



## ORIGINAL ARTICLE

# Waist circumference as a marker for screening nonalcoholic fatty liver disease in obese adolescents



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### KEYWORDS

Aspartate aminotransferase;  
Alanine aminotransferase;  
Abdominal fat;  
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### Abstract

**Objective:** To assess the relationship between the degree of waist circumference (WC) and non-alcoholic fatty liver disease (NAFLD) in obese adolescents of both genders, analyzed according to quartiles of WC.

**Methods:** Cross-sectional study that involved 247 obese adolescents aged 12–19 years. Mean values of the nutritional parameters and serum analyses were compared with the groups using the independent *t*-test. Pearson correlation coefficient was used to determine the relationship of the parameters studied. Chi-square test for trend was used to determine the relationship between the prevalence of the NAFLD and WC quartile by gender.

**Results:** NAFLD were presented in 60% of the study participants. Obese adolescents in the 3rd and 4th quartiles of WC presented higher prevalence of NAFLD when compared with that in the 1st quartile in both genders. The NAFLD patients had significantly higher values for body weight, BMI (body mass index), BAZ-score (BMI-for-age z-scores), total fat (% and kg), WC, visceral fat, insulin, insulin resistance index (HOMA-IR), aspartate aminotransferase and alanine aminotransferase, when compared with non-NAFLD obese adolescents.

**Conclusions:** In conclusion, the results presented here suggest that an increase in WC can reliably predict the risk of NAFLD in obese adolescents. This is a low cost and easy-to-use tool that can help in screening in adolescents.

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**PALAVRAS-CHAVE**

Aspartato  
aminotransferase;  
Alanina  
aminotransferase;  
Gordura abdominal;  
Adolescentes

## Circunferência da cintura como marcador para triagem de doença hepática gordurosa não alcoólica em adolescentes obesos

**Resumo**

**Objetivo:** Avaliar a associação entre o grau de circunferência da cintura (CC) e doença hepática gordurosa não alcoólica (DHGNA) em adolescentes obesos de ambos os sexos, avaliados de acordo com quartis de CC.

**Métodos:** Estudo transversal envolvendo 247 adolescentes obesos com idades entre 12 a 19 anos. Os valores médios dos parâmetros nutricionais e análises séricas foram comparados com os grupos utilizando o teste *t* independente. O coeficiente de correlação de Pearson foi utilizado para determinar a relação entre os parâmetros estudados. O teste do qui-quadrado de tendência foi utilizado para determinar a relação entre a prevalência da DHGNA e quartil da CC por sexo.

**Resultados:** DHGNA estava presente em 60% dos participantes do estudo. Adolescentes obesos nos quartis 3 e 4 de CC apresentaram maior prevalência de DHGNA quando comparados com aqueles no primeiro quartil em ambos os sexos. Os pacientes com DHGNA tinham valores significativamente mais elevados de peso corporal, IMC (índice de massa corporal), IMC/I (IMC para Idade) z-escore, gordura total (% e kg), CC, gordura visceral, insulina, índice de resistência à insulina (HOMA-IR), aspartato aminotransferase e alanina aminotransferase, quando comparados com adolescentes obesos sem DHGNA.

**Conclusões:** Em conclusão, os resultados aqui apresentados sugerem que um aumento da CC pode prever com segurança o risco de DHGNA em adolescentes obesos. Essa é uma ferramenta de baixo custo e fácil de utilizar que pode ajudar na triagem de adolescentes.

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**Introduction**

Nonalcoholic fatty liver disease (NAFLD) is the most common cause of chronic liver disease worldwide and has been recognized as the early manifestation of obesity and metabolic syndrome.<sup>1</sup> NAFLD is characterized by the accumulation of large droplets of triglycerides within hepatocytes in the absence of chronic alcohol consumption.<sup>2</sup> Currently, NAFLD affects between 3% and 11% of the pediatric population reaching the rate of 46% among overweight and obese children and adolescents.<sup>3</sup> Indeed, previous study from our group found that NAFLD affected 52% of obese adolescents.<sup>4</sup>

NAFLD development is influenced by multiple genetic and environmental factors. Currently, NAFLD is recognized as the hepatic component of metabolic syndrome due to its strong association with obesity, dyslipidemia, hypertension and insulin resistance index (HOMA-IR). It has long been known that there is a highly significant relation between NAFLD and insulin resistance. A study developed with Japanese children suggested that hyperinsulinemia was the most important clinical manifestation associated with NAFLD.<sup>5</sup> Moreover, insulin resistance is accepted as the main pathophysiologic factor in developing NAFLD.<sup>6</sup>

In agreement, de Piano et al.<sup>7</sup> verified that adolescents with visceral obesity and high HOMA-IR levels presented a higher risk of developing NAFLD, which could lead to the accumulation of lipid in the hepatocytes. In addition, it was demonstrated that each 1-cm increase in visceral adiposity was associated with a two-fold greater risk of NAFLD in obese adolescents.<sup>8</sup>

In fact, the central adiposity is associated with chronic low-grade inflammation, which accelerates insulin

resistance and accumulation of hepatocellular fat. Subjects with NAFLD are at risk of developing cardiovascular disease (CVD) through insulin-resistance related mechanisms.<sup>9</sup> Therefore, it is important to assess visceral adiposity in clinical practices. For assessment of central obesity in young ages, ultrasound and magnetic resonance imaging are available. However, these procedures have some limitations for broad use, such as cost. On the other hand, WC may be a simple clinical and cost-effective tool to be used as a surrogate marker for NAFLD.<sup>10</sup> WC has been shown to be an inexpensive tool for assessing central obesity in the clinical practice, with excellent correlation with abdominal imaging and high association with CVD risk.<sup>11</sup> For this reason, WC is one of the diagnostic criteria proposed by the International Diabetes Federation (IDF) in adolescents and has been identified as a valuable predictor of metabolic syndrome and CVD risk.<sup>12</sup>

The relation between NAFLD and atherosclerosis development has been evaluated in pediatric studies.<sup>1,9</sup> Fallo et al.<sup>13</sup> reported that WC was a predictor for NAFLD in their study that included 86 hypertensive obese adults. Another study found that the increased WC and body mass index (BMI) were associated with a significant higher risk of insulin resistance and NAFLD in healthy Koreans adults. In addition, the authors reinforced the importance of using both BMI and WC in clinical practice, because they may be helpful in evaluating the risk of NAFLD and insulin resistance.<sup>14</sup> Finally, WC measurement has known to predict cardiovascular risk, although its value for NAFLD risk in adolescents has not yet been explored.

Therefore, WC is a convenient measure of abdominal obesity. However, few studies have been performed on the

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