山芹菜抗氧化及降血脂能力之研究

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摘 要

山芹菜在國內為國人常食用的蔬菜之一。對於山芹菜的研究，目前為止國內並無太多的相關文獻的報導。因此，本研究擬以本省產的山芹菜作為研究對象，進行抽取精油的化學結構、成分分析及抗氧化能力的分析。本論文抽取山芹菜整顆不同部位(包括種子、莖及葉)精油成分，進而以不同溶劑(正戊烷、乙醚、丙酮及甲醇)進行管柱層析區分，瞭解其組成分的差異及進行抗氧化能力的比較，並以山芹菜種子作為降血脂之研究對象，分別取種子、種子水萃物、種子甲醇萃取物、種子精油及種子精油的正戊烷及乙醚區分物，進行降血脂之動物實驗，以比較其降血脂能力的差異，並分析山芹種子、種子水萃物及種子甲醇萃取物中之機能性成份。 首先以水蒸氣蒸餾法抽取山芹種子、莖及葉精油，發現以種子的收率最高，其平均收率為0.4％。次高為葉子部位，平均收率為0.03％。最低為莖的部位，其平均收率為0.01％。 在山芹各部位(種子、莖及葉)之總揮發性成份中，發現皆以倍半?烯類化合物為主要的成份。含量分別為60.84%、 47.13%及75.87%，其中以E-β-farnesene及germacrene D為主成分。次要成分為單?烯類化合物，含量分別為13.19%、39.15%及10.58 %。其中以β-pinene、d-limonene為主要成分。而由山芹菜種子精油的區分物中發現，正戊烷區分物以倍半?烯類化合物為主要成分，含量為86.97%，其中以α-selinene、E-β-farnesene為主要成份，在乙醚區分物中則以醇酚類化合物為主要之成分含量佔30.28%，而在丙酮及甲醇區分物中則分別以3-pentanol、oleamide為主要成份。 在莖及葉子精油區分物部份：莖及葉子精油的正戊烷區分物中皆以倍半?烯類化合物為主要之成分，含量分別為85.24%及81.66%，其中皆以germacrene D含量最高，約佔總揮發性成份的16.6％及24.14%。而在莖及葉子的乙醚區分物中則以醇類及酚類化合物為主要成分，含量分別為40.10％及43.81%。丙酮及甲醇區分物中則以oleamide化合物為主要成分為佔約16.91%～48.4%。另於山芹菜各部位精油及其區分物中皆不含任何的phthalide類化合物。 本研究也探討攝取山芹種子及種子的水、甲醇萃取物與種子精油及其種子精油正戊烷及乙醚的區分物及以合成方法所製得oleamide化合物對倉鼠脂質型態之影響。以雄性倉鼠為實驗的對象，發現攝取飼料中添加山芹種子、水萃取物、甲醇萃取物、種子精油及其正戊烷及乙醚的區分物及oleamide化合物之倉鼠，其血液中三酸甘油酯、膽固醇及低密度膽固醇濃度均明顯的低於高油飲食組（p＜0.05）。而各組倉鼠之脂質型態相關指標與正常飲食組比較並無明顯差異。顯示攝食山芹菜種子、水萃取物、甲醇萃取物、種子精油及種子精油正戊烷及乙醚的區分物及以合成方法所製得oleamide化合物均可改善倉鼠脂質型態，且無任何的副作用產生。 在抗氧化能力方面，分析山芹菜種子、莖及葉子精油及其不同溶劑之抗氧化能力，結果顯示未區分前的山芹種子、莖及葉子精油在抗氧化能力是不佳的，但經不同溶劑區分後，發現各部位精油之乙醚區分物皆顯示具有最佳的螯合鐵離子及清除自由基的抗氧化能力。另在甲醇區分物中，則顯示其具有最佳的清除超氧陰離子的能力。 本論文分析山芹菜種子及其水萃取物及甲醇萃取物中總酚、類黃酮、植物固醇及水溶性膳食纖維的含量。結果發現山芹菜種子的總酚、類黃酮、植物固醇及水溶性膳食纖維含量，分別為3.3±0.7 mg/g、0.24±0.08 mg/g、14.14 ±0.36 mg/g及41±3.8 mg/g。而水萃物中總酚、類黃酮及水溶性膳食纖維含量，分別為30.4±2.3mg/g、2.2±0.4 mg/g及301±21 mg/g。甲醇萃取物中總酚及類黃酮含量，分別為36.2±1.5 mg/g、2.8±0.5 mg/g。 因此，推測山芹菜種子可能因含有活性成分，而提供山芹菜種子具有抗氧化能力及降血脂之功效。

關鍵詞 : 山芹菜、總酚、類黃酮、抗氧化能力、精油

目錄

參考文獻

1.尤新輝。1997。簡介茶多酚成分之機能性及其應用。食品工業發展研究所29(3): 10-18。 2.村松敬一郎。1991。茶的科學。第206頁。朝倉書局。日本。 3.松本 ???、原 征彥。1995。茶?????血中???????上昇抑制作用。食品工業38(6): 81。 4.吳德培。2009。Biochemistry, 3rd Edition。合記圖書出版社。 5.原征彥。1995。茶的機能性。食品工業。38(2): 71。 6.黃涵、洪利。1988。台灣蔬菜彩色圖說。P. 82-87。台北。 7.劉正才。2009。蔬菜藥用、藥膳食療寶典。第83-111頁。香港翰林苑出版社有限公司。 8.增山吉成。1997。自由基之陰謀。吳氏圖書有限公司。P. 59-78。 9.錢明賽。1998。蔬果中之抗氧化物質。食品工業發展研究所。30(8): 21-34。 10.陳潔如。2000。含類黃酮蔬果抗氧化性及青花抗氧化成分之研究。東海大學食品科學研究所碩士論文。台中。 11.陳湘宜。1994。不同品系老鼠脂蛋白元A-1基因之研究。國立陽明大學生命科學院生化研究所論文。台北。 12.顏國欽、劉展冏、韓建國、林聖敦等合著。2007。食品化學。第36頁。華格納企業有限公司。台中。 13.American Institute of Nutrition. 1977. Report of the AIN Ad. Hoc. Committee on standards for nutritional studies.107. Journal of nutrition. 107: 1340-1348. 14.Ahmad, N., Feyes, D.K., Nieminen, A.L., Agarwal, R. and Mukhtar, H., 1997. Green tea constituent epigallocatechin-3-gallate and induction of apoptosis and cell cycle in human carcinoma cells. J. Nat. Cancer Inst. 89: 1881-1886.

