UNIVERSITAS
GADJAH MADA
THE EFFECT OF STEAMING TIME ON THE PHYSICAL CHARACTERISTICS AND CARBOHYDRATES COMPONENTS OF UNRIPE
BANANA (Musa cavendishii) AND SWEET POTATO (Ipomoea batatas)
NAURA LAKSITA DEVI, Dr.nat.techn. Andriati Ningrum, S.T.P., M.Agr.; Prof. Dr. Ir. Umar Santoso, M.Sc.
Universitas Gadjah Mada, 2022 | Diunduh dari http://etd.repository.ugm.ac.id/

REFERENCES

Adao, R.C., & Gloria, M.B.A. 2005. Bioactive Amines and Carbohydrate Changes during Ripening of "Prata" Banana (Musa acuminate x M. balbisiana). *Food Chemistry*. 90: 705-711. https://doi.org/10.1016/j.foodchem.2004.05.020.

Al-Qodri, T., Murcitro, B., G., Alnopri, Prasetyo. 2021. The Growth and Production of Three Sweet Potato Varieties as Affected by Dosage of Potassium Fertlizer on the Ultisols of Bengkulu Province. *TERRA*. 4(2): 34-38.

Amchra, F.Z., Faiz, C.A., Chaouqi, S., Khiraouni, A., Benhmimou, A., & Guedira, T. 2018. Effect of Stevia Rebaudiana, Sucrose and Aspartame on Human Health: A Comprehensive Review. *Journal of Medicinal Plants Studies*. 6(1): 102-108.

Anderson RA, Conway HF, Pfeifer VF, Griffin E. 1969. Gelatinization of Corn Grits By Roll and Extrusion Cooking. *J Cereal Sci*. 14:4–12.

Andersson, J., Garrido-Ba˜nuelos, G., Bergdoll, M., Vilaplana, F., Menzel, C., Mihnea, M., et al. 2022. Comparison Of Steaming And Boiling Of Root Vegetables For Enhancing Carbohydrate Content And Sensory Profile. Journal Of Food Engineering. 312: 1-10. https://doi.org/10.1016/j.jfoodeng.2021.110754.

Arvanitoyannis, I.S., & Mavromatis, A. 2009. Banana Cultivars, Cultivation Practices, and Physicochemical Properties. *Critical Reviews in Food Science and Nutrition*. 49(2): 113-135. DOI: 10.1080/10408390701764344.

Aurore, G., Parfait, B., & Fahrasmane, L. 2009. Bananas, Raw Materials for Making Processed Food products. *Trends in Food Science & Technology*. 20(2): 78-91. https://doi.org/10.1016/j.tifs.2008.10.003.

Aweke, A., & Roba, B. 2016. Evaluation of Proximate Composition of Sweet Potato[Ipomoea batatas (L.) Lam] for Better Utilization Through Agro-food Processing Chain. Blob. *J. Med. Sci*. 4(4): 248-255.

Ayour, J., Gouble, B., Reling, P., Ribas-Agusti, A., Audergon, J., Maingonnat, J., Benichou, M., & Renard, C.M.G.C. 2016. Impact Of Cooking On Apricot

UNIVERSITAS
GADJAH MADA
THE EFFECT OF STEAMING TIME ON THE PHYSICAL CHARACTERISTICS AND CARBOHYDRATES COMPONENTS OF UNRIPE
BANANA (Musa cavendishii) AND SWEET POTATO (Ipomoea batatas)
NAURA LAKSITA DEVI, Dr.nat.techn. Andriati Ningrum, S.T.P., M.Agr.; Prof. Dr. Ir. Umar Santoso, M.Sc.
Universitas Gadjah Mada, 2022 | Diunduh dari http://etd.repository.ugm.ac.id/

Texture As A Function Of Cultivar And Maturity. *LWT - Food Science and Technology*. 3: 1-5.

Bahado-Singh, Perceval & Wheatley, A.O. & Ahmad, M & Morrison, Errol & Asemota, Helen. 2006. Food Processing Methods Influence The Glycemic Indices Of Some Commonly Eaten West Indian Carbohydrate-Rich Foods. *The British journal of nutrition*. 96: 476-81. 10.1079/BJN20061792.

Barclay, T., Ginic-Markovic, M., Cooper, P.D., & Petrovsky, N. 2012. The Chemistry And Sources Of Fructose And Their Effect On Its Utility And Health Implications. *J. Excipients and Food Chem.* 3(2): 67-82.

Bashir, K., & Aggarwal, M. 2019. Physicochemical, Structural And Functional Properties Of Native And Irradiated Starch: A Review. *Journal of Food Science and Technology*. 56(2): 513–523. https://doi.org/10.1007/s13197-018-3530-2.

Belitz, H.D., Grosch, W., & Schieberle, P. 2009. *Food Chemistry 4th revised and extended Edition*. Berlin: Springer.

Bener, M., Akyuz, E., Sen, F.B., Baskan, K.S., Tutem, E., & Apak, R. 2018. A Simple Automated Microplate Method for Determining Reducing Sugars in Food Extracts and Synthetic Serum using Cupric-neocuproine as Reductant. *Turk J Chem*. 42:794-807.

BeMiller, J. N. 2018. *Carbohydrate Chemistry for Food Scientists*. Elsevier Gezondheidszorg.

