

DAFTAR PUSTAKA

- Agirbasli, Z., dan Cavas, L. 2017. In silico evaluation of bioactive peptides from the green algae *Caulerpa*. *Journal of Applied Phycology* **29** (3): 1635–1646.
- Agyei, D., Bambarandage, E., dan Udenigwe, C.C. (2019). *The role of bioinformatics in the discovery of bioactive peptides*. Elsevier. 337-344.
- Alam, M.N., Bristi, N.J., dan Rafiquzzaman, M. 2013. Review on in vivo and in vitro methods evaluation of antioxidant activity. *Saudi Pharmaceutical Journal* **21** (2): 143–152.
- Aluko, R.E. 2015 Amino acids, peptides, and proteins as antioxidants for food preservation In *Handbook of Antioxidants for Food Preservation*, pp. 105–140. Elsevier.
- Ahmad, M., dan Benjakul, S. 2011. Characteristics of gelatin from the skin of unicorn leatherjacket (*Aluterus monoceros*) as influenced by acid pretreatment and extraction time. *Food Hydrocolloids* **25** (3): 381–388.
- Altinelataman, C., Koroleva, O., Fedorova, T., Torkova, A., Lisitskaya, K., Tsentelovich, M., Kononikhin, A., Popov, I., Vasina, D., Kovalyov, L., dan Çelik, U. 2019. An in vitro and in silico study on the antioxidant and cell culture-based study on the chemoprotective activities of fish muscle protein hydrolysates obtained from European seabass and gilthead seabream. *Food Chemistry* **271** (July 2018): 724–732.
- Amri, E., dan Mamboya, F. 2012. Papain, a plant enzyme of biological importance: A review. *American Journal of Biochemistry and Biotechnology* **8** (2): 99–104.
- Andonegi, M., de la Caba, K., dan Guerrero, P. 2020. Effect of citric acid on collagen sheets processed by compression. *Food Hydrocolloids* **100** (May 2019): 105427.
- AOAC Analysis of the Association of Official Analytical Chemists. (2005). Official Methods of Analysis of the Association of Official Analytical Chemists. Edisi ke-. Washington, D.C.
- Badan Pusat Statistik (2019). Statistik Pelabuhan perikanan 2019. ISSN: 2714-8432. 62 halaman.
- Badan Pusat Statistik (2022). Produksi buah-buahan menurut jenis tanaman menurut provinsi, 2021.
https://www.bps.go.id/indikator/indikator/view_data_pub/0000/api_pub/SGJsZ0s5RjRyTWN1eDNyUERzbTI0Zz09/da_05/1. [2 November 2022].

- Badarinath, A. V., Mallikarjuna Rao, K., Madhu Sudhana Chetty, C., Ramkanth, S., Rajan, T.V.S., dan Gnanaprakash, K. 2010. A review on In-vitro antioxidant methods: Comparisons, correlations and considerations. *International Journal of PharmTech Research* **2** (2): 1276–1285.
- Baehaki, A., Nopianti, R., dan Anggraeni, S. 2015. Antioxidant activity of skin and bone collagen hydrolyzed from striped catfish (*Pangasius pangasius*) with papain enzyme. *Journal of Chemical and Pharmaceutical Research* **7** (11): 131–135.
- Bah, C.S.F., Bekhit, A.E.D.A., McConnell, M.A., dan Carne, A. 2016. Generation of bioactive peptide hydrolysates from cattle plasma using plant and fungal proteases. *Food Chemistry* **213**: 98–107.
- Bahari, A.N., Bahari, A.N., Saari, N., Salim, N., Salim, N., Salim, N., Ashari, S.E., dan Ashari, S.E. 2020. Response factorial design analysis on papain-generated hydrolysates from *Actinopyga lecanora* for determination of antioxidant and antityrosinase activities. *Molecules* **25** (11): p.2663.
- Baharuddin, N.A., Halim, N.R.A., dan Sarbon, N.M. 2016. Effect of degree of hydrolysis (DH) on the functional properties and angiotensin I-converting enzyme (ACE) inhibitory activity of eel (*Monopterus* sp.) protein hydrolysate. *International Food Research Journal* **23** (4): 1424–1431.
- Barth, A., dan Zscherp, C. 2002. What vibrations tell us about proteins. *Quarterly Reviews of Biophysics* 369–430.
- Bechaux, J., Ferraro, V., Sayd, T., Chambon, C., Le Page, J.F., Drillet, Y., Gatellier, P., dan Santé-Lhoutellier, V. 2020. Workflow towards the generation of bioactive hydrolysates from porcine products by combining in silico dan in vitro approaches. *Food Research International* **132** (July 2019): 109123.
- Bechaux, J., Gatellier, P., Le Page, J.F., Drillet, Y., dan Sante-Lhoutellier, V. 2019. A comprehensive review of bioactive peptides obtained from animal byproducts and their applications. *Food and Function* **10** (10): 6244–6266.
- Biro, J.C. 2006. Amino acid size, charge, hydropathy indices and matrices for protein structure analysis. *Theoretical Biology and Medical Modelling* **3** (1): 1–12.
- Campbell, G.M., dan Mougeot, E. 1999. *Creation and characterisation of aerated food products* (1999). 1999. Ed. Campbell, G.M., and Mougeot, E. .
- Carbonaro, M., Maselli, P., dan Nucara, A. 2012. Relationship between digestibility and secondary structure of raw and thermally treated legume proteins: A Fourier transform infrared (FT-IR) spectroscopic study. *Amino Acids* **43** (2): 911–921.

- Carrasco-Castilla, J., Hernández-Álvarez, A.J., Jiménez-Martínez, C., Jacinto-Hernández, C., Alaiz, M., Girón-Calle, J., Vioque, J., dan Dávila-Ortiz, G. 2012. Antioxidant and metal chelating activities of peptide fractions from phaseolin and bean protein hydrolysates. *Food Chemistry* **135** (3): 1789–1795
- Cebi, N., Dogan, C.E., Mese, A.E., Ozdemir, D., Arıcı, M., dan Sagdic, O. 2019. A rapid ATR-FTIR spectroscopic method for classification of gelatin gummy candies in relation to the gelatin source. *Food Chemistry* **277**: 373–381.
- Chalamaiah, M., Dinesh Kumar, B., Hemalatha, R., dan Jyothirmayi, T. 2012. Fish protein hydrolysates: Proximate composition, amino acid composition, antioxidant activities and applications: A review. *Food Chemistry* 3020–3038
- Chen, H.M., Muramoto, K., Yamauchi, F., Fujimoto, K., dan Nokihara, K. 1998. Antioxidative Properties of Histidine-Containing Peptides Designed from Peptide Fragments Found in the Digests of a Soybean Protein. *Journal of Agricultural and Food Chemistry* **46** (1): 49–53.
- Chen, J., Liu, Y., Yi, R., Li, L., Gao, R., Xu, N., dan Zheng, M. 2017. Characterization of Collagen Enzymatic Hydrolysates Derived from Lizardfish (*Synodus fuscus*) Scales. *Journal of Aquatic Food Product Technology* **26** (1): 86–94.
- Chen, M., dan Li, B. 2012. The effect of molecular weights on the survivability of casein-derived antioxidant peptides after the simulated gastrointestinal digestion. *Innovative Food Science and Emerging Technologies* **16**: 341–348.
- Chen, Y.P., Liang, C.H., Wu, H.T., Pang, H.Y., Chen, C., Wang, G.H., dan Chan, L.P. 2018. Antioxidant and anti-inflammatory capacities of collagen peptides from milkfish (*Chanos chanos*) scales. *Journal of Food Science and Technology* **55** (6): 2310–2317.
- Chen, Y., Jin, H., Yang, F., Jin, S., Liu, C., Zhang, L., Huang, J., Wang, S., Yan, Z., Cai, X., Zhao, R., Yu, F., Yang, Z., Ding, G., dan Tang, Y. 2019. Physicochemical, antioxidant properties of giant croaker (*Nibea japonica*) swim bladders collagen and wound healing evaluation. *International Journal of Biological Macromolecules* **138**: 483–491.
- Cheung, I.W.Y., dan Li-Chan, E.C.Y. 2017. Enzymatic production of protein hydrolysates from steelhead (*Oncorhynchus mykiss*) skin gelatin as inhibitors of dipeptidyl-peptidase IV and angiotensin-I converting enzyme. *Journal of Functional Foods* **28**: 254–264.
- Chi, C.F., Cao, Z.H., Wang, B., Hu, F.Y., Li, Z.R., dan Zhang, B. 2014. Antioxidant and functional properties of collagen hydrolysates from Spanish mackerel skin as influenced by average molecular weight. *Molecules* **19** (8): 11211–11230.

