Reviewer’s report

Title: Correlations among adiposity measures in school-aged children

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Reviewer: David Freedman

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Although the paper has some interesting data, I think that there are several points that need to be addressed.

Major Compulsory Revisions

1) My biggest concern is the large number of missing values for some of the data. Although I think that it’s not mentioned in the text, footnotes to the tables state that some Ns were only 873; that is, 21% missing data. This could easily introduce some sort of bias, and I think that the general rule is that when the proportion of missing data is >15% [Harrell '01] (p 48), then a multiple imputation technique should be used. This is even more important when data are missing in a non-random manner, such as would be the case for children who were too big for the DXA examination table. (If this were the case, because the correlation between BMI and DXA fat mass is strongest at very high levels, then the BMI-DXA correlation would be biased downwards.) Multiple imputation techniques are not that difficult to apply in SAS, and I think that this would be necessary in the current study. Much more information should be given on the missing data – possibly the proportion missing for each variable could be given in Table 1. Based on the data in Table 3, it seems that it may be the DXA examinations that are responsible for most of the missing data – why did so many of the children not have a DXA exam?

2) Throughout the paper, the authors summarize the associations using Spearman correlation coefficients. Although I’m sure that this was done because several of the variables were not normally distributed, it makes it difficult to compare the results with those of previous studies. For a few of the associations, I’d like to see the comparison of the Spearman r with the Pearson r (after the data were transformed to approach normality).

3) Table 1 contains numerous variables that are not the focus of the paper, and I think they should be removed: birth weight, gestational age, breastfeeding duration, weight/height, leg length, etc. And, there are some variables that should be included in Table 1: prevalence of obesity, overweight plus obesity. It also seems rather silly to use an entire table for 1 column of data – would it not be possible to separate out the results by sex, race, age group, or some other characteristic (even the 3 BMI groups, normal-weight, overweight and obese), and then to present this in separate columns? This would allow the reader to examine the associations between the various characteristics and the...
stratification variable.

4) The very large number of variables in the analyses makes it difficult to focus on the important findings. Is it really necessary to include, for example, DXA fat, DXA trunk fat and DXA FMI in all Table 2? DXA percent body fat shows correlations of \( r=0.96 \) to 0.98 with the other 2 measures, so that any conclusions concerning DXA fat would certainly apply to the other 2 variables. I think the number of variables should be reduced, and more emphasis should be given to the associations with DXA fat and DXA %fat. Is MUAC really necessary?

5) Table 4 seems very odd as some of the cells are filled with ‘PPV = values’; in contrast to the current table, the PPVs, etc. should be the headings of additional columns and the values (e.g., 0.73) should be the cell entries. Please realize that the main reason for the low sensitivity in the bottom half (BMI obesity vs. DXA excess fat) is because the prevalence of excess DXA %fat \((231/875 = 26\%)\) is much higher than the prevalence of BMI obesity \((114/875, 13\%)\). Even if all the children with a high DXA %fat were obese (BMI # 95th percentile), the maximum sensitivity could only be 49\% \((114/231)\). The observed sensitivity is close to the maximum \((0.45 \text{ vs. } 0.49)\), without that the relatively low value of 45\% largely reflects the misalignment of the cut points for the 2 variables. One possible solution to this would be the addition of the kappa statistic to the table; this statistic is less strongly influenced by differences in marginal totals than is sensitivity.

6) I think that an additional 2 by 2 table is needed in which the prevalences of high BMI and high DXA %body fat are equal. The prevalence of BMI obesity is 13\% so one could use the 87th percentile of DXA %body fat as the cut point. If the prevalence of high DXA %fat changes by sex or age, then one could use the 87th percentile within each of these subgroups. This type of comparison, in which the prevalences of high DXA percent body fat and BMI obesity are approximately equal, would be more informative than the one in the bottom of Table 4. Also, please realize that the 30\% and 25\% cut points from reference 19 were chosen largely because humans have 5 fingers on each hand. The authors of that 1992 report did not examine whether 22.5 or 27.5 or 32.5 were superior cut points; they simply showed that the children with high (25 or 30\%) levels of body fat had a higher prevalence of adverse risk factor levels than did children with lower levels of %fat. The authors would have drawn similar conclusions based on an infinite number of alternative cut-points.

Minor Essential Revisions

7) The Intro gives the results of 2 studies that have Ns of 75 and 86, and this makes it seem as if the correlation between BMI and DXA has not been examined in larger studies. The text should probably include the results of several larger studies [Taylor ’02; Freedman ’07; Dugas ’11].

8) Stating that levels of BMI and waist circumference were correlated with metabolic risk factor levels is not very informative (p 3). Please give some idea of the range of the correlations that were observed.
9) Table 2 needs to be re-thought – presenting inter-correlations among everything is not very helpful, and I found that that I need to use a ruler to follow a specific row across the numerous columns of data. Would it be possible to focus on the relation of the DXA measures to the other variables? If this were done, then the associations would be presented overall, by sex, and possibly, by age group or race.

Discretionary Revisions

10) The correlation of $R^2$ of 0.19 between BIA %fat and DXA %fat is so low that it's almost unbelievable. If this is correct, is it not a reflection of the small sample size? Is it possible that this correlation is for the percentage change in DXA fatness rather than the actual level of DXA %fat?

11) It would be helpful to see a few of the Bland-Altman plots for the agreement between %fat (or fat mass) estimated from DXA and BIA.

12) The paper (p 7) states that BMI (and at times) skinfold thicknesses were the predictors in a linear regression model for DXA fat mass. Did these models also include age, sex, and race-ethnicity? If not, would the findings have changed?

13) Table 3: why is the correlation between leg length and height important?

14) The “higher correlations between adiposity measures in black and Hispanic children than white children” (p 11) should be shown in a table. Furthermore, rather than just saying that 1 correlation is higher than another, a statistical test should be performed. In the case of independent correlations, the appropriate formulas are given in many editions of the textbook by Snedecor and Cochran - in the 8th edition [Snedecor ’89], the test is on p 188 (section 10.6).

References


Level of interest: An article whose findings are important to those with closely related research interests

Quality of written English: Acceptable

Statistical review: No, the manuscript does not need to be seen by a statistician.

Declaration of competing interests:

I declare that I have no competing interests