15.Anderson, J. W., Jones, A. E. and Mason, S. R. 1994. Ten different dietary fiber have significantly different effect on serum and liver lipids of cholesterol-fed rats. J. Nutr. 124: 78-83. 16.Babu, K. G. D. and Kaul, V. K. 2005.Variation in essential oil composition of rose-scented geranium (Pelargonium sp.) distilled by different distillation techniques. Flavour and Fragrance Journal 20: 222-231. 17.Basile, A. S., Hanus, I. and Mendelson, W. B. 1999. Characterization of the hypnotic properties of oleamide. Neuroreport. 10: 947-951. 18.Bartlett, G. R. 1958. Phosphorous assay in column chromatography. J. Biol. Chem. 234: 466-468. 19.Benavente, G. O. 1997. Uses and properties of citrus flavonosids . J. Agric. Food Chem.45 (12): 4505-4516. 20.Basta, G., Schmidt, A M. and Caterina.R. D. 2004. Advanced glycation end products and vascular inflammation: implications for accelerated atherosclerosis in diabetes. Candiovasc Res. 63: 582-592. 21.Bors, W., Heller, W., Michel, C. and Saran, M. 1990. Flavonoids as antioxidants:determination of radical scavenging efficiencies. Methods Enzymol. 186: 343-355. 22.Bannwart, C., Fotsis, T., Heikkinen, R. and Adlercreutz, H. 1984. Identification of the isoflavonic phytoestrogen daidzein in human urine. Clin. Chim. Acta. 136: 165-172. 23.Coelho, J. A. P., Pereira, A. P., Mendes, R. L. and Palavra, A. M. F. 2003. Supercritical carbon dioxide extraction of Foeniculum vulgare volatile oil. Flavour and Fragrance Journal. 18: 316-319. 24.Chobi, M. R., Pay, M. and Alcaraz, M. J. 1991. Inhibitory effects of phenolic compounds on carbon tetrachloride-induced microsomal lipid peroxidation. Experiential. 47: 195-199. 25.Catherine, A., Rice-Evans, N. S., Nicholas, J. M. and George, P. 1997. Antioxidant properties of phenolic compounds. Trends in plant Sci. 2: 152-159. 26.Cheers, J. F., Cadogan, A. K., Marsden, C. A., Fone, K. C., Kendall, T. A. 1999. Modification of 5-HT2 receptor mediated behavior in the rat by oleamide and the role of cannabinoid receptors. Neuropharmacology. 4: 533-541. 27.Chait, A., Brazg, R. L., Tribble, D. L., and Krauss, R. M. 1993. Susceptibility small, dense, low-density lipoproteins to oxidative modification in subjects with 1 atherogenic lipoprotein phenotype, pattern M. Am. J. Med. 94: 350-356. 28.Crozier, A., Lean, M., Mcdonald, E. and Black, C. 1997. Quantitative analysis of the flavonoid content of commercial tomatoes, onions, lettuce and celery. J. Agric. Food Chem. 45: 590-595. 29.Dinis, T. C. P., Madeira, V. M. C., and Almeida. L. M. 1994. Action of phenolic derivatives (acetaminophen, salicylate, and 5-amino salicylate) as inhibitors of membrane lipide peroxidation and as peroxy radical scavenger. Archives of Biochemistry and Biophysics. 351: 161-169. 30.De-Groot, A. P., Luyken, P. and Pikaar, N. A. 1963. Cholesterol-lowering effect of rolled oats. Lancet. 