

Irisin in Relation to Anthropometric and Metabolic Parameters in Obese Children

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Abstract

Background: Childhood obesity has become a major global health problem in the recent years. It is the most important public health challenge for the 21st century, not only due to the rapidly increasing prevalence rates among children and adolescents, but also due to the consequences seen into adulthood. Children and adolescents constitute around 15% of the 1.5 billion obese population; 75% of them from the developing countries.

Objective: To evaluate Irisin and its relation to anthropometric and metabolic parameters in obese children.

Methodology: The study was carried out at the Child Health Clinic of National Research Centre. It included 40 obese children of both sexes with body mass index > 95th percentile, in addition to 40 normal weight children with (BMI 15 < 85 percentile) with matching age and sex. A detailed history was taken. Full clinical examination, anthropometric assessment, laboratory investigations.

Results: The mean irisin concentration was significantly higher in obese group 34.07 ± 20.72 pg/ml compared to control group 15.09 ± 8.74 pg/ml; meanwhile, it showed significant positive correlation with BMI, weight, height and waist circumference, while no significant correlation was noted with family history of chronic diseases, Tanner Staging, sports, age, sex or blood pressure. Interestingly, our study showed significant positive correlation between irisin and almost all biochemical parameters studied including Insulin, HOMA- IR, LDL, Cholesterol, Triglycerides. However, HDL showed significant negative correlation and glucose correlation was not significant. The mean SBP was significantly higher in obese group 101.00 ± 4.96 mmhg compared to control group 98.00 ± 5.16 mmhg, while the mean DBP in obese group 66.00 ± 4.96 mmhg compared to control group 63.25 ± 4.74 mmhg; therefore, it was significantly higher in obese group as well.

Conclusion: Irisin is associated with several parameters related to obesity and may play an important role in insulin resistance and metabolic syndrome.

Keywords: Irisin, Obesity, Children.

علاقة الايريزين بالقياسات الأنثروبومترية والأيضية لدى الأطفال البدناء

المقدمة: أصبحت السمنة مشكلة كبرى في السنوات الأخيرة، وقد اعتبرت منظمة الصحة العالمية السمنة أكبر تحدى صحي في القرن الحادي والعشرين. وتشير التقديرات الحالية إلى أن الأطفال والمراهقين يمثلون ما يقرب من 15% من إجمالي مليار ونصف المليار إنسان مصاب بالسمنة على مستوى العالم. يتعرض الأطفال المصابين بالسمنة لخطر الإصابة بارتفاع ضغط الدم وزيادة المقاومة للإنسولين وزيادة الدهون في الدم ومرض السكر من النوع الثاني وكذلك الأمراض القلبية.

الهدف: تقييم مستوى الايريزين في الدم وعلاقته بالقياسات الأنثروبومترية والأيضية في الأطفال البدناء.

المنهجية: أجريت الدراسة في عيادة صحة الطفل بالمركز القومي للبحوث، وشملت 40 طفلاً مصاباً بالسمنة، و 40 طفلاً من ذوى الأوزان الطبيعية من الجنسين. تم أخذ تاريخهم المرضي وعمل فحص كينيكي شامل لهم، كما تم أخذ القياسات الأنثروبومترية وعمل بعض التحاليل المعملية. وقد شملت التحاليل المعملية الكوليسترول والدهون الثلاثية والدهون منخفضة الكثافة والدهون عالية الكثافة، وكذلك الايريزين والسكر الصائم والإنسولين الصائم، كما تم حساب مقاومة الإنسولين من خلال معادلة هوما. وقد تم عمل التحليل الإحصائي مستخدمين أحدث الإصدارات من برنامج اس بي اس اس 16 كما تم أخذ الموافقة المستنيرة من الأهل بناء على توصيات لجنة الأخلاقيات في كلية الدراسات العليا للطفولة والمركز القومي للبحوث.

