

Request: Are there published studies that investigate how industrial microwave treatments affect the nutritional content of food (vs. conventional pasteurization methods)?

Response:

- Only a few studies that looked at the effect of microwave treatments on vitamins and minerals in foods were found. **In general, microwave treatments showed equivalent or better retention of nutrients than did conventional methods.**
 - One report (Qu et al., 2021) found that ascorbic acid levels in green beans treated by microwave-assisted thermal pasteurization (using a pilot-scale 915 MHz semi-continuous MAPS system) remained higher when compared to **green beans** treated by conventional hot water pasteurization.
 - One report looked at both water-soluble and fat-soluble vitamin content and other quality factors of **bottle gourd juice** subjected to either conventional processing or microwave plus ultrasound processing (Das et al., 2020). The microwave plus ultrasound treatment (using a Neos GR microwave system) resulted in superior vitamin content (and also antioxidant activity, color, and other parameters).
 - Sonar (2020) looked at the stability of encapsulated and non-encapsulated vitamin C as well as lipid soluble vitamins (A and E in esterified forms) in **mashed potatoes** following MAPS (also using a pilot-scale 915 MHz semi-continuous MAPS system) or conventional processing (Sonar et al., 2020). No differences in any of these vitamin levels were observed when comparing MAPS vs. conventional processing.
 - Soni (2020) reviewed several studies that compared retention of vitamins and minerals in **vegetables and meats** cooked by microwave vs. conventional treatment. These studies showed better retention of vitamins and minerals upon microwave treatment vs. conventional treatments (Soni et al., 2020)
 - Another trade magazine ([National Provisioner](#)) published a discussion of a study in which the vitamin content of meal (goulash with potatoes and red peppers) prepared by a conventional autoclave process and a proprietary industrial microwave technology were compared, stating that “after cooking, the vitamin content of the proprietary microwave technology fresh chilled ready meal was almost as twice as high as the other”. No additional information was provided.
- Other studies looked at the effect of microwave treatment on quality factors that might be related to nutrition:
 - Siguemoto et al. (2019) used MAPS vs. conventional pasteurization on apple juice and measured phenolics compounds and antioxidant capacity following both, concluding that “changes in phenolic contents of pasteurized samples were independent of the processing technology” (Siguemoto et al., 2019).
 - Another study (Bornhurst 2017) compared MAPS with traditional hot water pasteurization, both at either 90 or 95°C on mashed potato and green pea model foods. While the study focused more on control of nonproteolytic *Clostridium botulinum* and not nutrition, they did say that that MAPS (915 MHz in hot water) at 95°C resulted in the

least color change in the food by performing a color analysis of the foods before and after processing (Bornhorst et al., 2017). This analysis was used here and in other studies as kind of a surrogate for product quality.

- Apart from their effects on nutrition, several general papers that describe various commercial microwave food technologies were identified.
 - [The McHugh 2019 article](#) provides a discussion of microwave-assisted pasteurization technology (MAPS) and microwave-assisted thermal sterilization (MATS).
 - The Stanley (2017) book chapter describes various industrial continuous flow microwave systems for pasteurization or sterilization (Stanley and Petersen, 2017).
 - The Tang 2015 and 2018 papers discuss various microwave pasteurization/sterilization technologies with an emphasis on their use for RTE foods (Tang, 2015; Tang et al., 2018).

References

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