REFERENCES

Thai

สายสนม ประดิษฐดวง. 2551. ข้าวในมิติของอาหารต้านโรค. กรุงเทพฯ: ธนาเพรส.

อรอนงค์ นัยวิกุล. 2550. ข้าว: วิทยาศาสตร์และเทคโนโลยี. กรุงเทพฯ: สำนักพิมพ์มหาวิทยาลัยเกษตรศาสตร์.

English

Afaq, F., Saleem, M., Kueger, C.G., Reed, J.D., and Mukhtar, H. 2005. Anthocyanin and hydrolysable tannin-rich pomegranate fruit extract modulate sMAPK and NF-kappaB pathways and inhibits skin tumorigenesis in CD-1 mice. Int J Cancer 113: 423-433.

Ajarayasiri, J. and Chaiseri, S. 2008. Comparative study on aroma-active compounds in Thai, black and white glutinous rice varieties. Kasetsart J (Nat Sci) 42: 715-722.

Amarowicz, R., Pegg, R.B., Rahimi-Moghaddam, P., Barl, B., and Weil, J.A. 2004. Free-radical scavenging capacity and antioxidant activity of selected plant species from the Canadian prairies. Food Chem 84(4): 551-562.

Ames, B.N., and McCann, J. 1976. Detection of carcinogens as mutagens in the Salmonella/microsome test: assay of 300 chemicals. Proc Natl Acad Sci USA 73: 950-954.

Ames, B.N., and Whitfield, H.J. Jr. 1966. Frameshift mutagenesis in Salmonella. Cold Spring Harb Symp Quant Biol 31: 221-225.

Ames, B.N., Duston, W.E., Yamasaki, E., and Lee, F.D. 1973b. Carcinogens are mutagens: a simple test system combining liver homogenates for activation and bacteria for detection. Proc Natl Acad Sci USA 70(8): 2281-2285.

Ames, B.N., Lee, F.D., and Duston, W.E. 1973a. An improved bacterial test system for the detection and classification of mutagens and arcinogens. Proc Natl Acad Sci USA 70(3): 782-786.

Ames, B.N., McCann, J., and Yamasaki, E. 1975. Methods for detecting carcinogens and mutagens with the Salmonella/mammalian-microsome mutagenicity test. Mutat Res/Envir Mutag Related Subj 31(6): 347-363.

Ausman, L.M., Rong, N., and Nicolosi, R.J. 2005. Hypocholesterolemic effect of physically refined rice bran oil: studies of cholesterol metabolism and early atherosclerosis in hypercholesterolemic hamsters. J Nutri Biochem 16(9): 521-529.

Ball, L.M., Kohan, M.J., Claxton, L.D., and Lewtas, J. 1984. Mutagenicity of derivatives and metabolites of 1-nitropyrene: activation by rat liver S9 and bacterial enzymes. Mutat Res 138: 113-125.

Bång, J., Nukaya, H., and Skog, K. 2002. Blue chitin columns for the extraction of heterocyclic amines from cooked meat. J Chromatogr 977(1): 97-105.

Barber, M., Fitzgerald, R.C., and Caldas, C. 2006. Familial gastric cancer-aetiology and pathogenesis. Best Pract Res Clin Gastroenterol 20: 721-734.

Barlow, S., and Schlatter, J. 2010. Risk assessment of carcinogens in food. Toxicol Appl Pharmacol 243(2): 180-190.

Bartsch, H., Ohshima, H., and Pignatelli, B. 1988. Inhibitors of endogenous nitrosation. Mechanism and implications in human cancer prevention. Mutat Res 202: 307-324.

Benford, D., DiNovi, M., and Setzer, R.W. 2010. Application of the margin-of-exposure (MoE) approach to substances in food that are genotoxic and carcinogenic e.g.: benzo[a]pyrene and polycyclic aromatic hydrocarbons. Food Chem Toxicol 48: S42-S48.

Benzie, I.F.F., and Strain, J.J. 1999. Ferric reducing/ antioxidant power assay: direct measure of total antioxidant activity of biological fluids and modified version for simultaneous measurement of total antioxidant power and ascorbic acid concentration. Methods Enzymol 299: 15-27.

