

Insulin hormone was measured by using (ELISA) technique (Sandwich using Monobind kit (USA).

Vitamin D (ng/ml): was measured by using Electrochemiluminescence (ECL) kit by Cobas e411 analyzers, Also, **Calcium (mmol/L)** was estimated using BIOSYSTEM kit (Spain) and **Blood urea (mmol/L)** was estimated using BIOSYSTEM kit (France).

The levels of **glucose, total cholesterol, TG, and HDL** were estimated using ready-made assay (kits) from the company (BIOLABS) and using enzymatic methods, the concentration of anther clinical parameters in serum was calculated using the following equation

LDL-C (mmol/l) = Total cholesterol-HDL-C-(TG/2.2)
VLDL-Cholesterol conc.(mmol/L) = T.G/2.2
Non-HDL-C = Total cholesterol-HDL-C[18]
Atherogenic Index (AI) = Log (TG/HDL-C)
Atherogenic coefficient (AC) = TC-HDL-C/HDL-C
HOMA-IR = insulin (μU/ml) × glucose(m mol/L)/22.5[19]
HOMA-β (%) = insulin (μU/ml) × 20/(glucose (mmol/L) -3.5)[20]

Data Analysis

The obtained data were analyzed using Originpro 2021

1. Standard statistical procedures were used to obtain the mean and standard error.
2. The *t*-test is used to compare two parameters.
3. *P*-Value ≤ 0.05 was assumed statistically significant.
4. To determine the relationship between various clinical data, linear regression analysis [Pearson correlation coefficient (*r*)] was carried out.

Results

Baseline Parameter Comparison

As displayed in (Table 1) Controls and MetS groups. Mets patients exhibited significantly increased BMI, waist circumference, systolic blood pressure (SBP), diastolic blood pressure (DBP), total cholesterol (TC), triglyceride (TG), low-density lipoprotein-cholesterol (LDL-C), VLDL-C, Atherogenic Index, Atherogenic coefficient and lower Non-high-density lipoprotein cholesterol (Non-HDL) and high-density lipoprotein cholesterol (HDL-C) than those of the controls ($P < 0.001$).

The results in (Table 2) detected a significant increase at ($P < 0.001$) in the concentration of glucose, insulin, and insulin resistance but a decrease in homeostasis model assessment for beta-cell function, (HOMA-β) in metabolic syndrome patients as compared with the control group.

The results demonstrate that (Table 3) also showed that Mets patients had a significantly at ($P < 0.001$) decrease in calcium and Vit. D concentration compared to the control group.

Table 1. **General clinical and anthropometric characteristics of controls and MetS groups**

Variables	Controls means ± SE	MetS means ± SE	*P*-value
No. of subjects	76	95	–
Gender, M/F	36/40	46/49	0.001
Age (years)	44.3 ± 7.6	48.1 ± 5.9	0.05
Waist circumference (cm)	88.4 ± 5.5	97.7 ± 7.3	0.001
BMI (kg/m^2)	25.8 ± 1.9	29.7 ± 3.5	0.001
SBP (mm Hg)	125.3 ± 13.1	141.2 ± 14.5	0.001
DBP (mm Hg)	78.4 ± 7.9	91.5 ± 6.1	0.001
TC (mmol/l)	4.21 ± 0.4	6.45 ± 0.9	0.001
TG (mmol/l)	1.21 ± 0.5	3.45 ± 0.7	0.001
LDL cholesterol (mmol/l)	2.46 ± 0.2	3.95 ± 0.8	0.001
HDL cholesterol (mmol/l)	1.18 ± 0.1	0.90 ± 0.1	0.001
Non-HDL cholesterol (mmol/l)	3.08 ± 0.34	5.55 ± 0.99	0.001
VLDL-C (mmol/L)	0.54 ± 0.2	1.57 ± 0.3	0.001
Atherogenic Index (AI)	3.68 ± 0.59	6.64 ± 1.35	0.001
Atherogenic coefficient (AC)	2.72 ± 2.50	6.16 ± 9.9	0.001

Table 2. **Glucose metabolism in control and MetS groups**

Clinical parameters	Control means ± SE	MetS means ± SE	*P*-value
F.B.S (mmol/L)	4.8 ± 0.47	6.42 ± 0.35	0.001
Insulin	8.23 ± 5.22	18.1 ± 7.77	0.001
HOMA-IR	1.78 ± 0.71	3.97 ± 0.83	0.001
HOMA-β	116.88 ± 12.38	81.41 ± 35.03	0.001

Also, showed an increase significantly at ($P < 0.001$) for urea concentration in Mets patients compared to the control group.

The concentration of Asprosin hormone and Vitamin D in the control group compared with metabolic syndrome Patients

The findings in (Table 4) demonstrated that the asprosin hormone's normal concentration was (53.8 ± 3.7) ng/L in the healthy control group and there is an increased concentration of asprosin hormone (65.6 ± 4.4 ng/l) for metabolic syndrome patients groups at $P \leq 0.0001$.

Table 4 indicate that there is an increased concentration of asprosin hormone for control and metabolic syndrome patients groups at $P \leq 0.0001$ based on BMI.

Table 5 findings revealed that the concentration of Vitamin D was (40.3 ± 2.4 ng/ml) in the healthy control group and there is a decreased concentration of Vitamin D (20.4 ± 1.8 ng/ml) for metabolic syndrome patients groups at $P \leq 0.0001$.

Tables 5 indicate that there is an decreased concentration of Vitamin D for control and metabolic syndrome patients groups at $P \leq 0.0001$ based on BMI.