2: 303-304. 31.EI-Tamer, M. K., Lucker, J., Bosch, D., Verhoeven, H. A., Verstappen, F. W. A., Schwab, W., Van-Tunen, A. J., Voragen, A. G. J., De- Magged, R. A .and Bouwmeester, H. J. 2003. Domain swapping of Citrus limon monoterpene synthase: impact on enzymatic activity and product specificity. Archives of Biochemistry and Biophysics. 411: 196-203. 32.Eric, M. R., Magda, G., Rafael, C., Steve, J. H., Monica, M. D., Luz, N and Oscar, P. G. 2001. Oleamide modulates memory in rats. Neuroscience Letters. 313: 61-64. 33.Fletcher, M. J. 1968. A colorimetric method for estimating serum triglycerides. Clin. Chim. Acta. 22: 393-397. 34.Folch, J., Less, M. and Stanley, G. H. S. 1957. A simple method for the isolation and purification of total lipids from animal tissues. J. Biol. Chem. 226: 497-509. 35.Frias, A. C. and Sgarbieri, V. C. 1998. Guar gum effects on food intake, blood serum lipids and glucose levels of Wistar rats, Plant Foods Hum. Nutr. 153: 15-28. 36.Fang, Y. C., Chen, B. H., Huang, R. S. and Lu, Y. F. 2004. Effect of genistei supplementation on tissue genistein and lipid peroxidation of serum, liver and low-density lipoprotein in hamsters. Journal of nutritional biochemistry. 15: 142-148. 37.Fukumoto, L. R. and Mazza, G. 2000. Assessing antioxidant and prooxidant activities of phenolic compounds. J. Agric. Food Chem. 48: 3597-3604. 38.Fernandez, M. L., Sun, D. M., Josca, M. A. and Mcnamara, D. J. 1994. Citrus pectin and cholesterol interact to regulate hepatic cholesterol homeostasis and lipoprotein metabolism: a dose-response study in guinea pigs. Am. J. Clin. Nutr. 59: 869-878. 39.Fungwe, T. V., Cagen, L. M., Wilcox, H. G. and Heiberg, M.1992. Regulation of hepatic secretion of very low density lipoprotein by dietary cholesterol. J. Lipid Res.33: 179-191. 40.Gulcin, I., Sat, I. G., Beydemir, S., Elmastas, M. and Kufrevioglu, O. I. 2004. Comparison of antioxidant activity of clove(Eugenia caryophylata Thunb) buds and lavender(Lavandula atoechas L.). Food Chem. 87: 393-400. 41.Guenther, E.1952. The essential oils vol ID Van, Nostrand Co Inc. New York. p. 61-151. 42.Gerson, T., Shorland, F. B. and Dunckley, G. G.1965. The effect of beta-stiosterol on the metabolism of cholesterol and lipids in rats on a diet containing coconut oil. Biochem. J. 96: 399-403. 43.Gallaher, D. D., Hassel, C. A. and Lee, K. J.1993. Relationships between viscosity of hydroxypropyl methylcellulose and plasma cholesterol in hamsters. J. Nutr. 123: 1732-1738. 44.Hyslop, P. A., Hinshaw, D. B., Halsey, W. A., Jackson, J.H. and Cochrane, C.G. 1988. Mechanisms of oxidant-mediated injury. J. Biol. Chem. 263:1665-1675. 45.Hertog, M.G. L., Feskens, E. J. M. and Hollman, P. C. H. 1993. Dietary antioxidant flavanoids and risk of coronary heart disease. the Zutphen Elderly Study. Lancet. 