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Analysis of Microbiological Quality and Vitamin C Retention in Commercial Vegetable Processing Methods in Hospitals: A Narrative Literature Review

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ABSTRACT

Hospital food carries two mandates that can pull against each other: it must be microbiologically safe for vulnerable patients and remain nutritious, including vitamin C, which is easily lost through heat, water and time. This article reviews evidence on vitamin C retention and microbiological quality in commercial and institutional vegetable processing in hospitals and formulates a laboratory protocol that measures both. It is a narrative literature review of laboratory and field studies, a systematic review, outbreak reports and Indonesian regulations; no primary data are reported. The findings indicate that (1) vitamin C retention depends strongly on method and time, with boiling generally causing the largest losses and steaming and microwaving performing better; (2) in hospital service systems, important losses may occur after cooking, namely during hot-holding, chilling and reheating, and a systematic review found vitamin C losses between preparation and service in all seven studies included; (3) hospital microbiological studies generally find cooked vegetables compliant, whereas non-compliant results tend to come from equipment and water, and healthcare foodborne outbreaks are often attributed to inadequate time-temperature control and kitchen hygiene; and (4) in the author's search, almost no study measured microbiological quality and vitamin C on the same samples across the service cycle. The article proposes a factorial design with repeated sampling points and presents hypothetical decision rules that require testing

INTRODUCTION

Food is an integral part of hospital therapy. Indonesian hospital nutrition service guidelines define food quality as a value determined based on criteria for food safety, nutritional content, and standards for food and beverage ingredients. This includes food provision, whether through self-management or contracting to catering providers (Minister of Health Regulation No. 78 of 2013). This definition places two equal demands on food: safety and nutrition. In practice, these two demands do not always align.

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Vegetables are a source of vitamin C, and vitamin C is one of the micronutrients most susceptible to loss during processing and storage. A systematic review of food prepared in hospitals and care facilities noted that cases of scurvy in healthcare settings have been reported in various countries, and found that all seven included publications identified vitamin C losses between preparation and serving due to cooking methods (Armstrong et al., 2019). This means that the vitamin C content listed in raw food composition tables cannot be assumed to reach patients' plates.

From a safety perspective, hospitalized patients are a vulnerable group. A review of healthcare-associated food safety outbreaks in 16 OECD countries identified 57 outbreaks in the literature. Listeria monocytogenes was the leading pathogen based on the number of deaths, while the most frequently implicated food groups included mixed foods, fruits and vegetables, and meat. Reported contributing factors included providing high-risk foods to vulnerable patients, inadequate time and temperature control, poor kitchen and food hygiene, and food handlers acting as pathogen carriers (Boone et al., 2021).

The tension between these two demands is structural. Heat is the primary step in inactivating microbes, but heat and water also reduce vitamin C. Holding food hot protects against bacterial growth but prolongs the exposure time, which reduces vitamin C. Cooling food for later serving is also microbiologically safe when controlled, but increases the loss rate. However, the literature tends to separate these two dimensions: nutritional studies measure vitamin C without assessing microbes, while hygiene studies measure microbes without assessing nutrients. One study that measured both in food for neutropenic patients in a Brazilian hospital found that sanitized fruits and vegetables were below the detection limit for thermotolerant coliforms and coagulase-positive Staphylococcus aureus and free of Salmonella, but the vitamin C in boiled food was reduced by an average of 38.9 percent compared to raw, and this loss was positively correlated with cooking time (Galati et al., 2013).

In Indonesia, microbiological monitoring of hospital food is regulated, among other things, by Minister of Health Regulation Number 7 of 2019 concerning Hospital Environmental Health, which requires regular sampling of ready-to-eat food, clean water, food utensils, and cooking utensils. Microbiological studies in Indonesian hospital nutrition facilities encountered by the author generally examined food, cutlery, water, and the health of handlers (e.g., Fatimah et al., 2022), while vitamin C measurements in Indonesian hospital food were not found in the author's search. Commercial-scale vegetable processing methods, namely boiling in a large kettle, steaming, sautéing, and heat retention or cook-chill systems, are also rarely compared in an integrated manner for these two outcomes.

