

Answers to Reviewer's comments

REVIEWER 1

The manuscript entitled, “Waist circumference, waist-to-height ratio, and waist to hip ratio percentiles for Yemeni children aged six to nineteen years: the HYDY study.” By Bamoshmoosh M et al. deals with central obesity in Yemeni children and young adults. It was a cross-sectional population-based survey where 1552 girls and 1567 boys aged 6 to 19 years were enrolled in the HYPertension and DIabetes in Yemen (HYDY) study. They measured body weight, height, waist circumference (WC) and hip circumferences and calculated Waist to hip ratio (WHR) and waist-to-height ratio (WHtR). Their results show that average WC increased with age for both boys and girls although boys had a higher WC than girls until early adolescence, however, girls had higher values than boys in the later part. WHR has been shown to decrease both in boys and girls until early adolescence. Thereafter while it plateaued in boys, it continued to decrease in girls. They conclude that in Yemeni children central obesity indices percentile curves was more prevalent in urban sedentary subjects. While it is good study, it would have been nice if you could elaborate on statistical methods used, like how were the percentiles calculated etc.

Thank you for your interest in our paper.

You are right. For the sake of conciseness we omitted some methodological aspects regarding data analysis. While re-reading the text we agreed with your comment. Therefore the paragraph “Statistical analysis” of the Methods section was modified as follows:

Statistical analysis

Description and validation of the database can be found elsewhere (15). Data were preliminary checked for outliers using a cut-off of ± 5 SD of the corresponding age and sex Z-scores (16). Smoothed age (by year) and gender-specific percentiles (3rd, 5th, 10th, 25th, 50th, 75th, 90th, 95th, and 97th) for WC, WHR and WHtR were then constructed by means of the Box-Cox normal or LMS method of centiles estimation (17).

The LMS method summarizes the growth reference curve with three curves representing the median (M), the coefficient of variation (S) and the power to remove skewness from the data (L) by age and was implemented in the Generalized Additive Model for Location, Scale and Shape (GAMLSS) package included in R 2.14.0 software for Windows. In LMS method, GAMLSS parameters and the parameters of Box-Cox power exponential distribution (BCPE) were used for model fitting to data. These reference curves were fitted on the original data and the best fit was used to construct smoothed percentile curves. After the application of the Box Cox power transformation the data at each age were normally distributed and the points on each centile curve were defined in terms of the formula:

$$M = (1+LSz)^{1/L}$$

where L, M, and S are values of the fitted curves at each age, and z indicates the z score for the required centile.

WC, WHR, and WHtR differences between genders were tested within age groups using Mann-Whitney U-test. Data are expressed as crude values. Comparisons were performed by using logistic regression with adjustment for confounding variables including age (years), gender, years of school education, urban/rural residency and sedentary/active lifestyle. Results are expressed as adjusted Odd Ratio (OR) with 95% confidence interval (CI). Test of hypothesis was done at significance level 0.05 two sided. SPSS software, version 19.0 (SPSS Inc. Chicago IL, United States, 2010) was used for statistical comparisons.

REVIEWER 2

1. Change the first word of the introduction from "children" to "childhood". Read the paper carefully for language.

The first word "children" was changed with "childhood" in the introduction section.

The manuscript was revised.

2. In the methods section relating to Study Sites and Study Population mention the target population. Was this a representative sample of the entire country?

Target population of HYDY study was the entire population of the country aged 6 to 69 years. Therefore special effort was made to sample a source population reasonably representative of the target population. Yemen was subdivided into three main areas, the capital area, the inland, and the coastal area. Final results of the Yemen 2004 Population and Housing Census, conducted with support from United Nations Population Fund, were not yet available at the stage of HYDY study design. The number of subjects in each area was thus estimated using the preliminary data provided by the United Nations Population Fund. The same source was used to stratify Yemen population by age (decades) and gender (reference 13bis).

On these bases we can consider our source population to be representative of the target population.

The text was modified as follows:

“Study Sites and Study Population

~~The study included 1552 girls and 1567 boys aged 6 to 19 years (median age 13.5 years) enrolled in the Hypertension and Diabetes in Yemen (HYDY) study (13).~~ **Target population of the study was the population of the country aged 6 to 19 years. A representative sample of 3114 Yemeni children (1564 boys, 1550 girls) aged 6 to 19 years (median age 13.5 years) participating in the Hypertension and Diabetes in Yemen (HYDY) survey was studied (13).** The survey used a multi-stage stratified sampling method to select households as the setting for data collection (13). Briefly in the first stage, Yemen was stratified into three areas, the capital area, the inland, and the coastal area. The governorate of Sana’a (capital area), the governorate of Taizz (inland), and the governorates of Al Hudaydah and Hadramaut (coast) were selected to be representative of the geographic, economic, and climatic characteristics of the three areas. **The number of subjects in each area was estimated using the preliminary data provided by the United Nations Population Fund that is the same source used to stratify Yemen population by age and gender (14).** In the second stage, rural and city regions were identified from each study area. In the third stage, districts were arbitrarily identified within each urban and rural region, boundaries being defined using local maps or in consultation with the local

health workers. Households were selected because in developing countries not all children in the age groups of interest may have access to school. The survey was completed within 16 months. The response rate for subjects aged 6 to 19 years was 96% in urban and 97% in rural locations. The study was approved by the Ethical Committee of the University of Science and Technology, Sana'a, Yemen (Ref. 1–2007). Informed consent was obtained from participants and their parents before data collection. The procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation and with the Helsinki Declaration of 1964, as revised in 2004.