Bengtsson, A., Brackmann, C., Enejder, A., Alminger, M.L., Svanberg, U. 2010. Effects of Thermal Processing on the in Vitro Bioaccessibility and Microstructure of beta-Carotene in Orange-Fleshed Sweet Potato. *J. Agric. Food Chem*. 58: 11090–11096.

Bernárdez, M.M., Miguélez, J. De la Montaña., & Queijeiro, J. García. 2004. HPLC Determination Of Sugars In Varieties Of Chestnut Fruits From Galicia (Spain). *Journal of Food Composition and Analysis*. 17(1): 63-67. https://doi.org/10.1016/S0889-1575(03)00093-0.

Bunyameen, N., Perin, A., & Donlao, N. 2020. Utilization of Banana Agricultural Waste Effects of Processing Conditions on Properties of Unripe Banana

UNIVERSITAS
GADJAH MADA
THE EFFECT OF STEAMING TIME ON THE PHYSICAL CHARACTERISTICS AND CARBOHYDRATES COMPONENTS OF UNRIPE
BANANA (Musa cavendishii) AND SWEET POTATO (Ipomoea batatas)
NAURA LAKSITA DEVI, Dr.nat.techn. Andriati Ningrum, S.T.P., M.Agr.; Prof. Dr. Ir. Umar Santoso, M.Sc.
Universitas Gadjah Mada, 2022 | Diunduh dari http://etd.repository.ugm.ac.id/

(Musa Cavendish) Pulp and Peel Flours. *Engineering in Agriculture, Environment, and Food*. 13(4): 129-138.

Buvé, C., Pham, H.T.T., Hendrickx, M., Grauwet, T., Loey, A.V. 2021. Reaction Pathways And Factors Influencing Nonenzymatic Browning In Shelf-Stable Fruit Juices During Storage. *Compr Rev Food Sci Food Saf*. 20: 5698–5721.

Carandang, N.S. 2009. The Changing Structure of the Banana Industry in the Philippines and Its Implication on Local Workers. *Forum of International Developmnet Studies*. 38: 71-92.

TChaudhary, S.K., Mahto, D. K., Yadav, S.K., Singh, S.K., Sinha, N., & Kumar, M. 2014. Sweet Potato (Ipomoea Batatas (L.) A Storage Root Crop — Anover View. *Progressive Research – An International Journal Society for Scientific Development in Agriculture*. 9(3): 944-950.

Chen, W., Xie, T., Shao, Y., Chen, F., 2012. Phylogenomic Relationships Between Amylolytic Enzymes 54from 85 Strains of Fungi. *PLoS ONE*. 7: e49679. doi:10.1371/journal.pone.0049679.

Chen, Y., Xu, Y., Cao, Y., Fang, K., Xia, W., & Jiang, Q. 2017. Combined Effect of Microwave and Steam Cooking on Phytochemical Compounds and Antioxidant Activity of Purple Sweet Potatoes. *Food Science and Technology Research*. 23(2): 193-201.

Copeland, L., Blazek, J., Salman, H., & Tang, M.C. 2009. Form and Functionality of Starch. *Food Hydrocolloids*. 23(6): 1527-1534.

Cordenunsi, B. R., Shiga, T. M., & Lajolo, F. M. 2008. Non-Starch Polysaccharide Composition Of Two Cultivars of Banana (Musa Acuminata L.: Cvs Mysore and Nanicão). *Carbohydrate Polymers*. 71: 26–31.

Cornejo-Ramírez Y.I., Martínez-Cruz, O., Toro-Sánchez, C.L.D., Wong-Corral, F.J., Borboa-Flores, J., & F Cinco-Moroyoqui, F. J. 2018. The Structural Characteristics Of Starches And Their Functional Properties. *CyTA -Journal of Food*. 16:1, 1003-1017. DOI: 10.1080/19476337.2018.1518343.

Crow, R.R., Kumar, S., & Varela, M.F. 2012. *Maltose Chemistry and Biochemistry*. United Kingdom: The Royal Society of Chemistry.

UNIVERSITAS
GADJAH MADA
THE EFFECT OF STEAMING TIME ON THE PHYSICAL CHARACTERISTICS AND CARBOHYDRATES COMPONENTS OF UNRIPE
BANANA (Musa cavendishii) AND SWEET POTATO (Ipomoea batatas)
NAURA LAKSITA DEVI, Dr.nat.techn. Andriati Ningrum, S.T.P., M.Agr.; Prof. Dr. Ir. Umar Santoso, M.Sc.
Universitas Gadjah Mada, 2022 | Diunduh dari http://etd.repository.ugm.ac.id/

Das, I., Sasmal, S., & Arora, A. 2021. Effect Of Thermal And Non-Thermal Processing On Astringency Reduction And Nutrient Retention In Cashew Apple Fruit And Its Juice. *J Food Sci Technol*. 58(6): 2337–2348. 8 https://doi.org/10.1007/s13197-020-04744-4.

de Baerdemaeker, J., Jancsók, P.T., Verlinden, B.E. 2002. *Firmness and Softening of Fruits and Vegetables. In: Blahovec, J., Kutílek, M. (eds) Physical Methods in Agriculture*. Boston: Springer.