- Chi, C.F., Wang, B., Wang, Y.M., Zhang, B., dan Deng, S.G. 2015. Isolation and characterization of three antioxidant peptidas from protein hydrolysate of bluefin leatherjacket (*Navodon septentrionalis*) heads. *Journal of Functional Foods* **12**: 1–10.
- Chi, E.Y., Krishnan, S., Randolph, T.W., dan Carpenter, J.F. 2003. Physical Stability of Proteins in Aqueous Solution: Mechanism and Driving Forces in Nonnative Protein Aggregation. *Pharmaceutical research*, **20**(9): pp.1325-1336.
- Chys, P., Gielens, C., dan Meersman, F. 2011. FTIR 2D correlation spectroscopy of $\alpha 1$ and $\alpha 2$ fractions of an alkali-pretreated gelatin. *Biochimica et Biophysica Acta - Proteins and Proteomics* **1814** (2): 318–325.
- Chotphruethipong, L., Aluko, R.E., dan Benjakul, S. 2019. Hydrolyzed collagen from porcine lipase-defatted seabass skin: Antioxidant, fibroblast cell proliferation, and collagen production activities. *Journal of Food Biochemistry* **43** (5): .
- Choudhary, D.K., Kumar, M., Prasad, R. dan Kumar, V. eds., 2018. *In Silico Approach for Sustainable Agriculture*. Hal 161-167. Singapore: Springer.
- Cian, R.E., Vioque, J., dan Drago, S.R. 2015. Structure–mechanism relationship of antioxidant and ACE I inhibitory peptides from wheat gluten hydrolysate fractionated by pH. *Food Research International* **69**: 216–223.
- Coelho, R.C.G., Marques, A.L.P., Oliveira, S.M., Diogo, G.S., Pirraco, R.P., Moreira-Silva, J., Xavier, J.C., Reis, R.L., Silva, T.H., dan Mano, J.F. 2017. Extraction and characterization of collagen from Antarctic and Sub-Antarctic squid and its potential application in hybrid scaffolds for tissue engineering. *Materials Science and Engineering C* **78**: 787–795.
- Colquitt, R.B., Colquhoun, D.A., dan Thiele, R.H. 2011. In silico modelling of physiologic systems. *Best Practice and Research: Clinical Anaesthesiology* **25** (4): 499–510.
- Cotabarren, J., Rosso, A.M., Tellechea, M., García-Pardo, J., Rivera, J.L., Obregón, W.D., dan Parisi, M.G. 2019. Adding value to the chia (*Salvia hispanica* L.) expeller: Production of bioactive peptides with antioxidant properties by enzymatic hydrolysis with Papain. *Food Chemistry* **274**: 848–856.
- Cruz-López, H., Rodríguez-Morales, S., Enríquez-Paredes, L.M., Villarreal-Gómez, L.J., Olivera-Castillo, L., Cortes-Santiago, Y., dan López, L.M. 2021. Comparison of collagen characteristic from the skin and swim bladder of Gulf corvina (*Cynoscion othonopterus*). *Tissue and Cell* **72**: .

- Cstorer, A., dan Ménard, R. 1994. Catalytic mechanism in papain family of cysteine peptidases. *Methods in Enzymology* **244** (C): 486–500.
- Cui, Q., Sun, Y., Zhou, Z., Cheng, J., dan Guo, M. 2021. Effects of Enzymatic Hydrolysis on Physicochemical Properties and Solubility and Bitterness of Milk Protein Hydrolysates. *Foods* **10** (10): 2462.
- Damodaran, S. 2008. Fennema's food chemistry. In S. Damodaran, K. L. Parkin, & O. R. Fennema (Eds.), Amino acids, peptides, and proteins (4th ed., pp. 217–330). Boca Raton: CRC Press.
- Damrongsakkul, S., Ratanathammapan, K., Komolpis, K., dan Tanthapanichakoon, W. 2008. Enzymatic hydrolysis of rawhide using papain and neutrase. *Journal of Industrial and Engineering Chemistry* **14** (2): 202–206.
- Dara, P.K., Raghavankutty, M., Sebastian, N., Chatterjee, N.S., Mathew, S., Ravishankar, C.N., dan Anandan, R. 2020. Rheological, Physico-chemical, and Surface-Active Properties of Gelatin Extracted from Bigeye Tuna (*Thunnus obesus*) Skin Waste. *Journal of Aquatic Food Product Technology* **29** (5): 428–444.
- Dhakal, D., Koomsap, P., Lamichhane, A., Sadiq, M.B., dan Anal, A.K. 2018. Optimization of collagen extraction from chicken feet by papain hydrolysis and synthesis of chicken feet collagen based biopolymeric fibres. *Food Bioscience* **23** (February): 23–30.
- Díaz-Calderón, P., Flores, E., González-Muñoz, A., Pepczynska, M., Quero, F., dan Enrione, J. 2017. Influence of extraction variables on the structure and physical properties of salmon gelatin. *Food Hydrocolloids* **71**: 118–128.
- Ding, D., Yu, T., Du, B., dan Huang, Y. 2019. Collagen hydrolysate from *Thunnus orientalis* bone induces osteoblast proliferation and differentiation. *Chemical Engineering Science* **205**: 143–150.
- Ding, J., Liang, R., Yang, Y., Sun, N., dan Lin, S. 2020. Optimization of pea protein hydrolysate preparation and purification of antioxidant peptides based on an in silico analytical approach. *Lwt* **123** (February): 109126.
- Don, L.S.B., Pilosof, A.M.R., dan Bartholomai, G.B. 1991. Enzymatic modification of soy protein concentrates by fungal and bacterial proteases. *Journal of the American Oil Chemists Society* **68** (2): 102–105.
- Dziuba, M., dan Dziuba, B. 2010. In silico Analysis of Bioactive Peptides. *Bioactive Proteins and Peptides as Functional Foods and Nutraceuticals* 325–340.

