Author's response to reviews

Title: Is waist-to-height ratio an indicator of cardio metabolik risk in 6-10-year-old children?

Authors:

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Author's response to reviews: see over
Katherine Olino (on behalf of Dr Kevin R. Short)

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Dear Dr Olino,

First, we would like to thank you and the referees for the comments on our MS 8079409658072887. We are sure that they will be valuable and will improve the quality of the text. Below you will find our responses to the reviewers.

Reviewer 1: Ashwini Mallapa

1. All of the patients were classified by Tanner staging as non-pubertal (B1P1 in girls and G1P1 in boys). Although puberty may start earlier in African Americans, this was not seen in our cohort. This is specified in the Methods.

2. On page 6 of the Methods, the term p90 has been explained and substituted by ‘90th percentile (p90)’.

3. The sentence has been reworded as follows: ‘At the first clinical evaluation, the parents or guardians of all children were instructed to take their children to the CRTCA to have blood drawn after 12-hour overnight fasting for the measurement of fasting glycemia, total cholesterol (TC), LDL, TG, HDL, insulin, CRP and leukocyte count.’

4. The sentence on page 9, line 3 was reworded to clarify that the WHtR cut-off of 0.47 was sensitive for screening changes in HOMA-IR and any one of the cardio metabolic disturbances. It reads: ‘The most sensitive WHtR cut-off for HOMA-IR was 0.47, which was also capable of detecting any one of the cardio metabolic disturbances (LDL, HDL, TG or BP) when they were accounted together.’

5. In the Discussion’, page 11 we included ‘salt intake’ in the limitations of the study.

6. In the Conclusion, page 12, we corrected the verb ‘WHtR is’ (rather than ‘was’).
7. We have added a new table (Table 1) showing the demographic characteristics of the groups. The former Table 1 is now renumbered Table 2, on page 20, as shown below.

Table 2. Correlations between WHtR and cardio metabolic parameters in normal-weight and overweight/obese 6–10-year-old children from Campos.

<table>
<thead>
<tr>
<th>Metabolic variable</th>
<th>( r ) (95% CI)</th>
<th>( R^2 )</th>
<th>( p ) value</th>
</tr>
</thead>
<tbody>
<tr>
<td>HOMA-IR</td>
<td>0.83 (0.77–0.87)</td>
<td>0.68</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Insulin</td>
<td>0.79 (0.74–0.85)</td>
<td>0.64</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>LDL</td>
<td>0.25 (0.11–0.39)</td>
<td>–0.06</td>
<td>0.0008</td>
</tr>
<tr>
<td>HDL</td>
<td>–0.28 (–0.41–0.13)</td>
<td>0.08</td>
<td>0.0002</td>
</tr>
<tr>
<td>TG</td>
<td>–0.26 (–0.11–0.39)</td>
<td>0.07</td>
<td>0.0006</td>
</tr>
<tr>
<td>Glycemia</td>
<td>0.14 (–0.08–0.28)</td>
<td>0.02</td>
<td>0.063</td>
</tr>
</tbody>
</table>

8. The terms PAS and PAD stand for SBP and DBP, respectively (they were translated from Portuguese into English).

9. On page 21, Table 3 has been changed to Table 4 and a space has been added between ‘metabolic’ and ‘risk’.

Discretionary Revisions:

1. Table 1 is intended to show the demographic and clinic characteristics of the groups.
2. A declaration of competing interests has been written according to your suggestion: ‘I declare that I have no competing interests.’

Reviewer Christina Shay

Major:

1. The aim was not to perform a population study, because in this type of study the number of patients and the strategies employed are quite different and demand many more resources. In this case, a convenient sample was chosen to explore the relationship between some anthropometric parameters and cardiovascular risks in a population of 6–10-year-old children. The sample chosen was a group of students referred to the CRTCA where Dr. Kuba worked. This fact is highlighted in the discussion of the limitations of the study; we have no intention of extrapolating our data to the general population, but call attention to the possible correlation between an easy method of anthropometric evaluation (WHtR) and cardio metabolic risk. We agree that the criteria used to
select this sample have to be stressed (in red in the text in the Methods and Discussion).

2. As you suggested, a new table (Table 1) has been added to display the demographic characteristics of the children, showing their statistical significance.

3. In our country, where interracial relationships are widespread, it is always difficult to separate ‘whites’ from ‘non-whites’. There are many ‘mixed races’ and the proper characterization of this group is not an easy task. When we stated that our population of study was mainly of African descent, we meant (and we will try to make it clearer in the text) that, in Brazil, we have more people of African descent that in, for example, the US and other countries. However, in our cohort, when we compared overweight/obese children with the non-obese, the racial proportions were quite similar (Table 1). In the overweight/obese group, 49% were ‘whites’ and 51% were of ‘mixed racial background’; in the normal-weight group, 47% were ‘whites’ and 53% were ‘mixed’. Thus, we do not think that the composition of the sample in either group could have led to incorrect results.

