

The double-burden of functional vitamin B¹² deficiency among non-supplemented vegan adults: a systematic review and meta-analysis

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Plant-based diets, including vegan diets, are associated with significant health benefits but can also increase the risk of certain nutritional deficiencies, particularly vitamin B¹² deficiency⁽¹⁾. Pregnant and lactating vegan women are at an even more elevated risk of B¹² deficiency due to increased demand from the mother and foetus which, if not met⁽²⁾, can have severe health implications across the life course⁽³⁾. We carried out a systematic review and meta-analysis to develop a consensus on vitamin B¹² status among vegans and, more specifically, vegan women of childbearing age, using functional and static biomarkers.

A comprehensive search strategy of PubMed, Web of Science and Scopus was undertaken to identify studies comparing B¹² Status among vegans versus non-vegan controls. After removing duplicates, two independent reviewers used Rayyan software to screen articles based on a comprehensive set of inclusion and exclusion criteria. Specific study characteristics and outcomes, including static - serum B¹² & holotranscobalamin - and functional indicators of B¹² status - concentrations of methylmalonic acid and/or homocysteine - of participants who supplemented with B¹² were extracted. We conducted a random-effects meta-analysis framework for each outcome and undertook subgroup analyses to evaluate the influence of

B¹² supplementation on B¹² status among vegans.

A total of 1,894 records were identified. Only 13 studies were eligible and included in the systematic review & meta-analysis. Only one study provided gender-specific results for vitamin B¹² status. Our meta-analysis of B¹² status showed a significant trend towards lower serum B¹² and holotranscobalamin concentrations (mean difference: -158 pmol/L | p = 0.05 & -13.1 pmol/L | p = 0.08, respectively) and higher methylmalonic acid and homocysteine (mean difference: +148 nmol/L | p = 0.01 & +3.76 umol/L | p = 0.03, respectively) among vegan participants compared to omnivores. Sub-group analysis showed significant, consistent, and physiologically relevant improvements in all B¹² biomarkers between supplemented and non-supplemented vegan participants.

This is the first meta-analysis to highlight a significant and physiologically relevant decrease in vitamin

B¹² status between vegans and non-vegans using static and functional biomarkers. Furthermore, the findings suggest that B¹² supplementation can improve B¹² status, as evidenced by both static and functional biomarkers of B¹² status. Alarming, in light of B¹² deficiency rates of 62% among pregnant vegetarian women⁽⁴⁾, only one study presented results for functional vitamin B¹² status among vegan women of childbearing age. These findings underscore the importance of urgent research among this at-risk group, regularly monitoring B¹² status and the need for appropriate use of B¹² supplements among vegans, particularly those of child-bearing age. Further research is underway to explore the knowledge, attitudes and practices of B¹² and supplementation among UK-dwelling vegan women of child-bearing age.

References

1. Bakaloudi DR, Halloran A, Rippin HL, *et al.* (2021) *Clin Nutr* **40**, 3503–21.
2. Obeid R, Murphy M, Solé-Navais P, *et al.* (2017) *Adv Nutr* **8**, 971–79.
3. Rogne T, Tielemans MJ, Chong MF-F, *et al.* (2017) *Am J Epidemiol* **185**, 212–23.
4. Pawlak R, Parrott SJ, Raj S *et al.* (2013) *Nutr Rev* **71**, 110e7.