Inhibition on tyrosinase activity and melanoma cell growth by bovine colostrum hydrolysates / 吳秋慧 撰 .- 彰化縣大村鄉

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ABSTRACT

In recent years, there is an increasing interest in finding natural tyrosinase inhibitors from animals, plants and microorganisms. The tyrosinase inhibitors should have broad applications, especially, in food, medicinal and cosmetics products in relation to hyperpigmentation. This research used the bovine colostrums collected on the first to fifth days postpartum and normal milk to prepare skimmed colostrums and skimmed normal milk, and used two different enzymes, Alcalase and α-Chymotrypsin, to hydrolyze the samples, followed by investigating the inhibition of the hydrolysates on tyrosinase activity, and finally selected day 2 colostrums and normal milk hydrolysates for cell experiments, including melanoma cell viability, tyrosinase activity and melanin content in melanoma cells. The results are as follows: 1. The inhibitory effect of the Alcalase hydrolysates on tyrosinase activity was more profound than that of the α-Chymotrypsin hydrolysates. At a concentration of 5 mg/mL day 2 colostrum hydrolysates had the highest inhibition rate, 23.99 %; at a concentration of 10 mg/mL day 2 colostrum hydrolysates also had the highest inhibition the rate, 32.96 %; at a concentration of 15 mg/mL both day 2 colostrum and normal milk hydrolysates had the inhibition rate of 37.48 and 35.59 %, respectively. Overall the day 2 colostrum hydrolysate obtained by Alcalase hydrolysis for 4 hrs had the highest inhibitory activity on tyrosinase. The inhibitory activity of normal milk hydrolysates on tyrosinase increased with increasing hydrolysis time. 2. In the results of melanoma cell viability the hydrolysates of day 2 colostrums and normal milk could decrease the cell viability, and the cell viability decreased with increasing the hydrolysate concentration. 3. In the results of tyrosinase activity in melanoma cells the inhibitory effect of the Alcalase hydrolysates on tyrosinase activity was more profound than that of the α-Chymotrypsin hydrolysates. The inhibition rate of the Alcalase hydrolysate of day 2 colostrums at a concentration of 7.5 mg/mL was 54.01%. 4. In the results of melanin content in cells, both Alcalase and α-Chymotrypsin hydrolysates had comparable ability to reduce the melanin content in cells, and both colostrum and normal milk hydrolysates also had a ability to reduce the cellular melanin content.

Keywords : bovine colostrums、hydrolysis、tyrosinase、melanoma cell (B16-F10)