النتائج: أظهرت الدراسة أن متوسط مستوى الايريزين في الدم أعلى في الأطفال المصابين بالسمنة مقارنة بالأطفال ذوى الأوزان الطبيعية، بينما أظهر الايريزين تناسباً طردياً مع كل من مؤشر كتلة الجسم والوزن والطول ومحيط الخصر. كما أظهر الايريزين تناسباً طردياً مع معظم العوامل التي تم اختبارها مثل الإنسولين والكوليسترول والدهون الثلاثية والدهون منخفضة الكثافة ومقاومة الإنسولين، بينما أظهرت الدهون عالية الكثافة مع الايريزين تناسباً عكسياً، ولم يظهر السكر أى تناسب ذى قيمة إحصائية. كما أظهرت الدراسة أن ضغط الدم الانقباضى والانبساطى أعلى في الأطفال المصابين بالسمنة مقارنة بالأطفال ذوى الأوزان الطبيعية.

الخلاصة: لذلك من المرجح أن يكون للايريزين علاقة بمقاومة الإنسولين والمتلازمة الأيضية في الجسم.

الكلمات الدالة: الايريزين، السمنة، الأطفال.

Introduction:

Childhood obesity has become a major global health problem in the recent years. It is the most important public health challenge for the 21st century, not only due to the rapidly increasing prevalence rates among children and adolescents, but also due to the consequences seen into adulthood. Children and adolescents constitute around 15% of the 1.5 billion obese population; 75% of them from the developing countries (Menon, 2015). Obese children are more likely to become obese adults, and have a higher risk of morbidity including hypertension, insulin resistance, dyslipidemia, type 2 diabetes mellitus and cardiovascular diseases (Tobisch et.al., 2013).

Many of the metabolic and cardiovascular complications of obesity have their origins during childhood and are closely related to the presence of insulin resistance (Reinehr et.al., 2015).

Puberty is the process of physical changes through which a child's body matures into an adult body capable of sexual reproduction to enable fertilization; it is also associated with increased insulin resistance and secretion (Tobisch et.al., 2013).

Irisin is a novel glycosylated polypeptide hormone derived from its precursor fibronectin type III domain containing protein 5, located in the plasma membrane, after the cleavage of its extracellular portion (Fontana et.al., 2015).

Many studies revealed that irisin is involved in the pathogenesis of various complications of obesity including dyslipidemia, type 2 diabetes mellitus, and arterial hypertension, summarized in the definition of the Metabolic Syndrome (Reinehr et.al., 2015).

Aim Of The Study:

The aim of the study is to evaluate Irisin and its relation to anthropometric and metabolic parameters in obese children.

Subjects And Methods:

The study was carried out at the Child Health Clinic of National Research Centre, from October 2017 to December 2018. It included 40 obese children of both sexes with body mass index \geq 95th percentile, in addition to 40 normal weight children with (BMI 15< 85 percentile) with matching age and sex. The age of control and obese children was between 6 and 12 years. A detailed history was taken. Full clinical examination, anthropometric assessment, laboratory investigations (including irisin, lipid profile, fasting blood sugar and insulin) and pubertal development was done for each child.

Data was statistically analyzed into SPSS version 16 and appropriate statistical analysis was performed (Salah Mostafa& Omar El- Shourbagy, 5th edition, 2012).

Ethical approval from the scientific ethical committee of Faculty of Post Graduate Childhood Studies and National Research Centre was taken and an informed consent was obtained from the parents after explanation of the aim of the study and its possible benefits.

Results:

The mean irisin concentration was significantly higher in obese group

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34.07 \pm 20.72 pg/ml compared to control group 15.09 \pm 8.74 pg/ml; meanwhile, it showed significant positive correlation with BMI, weight, height and waist circumference, while no significant correlation was noted with family history of chronic diseases, Tanner Staging, sports, age, sex or blood pressure Table (2).

Interestingly, our study showed significant positive correlation between irisin and almost all biochemical parameters studied including Insulin, HOMA- IR, LDL, Cholesterol, Triglycerides. However, HDL showed significant negative correlation and glucose correlation was not significant Figure (1).