Table 3. **Vitamin D, Calcium, and Urea Concentration in Control and MetS groups**

Clinical parameters	Control means ± SE	MetS means ± SE	*P*-value
Vitamin D (ng/ml)	40.3 ± 2.4	20.4 ± 1.8	≤0.001
Calcium (mmol/L)	2.22 ± 0.1	1.91 ± 0.4	≤0.001
Urea (mmol/L)	4.92 ± 0.9	8.22 ± 0.7	≤0.001

Tables 4. **Comparison of the levels of asprosin hormone based on BMI**

Asprosin (ng/L)			
Variables	**Control means ± SE**	**MetS means ± SE**	***P*-value**
Underweight	36.7 ± 3.7	27.2 ± 4.8	≤0.001
Normal weight	45.9 ± 3.2	66.8 ± 4.2	≤0.001
Overweight	58.8 ± 2.7	74.1 ± 5.1	≤0.001
Obese	71.9 ± 3.2	88. 9 ± 2.8	≤0.001
Total	53.8 ± 3.7	65.6 ± 4.4	≤0.001

Table 5. **Comparison of the levels of vitamin D based on BMI**

Vitamin D (ng/ml)			
Variables	**Control means ± SE**	**MetS means ± SE**	***P*-value**
Underweight	52.13 ± 2.3	29.9 ± 1.6	≤0.001
Normal weight	43.35 ± 1.2	22.34 ± 1.2	≤0.001
Overweight	36.22 ± 2.2	17.70 ± 1.9	≤0.001
Obese	30.09 ± 4.2	11.35 ± 2.4	≤0.001
Total	40.3 ± 2.4	20.4 ± 1.8	

Correlation between Asprosin hormone and Vitamin D concentration and some clinical parameters in Mets patients:

Table 6 explains that adiposity-related indicators and Vitamin D had a favorable correlation with each other (BMI and waist circumference) at $P < 0.01$, and also found the same relationship with an asprosin hormone.

The results show that asprosin and Vitamin D concentration had a positive relationship with Fasting glucose, Insulin, HOMA-IR, LDL-cholesterol, total cholesterol, triglyceride and a negative correlation with HDL-C, concentration in patients, as well as a negative correlation with non–HDL-C and Atherogenic coefficient concentrations in patients.

Discussion

The clinical parameters in Mets patients group compared to the control group, can be explained by the fact that these results consistent with the literature that patients with metabolic syndrome have a high BMI or waist circumference[21-22] with increased blood pressure, lipid profile (triglycerides), and decrease (HDL), (non-HDL-C) they are a symptom of metabolic syndrome.[23-24]

Also, these results were consistent with another study. Mets caused significant increases in the proportion of glucose in the blood in a response to insulin resistance due to the rise in (FFA) in the blood, which causes hyperlipidemia.[25-26] Also, cells compensate for insulin resistance by secreting more insulin, which leads to hyperinsulinemia, and these tissues are less sensitive to insulin actions because they are full of fat, and excessive insulin production causes an imbalance in pancreatic beta cells which may explain the low in beta cell function. Pathological conditions that are distinctive to MetS include dyslipidemia and hyperglycemia, which are critical in the development of the condition.[27-28]

Table 6. **Correlation between Asprosin hormone and vitamin D concentration and some clinical parameters in Mets patients**

Clinical parameters	Asprosin hormon *r*-value	Vitamin D *r*-value
Asprosin with vitamin D	0.035	0.035
Waist circumference (cm)	0.171*	0.16*
BMI (kg/m^2)	0.206*	0.06 *
SBP (mm Hg)	0.102	0.25
DBP (mm Hg)	0.111	0.22
TC (mmol/l)	0.022 *	0.015*
TG (mmol/l)	0.251*	0.38 *
HDL-C(mmol/L)	-0.194 *	-0.21 *
LDL-C(mmol/L)	0.012*	0.012*
non –HDL-C	-0.31*	-0.29*
Atherogenic coefficient	-0.21*	-0.27*
F.B.S(mmol/L)	0.302*	0.175*
Insulin	0.002*	0.31*
HOMA-IR	0.316*	0.113*

*significant at *P* 0.5

Low risk of metabolic syndrome is connected with high blood calcium levels. The show that dietary Ca consumption is inversely related to the prevalence of MetS.[29-30]

Mets caused significant increases in urea, this result was consistent with another study.[31] Metabolic syndrome (MetS) is an independent risk factor for chronic kidney disease (CKD). Through a variety of processes, including stimulation of the renin-angiotensin system Evidence strongly suggested that blood asprosin levels were considerably raised in MetS, which was consistent with the results of researchs.[32-33] Based on BMI, MetS blood asprosin levels were considerably greater than those of controls.[18] and the lowest asprosin concentrations were seen in underweight people. These findings indicate a correlation between asprosin levels and obesity since asprosin levels rise as body mass index (BMI) rises.[19-20]

The results explain (Campbell and Drucker,) HypoVitaminosis D and the metabolic syndrome (MetS), that show a disorder marked by the presence of central obesity, arterial hypertension, and altered lipid and glucose metabolism, may be related, according to a number of studies. Lower 25(OH)D concentrations were independently linked to a higher risk of MetS, according to many studies.[34-36] Low risk of metabolic syndrome is connected with high blood calcium levels. The results show that dietary Ca consumption is inversely related to the prevalence of MetS.

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Conclusion

This study investigates the interaction of Vit D, asprosin hormones together in MetS. The results revealed there is a significant positive correlation in Vit D, asprosin with BMI in MetS and control group.

A significant rise in the asprosin, HOMA IR, TC, TG, LDL-C, Atherogenic Index, Atherogenic coefficient, blood pressure and urea in MetS.

A significant low in the Vit D, (HOMA-β), Non-HDL, (HDL-C), and calcium in MetS.

Conflict of Interest

None.

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