INSULIN SENSITIVITY AND INSULIN RESISTANCE IN PEOPLE WITH AND WITHOUT METABOLIC SYNDROME – A CASE-CONTROL STUDY

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Abstract
Metabolic syndrome is a group of risk factors that includes obesity, insulin resistance, hypertension, and dyslipidemia. Insulin resistance is an important part of the syndrome. We present a study for the evaluation of insulin resistance in metabolic syndrome, compared to a control group. The study included 401 apparently healthy individuals, chosen randomly. It is observed that people with metabolic syndrome have hyperinsulinemia in about 60.2% of individuals, and 39.8% of them had normal values. People with metabolic syndrome had higher insulin resistance that the one without the syndrome. In conclusion, metabolic syndrome is a potential for cardio metabolic disorders. Insulin resistance plays a major role in it through various mechanisms. Compared to individuals without metabolic syndrome, people with MS have higher insulinemia and lesser insulin sensitivity with create an ideal environment for metabolic disease to develop.

Keywords: insulin – metabolic syndrome – insulin resistance – obesity

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Introduction:

Metabolic syndrome is a group of risk factors that includes obesity, insulin resistance, hypertension, and dyslipidemia. The syndrome, even though was first described since the 1960s, was introduced as a new concept, in 1988 when Gerald Reaven introduced what he called "Syndrome X," an collection of independent, coronary heart disease risk factors presented in the same individual[1].

As seen from the description above, insulin resistance is an important part of the syndrome. It is identified as an impaired biologic response to insulin stimulation of target tissues, primarily the liver, muscle, and adipose tissue. Insulin resistance is primarily an acquired condition related to excess body fat, though genetic causes are identified as well. Clinically, insulin resistance is recognized via the metabolic consequences associated with insulin resistance as described in metabolic syndrome and insulin resistance syndrome.

We present a study for the evaluation of insulin resistance in metabolic syndrome, compared to a control group.

Materials and methods

The study included 401 apparently healthy individuals living in the city of Tirana aged 25-55. They were chosen randomly, from different neighborhoods. Participants in the study were volunteers. No gender differences were made.
In the study were excluded: Pregnant women. Individuals with Liver disease, Chronic renal disease, Cardiac disease, Peripheral artery disease, Cerebral vascular diseases, Depression, Diabetes Mellitus. People treated with chemotherapy; People who use alcohol, People who are treated with corticosteroids or antihypertensive or anticoagulants.
The prevalence of metabolic syndrome was determined based on the IDF (International Diabetes Federation) criteria as follow[2]:

Central obesity (waist circumference >94cm for men and >80cm for women), plus two of the four factors:

- Triglyceride level increase>150 mg/dl
- HDL cholesterol<40 mg/dl in men and <50 mg/dl in women
- Systolic pressure>=130mmHg or diastolic pressure above 85mmHg
- Fasting glucose>100mg/dl

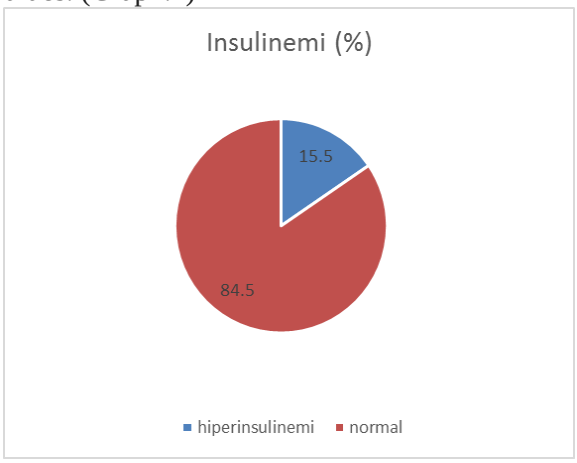
BMI was calculated using the formula body weight in kg and height in meters.
BMI= Weight (kg)/ [height (m)] ^{2}

Abdominal circumference was measured below the navel in the standing position.
Determination of insulin resistance was done with the HOMA index (Homeostasis model assessment). Homa – IR = blood glucose /mmol x insulinemia /22.5 (Where 22.5 is a constant).
It was evaluated as insulin resistance when HOMA was >3,
QUICK (quantitative insulin sensitivity check index) 1/(log fasting glycemia (mg/dl)+log fasting insulinemia (microUI/ml), varies from 0.45 to 0.30. The smaller the number is, the greater the insulin resistance and the lower the insulin sensitivity are.

