



Original article

Non-alcoholic fatty liver in children and adolescents with excess weight and obesity[☆]



M. Guadalupe Guijarro de Armas*, Susana Monereo Megías, Cristina Navea Aguilera, María Merino Viveros, M. Belén Vega Piñero

Servicio de Endocrinología y Nutrición, Hospital Universitario de Getafe, Getafe, Madrid, Spain

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ABSTRACT

Basis and objective: Hepatic steatosis, also known as non-alcoholic fatty liver (NAFL), is the most frequent liver disease in obese children. Due to an increase in infantile obesity, it is experiencing a significant increment in incidence. Our objectives are: estimate the prevalence of NAFL in children with excess weight and obesity using the glutamate pyruvate transaminase (GPT) value as a biochemical test and an abdominal ultrasound, and correlate the presence of hepatic steatosis with various anthropometric and biochemical parameters.

Patients and method: Cross-sectional prevalence study which includes children with excess weight and obesity between the ages of 5 and 15 years, between the years 2004 and 2012. The independent variables included were: age, sex, weight, size, body mass index (BMI), waist circumference (WC), waist size index (WSI), insulinemia, Homeostasis model assessment-insulin resistance (HOMA-R), total cholesterol, triglycerides (TG), high density lipoproteins (HDL), low density lipoproteins (LDL), glutamic-oxaloacetic transaminase (GOT), GPT and gamma-glutamyl transpeptidase (GGT).

Results: One hundred and twenty-six patients, with an average age of 11.94 (3.12) years were recruited. A percentage of 19.66 of the patients presented elevated GPT pathology. Of the 126 abdominal ultrasounds performed, 38 patients presented hepatic steatosis (30.15%). The levels of insulinemia, HOMA-R and LDL were significantly higher in patients with altered GPT, compared to those with normal GPT values ($P=.015$, $P=.008$ and $P=.002$, respectively). The patients with an objective HGNA in ultrasound, also showed greater levels of insulinemia, WC, WSI, total cholesterol, TG, LDL, GLT, GPT and GGT than the patients with normal ultrasounds, thereby achieving statistical significance in insulinemia, HOMA-R, LDL and GPT values.

Conclusions: NAFL is a relatively frequent disorder in obese children and adolescents. In our study, 2 of 10 children – using GPT – and 3 of every 10 – using abdominal ultrasound – present the same. The biochemical marker which best defines it is an elevation in GPT. A modification in lifestyle which includes weight loss as a principal means of avoiding complications in adult life, is essential and necessary.

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Hígado graso no alcohólico en pacientes con sobrepeso y obesidad infantojuvenil

RESUMEN

Fundamentos y objetivo: La esteatosis hepática, también denominada hígado graso no alcohólico (HGNA), es la enfermedad hepática más frecuente en niños obesos y está sufriendo un incremento importante en su incidencia debido al aumento de la obesidad infantil. Los objetivos de nuestro trabajo son: estimar la prevalencia de HGNA en niños con sobrepeso y obesidad utilizando el valor de la *glutamate pyruvate transaminase* (GPT, «transaminasa glutámico-pirúvica») y la ecografía abdominal, así como correlacionar la presencia de HGNA con distintos parámetros antropométricos y bioquímicos.

Palabras clave:

Obesidad infantil

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Transaminasa glutámico-pirúvica

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* Corresponding author.

E-mail address: docguada@hotmail.com (M.G. Guijarro de Armas).

Pacientes y método: Estudio transversal de prevalencia que incluye pacientes con sobrepeso y obesidad, con edades entre 5 y 15 años, reclutados entre 2004-2012. Las variables independientes incluidas fueron: edad, sexo, peso, talla, índice de masa corporal, perímetro de cintura (PC), índice cintura-talla (ICT), insulínemia, *Homeostasis model assessment-insulin resistance* (HOMA-R), colesterol total, triglicéridos (TG), *high density lipoproteins* (HDL, «lipoproteínas de alta densidad»), *low density lipoproteins* (LDL, «lipoproteínas de baja densidad»), *glutamic-oxaloacetic transaminase* (GOT, «transaminasa glutámico-oxalacética»), GPT y gamma glutamil transpeptidasa (GGT).

Resultados: Se seleccionaron 126 pacientes, con una edad media (DE) de 11,94 (3,12) años. El 19,66% presentó elevación patológica de GPT. Treinta y ocho pacientes (30,15%) presentaron esteatosis hepática utilizando la ecografía abdominal. Los valores de insulínemia, HOMA-R y LDL fueron significativamente mayores en pacientes con alteración de GPT ($p=0,015$, $p=0,008$ y $p=0,002$, respectivamente). Los pacientes con HGNA observado en ecografía también mostraron mayores valores de insulínemia, PC, ICT, colesterol total, TG, LDL, GOT, GPT y GGT que los pacientes con ecografía normal, alcanzándose la significación estadística en valor de insulínemia, HOMA, LDL y GPT.

