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Original Research Article

Association of Blood Pressure and Biochemical Parameters with Adiposity in Women

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ABSTRACT

Modifications in lifestyle have an impact on the incidence of metabolic disorders such as the development of type 2 diabetes, dyslipidemias and metabolic syndrome (MS) that aggravate the risk of developing cardiovascular diseases (CVD). The objective of this study was to evaluate blood pressure, biochemical and anthropometric parameters of a group of women assisted at the medicine Ambulatory at University of Marilia – Marilia – São Paulo - Brazil. Biochemical and anthropometric parameters as well as blood pressure were evaluated. Our results showed that the presence of hypertension was associated with altered values for lipids, glycaemia and anthropometric parameters. The levels of triglycerides, glycaemia and anthropometric parameters are higher in patients with altered values for total cholesterol. We may also observe that only values for WC are higher in patients with altered values for triglycerides. Patients with high values of glycaemia showed significant higher values for BMI and WC. In patients with altered values for BMI we may observe altered values for lipids, glycaemia and WC. For high values for WC we observe higher values for triglycerides, glycaemia and BMI. The results of our study showed that increased values of glycaemia, total cholesterol, triglycerides, WC, and BMI are related to increase in the cardiovascular risk. The distribution of adipose tissue in these patients evidences the accumulation of visceral fat and obesity which generates drastic metabolic alterations in this group. In addition, the prevalence of increased levels of triglycerides and glycaemia demonstrates the possible role of obesity in these changes.
Key words: glycaemia; lipids; body mass index; waist circumference; cardiovascular risk.

INTRODUCTION

Modern societies have achieved more benefits and comfort for the day to day, but these advantages have led to profound modifications in the way of life. The transition between the search for the food (and the consequent energy expenditure) for easy access to industrialized and ready-to-eat foods that usually contain high sugar and fat contents was quickly observed. Allied to this, there was also a drastic reduction in the practice of physical activity. Consequently, there was an increase in overweight and obesity worldwide. [1-3]

These lifestyle changes have an impact on the incidence of metabolic disorders such as the development of type 2 diabetes, dyslipidemias and metabolic syndrome (MS) that aggravate the risk of

developing cardiovascular diseases (CVD), which are the most common chronic-degenerative diseases related to mortality. Moreover, the increase in visceral adiposity and the resistance to insulin action lead to an increase in oxidative stress and generate a low-grade inflammatory process that will result in an increase in metabolic changes leading to non-cardiovascular diseases such as other endocrine disorders and cancer. [4-6]

Changes in the lipid and glycemic profile and visceral fat deposition are related to food consumption. Several studies have associated dietary pattern with cardiovascular risk factors and demonstrate that a healthy diet reduces the risk of resistance to insulin, MS and CVD. Changes in diet and regular practice of physical activity modify the metabolic and inflammatory profile, leading to an equilibrium that expands the quality and life expectancy of the patient. [7-10]

The variation in the body weight and adiposity can be evaluated by anthropometric measures that are commonly used in the assessment of body adiposity due to its practicality and low cost. Body mass index (BMI) is the most widely used measure and epidemiological studies show its clear association with elevated mortality. Parameters of obesity, such as waist circumference (WC) measurement and waist / hip ratio, are able to indirectly estimate intra-abdominal fat that reflects the visceral adipose tissue mass, which generates insulin resistance. The WC is considered the main diagnostic parameter of MS. [2, 11-12]

The objective of this study was to evaluate blood pressure, biochemical and anthropometric parameters of a group of women assisted at the medicine Ambulatory at University of Marilia – Marilia – São Paulo - Brazil.

METHODS

The work is a sectional study that encompassed 30 women aged 20 to 54 years randomly selected and was performed at the "AmbulatórioMédico de Especialidades da Universidade de Marília – UNIMAR", state of São Paulo, Brazil, and was approved by the Research Ethics Committee of UNIMAR. Patients were only included in this research after signing the consent form (Resolution 196/10 of October 1996 – National Health Council – CNS). The experimental protocols were in accordance with the *Ethical Standards of the Institutional Ethics Committee and the Helsinki Declaration* of 1975 (revised in 2008). Patients should not be pregnant or breastfeeding; use medications such as steroids, appetite suppressants, anxiolytics, antidepressants or appetite stimulants; and present hypothyroidism and hyperthyroidism.

The anthropomorphic measurements of weight, height and waist circumference (WC) were obtained following the techniques recommended by Gibson [13] using the digital scale (FILIZOLA®) with capacity for 150 kg properly calibrated and a fixed stadiometer (SECA®), positioned in a flat place and constituted by metric scale. Subsequently, the body mass index (BMI) was calculated.

Blood samples were collected by venipuncture to determine the plasma levels of total cholesterol, LDL-c, HDL-c, triglycerides and glycaemia.

