

## Letters to the Editor

# Obesity and vitamin D deficiency: is there an association?

Dear Editor,

We thank V. CN *Nwudu*(1) for her comments and discussion about our article on 'Obesity and vitamin D deficiency: a systematic review and meta-analysis' published in this journal aims to evaluate the association between obesity and vitamin D(2).

A supposed question was raised about the validity of our conclusions because of the methodological quality assessment of the studies included in our systematic review and meta-analysis. Although, we do not use instrument for assessing the methodological quality of studies, we clearly explain that one of the exclusion criteria of the articles was a methodological assessment, using the following criteria for evaluation: inference data for the population from a non-representative sample, and studies that evaluated the relationship between vitamin D deficiency and nutritional status; but did not explain in the methodology the parameters used to evaluate these events. Furthermore, it is important to emphasize that because this is a systematic review, all stages of the work were carried out, mandatorily, by independent reviewers.

In addition, we explored the heterogeneity using meta-regression; however, the selected variables showed no result to be statistically significant, so the random effects model, as explained in the manuscript, was adopted. All variables (latitude, Human Development Index – HDI, sample size, cut-offs to define vitamin D deficiency, age group and study design) that could explain the meta-regression were initially included in the meta-regression and the variables that best explain the heterogeneity of the meta-analysis were kept in the final model. It was observed that the study design ( $P=0.38$ ) did not explain the heterogeneity of the meta-analysis.

Therefore, the results of the meta-analysis are not inconsistent and support the literature on the subject. In addition, it should emphasize that other recent meta-analysis corroborates with our results, recording a relationship between vitamin D deficiency and obesity(2,3).

Furthermore, the author of the critical letter states that cohort studies provide information about causation and the direction of any association. However, the objective of the study was not to identify the causal nature of the relationship between obesity and vitamin D. Consequently, the data collected from the observational articles selected and included in the meta-analysis were cross section in their nature.

Finally, we expect that this brief discussion can contribute to improve the interpretation of our study and encourage new systematic review with a meta-analysis of the cohort studies investigating the causal connection and direction of the relationship between obesity and vitamin D deficiency.

### Conflicts of interest

We declare no competing interests.

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### References

1. *Nwudu VC*. Association between obesity and vitamin D deficiency. *Obes Rev* 2015; **16**: 817.
2. *Pereira-Santos M, Costa PR, Assis AM, Santos CA, Santos DB*. Obesity and vitamin D deficiency: a systematic review and meta analysis. *Obes Rev* 2015; **16**: 341–349.
3. *Yao Y, Zhu L, He L et al*. A meta-analysis of the relationship between vitamin D deficiency and obesity. *Int J Clin Exp Med* 2015; **8**: 14977–14984.