342: 1007-1011. 46.Harbone, J. B. and Williams, C. A. 2000. Advances in flavonoid research since 1992. Phytochemistry. 55: 481-504. 47.Han, J. H., Yang, Y. X. and Feng, M. Y. 2008. Contents of phytosterols in vegetables and fruits commonly consumed in China. Biomedical and Environmental Sciences. 21: 449-453. 48.Harborne, J. b. 1973. Phytochemical methods. Academic press. London. P. 89-105. 49.Halliwell, B., Murcia, M. A., Chirico, S. and Aruoma, O. I. 1995. Free radicals and antioxidants in food and in vivo: What they do and how they work. Crit. Rev. Food Sc. Nutr. 35: 7-20. 50.Halliwell, B., Gutteridge, J. M. C. and Cross, C. E. 1992. Free radical antioxidants and human disease; where are we now ? J. Lab. Clin. Med. 119: 598-620. 51.Hill, R. A. 2002. Dictionary of natural products on CD-ROM. Ed. Chapman & Hall/CRC. 10: 2-1. 52.Hayase, F. and Kato, H. 1984. Antioxidative components of sweet potatoes. J. of Nutrition Science and Vitaminology. 30: 37-46. 53.Husain, S. R., Cillard, J. and Cillard, P.1987. Hydroxy radical scavenging activity of flavonoids. Phytochem. 26: 2488-2491. 54.Hou, J., Sun, T., Hu, J., Chen, S., Cai, X. and Zou. G. 2007. Chemical composition, cytotoxic and antioxidant activity of the leaf essential oil of Photiniaserrulata. Food Chemistry. 103: 355-358 . 55.Ho, C. T. 1997. Antioxidant properties of plant flavonoids. Food Factors for Cancer Prevention. p. 593-597. 56.Knopp, R. H., Superko, H. R., Davidson, M., Insull, W., Dujovne, C. A., Kwiterrovich, P. O., Zavoral, J. H., Graham, K., O ' Connor, R. R. and Edelman, D. A. 1999. Longterm blood cholesterol-lowering effects of a dietary fiber supplement. Am . J. Prev. Med. 17: 18-23. 57.Kurushima, H., Hayashi, K., Toyota, Y., Kambe, M., Kajiyama, G.. 1995. Comparison of hypocholesterolemic effects induced by dietary linoleic acid and oleic acid in hamsters. Atherosclerosis. 114:

213-221. 58.Kim, H. O., Park, S. W. and Park, H. D. 2004. Inactivation of Escherichia coli O157: H7 by cinnamic aldehyde purified from Cinnamomum cassia shoot. Food Microbiology. 21: 105-110. 59.Kamal-Eldin A., Appelqvist L. A. 1996. The chemistry and antioxidant properties of tocopherols and tocotrienols. Lipids. 31: 671-701. 60.Kalemba, D., Kusewicz, D. and Swiader. K. 2002. Antimicrobial properties of the essential oil of Artemisia asiatica Nakai. Phytother.Res. 16 (3): 288-291. 61.Kris-Etherton, P. M., Etherton, T. D., Carlson, J. and Gardner, C. 2002 Recent discoveries in inclusive food-based approaches and dietary patterns for reduction in risk for cardiovascular disease. Curr. Opin. Lipidol.13: 397-407. 62.Knobloch, K., A. Pauli, B., Lberl, H. and Weigand, N. W. 1989. Antibacterial and Antifungal properties of essential oil components. J.Essent. Oil Res. 1:119-128. 