

## Documents

Rahman, N.<sup>a</sup>, Mahmood, K.<sup>a</sup>, Kamilah, H.<sup>b c</sup>, Sulaiman, S.<sup>a</sup>, Ibrahim, M.<sup>d</sup>, Ariffin, F.<sup>a</sup>

**Effects of blanching and pickling process on the alcohol acyltransferase (AAT) activity, myristicin content and quality parameters of pickled nutmeg (*Myristica fragrans*)**

(2022) *Journal of Food Science and Technology*, 59 (2), pp. 542-551. Cited 1 time.

DOI: 10.1007/s13197-021-05038-z

<sup>a</sup> Food Technology Division, School of Industrial Technology, Universiti Sains Malaysia, Penang, Gelugor, 11800, Malaysia

<sup>b</sup> Department of Crop Sciences, Faculty of Agriculture and Forestry, Universiti Putra Malaysia, Bintulu Sarawak Campus, Nyabau Road, Sarawak, P.O Box 396, Bintulu, 97008, Malaysia

<sup>c</sup> Halal Products Research Institute, Universiti Putra Malaysia, Selangor, Serdang, Malaysia

<sup>d</sup> Department of Nutrition Sciences, Kulliyah of Allied Health Sciences, International Islamic University Malaysia, Pahang, Kuantan, 25200, Malaysia

**Abstract**

Myristicin, a potential toxicant, is a major ester present in the pericarp of nutmeg (*Myristica fragrans*) and alcohol acyltransferase (AAT) is responsible for its generation. The objective of the study was firstly to estimate the effect of blanching and pickling process on the inactivation of AAT and production of myristicin in nutmeg pericarp. Secondly, the effect of pickling process on the physical, microbial, antioxidant and sensory properties of nutmeg was evaluated. The nutmeg fruit pericarp was water-blanching for 0, 3, 5, 7 and 9 min. The increased blanching time significantly ( $p < 0.05$ ) reduced the AAT activity (3.478 U/mg protein) compared to fresh nutmeg (39.034 U/mg protein). The reduction of myristicin was so efficient that it could not be detected after 9 min of blanching. Similarly, the pickling process significantly ( $p < 0.05$ ) inhibited the AAT activity and lowered the myristicin content. However, the blanching significantly ( $p < 0.05$ ) lowered the total phenol content and reduced the free radical scavenging capacity of pickled nutmeg (BP) when compared with commercial pickled nutmeg. Blanched pickled nutmeg (BP) presented the same color characteristics as of commercial one, although significant reduction in hardness was observed. No growth of yeast and mold was noticed for all the blanched pickled nutmeg. The sensory analysis data demonstrated that blanching up to 7 min maintained the overall acceptability of pickled nutmeg as of commercial pickled nutmeg. Thus, the study suggests that blanching and pickling treatment improved the quality of nutmeg effectively by inhibiting the AAT activity and reducing the myristicin content. © 2021, Association of Food Scientists & Technologists (India).

**Author Keywords**

Microbial quality; Nutmeg; Phenolics; Radical scavenging; Sensory analysis

**Index Keywords**

Free radicals, Pickling, Proteins, Sensory analysis; Alcohol acyltransferase, Color characteristics, Free radical scavenging capacity, Overall acceptability, Pickling treatment, Quality parameters, Sensory properties, Total phenol contents; Blanching

**Funding details**

University of Southern MaineUSM

The authors appreciate and acknowledge the financial support provided by the USM RUI Grant (1001.PTEKIND.8011042).

**References**

- Agbogidi, O.M., Azagbaekwe, O.P.  
**Health and nutritional benefits of nutmeg (*Mystica fragrans* houtt.)**  
(2013) *Sci Agric*, 1 (2), pp. 40-44.
- Akbarian, M., Ghasemkhani, N., Moayedi, F.  
**Osmotic dehydration of fruits in food industrial: a review**  
(2014) *Int J Biosci*, 6655, pp. 42-57.
- Badwaik, L.S., Gautam, G., Deka, S.C.  
**Influence of blanching on antioxidant, nutritional and physical properties of bamboo shoot**  
(2016) *J Agric Sci*, 10 (3), pp. 140-150.
- Barrett, D.M., Beaulieu, J.C., Shewfelt, R.  
**Color, Flavor, texture, and nutritional quality of fresh-cut fruits and vegetables:**

