

Is plasma vitamin C an appropriate biomarker of vitamin C intake? A systematic review and meta-analysis

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Abstract

Background

As the primary source of dietary vitamin C is fruit and to some extent vegetables, the plasma level of vitamin C has been considered a good surrogate or predictor of vitamin C intake by fruit and vegetable consumption. The purpose of this systematic review was to investigate the relationship between dietary vitamin C intakes measured by different dietary methods and plasma levels of vitamin C.

Method

We searched the literature up to May 2006 through the OVID interface: MEDLINE (from 1960) and EMBASE (from 1988). We also reviewed the reference lists in the articles, reviews, and textbooks retrieved. A total of 26 studies were selected and their results were combined using meta-analytic techniques with random-effect model approach.

Results

The overall result of this study showed a positive correlation coefficient between Food Frequency Questionnaire (FFQ) and biomarker ($r = 0.35$ for "both" genders, 0.39 for females, and 0.46 for males). Also the correlation between Dietary Recalls (DR)/diary and biomarker was 0.46 for "both" genders, 0.44 for females, and 0.36 for males. An overall correlation of 0.39 was found when using the weight record method. Adjusting for energy intake improved the observed correlation for FFQ from 0.31 to 0.41 . In addition, we compared the correlation for smokers and non-smokers for both genders (FFQ: for non-smoker $r = 0.45$, adjusted for smoking $r = 0.33$).

Conclusion

Our findings show that FFQ and DR/diary have a moderate relationship with plasma vitamin C. The correlation may be affected/influenced by the presence of external factors such as vitamin bioavailability, absorption condition, stress and food processing and storage time, or by error in reporting vitamin C intake.