Bermudo, E., Ruiz-Calero, V., Puignou, L., and Galceran, M.T. 2005. Analysis of heterocyclic amines in chicken by liquid chromatography with electrochemical detection. Anal Chim Acta 536: 83-90.

Biaudet, H., Pignatelli, B., and Dedry, G. 1996. In: Leo, M.L. (Ed.), Handbook of food analysis volume 2, pp. 1605-1613, New York, Marcel Dekker, Inc.

Bjeldanes, L.F., Morris, M.M., Felton, J.S., Healy, S., Stuermer, D., Berry, P., et al. 1982. Mutagens from the cooking of food II: Survey by Ames/Salmonella test of mutagen formation in the major protein-rich foods of the merican diet. Food Chem Toxicol 20: 357.

Blakeney, A. 1984. Rice grain quality. In: Currey, A. (Ed.), Rice Growing in New South Wales, pp. 1-5, Yanco, Australia: Department of Agriculture New South Wales and Rice Research Committee.

Bors, W., Heller, T.X., Michel, C. 1990. Flavonoids as antioxidants; determination of radical-scavenging efficiencies. Methods Enzymol 186; 343-355.

Brenner, H., Rothenbacher, D., and Arndt, V. 2009. Epidemiology of stomach cancer. Meth Mol Biol 472: 467-477.

Brockstedt, U., and Pfau, W. 1998. Formation of 2-amino-α-carbolines in pan-fried poultry and ^{32}P-postlabelling analysis of DNA adducts. Food Res Technol A207(6): 472-476.

Brouillard, R., and Dangles, O. 1993. Flavonoids and flower colour. In: Harborne, J.B. (Ed.), The Flavonoids, pp. 565–588, Chapman.

Bruyninckx, W.J., Mason, H.S., and Morse, S.A. 1978. Are physiological oxygen concentrations mutagenic? Nat 27: 606-607.

Campbell, J., Crumplin, C.C., Garner, J.V., Garner, R.C., Martin, C.N., and Rutter, A. 1981. Nitrated polycyclic aromatic hydrocarbons: potent bacterial mutagens and stimulators of DNA repair synthesis in cultured human cells. Carcinogenesis 2: 599-606.

Catalano, V., Labianca, R., Beretta, G.D., Gatta, G., de Braud, F., and Cutsem, E.V. 2009. Gastric cancer. Crit Rev Oncol/Hematol 71: 127-164.

Cerniglia, C.E., Howard, P.C., Fu, P.P., and Franklin, W. 1984. Metabolism of nitropolycyclic aromatic hydrocarbons by human intestinal microflora. Biochem Biophys Res Commun 123: 262-270.

Chanphrom, P. 2007. Antioxidants and antioxidant activities of pigmented rice varieties and rice bran. Master's Thesis, Department of Nutrition, Faculty of Graduate, Mahidol University.

Chapla, N.G., James, E.G.G., Miller, A., and Bartsch, H. 1972. Carcinogens as frameshift mutagens: metabolites and derivatives of 2-acetylaminofluorene and other aromatic amine carcinogens. PNAS 69: 3128-3132.

Chen, B.H., and Yang, D.J. 1998. An improved analytical method for determination of heterocyclic amines in chicken legs. Chromatographia 48: 223-230.

Chen, P.N., Kuo , W.-H., Chiang, C.-L., Chiou, H.-L., Hsieh, Y.-S., and Chu, S.-C. 2006. Black rice anthocyanins inhibit cancer cells invasion via repressions of MMPs and u-PA expression. Chem-Biol Interactions 163: 218-229.

Chiu, C.P., Yang, D.Y., and Chen, B.H. 1998. Formation of heterocyclic amines in cooked chicken legs. J Food Prot 61: 712-719.

Choi, Y., Jeong, H.-S. and Lee, J. 2007. Antioxidant activity of methanolic extracts from some grains consumed in Korea. Food Chem 103: 130-138.