63.Levrat-Verny, M. A., Behr, S., Mustad, V., Remesy, C. and Demigne C. 2000. Low levels of viscous hydrocolloids lower plasma cholesterol in rats primarily by impairing cholesterol absorption. J. Nutr. 130: 243-8. 64.Li, B. B., Md, B. S. and Hossain, M. 2006. Extraction of phenolics from citrus peels I. Solvent extraction method. Separation and Puri?cation Technology. 48:182 – 188 65.Loft, S. and Poulsen, H. E. 1996. Cancer risk and oxidative DNA damage in man. J. Mol. Med. 74: 297-312. 66.Liu, C. H., Hung, M. T. and Hung, P. C. 1995. Sources of triacylglycerol accumulating in livers of rats feed a cholesterol supplemented diet. Lipids. 30: 27-531. 67.Le, Q. T. and Elliott, W. J. 1991. Clin. Res. 39: 173A. 68.Middleton, E. J., Kandaswami, C. and Theoharides, J. C. 2000. The effects of plant flavonoids on mammalian cells implications for inflammation. heart diseaseand cancer. Pharmacol Rev. 52: 673-751. 69.Mackey, M.C. 1979. Periodic auto-immune hemolytic anemia: Aninduced dynamical disease. Bull Math Biol. 41: 829-834. 70.Moses,A. A., Samuel, O. A.and Olapade, R. I. 2007. Neurpharmacological effects of oleamide in male and female mice. Behavioural Brain Research. 82: 88-94. 71.Minh Tu, N. T., Thanh, L. X., Une, A., Ukeda, H. and Sawamura, M. 2002. Volatile constituents of Vietnamese pummelo, orange, tangerine and lime peel oils. Flavour and Fragrance Journal. 17: 169-174. 72.Momin, R. A., Ramsewak, R.S. and Nair, M.G. 2000. Bioactive compoundsand,3-Di[(cis)-9-octadecenoyl]-2-[(cis,cis)-9,12-octadecadienoyl] glycerol from Apiumgraveolens L. Seeds. J. Agri. Food Chem. 48: 3785-3788. 73.Macleod, G. and Ames, J. M. 1989. Volatile components of celery and celeriac. Phytochemistry. 28(7): 1817-1824. 74.Michael, H. D. and Arline, M. 1998. Fiber: forms and function. Nutr. Res. 18: 617-624. 75.Mia, M. A., Siddiqui, M. N., Haque, M. S., Islam, M. N., Rukunzzaman, M. and Deb, K. 2002. Dietary fibre and coronary heart disease. Mymensingh Med. J. 11: 133-135. 76.Miettinen, T. A. and Gylling, H. 1999. Regulation of cholesterol metabolism by dietary plant sterols. Curr. Opin. Lipidol. 10: 9-14. 77.Nikkari, S. T., Solakivi, T. and Jaakkola, O. 1991. The hyperlipidemic hamster as an atherosclerosis model. Artery. 18: 285-290. 78.Nnagata, M., Osawa, T., Namiki, M., Fukuda, F. and Ozaki, T. 1987. Stereochemical structures of antioxidative bisepoxylignans, sesaminol and its isomers, transformed from sesamolin. Agric. Biol. Chem. 51:1285-1289. 79.Pallado, P., Tassinato, G., D'Alpaos, M. and Traldi, P. 1997. Gas Chromatography/Mass Spestrometry in aroma chemistry: a comparison of essential oils and flavours extracted by classical and supercritical techniques. Rapid Communications in Mass Spectrometry. 11: 1333-1341. 