However, when we tried to separate the patients by sex and race in the obese and normal-weight groups, the number of patients in each subgroup was low and we lost statistical power.

4. We would like to highlight that there are several population-based studies that reinforce the usefulness of WHtR in screening for metabolic risk in children and adults, recommending it for screening. We have added the study of Khan et al. (ref. 19 in red). However, we agree with the referee on this topic based solely on our findings and we will change the text accordingly.

- On page 9, the sentence has been changed as follows: ‘We found WHtR to be capable of detecting an increase in LDL at a cut-off value of > 0.48, which would not have been possible using the WHO BMI only; children with this WHtR are considered lean according to the WHO BMI, because they are classified as BMI z score < 0.8. Such findings are in agreement with those of other population-based studies that reinforce the importance of including WHtR measurements in routine care, with the aim of detecting the presence of cardio metabolic risk factors even in normal-weight children (6,16,18,19)’.

- The sentence ‘WHtR should be measured routinely in primary pediatric care’ was removed from the Abstract and the conclusions were altered as follows: ‘In our sample, the WHtR was as sensitive as the 2007 WHO BMI in screening for metabolic risk in 6–10-year-old children. The public health message “keep your waist to less than half of your height” can be effective in reducing cardio metabolic risk, but because this is the first study to correlate the WHtR with inflammatory markers in this age group, we recommend further exploration of the use of WHtR as an indicator of metabolic risk in this and other population-based samples.’

Minor:

1. The readability of the introductory paragraph has been improved, but we have retained it because it emphasizes the frequency of dyslipidemia and high blood pressure in overweight children, which were important findings of our study.
2. The text was initially reviewed by the Edanz service before we sent it to *BMC Pediatrics*. It has been reviewed again to correct the use of commas and indentation of paragraphs.

3. The word ‘performance’ was removed from the objectives sentence.

4. We substituted the word ‘prediction’ for ‘indicator’, including in the Introduction. Furthermore, we would like to emphasize that the aim of the study was to screen for the presence of cardio metabolic risk factors at the time of clinical examination and not in the future. To make this clearer, we added ‘the presence of metabolic risk factors’ to the objectives sentence and ‘risk factors’ to Tables 4 and 5.

5. The abbreviations in the footnotes have been removed.

6. The word ‘not significant’ has been removed from Tables 3, 4 and 5 and the exact *p* values are displayed in Table 3. 95% confidence intervals were retained in Tables 4 and 5 as appropriate.
Abstract

Background: Childhood obesity is a public health problem worldwide. Visceral obesity, particularly associated with cardio metabolic risk, has been assessed by body mass index (BMI) and waist circumference, but both methods use sex- and age-specific percentile tables and are influenced by sexual maturity. Waist-to-height ratio (WHtR) is easier to obtain, does not involve tables and can be used to diagnose visceral obesity, even in normal-weight individuals. This study aimed to compare WHtR and the 2007 World Health Organization (WHO) reference for BMI in screening for the presence of cardio metabolic and inflammatory risk factors in 6–10-year-old children.

Methods: A cross-sectional study was undertaken with 175 subjects selected from the Reference Center for the Treatment of Children and Adolescents in Campos, Rio de Janeiro, Brazil. The subjects were classified according to the 2007 WHO standard as non-obese (BMI z score > –1 and < 1) or overweight/obese (BMI z score ≥ 1). Systolic blood pressure (SBP), diastolic blood pressure (DBP), fasting glycemia, low-density lipoprotein (LDL), high-density lipoprotein (HDL), triglyceride (TG), Homeostatic Model Assessment – Insulin Resistance (HOMA-IR), leukocyte count and ultrasensitive C-reactive protein (CRP) were also analyzed.

Results: There were correlations between WHtR and BMI z score (r = 0.88, p < 0.0001), SBP (r = 0.51, p < 0.0001), DBP (r = 0.49, p < 0.0001), LDL (r = 0.25, p < 0.0008), HDL (r = –0.28, p < 0.0002), TG (r = 0.26, p < 0.0006), HOMA-IR (r = 0.83, p <0.0001) and CRP (r = 0.51, p < 0.0001). WHtR and BMI areas under the curve were similar for all of the cardio metabolic parameters. A WHtR cut-off value of > 0.47 was sensitive for screening insulin resistance and any one of the cardio metabolic parameters. Conclusions: WHtR was as sensitive as the 2007 WHO BMI in screening for metabolic risk factors in 6–10-year-old children. The public health message “keep your waist to less than half your height” can be effective in reducing cardio metabolic risk, but because this is the first study to correlate WHtR with inflammatory markers in this age group, we recommend further exploration of the use of WHtR as an indicator of metabolic risk in this and other population-based samples.