This article answers three questions. First, what is known about vitamin C retention in commercial vegetable processing methods and at different stages of the hospital service cycle? Second, what is known about the microbiological quality of processed vegetables in hospitals and which stages pose risk? Third, how can a laboratory study that measures both simultaneously be designed and what decision rules can be tested from it. This article is a narrative literature review and does not report primary data, and therefore does not represent new laboratory analysis results.

METHODOLOGY

This article is a narrative literature review with a proposed research protocol. It is not a formal systematic review and does not contain new primary data or meta-analyses.

The sources are grouped into five groups: (1) laboratory studies on the effect of cooking methods on vitamin C in vegetables; (2) studies of vitamin C retention in hospital care systems and institutional restaurants, including systematic reviews; (3) microbiological studies on hospital food, including reports from Indonesia; (4) reviews of food safety outbreaks in healthcare; and (5) Indonesian regulations on nutrition services and hospital environmental health.

The search was conducted in September 2026 through web search engines and open databases (including PubMed and PubMed Central, as well as national journal portals), using Indonesian and English keywords such as "vitamin C vegetable cooking method," "ascorbic acid loss hospital foodservice," "cook-chill vitamin retention," "microbiological quality of food in hospital nutrition installations," and "healthcare-associated foodborne outbreaks." Inclusion criteria were studies measuring vitamin C or microbiological indicators in vegetables or processed foods in the context of a hospital or institutional dining service, or laboratory studies comparing cooking methods. The most relevant retention studies for the hospital system question included classic works from the 1990s that were retained because there were no equivalent replacements.

The synthesis was conducted thematically according to three research questions. Limitations of the study should be stated. The search did not follow the PRISMA protocol and did not use a formal risk of bias assessment tool. Vitamin C analysis methods differed between studies (high-performance liquid chromatography, titration with 2,6-dichlorophenolindophenol, colorimetric reaction, and UV method), so retention rates were not fully comparable. Most evidence comes from outside Indonesia and some is from decades ago. Some studies could only be assessed from abstracts, making methodological details unverifiable. The proposed protocol in subsection 4.5 has not yet been implemented.

RESULTS AND DISCUSSION

Vitamin C retention according to cooking method

Laboratory studies of cooking methods have shown wide variations in vitamin C retention. In a study comparing blanching, boiling, microwaving, and steaming of several vegetables by calculating true retention based on yield, vitamin C retention ranged from 0.0 to 91.1 percent, generally higher with microwaving and lower with boiling, and depending on the vegetable type and process (Lee et al., 2018). In six vegetables consumed in northeastern Bangladesh, boiling resulted in the greatest reduction in ascorbic acid (9.83 to 70.88 percent), with spinach experiencing the greatest reduction, while microwaving retained more than 90 percent of the original level and steaming had a moderate effect (Razzak et al., 2023). In broccoli cooked by five household methods, all treatments except steaming resulted in significant losses of chlorophyll and vitamin C, with sautéing and sauté-boiling resulting in the greatest losses (Yuan et al., 2009). A review comparing restaurant systems suggested cooking by steaming, pressure cooking, or steaming with a small amount of water, as well as monitoring cooking time and temperature (Moraes et al., 2010).

Two important caveats need to be added. First, most laboratory studies use small portions and short times, whereas hospital kitchens cook in large kettles and appliances with longer heating and removal times. Extrapolating laboratory retention figures to institutional kitchens therefore requires caution. Second, vitamin C is not the sole measure of quality. Studies of cooking methods have found that total antioxidant capacity can increase in cooked vegetables as the matrix softens, and that the best method varies among

vegetables (Miglio et al., 2008). For the purposes of this article, vitamin C is used as a marker of nutrient loss that is sensitive to heat, water, and time, not as a comprehensive assessment of vegetable quality.

