

Hepatic steatosis and acanthosis nigricans in obese adolescents aged 15 to 19 years with high risk of diabetes mellitus according to the Findrisk test

Esteatosis hepática y acantosis nigricans en adolescentes obesos de 15 a 19 años con alto riesgo de diabetes mellitus según el test de Findrisk

AKÉ-CANCHÉ, Baldemar^{''}, VELÁZQUEZ-SARABIA, Betty Mónica[†], SARABIA-ALCOCER, Betty*['] and LÓPEZ-GUTIÉRREZ, Tomás Joel^{''}

['] *Universidad Autónoma de Campeche, Faculty of Medicine, Mexico.*

^{''} *Universidad Autónoma de Campeche, Faculty of Chemical and Biological Sciences, Mexico.*

ID 1st Author: *Baldemar, Aké-Canché* / ORC ID: 0000-0003-2636-5334

ID 1st Co-author: *Betty Mónica, Velázquez-Sarabia* / ORC ID: 0000-0002-9165-9016

ID 2nd Co-author: *Betty, Sarabia-Alcocer* / ORC ID: 0000-0002-7912-4377

ID 3rd Co-author: *Tomás, López-Gutiérrez* / ORC ID: -0000-0002-3554-1347

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Abstract

Objective: To determine hepatic steatosis and acanthosis nigricans in obese adolescents from 15 to 19 years of age with a high risk of suffering from Diabetes Mellitus. **Methodology:** Observational, cross-sectional and analytical study. **Results:** The ultrasound revealed that the most frequent hepatic steatosis in this study group was mild with 29.5%. Acanthosis Nigricans in more than two areas was the most frequent in 65.57%, only 6.55% did not have this presence; the highest body mass index (31.5) was found in a 15-year-old adolescent, the largest abdominal perimeter (95.5cm) was identified in the group of adolescents with acanthosis of the neck; The presence of acanthosis and data on hepatic steatosis stands out in the case of moderate steatosis, which occurs in an adolescent with acanthosis in more than two areas, with the highest score on the Findrisk test, body mass index and Abdominal perimeter.

Acanthosis nigricans, Hepatic steatosis, Findrisk test

Resumen

Objetivo: Determinar la Esteatosis hepática y Acanthosis nigricans en adolescentes obesos de 15 a 19 años de edad con alto riesgo de padecer Diabetes Mellitus. **Metodología:** Estudio observacional, transversal y analítico. **Resultados:** El ultrasonido reveló que la Esteatosis hepática más frecuente en este grupo de estudio fue la leve con un 29.5%. La Acanthosis Nigricans en más de dos áreas fue la más frecuente en un 65.57%, solo el 6.55% no tuvo presencia de esta; el mayor índice de masa corporal (31.5) se presentó en un adolescente de 15 años, el perímetro abdominal con más amplitud (95.5cm) se identificó en el grupo de adolescentes con acantosis en nuca; La presencia de acantosis y datos de esteatosis hepática, se destaca en el caso de la Esteatosis moderada la cual se presenta en un adolescente con acantosis en más de dos áreas, con el más alto puntaje en el test de Findrisk, índice de masa corporal y perímetro abdominal.

Acanthosis nigricans, Esteatosis hepática, Test de Findrisk

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* Correspondence to Author (E-mail: betty_sarabia_alcocer@hotmail.com)

† Researcher contributing as First Author

Introduction

Adolescence is the transition from childhood to adulthood, in which numerous and profound changes occur in the individual as a biological and social being and in his or her total integrity. According to the concepts conventionally accepted by the World Health Organisation, adolescence is the stage between the ages of 10 and 19.

Diabetes mellitus type 2 is a chronic disease that represents one of the main causes of morbidity, mortality and disability in Mexico. Methods to prevent it have been sought; as part of this search, the clinical term prediabetes was recently identified as a high risk factor for developing diabetes (REDD). It is estimated that between 40 and 50% of the population carrying this factor will develop type 2 diabetes mellitus. Type 2 diabetes mellitus is a severe, progressive, multisystemic disease, with the potential to develop chronicity, characterised by sustained elevation of glucose with impaired intermediary metabolism of carbohydrates, proteins and fats, with a relative or absolute deficiency in insulin secretion and varying degrees of insulin resistance.