Table of Contents

REFERENCES

1.石原和之。2001。紫外線與皮膚癌。林鬱文化事業有限公司。臺北。 2.江淑華，謝淳仁，張基郁。2005。酵素水解條件對牛初乳蛋白水解物抗氧化性之影響。中華生質能源學會誌，24(1,2): 9-18。 3.服部淳彥。1997。退黑激素的功效。青春出版社。臺北。 4.林慶文。1993。乳品加工學。華香園出版社。臺北。 5.許惠惇。2000。黃豆蛋白質酵素水解物中生理活性胜?之篩檢研究。國立陽明大學生物化學研究所碩士論文。台北。 6.郭智宏。2001。鯖魚肉與內臟水解物之抗氧化性研究。國立台灣海洋大學食品科學系研究所碩士論文。基隆。 7.陳志瑋。2007。微膠囊化牛初乳蛋白質水解物之抗氧化安定性。私立大葉大學生物產業科技學系研究所碩士論文。彰化。 8.楊正獲。1983。剩餘初乳利用性之研究。國立中興大學畜牧研究所碩士論文。台中。 9.楊佳璋，陳宜嫻，黃宜純，黃淑桂，傅如嶽，溫慧萍，鄭智交。2004。皮膚生理學(二版)。華格那企業有限公司。台中。 10.鄭名凡。1999。蛋白水解物的功能與應用。食品資訊。160:49-54。 11.鄭靜桂。1997。蛋白質水解與水解液之利用。食品工業，29(5): 10-17。 12.Al-Mashikhi S. A. and Nakai S. 1987. Isolation of bovine immuneoglobulins and lactoferin from whey protein by gel filtrateion techniques. Journal of Dairy Science 70: 2486-2492. 13.Amiota J., Germainb L., Turgeona S., Lemaya M. and Francois C. O. S. 2004. Peptides from milk protein hydrolysates to improve the growth of human keratinocytes in culture. International Dairy Journal 14: 619-626. 14.AOAC. 1984. Official Methods of Analysis of the AOAC, 16th ed. Association of Official Analytical Chemists. Washington, DC. 15.Baurin N., Arnoult E., Scior T., Do Q. T. and Bernard P. 2002. Preliminary screening of some tropical plants for anti-tyrosinase activity. Journal of Ethnopharmacology 82: 155-/158. 16.Brun J. M. and Dalgleish D. G. 1999. Some effects of heat on the competitive adsorption of caseins and whey proteins in oil-in-water emulsions. International Dairy Journal 9: 323-327. 17.Bryant C. M. and McClements D. J. 1998. Molecular basis of protein functionality with special consideration of cold-set gels derived from heat-denatured whey. Trend in Food Science and Technology 9: 143-151. 18.Chang C. Y., Wu K. C., Chiang S. H. 2007. Antioxidant properties and protein compositions of porcine haemoglobin hydrolysates. Food Chemistry 100: 1537-1543. 19.Chen C. Y., Kuo P. L., Chen Y. H., Huang J. C., Ho M. L., Lin R. J., Chan J. S. and Wang H. M. 2010. Tyrosinase inhibition, free radical scavenging, antimicroorganism and anticancer proliferation activities of Sapindus mukorossi extracts. Journal of the Taiwan Institute of Chemical Engineers 41: 129-135. 20.Chiari M. E., Joray M. B., Ruiz G., Palacios S. M., Carpinella M. C. 2010. Tyrosinase inhibitory activity of native plants from central Argentina: Isolation of an active principle from Lithrea molleoides. Food Chemistry 120: 10-14. 21.Chicon R., Belloque J., Alonso E. and Lopez-Fandino R. 2009. Antibody binding and functional properties of whey protein hydrolysates obtained under high pressure. Food Hydrocolloids 23: 593-599. 22.Cumby N., Zhong Y., Naczk M. and Shahidi F. 2008. Antioxidant activity and water-holding capacity of canola protein hydrolysates. Food Chemistry 109: 144-148. 23.Fujimoto A., Shingai Y., Nakamura M., Maekawa T., Sone Y. and Masud T. 2010. A novel ring-expanded product with enhanced tyrosinase inhibitory activity from classical Fe-catalyzed oxidation of rosmarinic acid, a potent antioxidative Lamiaceae polyphenol. Bioorganic & Medicinal Chemistry Letters 20: 7393-7396. 