Vitamin C retention in the hospital service cycle

Evidence from hospital systems suggests that losses are not solely a matter of cooking method. In a simulated cook/chill and cook/hot-hold system for seven vegetables, using chromatographic analysis, vegetables reheated after one day of cold storage lost more vitamin C and folate than those held at 72°C for 30 minutes, but more than those held hot for two hours; the reheating method (conduction or infrared) did not differ significantly, and when the warm hold was limited to less than 90 minutes, vitamin retention was likely higher in the hot-hold system than in the cook/chill system (Williams et al., 1995). A review of 66 studies corroborates this picture: vitamin C and folate losses can exceed 30 percent when foods are reheated after 24 hours of storage at 3°C, and under normal operating conditions with hot holds of less than 90 minutes, vitamin retention is better in conventional than in the cook/chill system (Williams, 1996).

A field study in a hospital plate cook-chill system measured ascorbic acid in carrots, peas, and potatoes by titration. Raw levels of 6 to 10 mg per 100 g decreased to 1.7 to 5.8 mg per 100 g at the end of the service cycle, with losses as high as 76 percent in mashed potatoes and as low as 42 percent in peas, and significant losses during the cooking and regeneration stages (McErlain et al., 2001). In Brazil, cumulative vitamin C losses in seven vegetables after all handling stages reached 44.38 to 67.03 percent in institutional restaurants and 32.90 to 71.32 percent in commercial restaurants, with storage being the stage with the greatest losses for most vegetables (Moraes et al., 2010). In a hospital nutrition unit, the application of 24-hour storage criteria at 10 °C, 15-minute washing, and immediate distribution after preparation did not result in significant differences in vitamin C between handling stages, but ascorbic acid retention decreased to 46.94 percent in green cabbage after 60 minutes of exposure before consumption and 71.81 percent in tomatoes after 120 minutes (Della Lucia et al., 2008).

A summary of the studies is presented in Table 1. Two cautious conclusions can be drawn. First, in hospital systems, post-cooking time and stages (holding, cooling, reheating, and waiting to serve) account for a significant portion of losses, so comparing cooking methods without considering the service system may be misleading. Second, a systematic review synthesizing studies in hospitals and nursing facilities found that all included studies identified vitamin C losses between preparation and serving (Armstrong et al., 2019), so vitamin C values from food composition tables cannot be assumed to reflect patient consumption.

Table 1. Summary of studies on vitamin C retention in cooking methods and in the hospital service cycle

Source	Materials and design	Method or system	Main findings
Lee et al. (2018)	Some vegetables; true retention is calculated from yield	Blanch, boil, microwave, steam	Vitamin C retention 0.0–91.1%; generally highest in microwave, lowest in boiling; depends on vegetable type

Source	Materials and design	Method or system	Main findings
Razzak et al. (2023)	Six vegetables in northeastern Bangladesh	Boil, steam, microwave	Boiling reduced ascorbic acid the most (9.83–70.88%); microwaving retained more than 90%; steaming moderately
Yuan et al. (2009)	Broccoli; five household methods	Steam, microwave, boil, stir-fry, stir-fry-boil	All treatments except steaming caused significant vitamin C loss; the biggest stir-fries and stir-fries
Galati et al. (2013)	Three vegetables and nine fruits for neutropenic patients; raw vs. boiled; colorimetry	Boiled	Vitamin C loss averaged 38.9% and was positively correlated with cooking time; microbes below detection limit; Salmonella absent
Williams et al. (1995)	Seven vegetables; hospital service simulation; HPLC	Cook/chill vs cook/hot-hold	Reheating after 1 day of cold: greater loss than 30-minute 72°C hold, better than 2-hour hot hold; reheating method no different
Williams (1996)	Review of 66 studies	Hot-hold, chill, reheat	Vitamin C, folate, B6 lost >10% after 2 hours hot-hold; >30% (vit. C, folate) after 24 hours storage at 3 °C and reheating
McErlain et al. (2001)	Carrots, peas, potatoes; plated cook-chill service; titration	Cook-chill	Raw levels 6–10 decrease to 1.7–5.8 mg/100 g; loss 42% (peas) to 76% (mashed potatoes)
Moraes et al. (2010)	Seven vegetables; institutional and commercial restaurants; HPLC	All stages of handling	Cumulative losses 44.4–67.0% (institutional) and 32.9–71.3% (commercial); greatest storage losses in most vegetables
Della Lucia et al. (2008)	Green cabbage and tomatoes; hospital nutrition unit; HPLC	Store 24 hours at 10°C, wash 15 minutes, distribute immediately	There was no significant difference between the stages; retention was 46.9% (green cabbage, 60 minutes) and 71.8% (tomato, 120 minutes) after pre-consumption exposure.
Armstrong et al. (2019)	Systematic review, 7 publications	Cooking methods in hospitals and care facilities	All studies identified a loss of vitamin C between preparation and serving.