80.Quttier-Deleu, C., Gressier, B., Vasseur, J., Dine, T., Brunet, C., Luyckx, M., Cazin, M., Cazin, J. C., Bailleul, F. and Trotin, F. 2000. Phenolic compounds and antioxidant activities of buckwheat(Fagopyrum esculentum Moench) hulls and flour. J. Ethnopharmacology. 72: 35-42 . 81.Rinkus, S. J. and Taylor, R. T. 1990. Analysis of hydrogen peroxide in freshly prepared coffees. Food and Chemical Toxicology. 28: 323-331. 82.Rice-Evans, C. A., Miller, N. J. and Paganga, G. 1997. Antioxidant properties of phenolic compounds. Trends Plant Sci. 2: 152-159. 83.Ramarathnam, N., Osawa, T., Namiki, M. and Tashiro, T. 1986. Studies on the relationship between antioxidative activity of rice hull and germination ability of rice seeds. J. of the Science of Food and Agriculture. 37: 719-726. 84.Ramarathnam, N., Ochi, H. and Takeuchi, M. 1997. Antioxidative defense system in vegetable extracts Natural Antioxidants. Edito: Shahidi, F. AOCS Press. 85.Ruberto, G. M. S.and Baratta. 2000. Antioxidant activity of selected essential oil components in two lipid model system. Food Chem.69: 167-174. 86.Spady, D. K., Stange, E. F., Bilhartz, L. E. and Dietschy, J. M. 1986. Bile acids regulate hepatic low density lipoprotein receptor activity in hamster by altering cholesterol flux across the liver. Proc. Natl. Acad. Sci. 83:1916-1920. 87.Shimada, K., Fujikawa, K., Yahara, K. and Nakamura, T. 1992. Antioxidative properties of xanthan on the autoxidation of soybean oil in cycloextrin emulsion. J. Agric. Food Chem. 40: 945-948. 88.Salvador, H. R., Lhys, G., Benjamin, F. C. and Steven, J. H. 2001. Effects of oleamide on sleep and its relationship to blood pressure body temperature and locomotor activity in rats. Experimental Neurology. 172 : 235-243. 89.Srivastava, A., Harish, R. and Shivanandappa, T. 2006. Novel antioxidant compounds from the aqueous extract of the roots of Decalepis hamiltonii (Wight and Arn.) and their inhibitory effect on Low-Density Lipoprotein oxidation. J. Agric. Food Chem. 54: 790-795. 90.Shaw, P. E. 1979. Review of quantitative of citrus essential oils. J. Agric. Food Chemistry. 27: 246-257. 91.Sperry, W. M. and Web, b. 1950. A revision of the schoenheimersperry method for cholesterol determination. J. Biol. Chem. 187: 97-106. 92.Sessions, V. A., Martin, A., Gomez-Munoz, A., Brindley, D. N. and Salter, A. M. 1993.Cholesterol feeding induces hypertriglyceridemia in hamsters and increases the activity of the Mg2+-dependent phosphatidate phosphohydrolase in the liver. Biochem. Biophy. Acta. 1166: 238-248. 93.Saleh, M. M., Zwaving, J. H., Malingre, T. M. and Bos, R. 1985. The essential oil Apium graveolens var. secalinum and its cercaricidal activity. Pharmaceutich Weekblad Scientific Edition. 7: 277-279. 