24.Gallaher J. J., Hollender R., Peterson D. G., Roberts R. F. and Coupland J. N. 2005. Effect of composition and antioxidants on the oxidative stability of fluid milk supplemented with an algae oil emulsion. International Dairy Journal 15: 333-341. 25.Gildberg A. 1993. Enzymatic processing of marine raw materials. Process Biochemistry 28: 1-15. 26.Gill H. S. and Cross M. L. 2000. Anticancer propertyes of bovine milk. British Journal of Nutrition 84: S161-S166.Hekmat S. and McMahon D. J. 1998. Distribution of iron between caseins and whey proteins in acidified milk. Lebensmittel-Wissenschaft und-Technologie 31: 632-638. 27.Ha Y. M., Kim J. A., Park Y. J., Park D., Kim J. M., Chung K. W., Lee E. K., Park J. Y., Lee J. Y., Lee H. J., Yoon J. H., Moon H. R., Chung H. Y. 2011. Analogs of 5-(substituted benzylidene)hydantoin as inhibitors of tyrosinase and melanin formation. Biochimica et Biophysica Acta 1810: 612-619. 28.Hekmat, S. and McMahon, D. J. 1998. Distribution of iron between caseins and whey proteins in acidified milk. Lebensmittel-Wissenschaft und-Technologie 31: 632-638. 29.Hooijdonk A. C. M., Kussendrager K. D. and Strijns J. M. 2000. In vivo antimicrobial and antiviral activity of components in bovine milk and colostrums involved in non-specific defence. British Journal of Nutrition 84: S127-S134. 30.Im S. J., Kim K. N., Yun Y. G., Lee J. C., Mun Y. J., Kim J. H. and Woo W. H. 2003. Effect of radix ginseng and radix trichosanthis on the melanogenesis. Biological and Pharmaceutical Bulletin 26: 849-853. 31.Kentaro T. N., Tomoko H., Takeshi O. and Takao T. 2007. Modulating effects of a novel skin-lightening agent, a-lipoic acid derivative, on melanin production by the formation of DOPA conjugate products. Bioorganic & Medicinal Chemistry 15: 1967-1975. 32.Kong X. Z., Guo M. M., Hua Y. F., Cao D. and Zhang C. M. 2008. Enzymatic preparation of immunomodulating hydrolysates from soy proteins. Bioresource Technology 99: 8873-8879. 33.Lahl W. J. and Brum S. T. 1994. Enzymatic production of protein hydrolysates for food use. Food Technology 48(10): 68-71. 34.Lee C. W., Son E. M., Kim H. S., Xu P., Batmunkh T., Lee B. J. and Koo K. A. 2007. Synthetic tyrosyl gallate derivatives as potent melanin formation inhibitors. Bioorganic & Medicinal Chemistry Letters 17: 5462-5464. 35.Lee J., Kim Y. S. and Park D. 2007. Rosmarinic acid induces melanogenesis through protein kinase A activation signaling. Biochemical pharmacology 74: 960-968. 36.Lin Y. P., Hsu F. L., Chen C. S., Chern J. W. and Lee M. H. 2007. Constituents from the Formosan apple reduce tyrosinase activity in human epidermal melanocytes. Phytochemistry 68: 1189-1199. 37.Lindmark-Mansson H. and Akesson B. 2000. Antioxidative factors in milk. British Journal of Nutrition 84: S103-S110. 38.Loa Y. H., Linb R. D., Lind Y. P., Liue Y. L. and Lee M. H. 2009. Active constituents from Sophora japonica exhibiting cellular tyrosinase inhibition in human epidermal melanocytes. Journal of Ethnopharmacology 124: 625-629 39.Mackie I. M. 1982. Fish protein hydrolysates. Process Biochemistry. 31: 26-31. 40.Mahendra Kumar C., Sathisha U. V., Shylaja D., Rao A. A.