Cicero, A.F., and Gaddi, A. 2001. Rice bran oil and gamma-oryzanol in the treatment of hyperlipoproteinaemias and other conditions. Phytother Res 15(4): 277-289.

Combet, E., Paterson, S., and McColl, K. 2007. Diet, gastric nitrosation and stomach cancer. Comp Biochem Physiol, A 146(4): S61.

Couch, D.B., and Friedman, M.A. 1975. Interactive mutagenicity of sodium nitrite, dimethylamine, methylurea and ethylurea. Mutat Res 31(2):109-114.

Dashwood, R.H. 2002. Modulation of heterocyclic amine induced mutagenicity and carcinogenicity an A to Z guide to chemopreventive agent promoters and transgenic models. Mutat Res/Review Mutat Res 511(2): 89-112.

de Meester, C. 1989. Bacterial mutagenicity of heterocyclic amines found in heat-processed food. Mutat Res 221: 235-262.

Deguchi, T., Ohba, R., and Ueda, S. 2000a. Radical scavenging activity of a purple pigment, hordeumin, from uncooked barley bran-fermented broth. J Agric Food Chem 48(8): 3198–3201.

Deguchi, T., Yoshimoto, M., Ohba, R., and Ueda, S. 2000. Antimutagenicity of the purple pigment, hordeumin, from uncooked barley bran-fermented broth. Biosci Biotechnol Biochem 64(2): 414–416.

del Rosario, N.R., Briones, V.P., Vidal, A.J., and Juliano, B.O. 1968. Composition and endosperm structure of developing and mature rice kernel. Cereal Chem 45: 225-235.

Delgado-Vargas, F., Jiménez, A.R., and Paredes-López, O. 2000. Natural pigments: carotenoids, anthocyanins, and betalains - characteristics, biosynthesis, processing, and stability. Food Sci Nutri 40(3): 173-289.

Deutsche Forschungsanstalt für Lebensmittelchemie, Garching bei München (Eds.), Der kleine "Souci-Fachmann-Kraut" Lebensmitteltabelle für die Praxis, WVG, Stuttgart 1991.

Dhillon, P.K., Farrow, D.C., Vaughan, T.L., Chow, W.H., Risch, H.A., Gammon, M.D., et al. 2001. Family history of cancer and risk of esophageal and gastric cancers in the United States. Int J Cancer 93(1): 148-152.

Ding, M., Feng, R., Wang, S.Y., Bowman, L., Lu, Y., Qian, Y., et al. 2006. Cyanidin-3-glucoside, a natural product derived from black berry, exhibits chemopreventive and chemotherapeutic activity. J Biol Chem 281: 17359-17368.

DiPaolo, J.A., Demarianis, A.J., Chow, F.L., Garner, R.C., Martin, C.N., and Doniger, J. 1983. Nitration of carcinogenic and non-carcino- genic polycyclic aromatic hydrocarbons results in products able to induce transformation of Syrian hamster cells. Carcinogenesis 4: 357-359.

Đorđević, T.M., Šiler-Marinkovića, S.S. and Dimitrijević-Brankovića, S.I. 2009. Effect of fermentation on antioxidant properties of some cereals and pseudo cereals. Food Chem 119(3): 957-963.

Douglass, M.L. 1978. The chemistry of nitrosamine formation, inhibition and destruction. J Soc Cosmet Chem 29: 581-606.

Droge, W. 2002. Free radicals in the physiological control of cell function. Physiol Rev 82: 47-95.

Dunkel, V.C., Zeiger, E., Brusick, D., McCoy, E., McGregor, D., Mortelmans, K., et al. 1984. Reproducibility of microbial mutagenicity assay: I. Test with *Salmonella typhimurium* and *Escherichia coli* using a standardized protocol. Envir Mutag 6(Suppl. 2): 1-254.

Dunkel, V.C., Zeiger, E., Brusick, D., McCoy, E., McGregor, D., Mortelmans, K., et al. 1985. Reproducibility of microbial mutagenicity assay: II. Testing of carcinogens and noncarcinogens in *Salmonella typhimurium* and *Escherichia coli*. Envir Mutag 7(Suppl. 5): 1-248.