- Esfandi, R., Walters, M.E., dan Tsopmo, A. 2019. Antioxidant properties and potential mechanisms of hydrolyzed proteins and peptides from cereals. *Heliyon* **5**: 1–26.
- Engel, J., dan Bächinger, H.P. 2005. Structure, stability and folding of the collagen triple helix. *Topics in Current Chemistry* **247**: 7–33.
- FAO. (2020). *The State of World Fisheries and Aquaculture 2020. Sustainability in action*. Rome.
- Farrell, H.M., Wickham, E.D., Unruh, J.J., Qi, P.X., dan Hoagland, P.D. 2001. Secondary structural studies of bovine caseins: temperature dependence of b-casein structure as analyzed by circular dichroism and FTIR spectroscopy and correlation with micellization q. *Food Hydrocolloids* **15**: 341–354.
- Fathollahy, I., Farmani, J., Kasaai, M.R., dan Hamishehkar, H. 2021. Characteristics and functional properties of Persian lime (*Citrus latifolia*) seed protein isolate and enzymatic hydrolysates. *Lwt* **140** (September 2020): 110765.
- Fenton, H.J.H. 1894. 16 Oxidation of Tartatic Acid in Presence of Iron. *Journal of the Chemical Society, Transactions* **65** (0): 899–910.
- Fernández-Lucas, J., Castañeda, D., dan Hormigo, D. 2017. New trends for a classical enzyme: Papain, a biotechnological success story in the food industry. *Trends in Food Science and Technology* 91–101.
- Floegel, A., Kim, D.O., Chung, S.J., Koo, S.I., dan Chun, O.K. 2011. Comparison of ABTS/DPPH assays to measure antioxidant capacity in popular antioxidant-rich US foods. *Journal of Food Composition and Analysis* **24** (7): 1043–1048.
- Foti, M.C. 2015. Use and Abuse of the DPPH• Radical. *Journal of Agricultural and Food Chemistry* **63** (40): 8765–8776.
- Fu, Y., Therkildsen, M., Aluko, R.E., dan Lametsch, R. 2019. Exploration of collagen recovered from animal by-products as a precursor of bioactive peptides: Successes and challenges. *Critical Reviews in Food Science and Nutrition* **59** (13): 2011–2027.
- Fu, Y., Wu, W., Zhu, M., dan Xiao, Z. 2016. In Silico Assessment of the Potential of Patatin as a Precursor of Bioactive Peptides. *Journal of Food Biochemistry* **40** (3): 366–370.
- Gajanan, P.G., Elavarasan, K., dan Shamasundar, B.A. 2016. Bioactive and functional properties of protein hydrolysates from fish frame processing waste using plant proteases. *Environmental Science and Pollution Research* **23** (24): 24901–24911.

- Gamarro, E., Orawattanamateekul, W., Sentina, J., dan Gopal, S. 2013. By-products of tuna processing. *GLOBEFISH Research Programme FAO*. **112**: 1–48.
- Gbogouri, G.A., Linder, M., Fanni, J., dan Parmentier, M. 2004. Influence of Hydrolysis Degree on the Functional Properties of Salmon Byproducts Hydrolysates. *Journal of Food Science* **69** (8): C615–C622.
- Gelse, K., Pöschl, E., dan Aigner, T. 2003. Collagens - Structure, function, and biosynthesis. *Advanced Drug Delivery Reviews* **55** (12): 1531–1546.
- Gharbi, N., dan Labbafi, M. 2019. Influence of treatment-induced modification of egg white proteins on foaming properties. *Food Hydrocolloids* **90**: 72–81.
- González-Serrano, D.J., Hadidi, M., Varcheh, M., Jelyani, A.Z., Moreno, A., dan Lorenzo, J.M. 2022. Bioactive Peptide Fractions from Collagen Hydrolysate of Common Carp Fish Byproduct: Antioxidant and Functional Properties. *Antioxidants* **11** (3): 509.
- Gordon, M.K., dan Hahn, R.A. 2010. Collagens. *Cell and Tissue Research* **339** (1): 247–257.
- Guo, H., Kouzuma, Y., dan Yonekura, M. 2009. Structures and properties of antioxidative peptides derived from royal jelly protein. *Food Chemistry* **113** (1): 238–245.
- Gupta, S., Kapoor, P., Chaudhary, K., Gautam, A., Kumar, R., dan Raghava, G.P.S. 2013. In Silico Approach for Predicting Toxicity of Peptides and Proteins. *PLoS ONE* **8** (9): .
- Hadinoto, S., dan Idrus, S. 2018. Proporsi dan Kadar Proksimat Bagian Tubuh Ikan Tuna Ekor Kuning (*Thunnus albacares*) Dari Perairan Maluku. *Majalah BIAM* **14** (2): 51.
- Haida, Z., dan Hakiman, M. 2019. A comprehensive review on the determination of enzymatic assay and nonenzymatic antioxidant activities. *Food Science and Nutrition* **7** (5): 1555–1563.
- Hakeem, K.R., Shaik, N.A., Banaganapalli, B., dan Elango, R. 2019. Essentials of bioinformatics, volume III: In silico life sciences: Agriculture. *Essentials of Bioinformatics, Volume III: In Silico Life Sciences: Agriculture* 1–218.
- Halliwell, B. 1999. Antioxidant defence mechanisms: From the beginning to the end (of the beginning). *Free Radical Research* **31** (4): 261–272.
- Hames, B.D. ed., 1998. Gel electrophoresis of proteins: a practical approach (Vol. 197). OUP Oxford.
- Hema, G.S., Joshy, C.G., Shyni, K., Chatterjee, N.S., Ninan, G., dan Mathew, S. 2017. Optimization of process parameters for the production of collagen