Source: Author's synthesis of the studies in the first column. Vitamin C analysis methods differ between studies, so the figures are not completely comparable.

Microbiological quality of processed vegetables in hospitals

On the microbiological side, evidence from hospitals suggests two patterns. First, well-cooked and sanitized vegetables tend to meet the requirements. In food for neutropenic patients in Brazil, Salmonella was absent, and populations of coagulase-positive S. aureus and thermotolerant coliforms were below the detection limit (less than 100 CFU/g and less than 3 MPN/g) (Galati et al., 2013). In a hospital nutrition facility in Banjarmasin, all 24 food samples (vegetables and animal dishes) taken monthly for six months were negative for E. coli and Salmonella, and all 18 anal swab samples from handlers were negative (Fatimah et al., 2022).

Second, non-compliant findings tend to originate from the supporting environment, not from the cooked food. In the same Banjarmasin study, two of four cutlery samples were non-compliant (1 and 5 CFU/cm², while the cutoff is zero), and one tap water sample contained coliforms (Fatimah et al., 2022). The authors' interpretation, which needs to be tested, is that the greatest risk for cooked vegetables lies not in the cooking stage itself, but in post-cooking recontamination via equipment, water, hands, and trolleys, as well as in time-temperature control during handling and distribution. This interpretation aligns with a review of outbreaks in healthcare settings that cited inadequate time and temperature control, kitchen hygiene, and handlers as pathogen carriers as reasons for outbreaks (Boone et al., 2021). The Banjarmasin study is descriptive, with a small sample size and limited parameters (E. coli and Salmonella), so it cannot describe the full range of risks, including L. monocytogenes, and should not be generalized.

The frequency of monitoring is also worth noting. Regulations require sampling at least twice a year (Minister of Health Regulation No. 7 of 2019, as summarized in Jogloabang, 2023), while hospitals in the Banjarmasin study reported monthly food inspections (Fatimah et al., 2022). This discrepancy suggests that regulatory minimums do not reflect best practice, but also that the quality of monitoring depends heavily on individual hospital policies.

Finally, the choice of cooking method can interact with the initial state of the ingredients. A study on the influence of culinary processing on vegetable quality, which assessed nutritional value, sensory quality, and contamination level, concluded that cooking method should be determined by nutritional value and contamination level: for uncontaminated vegetables, low-water methods preserve nutrients, while high-water methods are recommended for contaminated vegetables (Czarniecka-Skubina & Gołaszewska, n.d.). This finding illustrates a direct dilemma: the best approach for vitamin C is not always the best approach for safety when the starting material is problematic, making the quality of the starting material and sanitation crucial for any nutritional decision.

Trade-off analysis and hypothetical decision rules

Table 2 compares processing stages and methods with their microbiological benefits, impact on vitamin C, and decision notes. The decision column contains working hypotheses derived from indirect evidence, not final recommendations.