G. and Sridevi S. A. 2011. Interaction of sesamol (3,4-methylenedioxyphenol) with tyrosinase and its effect on melanin synthesis. Biochimie 93: 562-569. 41.Manlry C. H. and Ahmedi S. 1995. The development of process flavors. Trends in Food Science and Technology 6: 46-51. 42.McCord C. P. and Allen F. P. 1997. Eridences associating pineal gland function with alternation in pigmentation. Journal of Experimental Zoology 23: 207-227. 43.Momtaz S., Mapunya B. M., Houghton P. J., Edgerly C., Hussein A., Naidoo S. and Lall N. 2008. Tyrosinase inhibition by extracts and constituents of Sideroxylon inerme L. stem bark, used in South Africa for skin lightening. Journal of Ethnopharmacology 119: 507-512. 44.Mun Y. J., Lee S. W., Jeong H. W., Lee K. G., Kim J. H. and Woo W. H. 2004. Inhibitory effect of miconazole in melanogenesis. Biological and Pharmaceutical Bulletin 27: 806-809. 45.Nerya O., Musa R., Khatib S., Tamir S. and Vaya J. 2004. Chalcones as potent tyrosinase inhibitors: the effect of hydroxyl positions and numbers. Phytochemistry 65: 1389-1395. 46.No J. K., Soung D. Y., Kim Y. J., Shim K. H., Jun Y. S., Rhee S. H., Yokozawa T. and Chung H. Y. 1999. Inhibition of tyrosinase by green tea components. Pharmacology letters 65(21): 241-246. 47.Noh J. M., Kwak S. Y., Seo H. S., Seo J. H., Kim B. G. and Lee Y. S. Kojic acid – amino acid conjugates as tyrosinase inhibitors. 2009. Bioorganic and Medicinal Chemistry Letters 19: 5586-5589. 48.Ozeki H., Ito S., Wakamatsu K. and Ishiguro I. 1997. Chemical characterization of pheomelanogenesis starting from dihydroxyphenylalanine or tyrosine and cysteine. Effects of tyrosinase and cysteine concentrations and reaction time. Biochimica et Biophysica Acta 1336: 539-548. 49.Pena-Ramosa E. A. and Xiong Y. L. 2003. Whey and soy protein hydrolysates inhibit lipid oxidation in cooked pork patties. Meat Science 64: 259-263. 50.Peng X., Kong B., Xia X., Liu Q. 2010. Reducing and radical-scavenging activities of whey protein hydrolysates prepared with Alcalase. International Dairy Journal 20: 360-365. 51.Rout S. and Banerjee R. 2007. Free radical scavenging, anti-glycation and tyrosinase inhibition properties of a polysaccharide fraction isolated from the rind from Punica granatum. Bioresource Technology 98: 3159-3163. 52.Satue-Gracia M. T., Frankel E. N., Rangavajhyala N. and German J. B. 2000. Lactoferrin in infant formulas: effect on oxidation. Journal Agriculture and Food Chemistry 48: 4984-4990. 53.Thapa B. R. 2005. Health factors in colostrums. Indian Journal of Pediatrics 72 (7): 579-581. 54.Too J. R. and Tsai M. F. 1999. Functional properties of hydrolysatesfrom porcine blood cells. Food Science 26: 36-46. 55.Varnam H. and Sutherland P. 1994. Milk and milk products. Chapman and Hall, London. 56.Wang K. H., Lin R. D., Hsu F. L., Huange Y. H., Chang H. C., Huang C. Y. and Lee M. H. 2006. Cosmetic applications of selected traditional Chinese herbal medicines. Journal of Ethnopharmacology 106: 353-359. 57.Wei Y., Rihui C., Huan W., Qin Y., Binhua Z., Yiqian W., Lin A. and Huacan S. 2008. Synthesis and biological evaluation of helicid analogues as mushroom tyrosinase inhibitors. Bioorganic & Medicinal Chemistry Letters 18: 6490-6493. 58.Wu J. J., Lin J. C., Wang C. H., Jong T. T., Yang H. L., Hsu S. L. and Chang C. J. 2009. Extraction of antioxidative compounds from wine lees using supercritical fluids and associated anti-tyrosinase activity. The Journal of Supercritical Fluids 50: 33-41. 59.Ye Y., Chou G. X., Mu D. D., Wang H., Chu J. H., Leung A. K. M., Fong W. f., Yu Z. L. 2010. Screening of Chinese herbal medicines for antityrosinase activity in a cell free system and B16 cells. Journal of Ethnopharmacology 129: 387-390. 60.Yi W., Wu X., Cao R., Song H. and Ma L. 2009. Biological evaluations of novel vitamin C esters as mushroom tyrosinase inhibitors and antioxidants. Food Chemistry 117: 381-386. 61.Zhu K., Zhou H. and Qian H. 2006. Antioxidant and free radical-scavenging activities of wheat germ protein hydrolysates (WGPH) prepared with alcalase. Process Biochemistry 41: 1296-1302.