Blood pressure (BP) was evaluated according to the diagnostic criteria of the "2014 evidence-based guideline for the management of high blood pressure in adults". [14]

Statistics

Statistical analysis was performed using the Bioestat 5.0 program. The comparisons of the parametric data were made by Student's test and the non-parametric by the Mann Whitney test. The significance level adopted was 5% ($p < 0.05$).

RESULTS AND DISCUSSION

The presence of hypertension may also be associated with altered values for lipids, glycaemia and anthropometric parameters as we may see in Table 1.

Table 1: Triglycerides, total cholesterol, glycaemia, Body Mass Index (BMI) and Waist circumference (WC) according to the presence of Hypertension.

Parameters	Hypertension	
	Yes	No
Triglycerides	195.7 ± 24.8 (B) [1]	175.3 ± 13.1 (A)
Total cholesterol	201.2 ± 24.8 (A)	191.8 ± 42.1 (A)
Glycaemia	94.8 ± 17.2 (B)	83.7 ± 8.8 (A)
BMI	37.7 ± 6.4 (B)	26.5 ± 4.2 (A)
WC	99.3 ± 14.5 (B)	84.0 ± 10.7 (A)

[1]Means followed by at least one same letter do not statistically differ. BMI: Body Mass Index. WC: Waist Circumference.

The values of triglycerides, glucose, BMI, and WC were markedly higher in hypertensive patients (Table 2). Furthermore, the distribution of adipose, mainly the accumulation of visceral fat and obesity, is also related to enhance the action of the Sympathetic Nervous System in patients with hypertension. [15-17]

The modern lifestyle, with a large decrease in physical activity in general, has profoundly influenced the prevalence of hypertension in the population. By the year 2025, about 30% of adults around the world are believed to be hypertensive. [18-22] Physical inactivity may contribute with the risk of developing hypertension that is considered the major modifiable risk factor for cardiovascular morbidity and mortality and is itself associated with cardiovascular complications. Our data are in agreement with several authors that have been demonstrated the association among sedentary lifestyle and risk factors for Cardiovascular Disease and Metabolic Syndrome (MS). [23-24]

Table 2: Association between biochemical and anthropometric parameters.

Parameters	Total cholesterol	
	< 200	≥ 200
Triglycerides	180.9 ± 21.8 (A)[1]	202.8 ± 21.6 (B)
Glycaemia	84.3 ± 10.5 (A)	98.9 ± 17.3 (B)
BMI	29.7 ± 6.9 (A)	± 6.2 (A)
WC	89.8 ± 14.0 (A)	99.2 ± 15.2 (B)
	Triglycerides	
	< 150	≥ 150
Total cholesterol	204.3 ± 38.8 (A)	196.8 ± 33.0 (A)
Glycaemia	86.6 ± 12.8 (A)	92.0 ± 16.3 (A)
BMI	28.2 ± 9.6 (A)	31.9 ± 6.0 (A)
WC	83.0 ± 14.4 (A)	96.4 ± 14.5 (B)
	Glycaemia	
	< 100	≥ 100
Triglycerides	187.1 ± 17.3 (A)	204.0 ± 38.5 (A)
Total cholesterol	194.3 ± 34.8 (A)	218.0 ± 9.0 (A)
BMI	29.3 ± 5.6 (A)	39.4 ± 4.4 (B)
WC	89.8 ± 12.9 (A)	111.8 ± 9.6 (B)

[1]Means followed by at least one same letter do not statistically differ. BMI: Body Mass Index. WC: Waist Circumference.

Table 2 shows that the levels of triglycerides, glycaemia and anthropometric parameters are higher in patients with altered values for total cholesterol. We may also observe that only values for WC are higher in patients with altered values for triglycerides. Patients with high values of glycaemia showed significant higher values for BMI and WC.

In patients with altered values for BMI we may observe altered values for lipids, glycaemia and WC. For high values for WC we observe higher values for triglycerides, glycaemia and BMI (Table 3).

Table 3: Association between anthropometric and biochemical parameters.

Parameters	BMI	
	< 25	≥ 25
Triglycerides	169.0 ± 13.1 (A) [1]	193.9 ± 23.8 (B)
Total cholesterol	177.0 ± 34.1 (A)	203.0 ± 31.8 (B)
Glycaemia	83.0 ± 8.2 (A)	92.7 ± 16.5 (B)
WC	73.6 ± 5.4 (A)	98.3 ± 12.8 (B)
Parameters	WC	
	< 88	≥ 88
Triglycerides	176.8 ± 13.8 (A)	197.3 ± 25.1 (B)
Total cholesterol	190.8 ± 40.4 (A)	203.2 ± 27.2 (A)
Glycaemia	84.4 ± 8.4 (A)	95.6 ± 18.0 (B)
BMI	25.1 ± 3.7 (A)	35.4 ± 12.8 (B)

[1]Means followed by at least one same letter do not statistically differ. BMI: Body Mass Index. WC: Waist Circumference.