Table 2. Trade-off of microbiological safety and vitamin C retention according to processing stage or method

Stages or methods	Microbiological benefits	Impact on vitamin C	Decision note (hypothesis)
Large volume boiling	Even heating; recommended if the material is contaminated (Czarniecka-Skubina & Gołaszewska, n.d.)	The greatest losses were in many vegetables (Lee et al., 2018; Razzak et al., 2023)	Reduce water volume and time; ensure the quality of the starting materials
Steaming	Core temperature can be achieved and verified	Lower losses in broccoli (Yuan et al., 2009); recommended for institutional restaurants (Moraes et al., 2010)	Prime candidate; verify core temperature and time
Stir-frying	High temperature, short time; results vary	Large losses in broccoli (Yuan et al., 2009); waiting time increases losses	Test per vegetable type; limit waiting time
Heat resistance ≥ 60 °C	Prevent growth in dangerous temperature zones (WHO, 2006)	>10% lost after 2 hours (Williams, 1996)	Limit to about 90 minutes (Williams et al., 1995)
Cook-chill	Rapid cooling and cold storage limit growth	Loss of each stage; >30% after 24 hours and reheating (Williams, 1996)	Use when service hours demand; measure losses and adjust menus accordingly.
Storage of raw materials	Cold temperatures suppress growth	The greatest loss stage in most restaurant vegetables (Moraes et al., 2010)	Order as needed; keep cold
Washing and sanitation	Reduce initial contamination	Leaching if too long; the 15 minute criterion was used in the hospital study (Della Lucia et al., 2008)	Limit the duration; use clean water

Source: author's synthesis; the last column is the hypothesis that needs to be tested.

From this table, five hypothetical decision rules worth testing can be formulated. First, among cooking methods, steaming or low-water, short-time methods are expected to preserve vitamin C better than large-volume boiling, provided the core temperature is verified. Second, the heat retention time is limited to approximately 90 minutes, given that vitamin C loss increases with time and retention is better with shorter retention times (Williams et al., 1995; Williams, 1996), while maintaining the temperature above 60°C (WHO, 2006). Third, cook-chill is used when service hours require it, with rapid cooling

and measurement of vitamin C loss as part of menu validation. Fourth, the pre-cooking phase is controlled: ingredients are ordered as needed, kept cold, and washing times are kept short (Moraes et al., 2010; Della Lucia et al., 2008). Fifth, menu planning uses post-service vitamin C estimates, rather than raw values, given documented losses (Armstrong et al., 2019). These rules rely on evidence that mostly does not come from Indonesia and does not measure microbes and vitamin C in the same sample, so their interaction has never been tested.

Proposed laboratory research protocol

A key gap in this review is the lack of studies measuring both microbiological quality and vitamin C on the same sample throughout the service cycle. Table 3 proposes a factorial design that addresses this gap. The principle is to take the same sample at multiple points and analyze it for both outcomes, allowing each combination of cooking method and service system to be assessed on both axes simultaneously.

Table 3. Proposed factorial protocol to measure microbiological quality and vitamin C retention simultaneously

Element	Proposal
Design	Experimental study of laboratory or test kitchen with factorial design: type of vegetable × cooking method × service system; three batches on different days with analytical duplicates
Vegetables	Examples: leafy vegetables (spinach or kale), root vegetables (carrots), and flower/cabbage vegetables (broccoli or cauliflower); ingredients from the same supplier in one batch
Cooking method	Boil (standard water volume), steam, and stir-fry, using an institutional scale apparatus with recorded working volume load; core temperature and time recorded with a logger
Service system	(a) Serve immediately; (b) hot-hold ≥ 60 °C for several holding times (e.g., 30, 90, and 120 minutes); (c) cook-chill with rapid cooling, store ≤ 5 °C for 24 hours, and reheat
Sampling point	Raw materials after receipt; after washing and cutting; after cooking; after holding or reheating; on plates or trolleys (point of consumption)
Microbiological output	Total plate count, coliform or Enterobacteriaceae, E. coli, S. aureus, Salmonella, and Listeria; acceptance criteria follow current regulations and accredited laboratories; swab equipment, water, and hands at the same point
Chemical output	Vitamin C (ascorbic acid and dehydroascorbic acid) by high-performance liquid chromatography, extraction with stabilizing acid solution; true retention corrected by yield
Analysis	Mixed model or factorial ANOVA with batch as random effect; microbial in log10 CFU/g with consistent treatment for values below the detection limit; joint decision matrix microbiological compliance × vitamin C retention

Element	Proposal
Sample size	Determined from the variation of preliminary study results (pilot)
Safety and ethics	No human subjects involved; handling of microbiological samples according to laboratory safety procedures; kitchen permit if sampling is conducted in a hospital

Source: author's formulation based on synthesis in subchapters 4.1 to 4.4.