94.Taniguchi, M., Tsuji, T., Shibata, M. and Kobayashi, T. 1985. Extraction of oils from wheat germ with supercritical carbon dioxide. Agric- ultural and Biological Chemistry. 49: 2367-2372. 95. Taga, M. S, Miller, E. E. and Pratt, D. E. 1984. China seeds as a source of n- atural antioxidant. J. Am. oil Chem. Soc. 61: 928-931. 96. Vischer, U.M. 1999.Hyperglycemia and the pathogenesis of atheroscl- erosis:lessons from murine models. Euro. J. Endocrinol. 140:1-3. 97. Washington, D. C. 1995. Official Methods of Analysis, 16th. Association of Official Analytical Chemists. AOAC. 98. Wallace, H. and Yokoyama. 2004. Plasma LDL cholesterol lowering by pla- nt phytosterols in a hamster model. Food Science&Technology. 15: 528- 531. 99. Wilson, T. A., Kritchevsky, D., Kotyla, T., Nicolosi, R. J. 2006. Structured t- riglycerides containing caprylic (8:0) and oleic (18:1) fatty acids reduce blo- od cholesterol concentrations and aortic cholesterol accumulation in hamste- r. Biochimica et Biophysica Acta. 1761: 345 – 349. 100.Wilson, C. W.

1970. Relative recovery and identification of carbonyl comp- ounds from celery essential oil. J. Food Sci. 35: 766-768. 101.Wilson, C. W. 1969a. Terpene and sesquiterpene hydrocarbons in the essent- ial oil from fresh celery. J. Food Sci. 34: 521-523. 102.Wilson, C.W. 1969b. Identification and quantitative estimation of alcohols in celery essential oil. J. Food Sci. 34: 535-537. 103.Waltzl, B. 1996. Health- promotiong effects of phytochemicals. Proceeding of IUFOST ' 96 ' regional symposium. 104.Wei, H., Wei, L., Frenkel, K., Bowen, R. and Barnes, S. 1993. Inhibition of tumor promoter-induced hydrogen peroxide formation in vitro and in vivo by genistein. Nutr. Cancer. 20: 1-12. 105.Wang, H., Cao, G. and Prior, R. 1997. Oxygen radical absorbing capacity of anthocyanins. J. Agric. Food Chem. 45: 304-309. 106.Xu, F., Geng, Z. C., Sun, J. X., Liu, C. F., Ren, J. L, Sun, R. C., Fowler, P. and Baird, M. S. 2006. Fractional and structural characterization of hemicel- lulose from perennial ryegrass (Lolium perenne) and cocksfoot grass(D- actylis glomerata). Carbohydrate Research. 341: 2073-2082. 107.Xu, M. Z., Lee, W. S., Kim, M. J., Park, D. S., Yu, H., Tian, G. R., Jeong, T. S. and Park, H. Y. 2004. Acyl-CoA : cholesterol acyltransferase inhibitory activities of fatty acid amide isolated from Mylabris phalerate Pallas. Biorg- anic and Medicinal Chemistry Letters. 14: 4277- 4280. 108.Yoshida, M., Saki, T., Hosokawa, N., Marui, N., Matsunoto, K. and F- ujioka, A. 1990. The effect of quercetin on cell cycle progression and growth of human gastric cancer cells. FEBS Lett. 260: 10-13. 109.Zheng, G. Q., Kenney, P. M., Zhang, J. and Lam, L. K. T. 1993. Chemoprev- ention of benzo[a] pyrene-induced forestomach cancer in mice by natural p- hthalides from celery seed oil. Nutr. Cancer. 19: 77-86.