

论文

发酵莴苣茎叶功能活性研究

崔莉<sup>1,2</sup>, 刘春泉<sup>1,2</sup>, 李大婧<sup>1,2</sup>, 宋江峰<sup>1,2</sup>, 江宁<sup>1,2</sup>, 刘春菊<sup>1,2</sup>, 吴海虹<sup>1,2</sup>, 朱丹宇<sup>1,2</sup>

1. 江苏省农业科学院农产品加工所, 江苏 南京 210014;
2. 国家农业科技华东(江苏)创新中心农产品加工工程技术研究中心, 江苏 南京 210014

摘要:

通过测定ACE抑制活性、抗氧化活性及、总黄酮、总多酚的含量研究乳酸发酵对莴苣茎叶生物活性的影响。结果表明,无论发酵与否,莴苣叶各项指标均高于莴苣茎。发酵后莴苣叶的ACE抑制活性从61.5%显著升高至92.9%,莴苣茎从48.5%显著升高至68.3%( $P<0.05$ )。但发酵使莴苣茎和叶的抗氧化活性显著下降,莴苣叶对DPPH自由基的半数清除浓度从0.22mg/ml增加至2.13mg/ml,莴苣茎从16.5mg/ml增加至33.4mg/ml,且发酵后莴苣叶的抗氧化物质含量显著下降,而莴苣茎则变化不显著,说明总黄酮和总多酚不是莴苣中产生ACE抑制活性的主要物质。经本发酵工艺生产的莴苣茎叶发酵产品的各项指标均符合国家标准。

关键词: 莴苣 发酵 ACE抑制活性 抗氧化活性 抗氧化物质

FUNCTIONALACTIVITIES OF FERMENTED LETTUCE STEM AND LEAF

CUI Li<sup>1,2</sup>, LIU Chun-quan<sup>1,2</sup>, LI Da-jing<sup>1,2</sup>, SONG Jiang-feng<sup>1,2</sup>, JIANG Ning<sup>1,2</sup>, LIU Chun-ju<sup>1,2</sup>, WU Hai-hong<sup>1,2</sup>, ZHU Dan-yu<sup>1,2</sup>

1. Institute of Farm Product Processing, Jiangsu Academy of Agricultural Sciences, Nanjing, Jiangsu 210014;
2. Engineering Research Center for Agricultural Products Processing, National Agricultural Science and Technology Innovation Center in East China, Nanjing, Jiangsu 210014

Abstract:

Effects of fermentation on contents of phenolics and total flavonoid, angiotensin converting enzyme (ACE) inhibitory activity and antioxidant activities of lettuce stem and leaf were investigated. The results show that fermentation caused significant increasing on ACE inhibitory activity of both lettuce stem and leaf ( $P<0.05$ ). The ACE inhibitory activity of lettuce leaf increased from 61.5% to 92.9%, and from 48.5.9% to 68.3% in lettuce stem. The antioxidant activities of both lettuce stem and leaf decreased after fermentation. The  $IC_{50}$  value of DPPH radical scavenging effect increased from 0.22mg/ml to 2.13mg/ml in leaf and from 16.5mg/ml to 33.4mg/ml in leaf. The contents of total phenolics and total flavonoid in lettuce leaf significantly decreased ( $P<0.05$ ) but in stem the change was not obviously. It indicated that the phenolics and flavonoid were not the main components of ACE inhibitory activity in lettuce. All the physicochemical and microbial index were in line with national standards.

Keywords: lettuce fermentation angiotensin converting enzyme (ACE) inhibitory activity antioxidant activity antioxidant compounds

收稿日期 2010-06-07 修回日期 2010-08-18 网络版发布日期

DOI:

基金项目:

江苏省农业科技自主创新资金项目(CX(08)611)

通讯作者: 刘春泉 (1959-),男,江苏如东人,研究员,主要从事农产品精深加工研究。Tel:025-84390613;E-

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#### 参考文献:

- [1] Caldwell C R. Alkylperoxyl radical scavenging activity of red leaf lettuce (*Lactuca sativa* L.) phenolics  
[J]. Journal of Agricultural and Food Chemistry, 2003, 51: 4589-4595
- [2] Chu Y F, Sun J, Wu X, Liu R H. Antioxidant and antiproliferative activities of common vegetables  
[J]. Journal of Agricultural and Food Chemistry, 2002, 50: 6910-6916
- [3] Cao G, Sofic E, Prior R L. Antioxidant capacity of tea and common vegetables  
[J]. Journal of Agricultural and Food Chemistry, 1996, 44: 3426-3431
- [4] Cushman D W, Cheung H S. Spectrometric assay and properties of angiotensin converting enzyme of rabbit lung  
[J]. Biochem Pharmacol, 1971, 20: 1637-1647
- [5] Blois M S. Antioxidant determination by the use of a stable free radical  
[J]. Nature, 1958, 181: 1199-1200
- [6] Benzie I F F, Strain J J. The ferric reducing ability of plasma as a measure of "Antioxidant Power": The FRAP assay  
[J]. Analytical Biochemistry, 1996, 239: 70-76
- [7] 中华人民共和国卫生部药典委员会编著. 中华人民共和国药典(1部)  
[S]. 北京: 人民出版社, 1995: 311
- [8] Cheung L M, Cheung P C K, Coi V E C. Antioxidant activity and total phenolics of edible mushroom extracts  
[J]. Food Chemistry, 2003, 81: 249-255
- [9] SB/T 10439-2007, 酱腌菜  
[S]
- [10] GB/T 5009.3-2003, 食品中水分的测定  
[S]
- [11] GB/T 5009.51-2003, 非发酵性豆制品及面筋卫生标准的分析方法  
[S]
- [12] GB/T 5009.11-2003, 食品中总砷及无机砷的测定  
[S]
- [13] GB/T 5009.12-2003, 食品中铅的测定  
[S]
- [14] GB/T 5009.33-2003, 食品亚硝酸盐与硝酸盐的测定  
[S]
- [15] GB/T 4789.4, 食品卫生微生物学检验, 沙门氏菌检验  
[S]
- [16] GB/T 4789.5, 食品中卫生微生物学检验, 志贺氏菌检验  
[S]
- [17] GB/T 4789.10, 食品中卫生微生物学检验, 金黄色葡萄球菌检验  
[S]
- [18] Je J Y, Park P J, Kim B, Kim S K. Antihypertensive activity of chitin derivatives Biopolymers

[J]. Biopolymers, 2006, 83: 250-254

[19] Actis-Goretta L, Ottaviani J, Fraga C. Inhibition of angiotensin converting enzyme activity by flavanol-rich foods

[J]. Journal of Agricultural and Food Chemistry, 2006, 54: 229-234

[20] An B J, Lee J T. Isolation and characterization of angiotensin converting enzyme inhibitors from *Camellia sinensis* L. and their chemical structure determination

[J]. Food Science and Biotechnology, 1999, 8: 285-289

[21] Liu D Z, Lin Y S, Hou W C. Monohydroxamates of aspartic acid and glutamic acid exhibit antioxidant and angiotensin converting enzyme inhibitory activities

[J]. Journal of Agricultural and Food Chemistry, 2004, 52: 2386-2390

[22] Kawakami A, Inbe T, Kayahara H, Horii A. Preparation of enzymatic hydrolysates of buckwheat globulin and their angiotensin I converting enzyme inhibitory activities

[J]. Current Advances in Buckwheat Research, 1995, 1: 927-934

[23] Actis-Goretta L, Ottaviani J I, Fraga C G. Inhibition of angiotensin converting enzyme activity by flavanol-rich foods

[J]. Journal of Agricultural and Food Chemistry, 2006, 54: 229-234

[24] Ak111log ^ lu H G, Karakaya S. Effects of heat treatment and in vitro digestion on the Angiotensin converting enzyme inhibitory activity of some legume species

[J]. European Food Research and Technology, 2009, 229: 915-921

[25] Liu J C, Hsu F L, Tsai J C, Chan P, Liu J Y H, Thomas G N, Tomlinson B, Lo M Y, Lin J Y. Antihypertensive effects of tannins isolated from traditional Chinese herbs as non-specific inhibitors of angiotensin converting enzyme

[J]. Life Science, 2003, 73: 1543-1555

[26] 赵树平. 乳杆菌发酵乳中ACE抑制活性和 $\gamma$ -氨基丁酸的研究

[D]. 呼和浩特: 内蒙古农业大学食品科学系, 2008

[27] Korhonen H, Pihlanto A. Bioactive peptides: Production and functionality

[J]. International Dairy Journal, 2006, 16: 945-960

[28] 张丽梅. 灰树花中降压活性成分的分离纯化工艺研究

[D]. 北京: 北京化工大学化工系, 2005

[29] Franceschi S, Parpinel M, La Vecchia C, Favero A, Talamini R. Negrierole of different types of vegetables and fruit in the prevention of cancer of the colon, Rectum and Breast