Table (1) Comparison between characteristics of control and obese groups

Item	Obese (M= 40) Mean \pm SD	Control (M= 40) Mean \pm SD	P- Value
Waist Circumference (Cm)	76.23 \pm 3.64	56.63 \pm 2.42	0.000
Weight (Kg)	49.83 \pm 10.01	27.65 \pm 4.52	0.000
Height (Cm)	132 \pm 9.29	125.33 \pm 7.12	0.000
BMI (kg/m ²)	27.91 \pm 2.53	17.49 \pm 1.54	0.000
Systolic Blood Pressure (mmhg)	101.00 \pm 4.96	98.00 \pm 5.16	0.010
Diastolic Blood Pressure (mmhg)	66.00 \pm 4.96	63.25 \pm 4.74	0.013

Table (2) Comparison between biochemical parameters of control and obese groups

Item	Obese (M= 40) Mean \pm SD	Control (M= 40) Mean \pm SD	P- Value
Glucose (mg/dl)	79.95 \pm 6.90	74.83 \pm 6.42	0.001
Insulin (mg/dl)	18.07 \pm 5.31	6.56 \pm 2.09	0.000
Homa- Ir	3.563 \pm 1.10	1.21 \pm 0.41	0.000
Cholesterol (mg/dl)	158.83 \pm 9.86	140.33 \pm 7.72	0.000
Triglycerides (mg/dl)	90.48 \pm 5.19	55.05 \pm 6.83	0.000
HDL (mg/dl)	31.13 \pm 6.24	44.53 \pm 5.88	0.000
LDL (mg/dl)	109.63 \pm 8.88	84.85 \pm 5.49	0.000
Irisin (pg/ml)	34.07 \pm 20.72	15.09 \pm 8.74	0.001

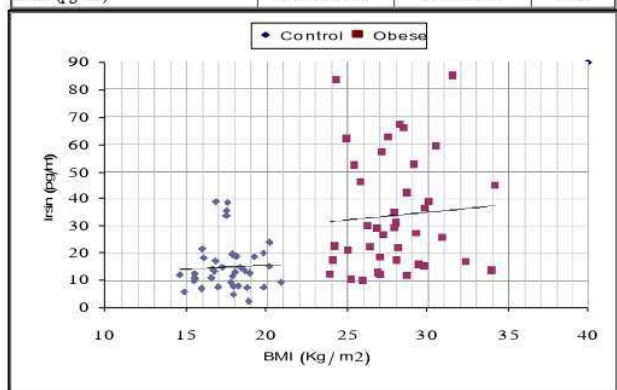


Figure (1) Correlation between irisin and BMI in obese and control groups

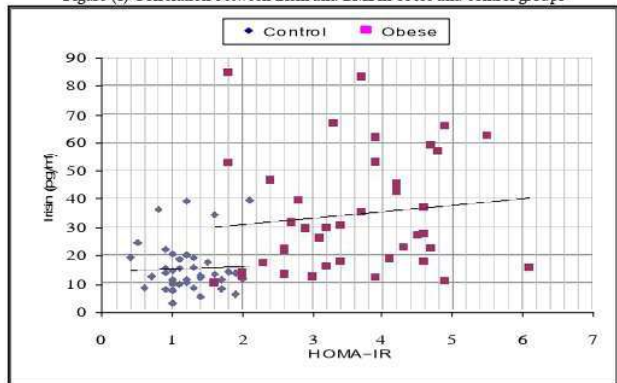


Figure (2) Correlation between irisin and HOMA- IR in obese and control groups

Discussion:

In our study, the mean irisin concentration was significantly higher in obese group 34.07 ± 20.72 pg/ml compared to control group 15.09 ± 8.74 pg/ml.

Our results come in agreement with De Meneck et al., 2018 who studied 24 obese children and 63 normal-weight children as controls from children attending the Youth Healthcare Centre, Sao Paulo, Brazil. The median serum irisin level was significantly higher in obese group 143.1 ng/ml compared to normal-weight children 75.2 ng/ml.