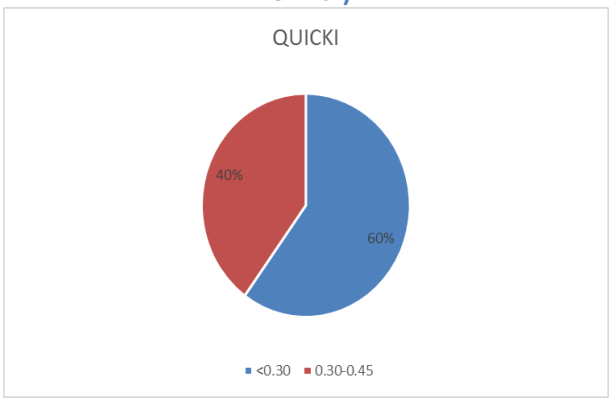
Statistical analysis: Continuous data were presented in mean value and standard deviation. Discrete data were presented in absolute value and percentage. Differences between two groups for continuous quantitative variables were studied with the student's test. Differences between groups for discrete variables were performed using the Chi-square test. Relationships between variables were analyzed using Pearson's correlation coefficients (when the variables are quantitative). Data presentation was performed using simple and composite tables, as well as through graphs. The data analysis was performed with the statistical package SPSS, version 20, (Statistical Package for Social Sciences). Values of $p \leq 0.05$ were considered significant.

Results

In the group of people whose insulinemia and insulin sensitivity were determined, it turned out that 15.5% of them had hyperinsulinemia, while 84.5% of these individuals had normal insulinemia values. (Graph.1)



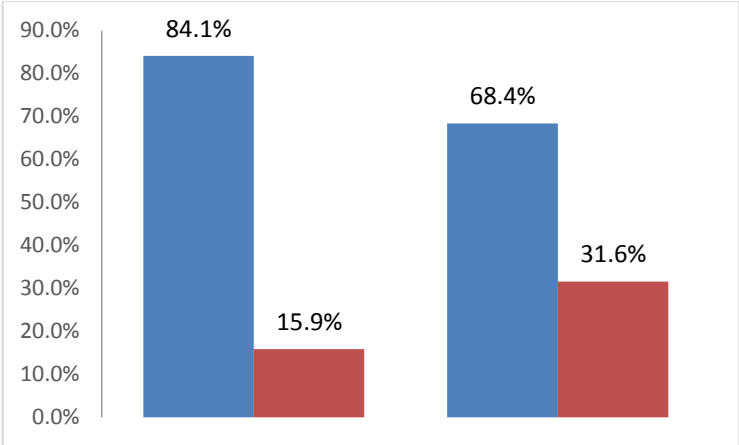
Graph. 1 Percentage of insulinemia in participants (blue – hyperinsulinemia, red – normal)



Graph. 2 QUICK based values of insulin sensitivity in participants

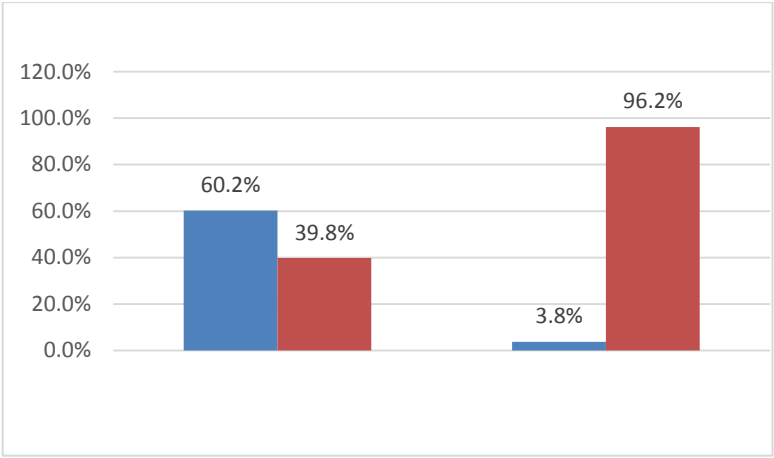
The results of our study show that 60% of the people who took part in the study have low insulin sensitivity and only 40% of these individuals have sensitivity in the normal values (based on QUICK). (Graph 2)

Regarding insulin resistance and insulin sensitivity in comparison between the two groups, we found these data. In our study, it was observed that among people with metabolic syndrome, 84.1% of them presented insulin resistance and 15.9% of them were not insulin resistant, compared to people without metabolic syndrome. (Graph 3)