Conclusiones: La esteatosis hepática es un trastorno relativamente frecuente en niños y jóvenes con obesidad. Dos de cada 10 niños –utilizando GPT– y 3 de cada 10 –utilizando la ecografía abdominal– la presentan, y el marcador bioquímico que mejor la define es una elevación de la GPT. Es imprescindible y necesaria una modificación en el estilo de vida que incluya la pérdida de peso como medida principal para evitar complicaciones en la vida adulta.

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Introduction

Obesity is the most frequent nutritional disorder during childhood and puberty in developing and industrialised countries. One hundred and ten million children in the world have excess weight (overweight and obesity).

Like in adult age, child obesity can be accompanied by other metabolic disorders associated with hyperinsulinism and insulin resistance (IR), mainly changes in the metabolism of glucose, high blood pressure or dyslipidaemia.

One of the complications associated with obesity and IR syndrome is non-alcoholic fatty liver disease (NAFLD), which includes a wide range of liver conditions, from a simple steatosis to steatohepatitis, advanced fibrosis and, finally, cirrhosis.^{1,2} Under normal conditions, 5% of the total weight of the liver corresponds to lipids, and a higher proportion is considered steatosis or fatty liver.

This disease was first described in obese children in the 1980s by Moran et al.³ There are few studies indicating the prevalence of NAFLD in obese children. In the U.S.A., according to the *Third National Health and Nutrition Examination Survey*, which included 2450 children from 12 to 18 years old, an increase in *glutamate pyruvate transaminase* (GPT) was found in 75 patients (3%). Another study carried out in Japan with abdominal ultrasound scan on 819 school-aged patients showed a prevalence of fatty liver in 2.6%.^{2,4,5} In several studies, it has been demonstrated that it is more frequent in boys than girls.⁶

A recent study estimates the prevalence of fatty liver in children is 9.6% (70,000 children, 2–19 years old).⁷ There are racial differences, with more prevalence in Hispanics, Asians and Caucasians in relation to African American children.

For the diagnosis of NAFLD, other diseases have to be excluded, such as: hepatitis B or C, autoimmune hepatitis, Wilson's disease, alpha-1-antitrypsin deficit and coeliac disease.⁴

GPT activity has been used as screening for fatty liver in obese children, because an increase is associated with the increase of liver fat and visceral fat. However, it has many limitations, since there are patients with GPT increase without NAFLD, and others who have the disease, but no GPT increase.

The abdominal ultrasound scan is the most widely used imaging test to assess the presence of steatosis (it is inexpensive and not aggressive). It has 89% sensibility and 93% specificity to detect steatosis.⁸ However, one disadvantage is that sensibility is low

when there is less than 30% of affected hepatocytes, and it has high rates of false positives and negatives. Other less used imaging tests are computed tomography and magnetic resonance imaging.

The *gold standard* test is the liver biopsy, which gives us a final diagnosis, but there are risks and a high cost in paediatric population, which is why it is used on very few occasions.⁹

The objectives of our work consist of establishing the prevalence of fatty liver in overweight and obese children, using GPT values as biochemical test and abdominal ultrasound scan as imaging test, as well as to correlate the presence of liver steatosis with body mass index (BMI), insulinaemia, IR and lipid profile.

Patients and method

The study is a cross-sectional study on prevalence, including 126 overweight and obese patients (BMI > p85 and BMI > p95, respectively, adjusted by age and gender), of both genders, from 5 to 15 years old, carried out at the Endocrinology Outpatient Service at Hospital Getafe during the years 2004–2012. In children and young patients, the criteria to define overweight and obesity are the specific values for age and gender of percentiles 85 and 95 of BMI, respectively.¹⁰

Patients attended the Endocrinology practice sent mainly from Primary Health Care, as a consequence of their overweight.

Other concomitant diseases causing liver disorders were excluded (autoimmune hepatitis, hepatitis B or C, Wilson's disease, alpha-1-antitrypsin deficit and coeliac disease).

The independent variables included in the work were: age, gender, weight, size, BMI, waist perimeter (WP), waist-to-height ratio (WHtR), biochemical parameters such as insulinaemia, *Homeostasis model assessment-insulin resistance* (HOMA-R), total cholesterol, triglycerides (TG), *high density lipoproteins* (HDL), *low density lipoproteins* (LDL), *glutamic-oxaloacetic transaminase* (GOT), GPT and gamma-glutamyl transpeptidase (GGT).

As dependant variables, we included the presence of fatty liver in the ultrasound scan.

All patients were assessed in the Endocrinology practice, were clinical data (personal background, current diseases, family history) and anthropometric data (weight, size, BMI, WP) were gathered. Likewise, a physical examination was performed. All of the patients were subject to the following tests.

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