3. In the Data Collection section mention the following: make and model of the scales used to measure weight, and whether or not they were calibrated. If there are data on inter and intra observer agreement of measures mention this here. This is particularly important for waist measures.

In the HYDY survey we used a pre-calibrated digital Laica PS6010 scale with a 150 kg capacity (accuracy 100 g) which was frequently checked by a known-weighing object. The CV for inter- and intra-observer effects for most anthropometric measures was < 5% (21).

4. Two decimal places for p-values are sufficient.

All the p-values have been corrected accordingly.

5. Please make sure that manuscript is consistent with the STROBE guidelines (www.thelancet.com Vol 370 October 20, 2007). This is particularly necessary for the discussion.

Thank you for the remark. Single issue of STROBE guidelines were checked (www.thelancet.com Vol 370 October 20, 2007) as follows.

Title: the following sentence was added “..a population based cross-sectional study.”

Authors: Contact details for the corresponding author (OK)

Study design: Description of the study design in the Abstract (OK)

Objective: Specific objectives or hypothesis are stated in the Abstract (OK)

Methods

Description of setting, follow-up dates or dates at which the outcome events occurred or at which the outcomes were present, as well as any points or ranges on other time scales for the outcomes (e.g., prevalence at age 18, 1998-2007).

The following sentence was added:

Children were evaluated between February 2008 and May 2009.

Participants

Cross-sectional study—Give the eligibility criteria, and the major sources and methods of selection of participants (OK)

Variables

Clearly define primary outcome for this report (OK).

Statistical methods

Describe statistical methods, including those used to control for confounding (OK).

Results

Participants

Report Number of participants at the beginning and end of the study (OK).

Main results

Report estimates of associations (OK).

Report appropriate measures of variability and uncertainty (e.g., odds ratios with confidence intervals) (OK).

Conclusions

General interpretation of study results (OK).

6. There is no mention of limitations and their potential impact on the results and interpretation.

There are limitations and strengths in this study. A first limitation is the unequal number of subjects in the 28 age strata. The population sample in the HYDY study was stratified by decades of age rather than by years of age. However discrepancy between age groups is limited and the less numerous group included an acceptable number of subjects. Secondly, the Tanner stage was not assessed. A third limitation is that in the HYDY study biochemical investigations on blood (glucose, cholesterol, and triglycerides) were not assessed in subjects aged less than 14 years. This decision, which precluded us drawing conclusions about the associations with obesity indices, was taken considering the child's perceptions and fears of the procedure of blood collection. The strengths of our study are 1) the novelty in Yemeni children, 2) the large sample size of children studied over different areas of the country with a constantly reproducible study procedure, and finally 3) the door to door approach adopted in the sampling procedure. We decided to adopt a door-to-door procedure rather than performing a school-based study because in low income countries not all children may have access to school. Considering the very high response rate we can exclude the presence of relevant selection bias. Our data provide the first description of the percentile distribution, derived from a large nationally representative sample of 6 to 19 year old children, of WC, WHR and WHtR in urban and rural Yemeni population.

7. The main issue in interpretation of percentiles in the absence of an external standard (or reference population) for comparison is that it does not account for a shift of the entire distribution. The authors could consider using BMI z-scores as the external standard. Overweight and obese categories estimated from BMI z-scores (which based on a reference population). Even though the agreement between measures of central adiposity and BMI are not perfect, the BMI measures are anchored against a reference population.

To our best knowledge this is the first study in Yemeni children and adolescents performed at a National level. However, we agree that we do not have an external or reference population. Differently from BMI, there are not internationally accepted percentiles for WC, all studies being performed at a National level. Recently, WHtR > 0.5 was proposed as a simple cut-off value for screening central obesity in the clinical practice. According to Mushtaq et al. (BMC Pediatr 2011) we analysed our population by using three criteria (WC-based, WHtR-based and a combination of both criteria).

8. What is MCA countries? Please spell out for the first time.

We have now changed the term Middle Crescent Area (MCA) with the term Middle Eastern Crescent (MEC), which indicates one of the 6 regions as presented in the original GBD 1990 study (http://www.who.int/healthinfo/global_burden_disease/definition_regions/en/).

9. The differences in physical activity levels among females in Yemen and Turkey may also be related to other factors such as weather, presence of sidewalks and parks, and attitudes of males towards women walking for leisure. This may be related more to culture than to Islam. (I am Muslim.)

You are right. The discussion was modified as follows:

A low physical activity for girls living in Yemen might be considered. This age related change was however not reported in Turkish girls (20). The differences among females in Yemen may be related to other factors such as weather, absence of sidewalks and parks, and culture such as attitudes of males towards women walking for leisure. Other cultural aspects, such as the adoption of western aesthetic values modifying the traditional consideration of plumpness as an index of beauty might also play a role (27).