De Roeck, A., Duvetter, T., Fraeye, I., der Plancken, I.V., Sila, D.N., Loey, A.V., & Hendrickx, M. 2009. Effect Of High-Pressure/High-Temperature Processing On Chemical Pectin Conversions In Relation To Fruit And Vegetable Texture. *Food Chemistry*. 115(1): 207-213. https://doi.org/10.1016/j.foodchem. 2008.12.016.

do Nascimento, J. R. O., Júnior, A. V., Bassinello, P. Z., Cordenunsi, B. R., Mainardi, J. A., Purgatto, E., & Lajolo, F. M. (2006, April). Beta-amylase expression and starch degradation during banana ripening. *Postharvest Biology and Technology*, *40*(1), 41–47. https://doi.org/10.1016/j.postharvbio.2005.11.008.

Dole. 2004. *Banana Color Guide*. Dole Fresh Fruit Company, Inc. USA

Dome, K., Podgorbunskikh, E., Bychkov, A., & Lomovsky, O. 2020. Changes in the Crystallinity Degree of Starch Having Different Types of Crystal Structure after Mechanical Pretreatment. *Polymers*. 12(641): 1-12. doi:10.3390/polym 12030641.

Duan, X., Joyce, D. C., & Jiang, Y. 2007. Postharvest Biology and Handling of Banana Fruit.

Duell, B. 1988. Ways of Eating Sweet Potatoes in Japan. *Conference: 8th Symposium of the International Society for Tropical Root Crops*. 601-608.

Dwivany, F. M., Aprilyandi, A. N., Suendo, V., & Sukriandi, N. 2020. Carrageenan Edible Coating Application Prolongs Cavendish Banana Shelf Life. *International Journal of Food Science*. 1–11. https://doi.org/10.1155/2020/8861610.

UNIVERSITAS
GADJAH MADA
THE EFFECT OF STEAMING TIME ON THE PHYSICAL CHARACTERISTICS AND CARBOHYDRATES COMPONENTS OF UNRIPE
BANANA (Musa cavendishii) AND SWEET POTATO (Ipomoea batatas)
NAURA LAKSITA DEVI, Dr.nat.techn. Andriati Ningrum, S.T.P., M.Agr.; Prof. Dr. Ir. Umar Santoso, M.Sc.
Universitas Gadjah Mada, 2022 | Diunduh dari http://etd.repository.ugm.ac.id/

Emaga, T.H., Robert, C., Ronkart, S.N., Wathelet, B. and Paquot, M. 2008. Dietary Fiber Components and Pectin Chemical Features of Peels during Ripening in Banana and Plantain Varieties. *Bioresource Technology*. 99: 4346-4354. https://doi.org/10.1016/j.biortech.2007.08.030.

Escobar-Puentes, A.A., Palomo, I., Rodríguez, L., Fuentes, E., Villegas-Ochoa, M.A., González-Aguilar, G.A., Olivas-Aguirre, F.J., & Wall-Medrano. 2022. A Sweet Potato (Ipomoea batatas L.) Phenotypes: From Agroindustry to Health Effects. *Foods*. 11(1058): 2-18. https://doi.org/10.3390/foods11071058.

EU. 2019. *The Food and Beverage Market Entry Handbook Japan*. Europe Union.

Fahrasmane, L., Parfait, B., & Aurore, G. 2009. Bananas, A Source Of Compounds With Health Properties. *International Symposium on Human Health Effects of Fruits and Vegetables*. 3: 75-80.

Falcomer, A. L., Riquette, R. F. R., de Lima, B. R., Ginani, V. C., & Zandonadi, R. P. 2019. Health Benefits of Green Banana Consumption: A Systematic Review. *Nutrients*. 11(6): 1-22. https://doi.org/10.3390/nu11061222.

FAO. 2022. Banana Market Review - Preliminary result 2021. Rome.

FAOSTAT. 2014. Food and Agricultural commodities production/Countries (Rome, Italy Commodity Food And Agriculture Organization Of The United Nations Statistics Division).

Farahnaky, A., Azizi, R., & Gavahian, M. 2012. Accelerated Texture Softening Of Some Root Vegetables By Ohmic Heating. *Journal of Food Engineering*. 113(2):275-280.

Ferrari, C. C., Sarantópoulos, C. I. G. L., Carmello-Guerreiro, S. M., & Hubinger, M. D. 2011. Effect of Osmotic Dehydration and Pectin Edible Coatings on Quality and Shelf Life of Fresh-Cut Melon. *Food and Bioprocess Technology*. 6(1): 80–91.

Figueira, A.C., Makinde, O., & Vieira, M.C. 2011. Process Optimisation of Sweet Potato (Ipomoea batatas) Puree as an Ingredient in a Formulation of Weaning Food. *Fruit, Vegetable and Cereal Science and Biotechnology*. 5(2): 25-34.

UNIVERSITAS
GADJAH MADA
THE EFFECT OF STEAMING TIME ON THE PHYSICAL CHARACTERISTICS AND CARBOHYDRATES COMPONENTS OF UNRIPE
BANANA (Musa cavendishii) AND SWEET POTATO (Ipomoea batatas)
NAURA LAKSITA DEVI, Dr.nat.techn. Andriati Ningrum, S.T.P., M.Agr.; Prof. Dr. Ir. Umar Santoso, M.Sc.
Universitas Gadjah Mada, 2022 | Diunduh dari http://etd.repository.ugm.ac.id/

Fraser-Reid, B.O., Tatsuta, K., & Thiem., J. 2008. *Glycoscience Chemistry and Chemical Biology Volume 1 2nd Edition*. Heidelberg: Springer.