This design produces a decision matrix: for each combination of vegetable type, cooking method, and service system, whether the microbiological criteria are met and the vitamin C retention at the point of consumption are recorded. The combination that meets the microbiological criteria and provides the highest retention becomes a candidate for standard practice, and an acceptable retention threshold is established prior to analysis with a clinical nutritionist. This design also allows for testing of the five decision rules formulated in section 4.4. Limitations to be addressed include the limited generalizability of a single kitchen or set of equipment, variation in ingredient quality between batches, and the need for accredited microbiology and food chemistry laboratories.

Practical implications for nutrition installations

While awaiting consolidation, nutrition facilities can take several evidence-based steps. First, map the vegetable production flow and record the time between cooking and serving, as time has been shown to be a major factor in vitamin C loss (Williams, 1996; Della Lucia et al., 2008). Second, prioritize controlling recontamination of equipment, water, and carts, as these are where non-compliant findings tend to occur (Fatimah et al., 2022). Third, review the frequency of microbiological monitoring above regulatory minimums, especially for immunocompromised patients who are susceptible to pathogens such as L. monocytogenes (Boone et al., 2021). Fourth, measure vitamin C levels at the point of consumption for selected vegetable dishes and use the results to adjust menu planning. For hospitals with a contract system, these steps should be included in the quality agreement with catering providers (Minister of Health Regulation No. 78 of 2013).

CONCLUSION

This review concludes four points. First, vitamin C retention in vegetables is highly dependent on the method and duration of processing, with boiling generally the most detrimental and steaming or microwaving preferable. Second, in hospital care systems, significant losses occur after cooking, i.e., during holding, cooling, reheating, and waiting to be served, and all included studies in the systematic review identified losses between preparation and serving. Third, the microbiological quality of cooked vegetables in hospitals is generally reported as acceptable, while non-existent findings tend to originate from equipment and water, and outbreaks in healthcare settings have been associated with time-temperature control and kitchen hygiene. Fourth, almost no studies have measured both microbes and vitamin C in the same sample, so the trade-off between safety and nutrient retention has never been directly assessed. The factorial design in Table 3 is proposed to fill this gap.

REFERENCES

Armstrong, E., Jamieson, R., & Porter, J. (2019). Food cooking methods contribute to the reduced vitamin C content of foods prepared in hospitals and care facilities: A systematic review. *International Journal of Food Science & Technology, 54*(1), 291–299.

Boone, I., Rosner, B., Lachmann, R., D'Errico, M. L., Iannetti, L., Van der Stede, Y., Boelaert, F., Ethelberg, S., Eckmanns, T., Stark, K., Haller, S., & Wilking, H. (2021). Healthcare-associated foodborne outbreaks in high-income countries: A literature review and surveillance study, 16 OECD countries, 2001 to 2019. *Eurosurveillance, 26*(41), 2001278. https://doi.org/10.2807/1560-7917.ES.2021.26.41.2001278

Czarniecka-Skubina, E., & Gołaszewska, B. (t.t.). Effect of culinary process on selected vegetables quality. *Żywność. Nauka. Technologia. Jakość*. https://journal.pttz.org/?p=5980

Della Lucia, C. M., Campos, F. M., Oliveira, D. S., & Pinheiro-Sant'Ana, H. M. (2008). Validation of criteria to control loss of vitamin C in vegetables prepared in a hospital food service unity. *Ciência e Tecnologia de Alimentos, 28*(4), 809–816.