[J]. Epidemiology, 1998, 9: 338-341

[30] 王 萍, 朱祝军. 腌制加工对不同品种叶用芥菜抗氧化物质含量和抗氧化活性的影响

[J]. 核农学报, 2006, 20(6): 516-520

[31] 胡玉霞. 雪里蕻腌渍过程中理化成分及其抗氧化性变化研究

[D]. 杭州: 浙江大学生物系统工程和食品科学系, 2007

[32] 余小林, 林 薇, 徐步前. 不同处理对数种果蔬抗氧化活性稳定性的影响

[J]. 食品科学, 2004, 25(6): 66-69

[33] 陈静波, 田迪英. 莴笋不同部位抗氧化活性的研究

[J]. 食品研究与开发, 2006, 27(9): 54-57

[34] Fang Z X, Hu Y X, Liu D H, Chen J C, Ye X Q. Changes of phenolic acids and antioxidant activities during potherb mustard (*Brassica juncea*, Coss.) pickling

[J]. Food Chemistry, 2008, 108: 811-817

[35] Velioglu Y S, Mazza G, Gao L, Oomah B D. Antioxidant activity and the total phenolics in selected fruits, vegetables, and grain products

[J]. Journal of Agricultural Food and Chemistry, 1998, 46: 4113-4117

[36] Maisuthisakul P, Pongsawatmanit R, Gordon M H. Characterization of the phytochemicals and

[37] 黄裕蜀. 茵苳  
[M]. 北京: 科学技术文献出版社, 1992: 2

#### 本刊中的类似文章

1. 宋安东, 陈红歌, 贾翠英, 张世敏. 离子注入对苹果酒酵母菌的影响[J]. 核农学报, 2004, 18(03): 190-192
2. 李卫旗, 何国庆.  $^{60}\text{Co}$ 射线诱变选育热凝胶多糖高产菌株的研究[J]. 核农学报, 2003, 17(05): 343-346
3. 陈建爱, 肖敏, 王未名, 陈为京, 孙永堂. 木霉诱变菌株发酵条件研究[J]. 核农学报, 2002, 16(05): 305-309
4. 李信, 刘云, 计林贞. 侧孢霉利用玉米秸秆固体发酵产生木质纤维素酶的研究[J]. 核农学报, 2000, 14(02): 99-103
5. 李信, 许雷, 裴鑫德. 蛹虫草(*Cordyceps militaris*)菌丝体液体培养基的优化和发酵条件的研究[J]. 核农学报, 1998, 12(01): 0-0
6. 吴萍, 史钧, 李正鹏, 祝嫦巍. 杏鲍菇产木聚糖酶固态发酵条件优化及其酶学性质[J]. 核农学报, 2010, 24(3): 542-547
7. 于海, 曹宏, 李想, 李苏政, 秦春君. 辐照对发酵香肠品质特性的影响[J]. 核农学报, 2010, 24(6): 1214-1218
8. 左斌, 刘唐兴, 丰来, 谭显胜, 孟桂元. *E. coli*谷氨酸脱羧酶高产菌株选育及发酵条件研究[J]. 核农学报, 2009, 23(5): 789-793
9. 杨英, 姜绍通, 魏兆军, 赵妍嫣, 孙晓明. 分枝杆菌降解植物甾醇制备雄烯二酮转化过程研究[J]. 核农学报, 2009, 23(5): 805-808
10. 宋安东, 苏丽娟, 谢慧, 曲音波, 杨铭.  $\gamma$ 射线对斜卧青霉的诱变筛选及产酶条件优化[J]. 核农学报, 2008, 22(03): 280-285
11. 王萍, 朱祝军. 腌制加工对不同品种叶用芥菜抗氧化物质含量和抗氧化活性的影响[J]. 核农学报, 2006, 20(06): 516-520+510
12. 李彦杰, 哈益明, 王锋, 李咏富. 辐照对黄原胶分子量及抗氧化活性的影响[J]. 核农学报, 2010, 24(6): 1208-1213