Fu, J., Wang, Y., Tan, S., & Wang, J. 2021. Effects of Banana Resistant Starch on the Biochemical Indexes and Intestinal Flora of Obese Rats Induced by a High-Fat Diet and Their Correlation Analysis. *Frontiers in Bioengineering and Biotechnology*. https://doi.org/10.3389/fbioe.2021.575724

Fuchigami, M., Teramoto. A., & Sasaki, A., 2002. Changes in Firmness, Pectin Subtances and Histological Structure of Sweet Potatoes During Cooking, Preheating or Pressurization. *J. Cookery Sci. Jpn*. 35(4): 343-356.

Fujimoto, S., Shimoozono, K., Nagahama, T., & Kanie, M. 1977. Properties of Starch from Green Banana. *J.Jap.Soc.Starch.Sci*. 24(2): 36-41.

Galani, Varsha, J. 2019. Musa paradisiaca Linn. – A Comprehensive Review. *Sch Int J Tradit Complement Med*. 2(4): 45-56.DOI:10.21276/sijtcm.2019.2.4.1.

Gallego-Catillo & Ayala-Aponte, A. A. 2018. Changes in Physical Properties of Sweet Potato Due to Effects of Thermal Pre-treatments for Puree Production. *DYNA*. 85(207): 135-142.

Gao, H., Huang, S., Dong, T., Yang, Q.S., & Yi, G.J. 2016. Analysis Of Resistantstarch Degradation In Postharvest Ripening Of Two Banana Cultivars: Focus Onstarch Structure And Amylases. *Postharvest Biol. Technol*. 199: 1-8.

Gaspar, E.M.S.M., Lopes, J.S., Gyamfi, D., & Nunes, I.S. 2012. *Food Sources and Analytical Approaches for Maltose Determination*. United Kingdom: The Royal Society of Chemistry.

Gębczyński, P., Skoczeń-Słupska, R., & Kur, K. 2017. Effect Of Storage On The Content Of Selected Antioxidants And Quality Attributes In Convection And Freeze-Dried Pears (Pyrus communis L.). *Italian Journal of Food Science*. 9: 454–462.

Gemma, H., Matsuyama, Y., & Wang, H.G. 1994. Ripening Characteristic and Chilling Injury of Banana Fruit. Jpn. *J. Trop. Agr*. 38(3): 216 – 220.

Genova, J., Zheliaskova, A., & Mitov, M.D. Monosaccharides (Fructose, Glucose) and Disaccharides (Sucrose, Trehalose) Influence The Elasticity of SOPC

UNIVERSITAS
GADJAH MADA
THE EFFECT OF STEAMING TIME ON THE PHYSICAL CHARACTERISTICS AND CARBOHYDRATES COMPONENTS OF UNRIPE
BANANA (Musa cavendishii) AND SWEET POTATO (Ipomoea batatas)
NAURA LAKSITA DEVI, Dr.nat.techn. Andriati Ningrum, S.T.P., M.Agr.; Prof. Dr. Ir. Umar Santoso, M.Sc.
Universitas Gadjah Mada, 2022 | Diunduh dari http://etd.repository.ugm.ac.id/

Membranes. *Journal Of Optoelectronics And Advanced Materials*. 9(2): 427 – 430.

Gibert, O., Dominique, D., Giraldo, A., & Diaz, A. 2010. Correction to Differentiation between Cooking Bananas and Dessert Bananas. 1. Morphological and Compositional Characterization of Cultivated Colombian Musaceae (Musa sp.) in Relation to Consumer Preferences. *Journal of Agricultural and Food Chemistry*. 58(16): 9290. DOI:10.1021/jf102810g.

Gouveia, P.F.D., & Zandonadi, R.P. 2013. Green banana: New Alternative for Gluten-free Products. *Agrofood Industry H Tech*. 24(3): 49-52.

Hasjim, J. 2009. Enzyme Digestibility of Starch and Methods to Produce Enzyme-Resistant Strach to Improve Human Health. *Graduate Theses and Dissertations*. 12126. https://lib.dr.iastate.edu/etd/12126

Hayati, M., Sabaruddin, Efendi, & Anhar, A. 2020. Morphological Characteristics and Yields of Several Sweetpotato (Ipomoea batatas L.) Tubers. *Earth and Environmental Science*. 425: 1-7. doi:10.1088/1755-1315/425/1/012055.

Hossain, Md. M., Rahim, Md. A., Moutosi, H.N., Das, L. 2022. Evaluation of The Growth, Storage Root Yield, Proximate Composition, and Mineral Content of Colored Sweet Potato Genotypes. *Journal of Agriculture and Food Research*. 8: 1-8.

Hrynets, Y., Bhattacherjee, A., & Betti, M. 2018. Nonenzymatic Browning Reactions: Overview. Reference Module in Food Science. *Food Chemistry*. 2: 233-243

Huaman, Z. 1992. *Syestematic Botany and Morphology of the Sweetpotato Plant*. Technical Information Bulletin 25. Peru: International Potato Center.

Hulme, A.C. 1970. *The Biochemistry of Fruits and their Products*. London: Academic Press Inc. (London) Ltd.

Johnson, J.M., & Conforti, F.D. 2003. *Encyclopedia of Food Sciences and Nutrition (Second Edition)*. Cambridge: Academic Press.