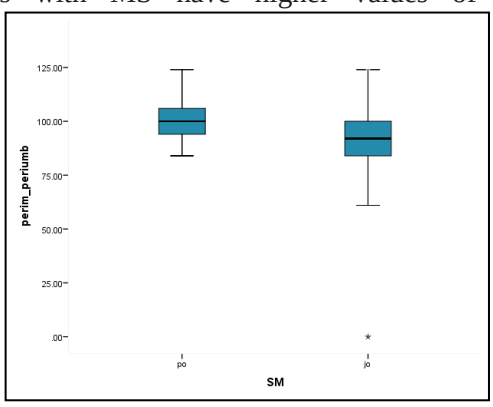
Graph. 3 Insulin Resistance in MS (first columns) vs Non MS (second columns), blue- insulin resistant, red – non resistant

It is observed that people with metabolic syndrome have hyperinsulinemia in about 60.2% of individuals, and 39.8% of them had normal values. While in people without metabolic syndrome, only 3.8% of them had hyperinsulinemia and 96.2% had normal insulinemia values. (Insulinemia > 20 is considered hyperinsulinemia). (Graph 4)

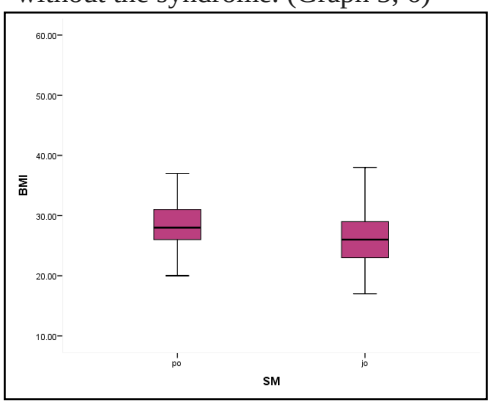


Graph. 4 Insulinemia in MS (first columns) vs Non MS (second columns), blue (hyperinsulinemia, red-normal)

The graphs below show our data for each criterion of people with metabolic syndrome (MS) compared to those without metabolic syndrome. Individuals with MS have higher values of abdominal circumference compared to individuals without metabolic syndrome. As well, BMI values in people with MS were higher than in people without the syndrome. (Graph 5, 6)



Graph. 5 Abdominal circumference in MS



Graph. 6 BMI in MS

Discussion

Insulin Resistance is an important factor contributing to metabolic syndrome and therefore to cardiometabolic disorders which can lead to illness and potential life hazard. It is part of the syndrome but it can be found even in individuals without the other risk factors. In the early stages of insulin resistance, the pancreas compensates by increasing the secretion of insulin into the bloodstream in an attempt to overcome defects in peripheral insulin action. In response to this increased demand for insulin production, the β-cells hypertrophy. Tissue accumulation of bioactive lipid species in peripheral tissues activate proinflammatory signaling pathways which are shown to impair insulin signal transduction. The molecular activitity inside the cell produce high level of insulin in the bloodstream which cause a chain reaction in the metabolic syndrome.[3] In order to evaluate the key role of insulin in MS we followed two groups: one with metabolic syndrome individuals and one apparently healthy people. In our study we compared between groups the level of insulin, insulin resistance and insulin sensitivity.

The gold standard for measurement of insulin resistance is the hyperinsulinemic-euglycemic glucose clamp technique. But because of practical difficulty, we utilize other methods too. These include HOMA-IR, HOMA2, QUICKI, serum triglyceride, and triglyceride/HDL ratio. In our study we evaluated HOMA IR, QUICK and other formulas for anthropometric data.

From our study, we concluded that individuals with metabolic syndrome had much higher insulin resistance compared to the one with apparently healthy individuals, but even in the latter insulin resistance were present with 68.4%. Like described in previous studies, insulin resistance can be found without MS but usually it is a precursor of it.[4]

According to Reaven, Insulin Resistance is the central pathophysiological feature of the metabolic abnormalities in MS which is similar to our conclusions.[1]

Anthropometric data collected in this study suggested that the higher the BMI and abdominal circumference were, the higher insulin resistance and insulinemia were, like shown previously.[5]

Conclusion

In conclusion, metabolic syndrome is a potential for cardio metabolic disorders. Insulin resistance plays a major role in it through various mechanism. Compared to individuals without metabolic syndrome, people with MS have higher insulinemi and lesser insulin sensitivity with create an ideal environment for metabolic disease to grow and expand. It is important to evaluate the role of insulin in the pathology of MS, in order to intervene in time.

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