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ORIGINAL

Nutrition assessment and indicators of visceral fat and subcutaneous fat in children with Down syndrome

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KEYWORDS
Body composition;
Nutrition assessment;
Body mass index;
Waist circumference

Abstract
Background: There are only few publications related to body composition in Down syndrome (DS).
Objective: Evaluate the relationship between indicators of nutrition assessment by Catalan references and CDC/NCHS and indicators of body composition, and compare the concordance between weight/height index (WHI), body mass index/age (BMIa) and weight/age (WA) to evaluate nutritional status in children with DS.
Materials and methods: Analytical cross-sectional study in which 40 children with DS, 20 girls and 20 boys between 3 and 13 years old were studied. Anthropometric measurements were performed to obtain indicators of nutrition assessment as WHI, BMIa and WA and indicators of subcutaneous and visceral fat and muscular compartment. Correlation tests and Kappa index were evaluated to establish relationship and agreement respectively.
Results: The nutrition assessment in children with DS shows that 60% presents overweight and obesity according to BMIa, and 75% according to WHI. Correlation analysis indicates that waist circumference, fat brachial area, % fat mass by Slaughter and Weststrate and Deurenberg have a high positive correlation with BMIa (P-value < 0.05). A logistic regression model showed that no indicator of fat mass is clinically significant in predicting an increase of the indicator WA. It was determined that the BMIa and WHI indicators have a higher concordance (Kappa = 0.59; P = 0.0000).
Conclusions: We determined a high correlation between nutritional diagnosis (BMIa and WA) with indicators of visceral fat (waist circumference) and subcutaneous (% fat mass and fat brachial area) in children with DS. A greater agreement was found between indicators of BMIa and WA suggesting that they are optimal for assessing the nutritional status.

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PALABRAS CLAVE
Composición corporal;
Estado nutricional;
Índice de masa corporal;
Circunferencia de la cintura

Evaluación nutricional e indicadores de grasa visceral y subcutánea en niños con síndrome de Down

Resumen
Antecedentes: Existen pocas publicaciones en relación a la composición corporal en niños con síndrome de Down (SD).
Objetivos: Evaluar la relación entre los indicadores del estado nutricional (EN) –utilizando referencias catalanas y del CDC/NCHS – y los indicadores de la composición corporal, y comparar la concordancia entre los índices peso/talla (IP/T), índice de masa corporal/edad (IMC/E), y peso/edad (P/E) para evaluar el estado nutricional en niños con SD.
Materiales y métodos: Estudio analítico de corte transversal en el que se estudiaron 40 niños con SD, 20 niñas y 20 niños de edades comprendidas entre 3 y 13 años. Se realizaron mediciones antropométricas para obtener indicadores del estado nutricional tales como IP/T, IMC/E y P/E, e indicadores de grasa visceral y subcutánea y del compartimiento muscular. Se evaluaron las pruebas de correlación y el índice de Kappa para establecer relación y concordancia, respectivamente.
Resultados: La evaluación nutricional realizada en niños con SD muestra que el 60% presenta sobrepeso y obesidad, según el indicador IMC/E, porcentaje que alcanza el 75% según el índice IP/T. El análisis de correlación indica que la circunferencia de la cintura, el área de grasa braquial, y el % de masa grasa según Slaughter y Weststrate y Deurenberg, muestran una alta correlación positiva con el IMC/E ($p < 0,05$). Un modelo de regresión logística reflejó que ningún indicador de la masa grasa es clínicamente significativo para predecir el incremento del indicador P/E. Se determinó que los indicadores IMC/E e IP/T tienen una mayor concordancia (Kappa = 0,59; $p = 0,0000$).
Conclusión: Determinamos una alta correlación entre el diagnóstico nutricional (IMC/E e IP/T) y los indicadores de las grasas visceral (circunferencia de la cintura) y subcutánea (porcentaje de masa grasa y de área grasa braquial) en niños con SD. Se encontró una mayor concordancia entre los indicadores de IMC/E e IP/T, lo que sugiere que estos son óptimos para evaluar el estado nutricional.

Introduction

Down syndrome (DS) is a genetic disorder caused by the presence of extra material in chromosome 21, affecting 2.93 per 1000 live Chilean newborns.[1,2] It is associated with intellectual disability and with various medical conditions.[3]

Children with DS are shorter than children without DS.[4,5] Some studies propose that children with DS with moderate to severe cardiac abnormalities are shorter than those who present slight abnormalities or absence of them. However, other studies find no association.[4] It is postulated that the deficiency in growth would be related to a predisposition to overweight.[6]

Growth standards for the general population are not appropriate for individuals with DS, given that their use could diagnose nutritional status (NS) incorrectly.[5,7] That is the reason why some countries have developed growth cures for this population (USA, UK and Ireland).[8] A proposal for using the growth standards for Spanish children with DS, developed by the *Fundación Catalana* [Catalan Foundation],[2,9,10] is currently being discussed in Chile. These standards are considered as the most appropriate for the Chilean population, given that they were designed based on a Hispanic population; however, they have the important limiting factor of the absence of the weight/height (WHI) indicator or body mass index/age (BMIa). The Pinhiero et al. study[9] on Chilean children with DS established the need to carry out a body composition study in this group to validate the diagnoses provided by the Spanish standard.

There is little information on body composition in DS.[11] Gonzalez-Aguero et al.[12] reported high levels of total and regional fat mass in Spanish children with DS. Similar results were observed in children from New Zealand, with significant differences in fat mass percentage (FM%) between males and females.[11]

High prevalence of malnutrition by excess (overweight and obesity) has been published for children with DS, approximately 30–50%.[11] Various mechanisms are postulated, such as hypothyroidism, leptin resistance, low energy consumption at rest, sedentary lifestyle and high energy intake, with the last two being the greatest contributors in excessive weight gain.[13] In the last few decades, life expectancy in individuals with DS has increased, producing important complications associated with excessive body fat, such as type 2 diabetes and cardiovascular diseases.[3,12] That is the reason why our objectives were to assess NS and body composition in children with DS using anthropometric