UNIVERSITAS
GADJAH MADA
THE EFFECT OF STEAMING TIME ON THE PHYSICAL CHARACTERISTICS AND CARBOHYDRATES COMPONENTS OF UNRIPE
BANANA (Musa cavendishii) AND SWEET POTATO (Ipomoea batatas)
NAURA LAKSITA DEVI, Dr.nat.techn. Andriati Ningrum, S.T.P., M.Agr.; Prof. Dr. Ir. Umar Santoso, M.Sc.
Universitas Gadjah Mada, 2022 | Diunduh dari http://etd.repository.ugm.ac.id/

Kadam, S. U., Tiwari, B. K., & O'Donnell, C. P. 2015. *Improved Thermal Processing For Food Texture Modification in Modifying Food Texture*. United Kingdom: Elsevier.

Kaplan, F., & Guy, C.L. 2004. Beta-Amylase Induction and the Protective Role of Maltose during Temperature Shock. *Plant Physiology*. 135: 1674–1684.

Karamura, D.A., Karamura, E.B., & Blomme, G. 2011. *Banana Breeding: Progress and Challenges*. Boca Raton: CRC Press.

Katayama, K., Kobayashi, A., Sakai, T., Kuranouchi, T., & Kai, Y. 2017. Recent Progress in Sweet Potato Breeding and Cultivars for Diverse Applications in Japan. *Breeding Science*. 67: 3-14.

Kikulwe, EM., Asindu, M., Mulumba, N., Mbabazi, G., & Ajambo, S. 2021. Gaging Consumer Demand And Preference For Peeled, Packaged, And Labeled Cooking Bananas In Uganda. *Discussion Paper*. Bioversity International. Rome. Italy. 21 p.

Kitahara, K., Nakamura, Y., Otani, M., Hamada, T., Nakayachi., & Takahata, Y. 2017. Carbohydrate Components In Sweetpotato Storage Roots: Their Diversities And Genetic Improvement. *Breeding Science*. 67: 62-72.

Lamessa, Kinde. 2021. Performance Evaluation of Banana Varieties, through Farmer's Participatory Selection. *International Journal Of Fruit Science*. 22(1): 768-778. https://doi.org/10.1080/15538362.2021.1930628.

Laurie, S.M., Calitz, F.J., Adebola, P.O., & Lezar, A. 2013. Characterization and Evaluation of South African Sweet Potato (*Ipomoea batatas (L.)* LAM) land Races. *S. Afr. J. Bot*. 85: 10-16.

Lešková, E., Kubíková, J., Kováčiková, E., Košická, M., Porubská, J., & Holčíková, K. 2006.Vitamin losses: Retention During Heat Treatment And Continual Changes Expressed By Mathematical Models. *Journal of Food Composition and Analysis.* 19(4): 252-276. https://doi.org/10.1016/j.jfca.2005.04.014

Li, Z., Guo, K., Lin, L., He, W., Zhang, L., & Wei, C. 2018b. Comparison of Physicochemical Properties of Starches from Flesh and Peel of Green Banana Fruit. *Molecules*. 23(9), 2312. https://doi.org/10.3390/molecules23092312.

UNIVERSITAS
GADJAH MADA
THE EFFECT OF STEAMING TIME ON THE PHYSICAL CHARACTERISTICS AND CARBOHYDRATES COMPONENTS OF UNRIPE
BANANA (Musa cavendishii) AND SWEET POTATO (Ipomoea batatas)
NAURA LAKSITA DEVI, Dr.nat.techn. Andriati Ningrum, S.T.P., M.Agr.; Prof. Dr. Ir. Umar Santoso, M.Sc.
Universitas Gadjah Mada, 2022 | Diunduh dari http://etd.repository.ugm.ac.id/

Lončarić, Ante & Svrakacic, Bernarda & Nedic, Nela & Kopjar, Mirela & Pilizota, Vlasta. 2016. Effect Of Baking And Steaming On Physicochemical And Thermal Properties Of Sweet Potato Puree Preserved By Freezing And Freeze-Drying. *Croatian Journal of Food Science and Technology*. 8: 90-98. 10.17508/CJFST.2016.8.2.08.

Mahmudatussa'adah, A., Rahmawati, Y., & Sudewi. 2016. Modification of Cilembu sweet potato starch with ethanoic acid. *IOP Conf. Ser.: Mater. Sci. Eng*. 128: 1-5.

Marta, H., Cahyana, Y., Djali, M., & Pramafisi, G. 2022. The Properties, Modification, and Application of Banana Starch. *Polymers*. 14(3092): 1-20. https://doi.org/10.3390/polym14153092,

Mcguire, R.G. 1992. Reporting Of Objective Color Measurements. *HortScience*. 12: 1754-1555.

Mohammad, Z.I. and Saleha, A. 2011. Musa paradisiaca L. and Musa sapientum L. A Phytochemical and Pharmacological Review. *Journal of Applied Pharmaceutical Science*. 1: 14-20.

Mohapatra, D., Mishra, S., & Sutar, N. 2010. Banana and its by-product utilisation: An overview. *Journal of Scientific and Industrial Research*. 69(5): 323-329.

Munegumi, T., Goto, A., & Nakamura, Y. 2019. A Comparison of Microwave-Assisted Heating with Conventional Heating of Sweet Potato (*Ipomoea batatas*): Analysis of Monosaccharides and Disaccharides. *Food and Nutrition Sciences*. 10: 315-324. https://doi.org/10.4236/fns.2019.103024.

Murayama, H., Takahashi, T., Honda, R., & Fukushima, T. 1998. Cell wall changes in pear fruit softening on and off the tree. *Postharvest Biology and Technology*. 14(2): 143–149.

