

Studies on the Antioxidant Effects and the Lipemia Reducing Effects of *Cryptotaenia japonica* Hassk

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ABSTRACT

Mountain celery is common vegetables in meal for people in Taiwan. However, there is not many related papers or reports published related the study of the mountain celery in Taiwan, Chemical composition of essential oil, functional components of the different extract and antioxidant capability of mountain celery were studied in present study. The purpose of this study is to extract and analyze the essential oils composition of seeds, stems and leaves of mountain celery, and to fractionate the oils into different organic solvent (pentane, ether, acetone, methyl alcohol) by silica gel column chromatography separation. Which were further analyzed by GC-MS to determine its chemical composition and the fractionated 's antioxidant capability were also evaluated. In addition to that, blood lipemid reducing effect of mountain celery seeds(including : seeds powder, water extract, methanolic extract, essential oils and fractions of (pentane and ether). Were studied using male hamsters. The analysis of the functional components of mountain celery seeds and its water, methanolic extract. The obtained of essential oils from the seeds, stems and leaves of mountain celery was performed by steam distillation, and to found the seeds have the highest yield of essential oil of 0.4%(w/w), the second highest yield of essential oil are leaves of 0.03%, and the lowest yield of essential oil was determined to stems of 0.01%. The major of volatile components of mountain celery seeds, stems and leaves are the sesquiterpenes which contained 60.84%, 47.13%, 75.87%, where two major compounds are E- -farnesene、germacrene D were found. The second major volatile components of mountain celery seeds are the monoterpenes which contained 13.19%, 39.15%, 10.58%for seeds, stems and leaves, and their major compounds were determined to -pinene and d-limonene. the major components of (pentane(F1), ether(F2), acetone(F3), MeOH(F4)) that the sesquiterpenes is the major components in pentane(F1) which contained 86.97%, and the major compounds are -selinene, E- -farnesene. The major components of ether(F2) are alcohols, phenols, and added up to 30.28% in total. The major compounds of acetone(F3), MeOH(F4) are 3-pentanol, oleamide. Our study have found that the sesquiterpenes are the major volatile components in stems(SF1), leaves(LF1) fractions and their contents were determined to be 85.24%and 81.66%, which germacrene D is the major component and were 16.6 % and 24.14% in total in SF1 and LF1. The major components of SF2, LF2 are alcohols, phenols, 40.10 % , 43.81% in total , respectively. The major compound of SF3, SF4, LF3, LF4 are oleamide, and with various contents from 16.91 to 48.4% in total. Unfortunately, the phthalides were not found in essential oil in fractions of mountain celery seeds, stems, leaves. Assessment of the effect of reducing lipemia of mountain celery seeds (including : seeds powder, water extract, methanolic extract, essential oil and its fractions(pentane, ether) and oleamide compound were performed. Take the male hamsters for experiment, the study showed that the animals feed with the seeds powder, water extract, methanolic extract, essential oil and its fractions(pentane, ether) of mountain celery seeds and oleamide compound. had lower triglyceride, total cholesterol, low-density cholesterol than the group without mountain celery seeds(H) ($p < 0.05$). Food intake, feed efficiency of all groups have shown no significantly different ($p > 0.05$). The result showed that the feed of seeds powder, water extract, methanolic extract, essential oil and its fractions(pentane, ether) of mountain celery seeds and oleamide compound helped to improve the lipid states of the male hamsters and without having any side-effects detected. Evaluation of the antioxidant capability of the seeds, stems, leaves of mountain celery and their fractions were performed, the results have shown that crude essential oils of seeds, stems and leaves of mountain celery are poor on antioxidant capability, but their ether fractions (F2、SF2、LF2) are best on Fe 2+ chelating capability and free radical scavenging capability. On the other hand, the MeOH fractions(F4、SF4、LF4) were determined to be the best on superoxide anion scavenging capability. The content of totalphenol, flavonoid, phytosteroid and dietary fiber from the mountain celery seeds and its extract(water extract, methanolic extract). The result showed they are 3.3 ± 0.7 mg/g, 0.24 mg/g, 14.14 mg/g, 41 ± 3.8 mg/g for the mountain celery seeds. The total phenol, flavonoid and dietary fiber of water extract contained 30.4 ± 2.3 mg/g, 2.2 ± 0.4 mg/g, 301 ± 21 mg/g. The total phenol and flavonoid contents of methanolic extract are 36.2 ± 1.5 mg/g, 2.8 ± 0.5 mg/g.

Keywords : *Cryptotaenia japonica* Hassk、antioxidant capability、essential oil、total phenol、flavonoid、antioxidant capability、essential oil

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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???????上升抑制作用。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. 錢明寶。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、劉展岡、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 flavonoids. 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. Cardiovasc 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. Experientia. 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 lipid 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. El-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 caryophyllata* Thunb) buds and lavender (*Lavandula atoechas* L.). Food Chem. 87: 393-400。
41. Guenther, E. 1952. The essential oils vol I D Van, Nostrand Co Inc. New York. p. 61-151。
42. Gerson, T., Shorland, F. B. and Dunkley, 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 *Photinia serrulata*. *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., Kwiterovich, 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. Kalembe, 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 Purification 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 disease and cancer. *Pharmacol Rev.* 52: 673-751. 69. Mackey, M. C. 1979. Periodic auto-immune hemolytic anemia: An induced 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 compounds and 3-Di[(cis)-9-octadecenoyl]-2-[(cis,cis)-9,12-octadecadienoyl] glycerol from *Apium graveolens* 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., Rukunzaman, 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 bisepoxy lignans, sesaminol and its isomers, transformed from sesamol. *Agric. Biol. Chem.* 51: 1285-1289. 79. Pallado, P., Tassinato, G., D'Alpaos, M. and Traldi, P. 1997. Gas Chromatography/Mass Spectrometry 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., Baillieu, 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 schoenheimsperry 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. Biophys. 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.