- desirable levels, instrumental and sensory measurement, and the effects of processing**  
(2010) *Crit Rev Food Sci Nutr*, 50, pp. 369-389.
- Chiralt, A., Talens, P.  
**Physical and chemical changes induced by osmotic dehydration in plant tissues**  
(2005) *J Food Eng*, 67 (1-2), pp. 167-177.
  - Corcuera, J.I.R.D., Cavalieri, R.P., Powers, J.R.  
(2004) *Blanching of foods. Encyclopedia of agri food and biological engineering*, pp. 1-5. Marcel Dekker, New York
  - Dawidowicz, A.L., Dybowski, M.P.  
**Simple and rapid determination of myristicin in human serum**  
(2013) *Forensic Toxicol*, 31 (1), pp. 119-123.  
COI: 1:CAS:528:DC%2BC3sXhsVCns70%3D
  - Deylami, M.Z., Rahman, R.A., Tan, C.P., Bakar, J., Olusegun, L.  
**Effect of blanching on enzyme activity, colour changes, anthocyanin stability and extractability of mangosteen pericarp: a kinetic study**  
(2016) *J Food Eng*, 178, pp. 12-19.
  - Doan, T., Babu, D., Buescher, R.  
**Inhibition of yeast in commercial pickle brines**  
(2012) *J Food Res*, 1 (3), pp. 295-301.
  - Ehrenpreis, J.E., DesLauriers, C., Lank, P., Armstrong, P.K., Leikin, J.B.  
**Nutmeg poisonings: a retrospective review of 10 years experience from the Illinois Poison Center, 2001–2011**  
(2014) *J Med Toxicol*, 10 (2), pp. 148-151.  
COI: 1:CAS:528:DC%2BC2cXhtVagsbzE
  - Escriche, L., Chiralt, J., Moreno, S.J.A.  
**Influence of blanching osmotic dehydration treatments on volatile fraction of strawberries**  
(2000) *J Food Sci*, 65 (7), pp. 1107-1111.  
COI: 1:CAS:528:DC%2BD3MXktlOgtbk%3D
  - Farag, M.A., Mohsen, E., Abd El Nasser, G.  
**Sensory metabolites profiling in Myristica fragrans (Nutmeg) organs and in response to roasting as analyzed via chemometric tools**  
(2018) *LWT Food Sci Technol*, 97, pp. 684-692.  
COI: 1:CAS:528:DC%2BC1cXhsVyns7nl
  - Kalua, C., Allen, M., Bedgood, D., Jr., Bishop, A., Prenzler, P.D., Robards, K.  
**Olive oil volatile compounds, flavour development and quality: A critical review**  
(2007) *Food Chem*, 100 (1), pp. 273-286.  
COI: 1:CAS:528:DC%2BD28Xmt1agtrw%3D
  - Lazarides, H.N., Gekas, V., Mavroudis, N.  
**Apparent mass diffusivities in fruit and vegetable tissues undergoing osmotic processing**  
(1997) *J Food Eng*, 31 (3), pp. 315-324.
  - Lovera, N., Ramallo, L., Salvadori, V.  
**Effect of processing conditions on calcium content, firmness, and color of papaya in syrup**  
(2014) *J Food Process*, pp. 1-8.
  - Nguyen, P., Kang, H., Le, T., Chae, J., Kim, S., Kwon, K., Lim, S., Oh, W.  
**Simple process for the decrease of myristicin content from myristica fragrans**

