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Comparing accuracy and precision of different analytical methods for determination of vitamin C content in fruits and vegetables

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Vitamin C is the most important vitamin for human wellbeing which is supplied through plant sources. As different analytical methods are applied to quantify vitamin C in fruits, beverage, pharmaceuticals etc., the aim of this study was to compare the different analytical methods and selecting more accurate methods for quantifying vitamin C in different varieties of fruits and vegetables. Reliable data for vitamin C content is important for consumers, food manufacturers, quality controlling agencies, and researchers etc. In this study six methods of vitamin C determination, including five titrimetric analysis and one spectrophotometric analysis were compared and validated for precision and accuracy. The titrimetric methods used in the study were titration with potassium iodate, sodium thiosulfate, N-bromosuccinimide, iodine and 2,6-dichloroindophenol (AOAC method), and 2,4-dinitrophenylhydrazine method was applied in spectrometric method. Three fruit species namely, *Syzygium jambos*, *Averrhoa carambola* and *Psidium guajava* (white flesh) which are known to contain low, middle and high vitamin C contents respectively and one vegetable species, *Solanum lycopersicum* were selected for the study. The methods were compared with AOAC official titrimetric method. Intra-day and inter-day precision and accuracy was calculated as percentage recovery of added standard ascorbic acid (AA). Precision of the method was presented as percentage of relative standard deviation (RSD%). One-way analysis of variance (ANOVA) and Tukey's test were performed to evaluate the significance ($p < 0.05$) of differences of the mean between different methods. An underestimation and overestimation of AA was observed in KIO_3 and $Na_2S_2O_3$ titrimetric methods respectively. Iodine method had almost 100% recovery of added standard AA. There is no significant difference between mean AA contents obtained from iodine and AOAC methods. Although N-bromosuccinimide gave reasonably comparative methods with iodine and AOAC methods, inter-day and intra-day RSD% are comparatively higher than other methods. 2,4-Dinitrophenylhydrazine method estimates total vitamin C content (AA + dehydroascorbic). Results of the current study reveals that iodine titrimetric method as well as AOAC method produce reliable values for AA in fruits and vegetables, and AOAC method cannot be applied for the extracts with intense colour, and iodine method can be used as an alternative for such.

Keywords: Vitamin C, Spectrometric, Titrimetric, Ascorbic acid, Dehydroascorbic acid

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