- peptides from fish skin (*Epinephelus malabaricus*) using response surface methodology and its characterization. *Journal of Food Science and Technology* **54** (2): 488–496.
- Hernández-Ledesma, B., Dávalos, A., Bartolomé, B., dan Amigo, L. 2005. Preparation of antioxidant enzymatic hydrolysates from α -lactalbumin and β -lactoglobulin. Identification of active peptides by HPLC- MS/MS. *Journal of Agricultural and Food Chemistry* **53** (3): 588–593.
- Homaei, A.A., Sajedi, R.H., Sariri, R., Seyfzadeh, S., dan Stevanato, R. 2010. Cysteine enhances activity and stability of immobilized papain. *Amino Acids* **38** (3): 937–942.
- Hong, H., Fan, H., Chalamaiah, M., dan Wu, J. 2019. Preparation of low-molecular-weight, collagen hydrolysates (peptidas): Current progress, challenges, and future perspectives. *Food Chemistry* **301** (April).
- Hong, H., Fan, H., Roy, B.C., dan Wu, J. 2021. Amylase enhances production of low molecular weight collagen peptidas from the skin of spent hen, bovine, porcine, and tilapia. *Food Chemistry* **352** (November 2020): 129355.
- Hoyle, N.T dan Merritt, J. H. 1994. *Quality of Fish Protein Hydrolysates from Herring (*Clupea harengus*)* (1994).Ed.
- Hu, H., Li-Chan, E.C.Y., Wan, L., Tian, M., dan Pan, S. 2013. The effect of high intensity ultrasonic pre-treatment on the properties of soybean protein isolate gel induced by calcium sulfate. *Food Hydrocolloids* **32** (2): 303–311.
- Huang, D., Boxin, O.U., dan Prior, R.L. 2005. The chemistry behind antioxidant capacity assays. *Journal of Agricultural and Food Chemistry* 1841–1856.
- Hulmes, D.J.S., 2008. *Collagen diversity, synthesis and assembly*. In *Collagen* (pp. 15-47). Springer, Boston, MA.
- Indriyani, N.L.P., Affandi, dan Sunarwati, D. Solok. 2008. *Pengelolaan Kebun Pepaya Sehat*. Balai Penerbitan Tanaman Buah Tropika. ISBN: 978-979-1465-03-8. Solok, Sumatera Barat. 22 hlm.
- Işıl Berker, K., Güçlü, K., Tor, I., Demirata, B., dan Apak, R. 2010. Total antioxidant capacity assay using optimized ferricyanide/Prussian blue method. *Food Analytical Methods* **3** (3): 154–168.
- Islam, Z., Islam, M.M., Saha, S., Jahangir, C.A., Basak, B., Islam, M.N., Islam, M.S., Paul, S., dan Khalekuzzaman, M. 2015. Identification and Computational Analysis of Chicken Alpha-1 Collagen Sequences. *International Journal of Scientific and Engineering Research* **6** (1): 217–221.

- Iwaniak, A., Minkiewicz, P., Darewicz, M., Sieniawski, K., dan Starowicz, P. 2016. BIOPEP database of sensory peptides and amino acids. *Food Research International* **85**: 155–161.
- Iwaniak, A., Minkiewicz, P., Pliszka, M., Mogut, D., dan Darewicz, M. 2020. Characteristics of Biopeptides Released in Silico from Collagens Using Quantitative Parameters. *Foods* **9** (7): 1–29.
- Jackson, M., dan Mantsch, H.H. 1995. The use and misuse of FTIR spectroscopy in the determination of protein structure. *Critical Reviews in Biochemistry and Molecular Biology* **30** (2): 95–120.
- Jafarpour, A., Gomes, R.M., Gregersen, S., Sloth, J.J., Jacobsen, C., dan Moltke Sørensen, A.D. 2020. Characterization of cod (*Gadus morhua*) frame composition and its valorization by enzymatic hydrolysis. *Journal of Food Composition and Analysis* **89**.
- Jaziri, A.A., Shapawi, R., Mokhtar, R.A.M., Noordin, W.N.M., dan Huda, N. 2022. Biochemical and Microstructural Properties of Lizardfish (*Saurida tumbil*) Scale Collagen Extracted with Various Organic Acids. *Gels* **8** (5): 266.
- Je, J.Y., Park, P.J., dan Kim, S.K. 2005. Antioxidant activity of a peptide isolated from Alaska pollack (*Theragra chalcogramma*) frame protein hydrolysate. *Food Research International* **38** (1): 45–50.
- Je, J.Y., Park, S.Y., Hwang, J.Y., dan Ahn, C.B. 2015. Amino acid composition and in vitro antioxidant and cytoprotective activity of abalone viscera hydrolysate. *Journal of Functional Foods* **16**: 94–103.
- Jemil, I., Jridi, M., Nasri, R., Ktari, N., Ben Slama-Ben Salem, R., Mehiri, M., Hajji, M., dan Nasri, M. 2014. Functional, antioxidant and antibacterial properties of protein hydrolysates prepared from fish meat fermented by *Bacillus subtilis* A26. *Process Biochemistry* **49** (6): 963–972.
- Joseph, F.Z. 1997. Chapter 2 Water Holding Capacity of Proteins. *Functionality of Proteins in Food* 76–133.
- Kaewdang, O., Benjakul, S., Kaewmanee, T., dan Kishimura, H. 2014. Characteristics of collagens from the swim bladders of yellowfin tuna (*Thunnus albacares*). *Food Chemistry* **155**: 264–270.
- Kaiser, E.T., dan Kezdy, F.J. 1983. *Secondary structures of proteins and peptides in amphiphilic environments (A Review) (amphiphilic surfaces/apolipoproteins/peptide hormones/peptide secondary structure/peptide toxins)* (**80**, 1983). 1983. Ed. v.**80**.
- Kedare, S.B., dan Singh, R.P. 2011. Genesis and development of DPPH method of antioxidant assay. **48** (August): 412–422.

- Kelly, S. dan Nimbalkar, R., 2018. *Free Radicals and Antioxidants in Better Healthcare. In Antioxidant Nutraceuticals*. CRC Press. pp. 273-288.
- Kraus, A. 2015. Development of functional food with the participation of the consumer. Motivators for consumption of functional products. *International Journal of Consumer Studies* **39** (1): 2–11.
- Ktari, N., Jridi, M., Bkhairia, I., Sayari, N., Ben Salah, R., dan Nasri, M. 2012. Functionalities and antioxidant properties of protein hydrolysates from muscle of zebra blenny (*Salaria basilisca*) obtained with different crude protease extracts. *Food Research International* **49** (2): 747–756.
- Laemmli, U.K. 1970. Cleavage of Structural Proteins during the Assembly of the Head of Bacteriophage T4. *Nature* **227**: 680–685.
- Lafarga, T., Wilm, M., Wynne, K., dan Hayes, M. 2016. Bioactive hydrolysates from bovine blood globulins: Generation, characterisation, and in silico prediction of toxicity and allergenicity. *Journal of Functional Foods* **24**: 142–155.
- Lear, S., dan Cobb, S.L. 2016. Pep-Calc.com: A set of web utilities for the calculation of peptide and peptoid properties and automatic mass spectral peak assignment. *Journal of Computer-Aided Molecular Design* **30** (3): 271–277.
- Lemes, A.C., Sala, L., Ores, J.D.C., Braga, A.R.C., Egea, M.B., dan Fernandes, K.F. 2016. A review of the latest advances in encrypted bioactive peptides from protein-rich waste. *International Journal of Molecular Sciences* **17** (6): .
- Li, C., Qi, R., Yuan, J., Han, L., Wang, S., Li, W., dan Han, W. 2021. In silico study to predict potential precursors of human dipeptidyl peptidase-IV inhibitors from hazelnut. *Journal of Biomolecular Structure and Dynamics*.
- Li, Z., Wang, B., Chi, C., Gong, Y., Luo, H., dan Ding, G. 2013. Influence of average molecular weight on antioxidant and functional properties of cartilage collagen hydrolysates from *Sphyrna lewini*, *Dasyatis akjei* and *Raja porosa*. *Food Research International* **51** (1): 283–293.
- Li, Z.R., Wang, B., Chi, C. feng, Zhang, Q.H., Gong, Y. dan, Tang, J.J., Luo, H. yu, and Ding, G. fang. 2013. Isolation and characterization of acid soluble collagens and pepsin soluble collagens from the skin and bone of Spanish mackerel (*Scomberomorus niphonius*). *Food Hydrocolloids* **31** (1): 103–113.
- Liu, D., Liang, L., Regenstein, J.M., dan Zhou, P. 2012. Extraction and characterisation of pepsin-solubilised collagen from fins, scales, skins, bones and swim bladders of bighead carp (*Hypophthalmichthys nobilis*). *Food Chemistry* **133** (4): 1441–1448.