Mwanga, R.O.M., Mayanja, S., Swanckaert, J., Nakitto, M., Zum, F.T., Grüneberg, W., Mudege, N., Moyo, M., Banda, L., Tinyiro, S.E., Kisakye, S., Bamwirire, D., Anena, B., Bouniol, A., Magala, D.B., Yada, B., Carey, E., Andrade, M., Johanningsmeier, S.D., Forsythe, L., Fliedel, G., & Muzhingi. T. 2021. Development of a Food Product Profile for Boiled and Steamed

UNIVERSITAS
GADJAH MADA
THE EFFECT OF STEAMING TIME ON THE PHYSICAL CHARACTERISTICS AND CARBOHYDRATES COMPONENTS OF UNRIPE
BANANA (Musa cavendishii) AND SWEET POTATO (Ipomoea batatas)
NAURA LAKSITA DEVI, Dr.nat.techn. Andriati Ningrum, S.T.P., M.Agr.; Prof. Dr. Ir. Umar Santoso, M.Sc.
Universitas Gadjah Mada, 2022 | Diunduh dari http://etd.repository.ugm.ac.id/

Sweetpotato in Uganda for Effective Breeding. *Int J Food Sci Technol*. 56:1385–1398. https://doi.org/10.1111/ijfs.14792.

Nattapulwat N, Narumol P, Ornamphai S. 2009. Preparation and application of carboxymethyl yam (Dioscorea esculenta) starch. *AAPS Pharm Sci Technol*. 10(1):193–198.

Netshiheni, R.K., Omolola, A.O., Anyasi, T.A., & Jideani, A.I.O. 2019. *Banana Bioactives: Absorption, Utilisation and Health Benefits in Banana Nutrition - Function and Processing Kinetics*. London: Intechopen.

Nurhadi, B & Nurhasanah, S. 2010. *Sifat Fisik Bahan Pangan*. Bandung: Widya Padjajaran.

Oikawa, A., Otsuka, T., Nakabayashi, R., Jikumaru, Y., Isuzugawa, K., & Murayama, H. 2015. Metabolic Profiling of Developing Pear Fruits Reveals Dynamic Variation in Primary and Secondary Metabolites, Including Plant Hormones. *PLoS ONE*. 10(7): e0131408. doi:10.1371/journal.pone.0131408.

Pandey, A., Nigam, P., Soccol, C.R., Soccol, V.Y., Singh, D., Mohan, R. 2000. Advances in Microbial Amylases. *Biotechnology and Applied Biochemistry*. 31: 135–152.

Peroni-Okita, F.H.G., Simão, R.A., Cardoso, M.B., Soares, C.A., Lajolo, F.M., & Cordenunsi, B.R. 2010. In Vivo Degradation Of Banana Starch: Structural Characterization Of The Degradation Process. *Carbohydrate Polymers*. 81(2): Pages 291-299. https://doi.org/10.1016/j.carbpol.2010.02.022.

Picha, D. 2006. Sugar Content of Baked Sweet Potatoes from Different Cultivars and Lengths of Storage. *Journal of Food Science*. 51(3): 845-848

Pineda-Gómez, P., Angel-Gil, N. C., Valencia-Muñoz, C., Rosales-Rivera, A., & Rodríguez-García, M. E. 2014. Thermal Degradation Of Starch Sources: Green Banana, Potato, Cassava, And Corn - Kinetic Study By Non-Isothermal Procedures. *Starch - Stärke*. 66(7-8): 691–699. doi:10.1002/star.201300210

UNIVERSITAS
GADJAH MADA
THE EFFECT OF STEAMING TIME ON THE PHYSICAL CHARACTERISTICS AND CARBOHYDRATES COMPONENTS OF UNRIPE
BANANA (Musa cavendishii) AND SWEET POTATO (Ipomoea batatas)
NAURA LAKSITA DEVI, Dr.nat.techn. Andriati Ningrum, S.T.P., M.Agr.; Prof. Dr. Ir. Umar Santoso, M.Sc.
Universitas Gadjah Mada, 2022 | Diunduh dari http://etd.repository.ugm.ac.id/

Prommajak, T., Leksawasdi, N., & Rattanapanone, N. 2020. Tannins in Fruit Juices and their Removal. *Chiang Mai University Journal of Natural Sciences*. 19(1):76-90.

Prachayawarakorn, S., Raikham, C., & Soponronnarit, S. 2016. Effects Of Ripening Stage And Steaming Time On Quality Attributes Of Fat Free Banana Snack Obtained From Drying Process Including Fluidized Bed Puffing. *J. Food. Sci. Technol*. 53(2):946–955. DOI 10.1007/s13197-015-2051-5.

Qamar, S., & Shaikh, A. 2018. Therapeutic Potentials And Compositional Changes Of Valuable Compounds From Banana- A Review. *Trends in Food Science & Technology*. 79: 1–9. https://doi.org/10.1016/j.tifs.2018.06.016.

Qi, B., Moore, K. G., & Orchard, J. 2000. Effect of Cooking on Banana and Plantain Texture. *Journal of Agricultural and Food Chemistry*. 48(9): 4221–4226.

Queneu, Y., Jarosz, S., Lewandowski, B., & Fitremann, J. 2008. Sucrose Chemistry And Applications Of Sucrochemicals. *Advances In Carbohydrate Chemistry And Biochemistry*. 61: 217-291.