Diabetes, defined as type 2 diabetes associated with obesity, is a growing public health problem not only in adults but also in children and adolescents. (15) Early and timely detection of this series of disorders, using non-invasive markers that indicate their presence or possible development, is of utmost importance for preventive intervention in the population at risk and to avoid complications in the future.

The skin, the largest organ of our body, serves as a reflection of the metabolic alterations generated by obesity, facilitating the identification and timely diagnosis of pathologies such as acanthosis nigricans. On the other hand, acanthosis nigricans (AN), closely related to Diabetes Mellitus 2, has been considered by some researchers as a clinical marker to recognise those obese patients at higher risk of triggering metabolic events such as Diabetes Mellitus 2 and metabolic syndrome among others. Acanthosis Nigricans is a physical sign associated with obesity and Insulin Resistance and has been found in 90% of obese adolescents with Diabetes Mellitus.

Acanthosis Nigricans has been considered a predictor sign of IR, as increasing insulin increases the affinity for insulin-like growth factor receptors in the skin, exerting effects on cell proliferation of dermal fibroblasts, melanocytes and keratinocytes. Acanthosis Nigricans is now more common in young people, especially in populations with high rates of insulin resistance, diabetes mellitus and obesity.

Obesity is now considered to be the main aetiological factor in non-alcoholic fatty liver disease (NAFLD) and a risk factor for progression to more advanced forms of the disease such as steatohepatitis and cirrhosis. Hepatic steatosis is a common finding in obese children, and its pathophysiology is not well understood, although we know that insulin resistance and hypertriglyceridaemia are implicated in its development, with the time of progression playing an important role. Hepatic steatosis (HS) is the initial phase of the entity known as non-alcoholic fatty liver disease (NAFLD), characterised by the abnormal accumulation of fat in hepatocytes. It is the most common metabolic disorder in the liver, resulting from an imbalance between hepatocyte synthesis and secretion of triglycerides. Depending on the percentage of hepatocytes affected, HD is classified as mild, when less than 25% of hepatocytes are affected, moderate, 25-50%, and severe, when more than 50% of hepatocytes are affected.

Recent studies have shown a close association between hepatic steatosis and obesity in childhood. However, the higher or lower prevalence of juvenile hepatic steatosis will depend on the population studied, with estimates of less than 10% in the general population, compared to an estimated 70-75% in the obese juvenile population. (16) The prevalence of this disease is higher in peripubertal children who are overweight (BMI > 85th percentile) or obese (BMI > 95th percentile), or in males compared to age-matched females with similar BMI. Being of Hispanic origin is a risk factor, while being black appears to be a protective factor. Clusters of families with obesity, insulin resistance, NAFLD or type 2 diabetes mellitus are common and should be suspected in children with this history (17).

The most widely used DM risk scale in Europe is called FINDRISC (Finnish Diabetes Risk Score). This scale, based on the collection of clinical information on risk factors, allows an acceptable prediction of the 10-year incidence of DM. It uses a simple, validated, 8-item questionnaire and, most importantly, does not include laboratory variables. It requires information on age, sex, weight and height, waist circumference, use of blood pressure (BP) medication, personal history of blood glucose disorders, physical activity, family history of DM and daily fruit and vegetable consumption. Its most recent version classifies between 0 and 26 points as follows: < 7 points, low risk; 7-11, slightly elevated risk; 12-14, moderate risk; 15-20, high risk; > 20, very high risk. It can be filled in personally by the respondent and also serves as a "mini-intervention", as it provides information on what the risk factors for DM are in a way that is easy to understand. If the score obtained is high (> 14), a blood test for DM is recommended.

Methodology

Observational, cross-sectional, analytical study. All obese adolescents aged 15-19 years at high risk for type 2 diabetes mellitus were studied during the period July 2021 to May 2022.

Results

The present study was conducted in a sample of 61 obese adolescents aged 15-19 years, 62% of whom were obese. In terms of age, the 18-year age group stands out.

According to the abdominal perimeter (AP), males had a mean of 102.91 centimetres and females 94.42 centimetres.

It was found that only 1.6% exercised regularly for at least 30 minutes a day, and only 23% of those who consumed vegetables and/or fruit said they did so every day.