- Liu, D., Wei, G., Li, T., Hu, J., Lu, N., Regenstein, J.M., dan Zhou, P. 2015. Effects of alkaline pretreatments and acid extraction conditions on the acid-soluble collagen from grass carp (*Ctenopharyngodon idella*) skin. *Food Chemistry* **172**: 836–843.
- Liu, Q., Kong, B., Xiong, Y.L., dan Xia, X. 2010. Antioxidant activity and functional properties of porcine plasma protein hydrolysate as influenced by the degree of hydrolysis. *Food Chemistry* **118** (2): 403–410.
- Liu, R., Xing, L., Fu, Q., Zhou, G.H., dan Zhang, W.G. 2016. A review of antioxidant peptides derived from meat muscle and by-products. *Antioxidants* **5** (3):
- Liu, R., Wang, L., Zheng, W., dan Wu, H. 2015. In vivo antioxidant effects of hydrolysate derived from waste proteins of *Macraa veneriformis*. *Journal of Aquatic Food Product Technology* **24** (2): 143–152.
- Liu, Z., Su, Y., dan Zeng, M. 2011. Amino acid composition and functional properties of giant red sea cucumber (*Parastichopus californicus*) collagen hydrolysates. *Journal of Ocean University of China* **10** (1): 80–84.
- López-Barrios, L., Gutiérrez-Urbe, J.A., dan Serna-Saldívar, S.O. 2014. Bioactive Peptides and Hydrolysates from Pulses and Their Potential Use as Functional Ingredients. *Journal of Food Science* **79** (3): .
- López-Pedrouso, M., Borrajo, P., Pateiro, M., Lorenzo, J.M., dan Franco, D. 2020. Antioxidant activity and peptidomic analysis of porcine liver hydrolysates using alcalase, bromelain, flavourzyme and papain enzymes. *Food Research International* **137** (March): .
- Lowry, O.H., Rosebrough, N.J., Farr, A.L., dan Randall, R.J. 1951. Protein measurement with the Folin phenol reagent. *The Journal of biological chemistry* **193** (1): 265–275.
- Luo, H.Y., Wang, B., Li, Z.R., Chi, C.F., Zhang, Q.H., dan He, G. yuan. 2013. Preparation and evaluation of antioxidant peptide from papain hydrolysate of *Sphyrna lewini* muscle protein. *LWT - Food Science and Technology* **51** (1): 281–288.
- Marcet, I., Álvarez, C., Paredes, B., dan Díaz, M. 2016. The use of sub-critical water hydrolysis for the recovery of peptides and free amino acids from food processing wastes. Review of sources and main parameters. *Waste Management* **49**: 364–371.
- McCulloch, A.D., dan Huber, G. 2002. Integrative biological modelling in silico. *Novartis Foundation Symposium* **247**: 4–25.

- Menard, R., Khouri, H.E., Plouffe, C., Dupras, R., Ripoll, D., Vernet, T., Tessier, D.C., Laliberte, F., Thomas, D.Y., dan Storer, A.C. 1990. A protein engineering study of the role of aspartate 158 in the catalytic mechanism of papain. *Biochemistry* **29** (28): 6706–6713.
- Mendis, E., Rajapakse, N., dan Kim, S.K. 2005. Antioxidant properties of a radical-scavenging peptide purified from enzymatically prepared fish skin gelatin hydrolysate. *Journal of Agricultural and Food Chemistry* **53** (3): 581–587.
- Min, S.G., Jo, Y.J., dan Park, S.H. 2017. Potential application of static hydrothermal processing to produce the protein hydrolysates from porcine skin by-products. *LWT - Food Science and Technology* **83**: 18–25.
- Minkiewicz, P., Dziuba, J., Iwaniak, A., Dziuba, M., dan Darewicz, M. 2008. BIOPEP database and other programs for processing bioactive peptide sequences. *Journal of AOAC International* **91** (4): 965–980.
- Mirzapour-Kouhdasht, A., Moosavi-Nasab, M., Krishnaswamy, K., dan Khalesi, M. 2020. Optimization of gelatin production from Barred mackerel by-products: Characterization and hydrolysis using native and commercial proteases. *Food Hydrocolloids* **108**: .
- Molyneux, P. 2004. Molineux 07-DPPH. *Songklanakarin J. Sci. Technol* **26**: 211–219.
- Munawaroh, H.S.H., Gumilar, G.G., Berliana, J.D., Aisyah, S., Nuraini, V.A., Ningrum, A., Susanto, E., Martha, L., Kurniawan, I., Hidayati, N.A., Koyande, A.K., dan Show, P.L. 2022. In silico proteolysis and molecular interaction of tilapia (*Oreochromis niloticus*) skin collagen-derived peptides for environmental remediation. *Environmental Research* **212** (PA): 113002.
- Munteanu, I.G., dan Apetrei, C. 2021. Analytical Methods Used in Determining Antioxidant Activity: A Review. *International Journal of Molecular Sciences* **22** (7): 3380.
- Nakchum, L., dan Kim, S.M. 2016. Preparation of squid skin collagen hydrolysate as an antihyaluronidase, antityrosinase, and antioxidant agent. *Preparative Biochemistry and Biotechnology* **46** (2): 123–130.
- Nasri, M. (2017). *Protein Hydrolysates and Biopeptidas: Production, Biological Activities, and Applications in Foods and Health Benefits. A Review*. 1 ed. v.81. Elsevier Inc.
- Nguyen, B.C., Kha, T.C., Nguyen, K.H.N., dan Nguyen, H.M.X. 2021. Optimization of enzymatic hydrolysis of collagen from yellowfin tuna skin (*Thunnus albacares*) by response surface methodology and properties of hydrolyzed collagen. *Journal of Food Processing and Preservation* **45** (4): .