Ranjha, M.M.A.N., Irfan, S., Nadeem, M., & Mahmood, S. 2022. A Comprehensive Review on Nutritional Value, Medicinal Uses, and Processing of Banana. *Food Reviews International.* 38(2): 199-225.

Raquez, J. M., Degée, P., Narayan, R., & Dubois, P. 2000. "Coordination-Insertion" Ring-Opening Polymerization of 1,4-dioxan-2-one and Controlled Synthesis Of Diblock Copolymers Withε-Caprolactone. *Macromolecular Rapid Communications*. 21(15): 1063–1071.

Reddy, R., Soibam, H., & Ayam. 2018. Morphological Characterization of Sweet Potato Cultivars During Growth, Development and Harvesting. *Indian J. Agric. Res*. 52(1): 45-50.

Richardson, T., & Finley, J.W. 1985. *Chemical Changes in Food During Processing*. New York: AVI Book.

S Chandraju., Mythily, R., & Kumar, Chidan C.S. 2011. Extraction, Isolation, and Identification of Sugars from Banana peels (Musa Sapientum) by HPLC coupled LC/MS Instrument and TLC analysis. *J. Chem. Pharm. Res*. 3(3): 312-321.

UNIVERSITAS
GADJAH MADA
THE EFFECT OF STEAMING TIME ON THE PHYSICAL CHARACTERISTICS AND CARBOHYDRATES COMPONENTS OF UNRIPE
BANANA (Musa cavendishii) AND SWEET POTATO (Ipomoea batatas)
NAURA LAKSITA DEVI, Dr.nat.techn. Andriati Ningrum, S.T.P., M.Agr.; Prof. Dr. Ir. Umar Santoso, M.Sc.
Universitas Gadjah Mada, 2022 | Diunduh dari http://etd.repository.ugm.ac.id/

Salvador, A., Sanz, T., & Fiszman, S. 2007. Changes In Colour And Texture And Relationship With Eating Quality During Storage Of Two Different Dessert Bananas. *Postharvest Biology and Technology*. 43(3):319-325. DOI: 10.1016/j.postharvbio.2006.10.007.

Seppä, L., Railio, J., Mononen, R., Tahvonen, R., & Tuorila, H. 2012. From Profiles To Practice: Communicating The Sensory Characteristics Of Apples To The Wider Audience Through Simplified Descriptive Profiles. *LWT - Food Science and Technology*. 47(1): 46-55. ISSN 0023-6438. https://doi.org/10.1016/j.lwt.2012.01.003.

Shalini, R., & Antony, U. 2015. Fructan Distribution In Banana Cultivars And Effect Of Ripening And Processing On Nendran Banana. *J. Food. Sci. Technol*. 52(12): 8244–8251. DOI 10.1007/s13197-015-1927-8

Shendurse, A.M., & Khedkar, C.D. 2016. Glucose: Properties and Analysis. *The Encyclopedia of Food and Health*. 3: 239-247.

Shiga, T. M., Soares, C. A., Nascimento, J. R., Purgatto, E., Lajolo, F. M., & Cordenunsi, B. R. 2011. Ripening-Associated Changes In The Amounts Of Starch And Non-Starch Polysaccharides And Their Contributions To Fruit Softening In Three Banana Cultivars. *Journal of the Science of Food and Agriculture*. 91(8): 1511–1516. https://doi.org/10.1002/jsfa.4342.

Sidhu, J.S., & Zafar, T.A. 2018. Bioactive Compounds In Banana Fruits And Their Health Benefits. *Food Quality and Safety*. 2(4): 183–188. https://doi.org/10.1093/fqsafe/fyy019

Sila, D. N., Van Buggenhout, S., Duvetter, T., Fraeye, I., De Roeck, A., Van Loey, A., & Hendrickx, M. 2009. Pectins in Processed Fruits and Vegetables: Part II-Structure-Function Relationships. *Comprehensive Reviews in Food Science and Food Safety*. 8(2): 86–104. doi:10.1111/j.1541-4337.2009.00071

Singh, R., Kaushik, R., & Gosewade, S. 2018. Bananas as Underutilized Fruit Having Huge Potential as Raw Materials for Food and Non-Food Processing Industries: A Brief Review. *The Pharma Innovation Journal*. 7: 574-580.

UNIVERSITAS
GADJAH MADA
THE EFFECT OF STEAMING TIME ON THE PHYSICAL CHARACTERISTICS AND CARBOHYDRATES COMPONENTS OF UNRIPE
BANANA (Musa cavendishii) AND SWEET POTATO (Ipomoea batatas)
NAURA LAKSITA DEVI, Dr.nat.techn. Andriati Ningrum, S.T.P., M.Agr.; Prof. Dr. Ir. Umar Santoso, M.Sc.
Universitas Gadjah Mada, 2022 | Diunduh dari http://etd.repository.ugm.ac.id/

Sjöö, M., & Nilsson, L. 2017. *Starch in Food: Structure, Function and Applications (Woodhead Publishing Series in Food Science, Technology and Nutrition) (2nd ed.)*. Woodhead Publishing.

Smirnova, J., Fernie, A.R., Steup, M. 2015. Starch Degradation. In: Nakamura, Y. (eds) Starch. Springer, Tokyo. https://doi.org/10.1007/978-4-431-55495-0_7.

Sousa, M. B., Canet, W., Alvarez, M. D., & Fernández, C. 2007. Effect of Processing On The Texture and Sensory Attributes Of Raspberry (cv. Heritage) and Blackberry (cv. Thornfree). *Journal of Food Engineering*. 78: 9–21.