None of the patients studied had a history of taking antihypertensive drugs or a history of high glycaemia values.

All patients had at least one family member with a diagnosis of type 1 or type 2 diabetes (parents or siblings).

Ultrasound revealed that the most frequent hepatic steatosis in this study group was mild steatosis, which was present in 29.5%.

Table 1 shows that Acanthosis Nigricans in more than two areas was the most frequent in 65.57% of the adolescents, only 6.55% had no Acanthosis Nigricans; the highest body mass index (31.5) was found in a 15 year old adolescent, the largest abdominal circumference (95.5cm) was found in a 15 year old adolescent, and the largest abdominal circumference (95.5cm) was found in a 15 year old adolescent. 5cm) was identified in the group of adolescents with acanthosis on the nape of the neck; finally, the Findrisk test score range was 14 to 15, with a mean of 14.63 for the group with acanthosis in more than two areas.

Acanthosis Burke Scale	Patient's age (years)	Body Mass Index BMI (kg/m ²)	Abdominal girth BP (cm)	Findrisk Total Score
No Acanthosis	Adolescents	4 (6.55%)	4	4
Average	17.25	30.27	87.88	14.25
Minimum	16	30	86	14
Maximum	18	30	89	15
Nuca	Adolescents	6 (9.83%)	6	6
Average	16.67	30.76	94.27	14.5
Minimum	15	30	88	14
Maximum	19	31	105	15
Armpit	Adolescents	10 (16.39%)	10	10
Average	17.5	31.44	95.5	14.2
Minimum	16	30	86	14
Maximum	19	35	103	15
Knee	Adolescents	1 (1.63%)	1	1
Average	15	31.5	87	14
Minimum	15	32	87	14
Maximum	15	32	87	14
More than 2 areas	Adolescents	40 (65.57%)	40	40
Average	17.45	34.3	99.9	14.63
Minimum	15	30	86	14
Maximum	19	46	120	15

Table 1 Variables studied in adolescents aged 15 to 19 years old

The presence of acanthosis and data of hepatic steatosis is highlighted in the case of moderate steatosis, which occurs in an adolescent with acanthosis in more than two areas, a group that presented the highest mean of the Findrisk test (14.63), as well as BMI and BP.

Acanthosis	Ultrasound Result	Adolescents	Percentage
No acanthosis	Normal	4	100 %
Nuca	Normal	5	83.3 %
	Mild hepatic steatosis	1	16.7 %
	Total	6	100 %
Armpit	Normal	10	100 %
Knee	Normal	1	100 %
More than 2 areas	Normal	22	55 %
	Mild hepatic steatosis	17	42.5 %
	Moderate hepatic steatosis	1	2.5 %
	Total	40	100 %

Table 2 Hepatic Steatosis due to the presence of Acanthosis

Inferential statistics

Findrisk Test Score		Ultrasound Result		Acanthosis	
Spearman's Rho	14	Ultrasound result	Correlation coefficient	1,000	0.419
			Sig. (unilateral)	-	0.011
			N	30	30
		Acanthosis	Correlation coefficient	0.419	1,000
			Sig. (Unilateral)	0.011	-
			N	30	30
	15	Ultrasound Result	Correlation coefficient	1,000	0.276
			Sig. (unilateral)	-	0.067
			N	31	31
		Acanthosis	Correlation coefficient	0.276	1,000
			Sig. (Unilateral)	0.067	-
			N	31	31

Correlation is significant at the 0.05 level (one-sided).

Table 3 Correlation Hepatic Steatosis and Acanthosis nigricans

Acanthosis and hepatic steatosis show a significant correlation in the condition of a Findrisk Test score of 14, as shown in table 3.

Conclusions

According to the data found and analysed, it was observed that there is a correlation between acanthosis nigricans and hepatic steatosis in obese adolescents, with moderate and high risk factors for diabetes mellitus according to the Findrisk test, and that the higher the BMI and abdominal perimeter, the greater the risk of advanced hepatic steatosis. Ultrasound is therefore recommended for those patients who meet the risk factors and to continue evaluating the progression of the disease, as well as to establish a timely and multidisciplinary treatment, since all these preventive measures will be the basis for a healthy life in adulthood.