- Ningrum, A., dan Munawaroh, H. S. H. 2019. in Silico Approach of Collagen From Tuna Fish By-Product As Angiotensin-Converting Enzyme Inhibitor. *Asian Journal of Pharmaceutical and Clinical Research* **12** (10): 113–117.
- Ningrum, A., Wardani, D.W., Vanidia, N., Sarifudin, A., Kumalasari, R., Ekafitri, R., Kristanti, D., Setiaboma, W., dan Munawaroh, H.S.H. 2022. In Silico Approach of Glycinin and Conglycinin Chains of Soybean By-Product (Okara) Using Papain and Bromelain. *Molecules* **27**: 1–11.
- Noman, A., Xu, Y., AL-Bukhaiti, W.Q., Abed, S.M., Ali, A.H., Ramadhan, A.H., dan Xia, W. 2018. Influence of enzymatic hydrolysis conditions on the degree of hydrolysis and functional properties of protein hydrolysate obtained from Chinese sturgeon (*Acipenser sinensis*) by using papain enzyme. *Process Biochemistry* **67** (September 2017): 19–28.
- Nurilmala, M., Fauzi, S., Mayasari, D., dan Batubar, I. 2019. Collagen extraction from yellowfin tuna (*Thunnus albacares*) skin and its antioxidant activity. *Jurnal Teknologi* **81** (2): 141–149.
- Nurilmala, M., Hizbullah, H.H., Karnia, E., Kusumaningtyas, E., dan Ochiai, Y. 2020. Characterization and Antioxidant Activity of Collagen, Gelatin, and the Derived Peptidas from Yellowfin Tuna (*Thunnus albacares*) Skin. *Marine Drugs* **18** (2):1-12.
- Nurilmala, M., Pertiwi, R.M., Nurhayati, T., Fauzi, S., Batubara, I., dan Ochiai, Y. 2019. Characterization of collagen and its hydrolysate from yellowfin tuna *Thunnus albacares* skin and their potencies as antioxidant and antiglycation agents. *Fisheries Science* **85** (3): 591–599.
- Nwachukwu, I.D., dan Aluko, R.E. 2019. Structural and functional properties of food protein-derived antioxidant peptides. *Journal of Food Biochemistry* 1–13.
- Offengenden, M., Chakrabarti, S., dan Wu, J. 2018. Chicken collagen hydrolysates differentially mediate anti-inflammatory activity and type I collagen synthesis on human dermal fibroblasts. *Food Science and Human Wellness* **7** (2): 138–147.
- Olivos-Lugo, B.L., Valdivia-López, M.Á., and Tecante, A. 2010. Thermal and physicochemical properties and nutritional value of the protein fraction of mexican chia seed (*Salvia hispanica* L.). *Food Science and Technology International* **16** (1): 89–96.

- Opheim, M., Šližyte, R., Sterten, H., Provan, F., Larssen, E., dan Kjos, N.P. 2015. Hydrolysis of Atlantic salmon (*Salmo salar*) rest raw materials - Effect of raw material and processing on composition, nutritional value, and potential bioactive peptides in the hydrolysates. *Process Biochemistry* **50** (8): 1247–1257.
- Oyaizu, M. 1986. Studies on Product of Browning Reaction. 44 (6): 307–315.
- Ozuna, C., Paniagua-Martínez, I., Castaño-Tostado, E., Ozimek, L., dan Amaya-Llano, S.L. 2015. Innovative applications of high-intensity ultrasound in the development of functional food ingredients: Production of protein hydrolysates and bioactive peptides. *Food Research International* **77**: 685–696.
- Pa'ee, K.F., Razali, N., Sarbini, S.R., Ramonaran Nair, S.N., Yong Tau Len, K., dan Abd-Talib, N. 2021. The production of collagen type I hydrolyzate derived from tilapia (*Oreochromis sp.*) skin using thermoase PC10F and its in silico analysis. *Food Biotechnology* **35** (1): 1–21.
- Pal, G.K., dan Suresh, P. V. 2017. Physico-chemical characteristics and fibril-forming capacity of carp swim bladder collagens and exploration of their potential bioactive peptides by in silico approaches. *International Journal of Biological Macromolecules* **101**: 304–313.
- Pati, F., Adhikari, B., dan Dhara, S. 2010. Isolation and characterization of fish scale collagen of higher thermal stability. *Bioresource Technology* **101** (10): 3737–3742.
- Pearce, K.N., dan Kinsella, J.E. 1978. *Emulsifying Properties of Proteins: Evaluation of a Turbidimetric Technique* (26, 1978). 1978. Ed. v.26.
- Picot, L., Ravallec, R., Martine, F.P., Vandanjon, L., Jaouen, P., Chaplain-Derouiniot, M., Guérard, F., Chabeaud, A., Legal, Y., Alvarez, O.M., Bergé, J.P., Piot, J.M., Batista, I., Pires, C., Thorkelsson, G., Delannoy, C., Jakobsen, G., Johanssonm, I., dan Bourseau, P. 2010. Impact of ultrafiltration and nanofiltration of an industrial fish protein hydrolysate on its bioactive properties. *Journal of the Science of Food and Agriculture* **90** (11): 1819–1826.
- Piez, K.A., dan Gross, J. 1960. The amino acid composition of some fish collagens: the relation between composition and structure. *The Journal of biological chemistry* **235**: 995–998.
- Pooja, K., Rani, S., dan Prakash, B. 2017. In silico approaches towards the exploration of rice bran proteins-derived angiotensin-I-converting enzyme inhibitory peptides. *International Journal of Food Properties* **20**: 2178–2191.

- Prastyo, D.T., Trilaksani, W., dan Nurjanah. 2020. Aktivitas Antioksidan Hidrolisat Kolagen Kulit Ikan Nila (*Oreochromis niloticus*). *Jurnal Pengolahan Hasil Perikanan Indonesia* **23** (3): 423–433.
- Priatni, S., Harimadi, K., Buana, E., Kosasih, W., dan Rohmatussolihat, R. 2020. Production and characterization of spray-dried swamp eel (*Monopterus albus*) Protein hydrolysate prepared by Papain. *Sains Malaysiana* **49** (3): 545–552.
- Qiao, M., Tu, M., Chen, H., Mao, F., Yu, C., dan Du, M. 2018. Identification and in silico prediction of anticoagulant peptides from the enzymatic hydrolysates of *mytilus edulis* proteins. *International Journal of Molecular Sciences* **19** (7): .
- Raghavan, S., Kristinsson, H.G., dan Leeuwenburgh, C. 2008. Radical scavenging and reducing ability of tilapia (*Oreochromis niloticus*) protein hydrolysates. *Journal of Agricultural and Food Chemistry* **56** (21): 10359–10367.
- Rahali, V., Chobert, J.-M., Haertlé, T., dan Guéguen, J. 2000. *Emulsification of chemical and enzymatic hydrolysates of b-lactoglobulin: characterization of the peptides adsorbed at the interface* (2000). 2000. Ed.
- Rahmani-Manglano, N.E., Jones, N.C., Hoffmann, S. V., Guadix, E.M., Pérez-Gálvez, R., Guadix, A., dan García-Moreno, P.J. 2022. Structure of whey protein hydrolysate used as emulsifier in wet and dried oil delivery systems: Effect of pH and drying processing. *Food Chemistry* **390**: .
- Rajapakse, N., Mendis, E., Jung, W.K., Je, J.Y., dan Kim, S.K. 2005. Purification of a radical scavenging peptida from fermented mussel sauce and its antioxidant properties. *Food Research International* **38** (2): 175–182.
- Re, R., Pellegrini, N., Proteggente, A., Pannala, A., Yang, M., and Rice-Evans, C. 1999. *Original Contribution Antioxidant Activity Applying An Improved Abts Radical Cation Decolorization Assay* (1999).
- Rohman, Abdul, M.Si., Apt dan Prof. Dr. Ibnu Gholib Gandjar, DEA., Apt. 2007. *Metode Kromatografi Untuk Analisis Makanan BAB III* hal. 43-75. Yogyakarta: Pustaka Pelajar.
- Roy, J.J., Sumi, S., Sangeetha, K., dan Abraham, T.E. 2005. Chemical modification and immobilization of papain. *Journal of Chemical Technology and Biotechnology* **80** (2): 184–188.
- Rullmann, J.A.C., Bellido, M.N., dan van Duijnen, P.T. 1989. The active site of papain. All-atom study of interactions with protein matrix and solvent. *Journal of Molecular Biology* **206** (1): 101–118.