Fatimah, S., Hekmah, N., Fathullah, D. M., & Norhasanah. (2022). Cemaran mikrobiologi pada makanan, alat makan, air dan kesehatan penjamah makanan di unit instalasi gizi Rumah Sakit X di Banjarmasin. *Journal of Nutrition College, 11*(4), 322–327.

Galati, P. C., Lataro, R. C., Souza, V. M., De Martinis, E. C. P., & Chiarello, P. G. (2013). Microbiological profile and nutritional quality of raw foods for neutropenic patients under hospital care. *Revista Brasileira de Hematologia e Hemoterapia, 35*(2), 94–98. https://doi.org/10.5581/1516-8484.20130028

JDIH BPK. (t.t.). *Peraturan Menteri Kesehatan Nomor 7 Tahun 2019 tentang Kesehatan Lingkungan Rumah Sakit* [Status peraturan]. Database Peraturan BPK. https://peraturan.bpk.go.id/Details/111721/permenkes-no-7-tahun-2019

Jogloabang. (2023, 14 Maret). *Permenkes 7 Tahun 2019 tentang Kesehatan Lingkungan Rumah Sakit* [Ringkasan]. https://www.jogloabang.com/kesehatan/permenkes-7-tahun-2019-tentang-kesehatan-lingkungan-rumah-sakit

Lee, S., Choi, Y., Jeong, H. S., Lee, J., & Sung, J. (2018). Effect of different cooking methods on the content of vitamins and true retention in selected vegetables. *Food Science and Biotechnology, 27*(2), 333–342. https://doi.org/10.1007/s10068-017-0281-1

McErlain, L., Marson, H., Ainsworth, P., & Burnett, S.-A. (2001). Ascorbic acid loss in vegetables: Adequacy of a hospital cook–chill system. *International Journal of Food Sciences and Nutrition, 52*, 205–211.

Miglio, C., Chiavaro, E., Visconti, A., Fogliano, V., & Pellegrini, N. (2008). Effects of different cooking methods on nutritional and physicochemical characteristics of selected vegetables. *Journal of Agricultural and Food Chemistry, 56*(1), 139–147.

Moraes, F. A., Cota, A. M., Campos, F. M., & Pinheiro-Sant'Ana, H. M. (2010). Perdas de vitamina C em hortaliças durante o armazenamento, preparo e distribuição em restaurantes. *Ciência & Saúde Coletiva, 15*(1), 51–62. https://doi.org/10.1590/s1413-81232010000100010

Peraturan Menteri Kesehatan Republik Indonesia Nomor 78 Tahun 2013 tentang Pedoman Pelayanan Gizi Rumah Sakit. (2013). https://peraturan.go.id/id/permenkes-no-78-tahun-2013

Peraturan Menteri Kesehatan Republik Indonesia Nomor 7 Tahun 2019 tentang Kesehatan Lingkungan Rumah Sakit. (2019). https://peraturan.bpk.go.id/Details/111721/permenkes-no-7-tahun-2019

Razzak, A., Mahjabin, T., Khan, M. R. M., Hossain, M., Sadia, U., & Zzaman, W. (2023). Effect of cooking methods on the nutritional quality of selected vegetables at Sylhet City. *Heliyon, 9*(11), e21709. https://doi.org/10.1016/j.heliyon.2023.e21709

Williams, P. G. (1996). Vitamin retention in cook/chill and cook/hot-hold hospital foodservices. *Journal of the American Dietetic Association, 96*(5), 490–498.

Williams, P. G., Ross, H., & Brand Miller, J. C. (1995). Ascorbic acid and 5-methyltetrahydrofolate losses in vegetables with cook/chill or cook/hot-hold foodservice systems. *Journal of Food Science, 60*(3), 541–546.

World Health Organization. (2006). *Five keys to safer food manual*. WHO.

Yuan, G. F., Sun, B., Yuan, J., & Wang, Q. M. (2009). Effects of different cooking methods on health-promoting compounds of broccoli. *Journal of Zhejiang University Science B, 10*(8), 580–588.