Stover, R. H., & Simmonds, N. W. 1987. *Bananas, (3rd ed.)*. London: Longman.

Sugri, I., Nutsugah, S.K., Wiredu, A.N., Johnson, P.N.T., & Aduguba, D. 2012. Kendall's Concordance Analysis of Sensory Descriptors Influencing Consumer Preference for Sweet Potatoes in Ghana. *American Journal of Food Technology*. 7: 142-150.

Suhartanto, M. R., Sobir, Harti, H. & Nasution, M. A. 2009. Pengembangan Pisang Sebagai Penopang Ketahanan Pangan Nasional [Banana Development As The Support Of National Food Security]. Presentation presented at Proceedings of the Research Results Seminar. Bogor: Bogor Agricultural University.

Svihus, B., Uhlen, A. K., & Harstad, O. M. 2005. Effect Of Starch Granule Structure, Associated Components And Processing On Nutritive Value Of Cereal Starch: A Review. *Animal Feed Science and Technology*. 122: 303–320.

Terra, N. N., Garcia, E., & Lajolo, F. M. 2006. Starch-Sugar Transformation During Banana Ripening: The Behavior of UDP Glucose Pyrophosphorylase, Sucrose Synthetase and Invertase. *Journal of Food Science*. 48(4): 1097–1100.

Ukom, A.N., & Ojimelukwe, P.C. 2016. Changes in β-carotene Content of Thermally Processed Sweet Potato (Ipomoea batatas) Cultivar. *Journal of*

UNIVERSITAS GADJAH MADA
THE EFFECT OF STEAMING TIME ON THE PHYSICAL CHARACTERISTICS AND CARBOHYDRATES COMPONENTS OF UNRIPE
BANANA (Musa cavendishii) AND SWEET POTATO (Ipomoea batatas)
NAURA LAKSITA DEVI, Dr.nat.techn. Andriati Ningrum, S.T.P., M.Agr.; Prof. Dr. Ir. Umar Santoso, M.Sc.
Universitas Gadjah Mada, 2022 | Diunduh dari http://etd.repository.ugm.ac.id/

Applied Life Sciences International 5(1):1-7. DOI: 10.9734/JALSI/2016/22265.

Vadiveloo, M., Principato, L., Morwitz, V., & Mattei, J. 2019. Sensory Variety In Shape And Color Influences Fruit And Vegetable Intake, Liking, And Purchase Intentions In Some Subsets Of Adults: A Randomized Pilot Experiment. *Food Quality and Preference*. 71: 301-310. ISSN 0950-3293. https://doi.org/10.1016/j.foodqual.2018.08.002.

van Boekel, M., Fogliano, V., Pellegrini, N., Stanton, C., Scholz, G., Lalljie, S., Somoza, V., Knorr, D., Jasti, P.R., & Eisenbrand, G. 2010. A review on the beneficial aspects of food processing. *Mol Nutr Food Res*. 54(9): 1215-47. doi: 10.1002/mnfr.200900608. PMID: 20725924

Voora, V., Larrea, C., & Bermudez, S. 2020. *Global Market Report: Bananas. Sustaineble Commodities Marketplace Series 2019*. Winnipeg: International Institute for Sustainable Development.

Wang, J., Huang, H.H., & Chen, P.C. 2017. Structural And Physicochemical Properties Of Banana Resistant Starch From Four Cultivars. *International Journal of Food Properties*. 20(6): 1338-1347. DOI: 10.1080/10942912.2016.1209517

Weaver, C. 1996. The Food Chemistry Laboratory. Boca Raton: CRC Press.

Wei, S., Lu, G., & Cao, H. 2017. Effects Of Cooking Methods On Starch And Sugar Composition Of Sweetpotato Storage Roots. *PLoS ONE*. 12(8):e0182604. https://doi.org/10.1371/journal.pone.0182604.

Woo, K.S., Kim, H.Y., Hwang, I.G., Lee, S.H., & Jeong, H.S. 2015. Characteristics of the Thermal Degradation of Glucose and Maltose Solutions. *Prev. Nutr. Food Sci*. 20(2): 102-109

Yan, W., Yin, L., Zhang, M., Zhang, M., & Jia, X. 2021 Gelatinization, Retrogradation and Gel Properties of Wheat Starch–Wheat Bran Arabinoxylan Complexes. *Gels*. 7(200): 1-12. https://doi.org/10.3390/gels7040200.

Zandonadi, R.P., Botelho, R.B., Gandolfi, L., Ginani, J.S., Montenegro, F.M., & Pratesi, R. 2012. Green Banana Pasta: An Alternative for Gluten-free Diets.

UNIVERSITAS
GADJAH MADA
**THE EFFECT OF STEAMING TIME ON THE PHYSICAL CHARACTERISTICS AND CARBOHYDRATES COMPONENTS OF UNRIPE
BANANA (Musa cavendishii) AND SWEET POTATO (Ipomoea batatas)**
NAURA LAKSITA DEVI, Dr.nat.techn. Andriati Ningrum, S.T.P., M.Agr.; Prof. Dr. Ir. Umar Santoso, M.Sc.
Universitas Gadjah Mada, 2022 | Diunduh dari http://etd.repository.ugm.ac.id/

J Acad Nutr Diet. 112(7): 1068-72. doi: 10.1016/j.jand.2012.04.002. PMID: 22889636.