- Rutherford, S.M., 2010. Methodology for determining degree of hydrolysis of proteins in hydrolysates: a review. *Journal of AOAC International*, **93** (5): 1515-1522.
- Sai, K.P., dan Babu, M. 2001. *Studies on Rana tigerina skin collagen* (**128**, 2001). 2001. Ed. v.**128**.
- Sarmadi, B. H., dan Ismail, A. 2010. Antioxidative peptides from food proteins: a review. *Peptides* **31**(10), 1949–1956.
- Sarteshnizi, A.R., Sahari, M.A., Gavligi, H.A., Regenstein, J.M., Nikoo, M., dan Udenigwe, C.C. 2021. Influence of fish protein hydrolysate-pistachio green hull extract interactions on antioxidant activity and inhibition of α -glucosidase, α -amylase, and DPP-IV enzymes. *LWT* **142**: 111019.
- Schnell, S., dan Maini, P.K. 2000. Enzyme kinetics at high enzyme concentration. *Bulletin of Mathematical Biology* **62** (3): 483–499.
- Sen, S., dan Chakraborty, R. 2011. The role of antioxidants in human health. *ACS Symposium Series* **1083**: 1–37.
- Shang, W.H., Tang, Y., Su, S.Y., Han, J.R., Yan, J.N., Wu, H.T., dan Zhu, B.W. 2018. In silico assessment and structural characterization of antioxidant peptides from major yolk protein of sea urchin *Strongylocentrotus nudus*. *Food and Function* **9** (12): 6435–6443.
- Shahidi, F., Han, X.-Q., dan Synowiecki, J. 1995. *Production and characteristics of protein hydrolysates from capelin (*Mallotus villosus*)* (**53**, 1995).
- Shahidi, F., dan Zhong, Y. 2015. Measurement of antioxidant activity. *Journal of Functional Foods* **18**: 757–781.
- Shah, P., dan Modi, H.A. 2015. Comparative Study of DPPH, ABTS and FRAP Assays for Determination of Antioxidant Activity. .
- Shahi, Z., Sayyed-Alangi, S.Z., dan Najafian, L. 2020. Effects of enzyme type and process time on hydrolysis degree, electrophoresis bands and antioxidant properties of hydrolyzed proteins derived from defatted *Bunium persicum* Bioss. press cake. *Heliyon* **6** (2): e03365.
- Sharma, O.P., dan Bhat, T.K. 2009. DPPH antioxidant assay revisited. *Food Chemistry* **113** (4): 1202–1205.
- Shiao, W.-C., Wu, T.-C., Kuo, C.-H., Tsai, Y.-H., Tsai, M.-L., Hong, Y.-H., dan Huang, C.-Y. 2021. Physicochemical and Antioxidant Properties of Gelatin and Gelatin Hydrolysates Obtained from Extrusion-Pretreated Fish (*Oreochromis* sp.) Scales. *Marine Drugs* **19** (5): 275.

- Sikorski, Z.E., dan Borderias, J.A. 1994. Collagen in the Muscles And Skin Of Marine Animals Location Of Collagen And Connective Tissue In The Muscles. Seafood Pr Chapman & Hall. inc (1980): 58–59.
- Silvipriya, K.S., Krishna Kumar, K., Bhat, A.R., Dinesh Kumar, B., John, A., dan Lakshmanan, P. 2015. Collagen: Animal sources and biomedical application. *Journal of Applied Pharmaceutical Science* **5** (3): 123–127.
- Singh, P.P., Gupta, V., dan Prakash, B. 2021. Recent advancement in functional properties and toxicity assessment of plant-derived bioactive peptides using bioinformatic approaches. *Critical Reviews in Food Science and Nutrition*.
- Stani, C., Vaccari, L., Mitri, E., dan Birarda, G. 2020. FTIR investigation of the secondary structure of type I collagen: New insight into the amide III band. *Spectrochimica Acta - Part A: Molecular and Biomolecular Spectroscopy* **229**.
- Sun, L., Hou, H., Li, B., dan Zhang, Y. 2017. Characterization of acid- and pepsin-soluble collagen extracted from the skin of Nile tilapia (*Oreochromis niloticus*). *International Journal of Biological Macromolecules* **99**: 8–14.
- Tacias-Pascacio, V.G., Castañeda-Valbuena, D., Morellon-Sterling, R., Tavano, O., Berenguer-Murcia, Á., Vela-Gutiérrez, G., Rather, I.A., dan Fernandez-Lafuente, R. 2021. Bioactive peptides from fisheries residues: A review of use of papain in proteolysis reactions. *International Journal of Biological Macromolecules* 415–428.
- Tamilmozhi, S., Veeruraj, A., dan Arumugam, M. 2013. Isolation and characterization of acid and pepsin-solubilized collagen from the skin of sailfish (*Istiophorus platypterus*). *Food Research International* **54** (2): 1499–1505.
- Teuscher, A.C., Jongsma, E., Davis, M.N., Statzer, C., Gebauer, J.M., Naba, A., dan Ewald, C.Y. 2019. The in-silico characterization of the *Caenorhabditis elegans* matrisome and proposal of a novel collagen classification. *Matrix Biology Plus* **1**: 100001.
- Thiansilakul, Y., Benjakul, S., dan Shahidi, F. 2007. Compositions, functional properties and antioxidative activity of protein hydrolysates prepared from round scad (*Decapterus maruadsi*). *Food Chemistry* **103** (4): 1385–1394.
- Tkaczewska, J., Borawska-Dziadkiewicz, J., Kulawik, P., Duda, I., Morawska, M., dan Mickowska, B. 2020. The effects of hydrolysis condition on the antioxidant activity of protein hydrolysate from *Cyprinus carpio* skin gelatin. *LWT* **117**: .