- (nutmeg) and its activity with amp-activated protein kinase (ampk)**  
(2011) *J Food Biochem*, 35 (6), pp. 1715-1722.  
COI: 1:CAS:528:DC%2BC38XmvFyk
- Nunes, C.A., Souza, V.R., Corrêa, S.C., Silva, M.C.C., Bastos, S.C., Pinheiro, A.C.M.  
**Heating on the volatile composition and sensory aspects of extra-virgin olive oil**  
(2013) *Ciência e Agrotecnologia*, 37 (6), pp. 566-572.
  - Nurul, S., Asmah, R.  
**Evaluation of antioxidant properties in fresh and pickled papaya**  
(2012) *Int Food Res J*, 19 (3), pp. 1117-1124.  
COI: 1:CAS:528:DC%2BC38Xhs1SqtrrJ
  - Perez, A.G., Sanz, C., Olias, R., Rios, J.J., Olias, J.M.  
**Evolution of strawberry alcohol acyltransferase activity during fruit development and storage**  
(1996) *Agric Food Chem*, 44, pp. 3286-3290.  
COI: 1:CAS:528:DyaK28XlvVeku7c%3D
  - Phisut, N., Rattanawedee, M., Aekkasak, K.  
**Effect of osmotic dehydration process on the physical, chemical and sensory properties of osmo-dried cantaloupe**  
(2013) *Int Food Res J*, 20 (1), pp. 189-196.  
COI: 1:CAS:528:DC%2BC3sXhsVOIsrrN
  - Putsakum, G., Rahman, N., Kamilah, H., Mahmood, K., Ariffin, F.  
**The effects of blanching pretreatment and immersion of sodium metabisulfite/citric acid solution on the myristicin content and the quality parameter of nutmeg (*Myristica fragrans*) pericarp**  
(2020) *J Food Meas Charact*, 14 (6), pp. 3455-3461.
  - Rahman, N., Xin, T.B., Kamilah, H., Ariffin, F.  
**Effects of osmotic dehydration treatment on volatile compound (*Myristicin*) content and antioxidants property of nutmeg (*Myristica fragrans*) pericarp**  
(2018) *J Food Sci Technol*, 55 (1), pp. 183-189.  
COI: 1:CAS:528:DC%2BC2sXhslKnt7jK
  - Rizzolo, A., Gerli, F., Prinziavalli, C., Buratti, S., Torreggiani, D.  
**Headspace volatile compounds during osmotic dehydration of strawberries (cv Camarosa): Influence of osmotic solution composition and processing time**  
(2007) *LWT Food Sci Technol*, 40 (3), pp. 529-535.  
COI: 1:CAS:528:DC%2BD28XhtFOhsLrE
  - Salwanee, S., Mustapha, W.A.W., Mamot, S., Maskat, M.Y., Ibrahim, S.  
**Effects of enzyme concentration, temperature, pH and time on the degree of hydrolysis of protein extract from viscera of tuna (*Euthynnus affinis*) by using alcalase**  
(2013) *Sains Malays*, 42 (3), pp. 279-287.  
COI: 1:CAS:528:DC%2BC3sXmsValu78%3D
  - Sette, P.A., Franceschinis, L.E., Schebor, C., Salvatori, D.  
**Osmotic dehydrated raspberries: changes in physical aspects and bioactive compounds**  
(2015) *Dry Technol*, 33 (6), pp. 659-670.  
COI: 1:CAS:528:DC%2BC2MXjtV2kt74%3D
  - Severini, C., Baiano, A., De Pilli, T., Romaniello, R., Derossi, A.  
**Prevention of enzymatic browning in sliced potatoes by blanching in boiling saline solutions**  
(2003) *LWT Food Sci Technol*, 36 (7), pp. 657-665.  
COI: 1:CAS:528:DC%2BD3sXmvF2gu7g%3D

- Shalit, M., Katzir, N., Tadmor, Y., Larkov, O., Burger, Y., Shalekhet, F., Lastochkin, E., Edelstein, M.  
**Acetyl-CoA: alcohol acetyltransferase activity and aroma formation in ripening melon fruits**  
(2001) *J Agric Food Chem*, 49 (2), pp. 794-799.  
COI: 1:CAS:528:DC%2BD3MXhtlSrug%3D%3D
- Tan, K., Khoo, H., Azrina, A.  
**Comparison of antioxidant components and antioxidant capacity in different parts of nutmeg (*Myristica fragrans*)**  
(2013) *Int Food Res J*, 20 (3), p. 1049.
- Yadav, A.K., Singh, S.V.  
**Osmotic dehydration of fruits and vegetables: a review**  
(2014) *J Food Sci Tech*, 51 (9), pp. 1654-1673.
- Yilmaz, E., Aydeniz, B.  
**Sensory evaluation and consumer perception of some commercial green table olives**  
(2012) *Br Food J*, 114 (8), pp. 1085-1094.

**Correspondence Address**

Ariffin F.; Food Technology Division, Penang, Malaysia; email: fazilah@usm.my

**Publisher:** Springer

**ISSN:** 00221155

**CODEN:** JFSTA

**Language of Original Document:** English

**Abbreviated Source Title:** J Food Sci Technol

2-s2.0-85101548406

**Document Type:** Article

**Publication Stage:** Final

**Source:** Scopus

---

**ELSEVIER**

Copyright © 2023 Elsevier B.V. All rights reserved. Scopus® is a registered trademark of Elsevier B.V.

 RELX Group™