Catli et al., 2016 who studied 37 obese children and 31 non obese children found similar results, The mean serum irisin level was significantly higher in obese group 148.4 ± 59.6 ng/ml compared to normal-weight children 112.5 ± 33 ng/ml.

Elizondo- Montemayor et al., 2017 found that Plasma irisin levels were significantly lower for the underweight group 164.2 ± 5.95 ng/ml than for the normal weight and obese groups 182.8 ± 5.58 ng/ml.

Shoukry et al., 2016 studied 150 newly diagnosed T2DM adult patients as well as 150 nondiabetic control subjects matched to T2DM patients by age and gender. All patients were recruited from outpatient clinics of Endocrinology Unit of the Internal Medicine Department, Faculty of Medicine, Zagazig University, Egypt, between April 2014 and December 2015. They found that obese nondiabetic controls had significantly higher serum irisin levels compared with lean nondiabetic controls.

While Shim et al., 2017 in contrast to our study examined Ninety- six prepubertal Korean children (56 males and 40 females) aged 6.0- 9.9 years old were included in this study. All participants underwent a health examination at the Kangdong Sacred Heart Hospital. The study, in contrast to ours, revealed that Children with obesity significantly exhibited a lower mean irisin concentration 19.49 ± 4.42 ng/ml compared to those with normal weight 24.61 ± 18.50 ng/ml.

In our study glucose, insulin, HOMA- IR and lipid profile showed significant difference between both groups as shown in table

This comes in agreement with De Meneck et al., 2018, Shim et al., 2017, Elizondo- Montemayor et al., 2017, Shoukry et al., 2016 and Catli et al., 2016. This could be attributed to the metabolic syndrome which is well established in the medical literature as it links the obesity to insulin resistance and eventually hyperglycemia and diabetes mellitus as well as hyperlipidemia.

In our study irisin showed significant positive correlations with BMI, weight, height and waist circumference, while no significant correlation was noted with family history of chronic diseases, Tanner Staging, sports, age, sex or blood pressure.

Interestingly, our study showed significant positive correlations between irisin and almost all biochemical parameters studied including Insulin, HOMA- IR, LDL, Cholesterol, Triglycerides. However, HDL showed significant negative correlation and glucose correlation was not significant.

Elizondo- Montemayor et al., 2017 found that irisin levels correlated positively with BMI, while no association with metabolic parameters. A negative correlation with physical activity was observed.

De Meneck et al., 2018 found positive correlation between irisin and BMI, triglycerides, glucose, insulin, HOMA- IR and waist circumference, while HDL and cholesterol were negatively correlated.

Shim et al., 2017 found significant inverse correlation between irisin and BMI ($r=-0.210$, $P=0.041$), waist circumference ($r=-0.203$, $P=0.049$), and glucose ($r=-0.296$, $P=0.004$).

In our study, it was noted that the mean SBP was significantly higher in obese group 101.00 ± 4.96 mmhg compared to control group 98.00 ± 5.16 mmhg, while the mean DBP in obese group 66.00 ± 4.96 mmhg compared to control group 63.25 ± 4.74 mmhg; therefore, it was significantly higher in obese group as well.

Shim et al., 2017 found that DBP is significantly higher in obese group compared to control group, while no significant difference regarding SBP. De Meneck et al., 2018 found significant difference in both categories, while Yan et al., 2014 who studied irisin in adults found no significant association with blood pressure.

The cause of hypertension is uncertain, however it can be explained by increased peripheral resistance, coupled with high cardiac output. Also obese subjects have increased basal and stimulated level of norepinephrine.

Conclusion:

Irisin is associated with several parameters related to obesity and may play an important role in insulin resistance and metabolic syndrome.

Recommendations:

1. Strict follow up of weight, height and BMI for all children.
2. Routine assessment of arterial blood pressure in obese children.
3. Healthy diet for children should be adopted in our community.
4. We suggest that a meta- analysis could be done to clarify exactly the relationship between irisin, weight, metabolic parameters and exercise to come to an agreement with regards to the actual effects of irisin.
5. Consequently, irisin could be used as a blood test for follow up of obese children or for treatment according to results.

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