- Tsumura, K., Saito, T., Tsuge, K., Ashida, H., Kugimiya, W., dan Inouye, K. 2005. Functional properties of soy protein hydrolysates obtained by selective proteolysis. *LWT - Food Science and Technology* **38** (3): 255–261.
- Tu, M., Cheng, S., Lu, W., dan Du, M. 2018. Advancement and prospects of bioinformatics analysis for studying bioactive peptides from food-derived protein: Sequence, structure, and functions. *TrAC - Trends in Analytical Chemistry* **105**: 7–17.
- Ulug, S.K., Jahandideh, F., dan Wu, J. 2021. Novel technologies for the production of bioactive peptides. *Trends in Food Science and Technology* **108**: 27–39.
- Vásquez, P., Sepúlveda, C.T., dan Zapata, J.E. 2022. Functional properties of rainbow trout (*Oncorhynchus mykiss*) viscera protein hydrolysates. *Biocatalysis and Agricultural Biotechnology* **39**: 102268.
- Vázquez-Ortiz, F.A., Caire, G., Higuera-Ciapara, I., dan Hernández, G. 1995. High Performance Liquid Chromatographic Determination of Free Amino Acids in Shrimp. *Journal of Liquid Chromatography* **18** (10): 2059–2068.
- Viji, P., Phannendra, T.S., Jesmi, D., Madhusudana Rao, B., Dhiju Das, P.H., dan George, N. 2019. Functional and Antioxidant Properties of Gelatin Hydrolysates Prepared from Skin and Scale of Sole Fish. *Journal of Aquatic Food Product Technology* **28** (10): 976–986.
- Vioque, J., Clemente, A., Pedroche, J., Yust, M.D.M., dan Millán, F. 2001. Obtention and uses of protein hydrolysates. *Grasas y Aceites* **52** (2): 132–136.
- Wang, B., Wang, Y.M., Chi, C.F., Luo, H.Y., Deng, S.G., dan Ma, J.Y. 2013. Isolation and characterization of collagen and antioxidant collagen peptides from scales of croceine croaker (*Pseudosciaena crocea*). *Marine Drugs* **11** (11): 4641–4661.
- Wang, T.Y., Hsieh, C.H., Hung, C.C., Jao, C.L., Lin, P.Y., Hsieh, Y.L., dan Hsu, K.C. 2017. A study to evaluate the potential of an in silico approach for predicting dipeptidyl peptidase-IV inhibitory activity in vitro of protein hydrolysates. *Food Chemistry* **234**: 431–438.
- Wang, C., Tu, M., Wu, D., Chen, H., Chen, C., Wang, Z., and Jiang, L. 2018. Identification of an ACE-inhibitory peptide from walnut protein and its evaluation of the inhibitory mechanism. *International Journal of Molecular Sciences* **19** (4): .
- Wang, Y., dan Selomulya, C. 2020. Spray drying strategy for encapsulation of bioactive peptide powders for food applications. *Advanced Powder Technology* **31** (1): 409–415.

- Waterborg, J.H., and Matthews, H.R. 1994. *The Lowry Method for Protein Quantitation* (1994).
- Waters. 2012. *Acquity UPLC H-Class and H-Class Bio Amino Acid Analysis System Guide*. Irelandia: Waters Corporation.
- Weber, K., Pringle, J.R., dan Osborn, M. 1972. Measurement of Molecular Weights by Electrophoresis on SDS-Acrylamide Gel. *Methods in Enzymology* **26** (C): 3–27.
- Weng, W., Tang, L., Wang, B., Chen, J., Su, W., Osako, K., dan Tanaka, M. 2014. Antioxidant properties of fractions isolated from blue shark (*Prionace glauca*) skin gelatin hydrolysates. *Journal of Functional Foods* **11** (C): 342–351.
- Wouters, A.G.B., Rombouts, I., Fierens, E., Brijs, K., dan Delcour, J.A. 2016. Relevance of the Functional Properties of Enzymatic Plant Protein Hydrolysates in Food Systems. *Comprehensive Reviews in Food Science and Food Safety* 786–800.
- Wu, H.-C., Chen, H.-M., dan Shiau, C.-Y. 2003. Free amino acids and peptides as related to antioxidant properties in protein hydrolysates of mackerel (*Scomber austriasicus*). *Food Research International* **36** (9–10): 949–957.
- Yang, B., Yang, H., Li, J., Li, Z., dan Jiang, Y. 2011. Amino acid composition, molecular weight distribution and antioxidant activity of protein hydrolysates of soy sauce lees. *Food Chemistry* **124** (2): 551–555.
- Yang, K., Wang, L., Guo, J., Wu, D., Wang, X., Wu, M., Feng, X., Ma, J., Zhang, Y., dan Sun, W. 2021. Structural changes induced by direct current magnetic field improve water holding capacity of pork myofibrillar protein gels. *Food Chemistry* **345** (August 2020): 1–7.
- Yang, Q., Cai, X., Yan, A., Tian, Y., Du, M., dan Wang, S. 2020. A specific antioxidant peptide: Its properties in controlling oxidation and possible action mechanism. *Food Chemistry* **327**: 126984.
- Yang, X.R., Zhang, L., Ding, D.G., Chi, C.F., Wang, B., dan Huo, J.C. 2019. Preparation, Identification, and Activity Evaluation of Eight Antioxidant Peptides from Protein Hydrolysate of Hairtail (*Trichiurus japonicas*) Muscle. *Marine Drugs* **17** (1): 1–18.
- Yang, Z., Dai, L., Sun, Q., McClements, D.J., dan Xu, X. 2022. Effect of molecular weight on the interfacial and emulsifying characteristics of rice glutelin hydrolysates. *Food Hydrocolloids*.
- You, L., Regenstein, J.M., dan Liu, R.H. 2010. Optimization of hydrolysis conditions for the production of antioxidant peptides from fish gelatin using response surface methodology. *Journal of Food Science* **75** (6): 582–587.

- You, L., Zhao, M., Regenstein, J.M., dan Ren, J. 2011. In vitro antioxidant activity and in vivo anti-fatigue effect of loach (*Misgurnus anguillicaudatus*) peptides prepared by papain digestion. *Food Chemistry* **124** (1): 188–194.
- Zamorano-Apodaca, J.C., García-Sifuentes, C.O., Carvajal-Millán, E., Vallejo-Galland, B., Scheuren-Acevedo, S.M., dan Lugo-Sánchez, M.E. 2020. Biological and functional properties of peptida fractions obtained from collagen hydrolysate derived from mixed by-products of different fish species. *Food Chemistry* **331** : 127350.
- Zhang, Y., Liu, W., Li, G., Shi, B., Miao, Y., dan Wu, X. 2007. Isolation and partial characterization of pepsin-soluble collagen from the skin of grass carp (*Ctenopharyngodon idella*). *Food Chemistry* **103** (3): 906–912.
- Zhang, Y., Olsen, K., Grossi, A., dan Otte, J. 2013. Effect of pretreatment on enzymatic hydrolysis of bovine collagen and formation of ACE-inhibitory peptidas. *Food Chemistry* **141** (3): 2343–2354.
- Zhang, Y., Zhang, Y., Liu, X., Huang, L., Chen, Z., dan Cheng, J. 2017. Influence of hydrolysis behaviour and microfluidisation on the functionality and structural properties of collagen hydrolysates. *Food Chemistry* **227**: 211–218.
- Zhao, T., Zhang, Q., Wang, S., Qiu, C., Liu, Y., Su, G., dan Zhao, M. 2018. Effects of Maillard reaction on bioactivities promotion of anchovy protein hydrolysate: The key role of MRPs and newly formed peptides with basic and aromatic amino acids. *LWT* **97**: 245–253.
- Zhao, X., Han, G., Wen, R., Xia, X., Chen, Q., dan Kong, B. 2020. Influence of lard-based diacylglycerol on rheological and physicochemical properties of thermally induced gels of porcine myofibrillar protein at different NaCl concentrations. *Food Research International* **127** : 108723.
- Zhu, L., Chen, J., Tang, X., and Xiong, Y.L. 2008. Reducing, Radical Scavenging, and Chelation Properties of in Vitro Digests of Alcalase-Treated Zein Hydrolysate. *Journal of Agricultural and Food Chemistry* **56** (8): 2714–2721.