References

- American Diabetes Association. Estándares para la atención médica de la diabetes -2012. The Journal of Clinical and Applied Research and Education. Diabetes Care. Vol. 35, enero 2012, pp s11-s63.
- Ortiz-Contreras Evelia, E. Baillet-Esquivel Laura, R. Ponce-Rosas Efrén. Frecuencia de "riesgo elevado de desarrollar diabetes" en pacientes de una clínica de medicina familiar. Aten Fam 2013;20
- Matilde García de Blanco, Merino Gisela. et al. Diabetes Mellitus en niños y adolescentes. Revista Venezolana de endocrinología y metabolismo - Volumen 10, supl. 1; 2012, 13-21.
- Fernández Canton Sonia, Montoya Núñez Yura. et al. Overweight and obesity in mexican children under 20 years of age. Vol med Hosp Infant Mex 2011;68(1):79-81
- Instituto Mexicano del Seguro Social. Guía de práctica clínica. Prevención y diagnóstico de sobrepeso y obesidad en niños y adolescentes en el primer nivel de atención. Recuperado: <http://www.cenotec.salud.gob.mx.interior.catalogo/M>
- González Fernández Pedro, Cabrera Rode Eduardo. et al. Resistencia a la insulina e historia familiar de Diabetes en niños y adolescentes obesos con acantosis nigricans y sin ella. Revista Cubana de Endocrinología. 2011; 22(3):210-224.
- Secretaría de salud. Encuesta nacional de salud y nutrición (ENSANUT). Secretaría de salud. 2012. México.
- Peralta José de Jesús, Romero A. Jaime Héctor. et, al. Genética de la obesidad infantil. Rev med inst mex seguro soc. 2014; 52, Sup 1: s78-s87.
- Moreno G Manuel. Definición y clasificación de la obesidad. Rev. Med. Condes- 2012; 23 (2) 124-128

10. Valdés Rodríguez Rodrigo, Moncada González Benjamín, et, al. Acrocordones y Acanthosis nigricans: Correlación con resistencia a la insulina y sobrepeso en niños mexicanos. *Gaceta médica de México*. 2011;147:297-302.
11. P. Burke James, Phd Daniel. et, al. A quantitative scale of acanthosis nigricans. *Diabetes care*, Volume 22, Number 10, October 1999.
12. Barisio D'Angelo María Gabriela, Actis Andrea Mariel, Hígado graso no alcohólico: una entidad cada vez más frecuente y de pronóstico incierto. *facultad de medicina, universidad de buenos aires*. 45-50.
13. G. Rodríguez, S. Gallego, C. Breidenasse. Is liver transaminases assessment an appropriate tool for the screening of non-alcoholic fatty liver disease in at risk obese children and adolescents? *Nutr hosp*. 2010; 25(5):712-717.
14. González Pérez Brian, salas-flores. Esteatosis hepática en niños obesos. *Revista de endocrinología y nutrición* 2008;16(2):74-82
15. Santos Mata, Macías López, Díaz Colón, et, al. Esteatosis hepática no alcohólica en nuestra consulta: evolución tras un año de seguimiento. *Rev Esp Endocrinol Pediatr* 2011; 2, 175-180.
16. González Jiménez Emilio, Schmidt Río-Valle Jacqueline. et al. Fatty liver and its clinical management in obese adolescents *Endocrinol Nutr*. 2011; 58(1):32-37
17. Bojórquez Ramos María del Carmen. Enfermedad por hígado graso no alcohólico en pediatría. *Rev Med inst mex seguro social*. 2014; 52 (1): s 110- s 114.
18. Wolpert Barraza Enrique, kershenobich Stalnikowitz David. Esteatosis y esteatohepatitis no alcohólica, 1-15.
19. Camacho Nolis, Guillén Májela, Giobely Gil. et, al. Esteatosis hepática en niños y adolescentes obesos: asociación con adiposidad, lípidos, insulina y enzimas hepáticas. *Rev Venez Endocrinol Metab* 2010; 8(1): 19-29
20. Bejarano Forqueras Haldrin Antonio, Lazarte Amaya Rossio Karen. Childhood obesity related to development of Fatty Liver in children from 6 to 14 in Cochabamba, Bolivia. *Rev Cient Cienc Med*. 2014;17(1): 15-18.