Hypercholesterolemia is a clinical condition interrelated to oxidative stress, insulin resistance, hyperglycemia and obesity. A common feature of these disorders present in MS is impairment of endothelial function. In addition, high cholesterol levels are a direct cause of atherosclerosis, which is a chronic inflammatory disease with a multifactorial etiology that manifests itself in response to endothelial aggression, mainly affecting the intimate layer of medium- and large-caliber arteries. [7, 17, 25]

Aggression to the vascular endothelium involves several risk factors such as dyslipidemia, hypertension or smoking. Increased permeability of the intima to the lipoproteins present in plasma is one of the consequences of endothelial dysfunction, in order to facilitate the retention of the same in the sub-endothelial space. The retention of the cholesterol particles and the subsequent oxidation

expose several immunogenic spots, which are targets of low-grade chronic inflammatory response and prothrombotic stimuli. This pathophysiological process occurs in balance with the increase in circulating plasma cholesterol levels. [26-27]

The increase in the WC is also related to the MS in order to cause drastic metabolic alterations and high cardiovascular risk. In addition, the prevalence of increased triglycerides in patients with increased WC also demonstrates the central role of obesity in these changes. Triglycerides with concentrations higher than 150 mg/dL in association with central obesity and hypercholesterolemia increase the systemic inflammatory response in order to predispose the activation of the atherogenesis process and cardiovascular complications. They are considered markers of atherogenic lipoproteins, being particularly important in the process of dyslipidemia, insulin resistance and type II diabetes. [28-29]

There is a well-established association between obesity and the development of a cascade of events that lead to inflammation and insulin resistance. Central obesity, marked by the accumulation of visceral fat, is directly related to the high values of BMI and WC. The dysfunctional adipose tissue generated by obesity is a pathological key in the process of metabolic diseases, with insulin resistance being the main disorder. It is also the main risk factor for the development of type 2 diabetes mellitus, in addition to deficiency of lipid metabolism and increased cardiovascular risk. [30-32]

The abdominal accumulation of body fat predicts metabolic disorders that are fundamental in the composition of MS, such as dyslipidemia and insulin resistance. BMI is the most widely used anthropometric measure for assessing body adiposity, and epidemiological studies show its clear association with elevated mortality. The high BMI, in association with the high values of WC, triglycerides and total cholesterol constitute a pathophysiological substrate of MS and an important risk factor for CVD. [17, 33-35]

The immune cells present in adipose tissue, mainly visceral accumulation, are predominantly macrophages. Authors say these cells are the primary effectors of the insulin resistance, and one of the key mechanisms involving in the increase of expression of genes encoding pro-inflammatory cytokines, thus representing the pathophysiological substrates of obesity. This condition induces significant endocrine and metabolic dysfunctions in adipose tissue, leading to an increase in the synthesis of adipokines such as the transformation growing factorβ (TGF-β), the Monocyte Chemotactic Protein (MCP-1), the Tumor Necrosis Factor α(TNF-α), Interleukin-6 and Leptin, which are intrinsically related to insulin resistance. In addition, the synergistic action of all these adipokines leads to reduced levels of adiponectin, and consequently, a decrease in anti-inflammatory and anti-insulin resistant action. The increase in adipokines has an impact not only on the various organ functions but it is also strongly related to increased cardiovascular risk. [12, 36-38]

Visceral fat deposition has also been associated with elevations in triglyceride levels, decrease in HDL-c levels and increase in systolic blood pressure and fasting glycaemia. [17, 29, 39-40]

The presence of the components of the MS is associated with an increased risk of cardiovascular and diabetes-associated morbidity and mortality. The increase in the BMI and WC that are related to the increase in the amount of visceral fat, associated with a chronic inflammatory process predisposes to the development of arteriosclerosis. Furthermore, the MS risk factors are also linked to non-cardiovascular diseases such as cancer as well as psychiatric or endocrine disorders. [18, 29]

CONCLUSION

The results of our study showed that increased values of glycaemia, total

cholesterol, triglycerides, WC, and BMI are related to increase in the cardiovascular risk. The distribution of adipose tissue in these patients evidences the accumulation of visceral fat and obesity which generates drastic metabolic alterations in this group. In addition, the prevalence of increased levels of triglycerides and glycaemia demonstrates the possible role of obesity in these changes.

Therefore, it is important to study these parameters in several segments of the population to know the metabolic profiles so that the research may help in the prevention and improvement of the quality and life expectancy of these patients.

Conflict of Interests

Authors declare no conflict of interests.

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