Edenharder, R., and Tang, X. 1997. Inhibition of the mutagenicity of 2-nitrofluorene, 3-nitrofluoranthene and 1-nitropyrene by flavonoids, coumarins, quinones and other phenolic compounds. Food Chem Toxicol 35: 357-72.

Edenharder, R., Rauscher, R., and Platt, K.L. 1997. The inhibition by flavonoids of 2-amino-3-methylimidazo[4,5-*f*]quinoline metabolic activation to a mutagen: a structure–activity relationship study. Mutat Res 379(1): 21-32.

Edenharder, R., Von petersdorff, I., and Rauscher, R. 1993. Antimutagenic effects of flavonoids, chalcones and structurally related compounds on the activity of 2-amino-3-methylimidazo[4,5-*f*]quinoline (IQ) and other heterocyclic amine mutagens from cooked food. Mutat Res 287(2): 261-274.

Edenharder, R., von Petersdorff, I., and Rauscher, R. 1993. Antimutagenic effects of flavonoids, chalcones and structurally related compounds on the activity of 2-amino-3-methylimidazo[4,5-f]quinoline (IQ) and other heterocyclic amine mutagens from cooked food. Mutat Res 287: 261–274.

Einistö, P., Watanabe, M., Nohmi, M.T., and Ishidate, Jr. M. 1991. Mutagenicity of 30 chemicals in *Salmonella typhimurium* strains possessing different nitroreductase or *O*-acetyltransferase activities. Mutat Res 259: 95-102.

Eklund, P.C., Langvik, O.K., Warna, J.P., Salmi, T.O., Willfor, S.M., and Sjoholm, R.E. 2005. Chemical studies on antioxidant mechanisms and free radical scavenging properties of lignans. Org Biomol Chem 3(18): 3336-3347.

El-Bayoumy, K., and Hecht, S.S. 1983. Identification and mutagenicity of metabolites of 1-nitropyrene formed by rat liver. Cancer Res 43: 3132-3137.

El-Bayoumy, K., and Hecht, S.S. 1984. Metabolism of 1-nitroU-4,5,9,10-14Cpyrene in the F344 rat. Cancer Res 44: 4317-4322.

El-Bayoumy, K., Hecht, S.S., Sackl, T., and Stoner, G.D. 1984. Tumorigenicity and metabolism of 1-nitropyrene in A/J mice. Carcinogenesis 5: 1449-1452.

Esscribano-Bailón, M.T., Santos-Buelga, C., and Rivas-Gonzalo, J.C. 2004. Anthocyanins in cereals. J Chromatograph A 1054: 129-141.

Faller, A.L.K., and Fialho, E. 2009. The antioxidant capacity and polyphenol content of organic and conventional retail vegetables after domestic cooking. Food Res Int 42(1): 210-215.

Felton, J.S., and Knize, M.G. 1990. Heterocyclic-amine mutagens/carcinogens in foods. In: Cooper, C.S., and Graver, P.L. (Eds.), Handbook of Experimental Pharmacology, 94/I, pp. 471-502, Springer-Verlag, Berlin.

Felton, J.S., and Knize, M.G. 1991. Occurrence, identification and bacterial mutagenicity of heterocyclic amines in cooked food. Mutat Res 259(3-4): 205-218.

Ferguson, L.R., Philpotta, M. and Karunasinghea, N. 2004. Dietary cancer and prevention using antimutagens. Toxicol 198(1-3): 147-159.

Fuccio, L., Zagari, R. M., Minardi, M. E., and Bazzoli, F. 2007. Systematic review: *Helicobacter pylori* eradication for the prevention of gastric cancer. Alimentary Pharmacol Ther 25(2): 133-141.

Fukumoto, L.R., and Mazza, G. 2000. Assessing antioxidant activities of phenolic compounds. J Agric Food Chem 48: 3597-3604.

Galvano F., Fauci, L.L., Lazzarino, G., Fogliano,V., Ritieni, A., Ciappellano, S., et al. 2004. Cyanidins: metabolism and biological properties. J Nutr Biochem 15: 2-11.

Gangolli, S.D., van den Brandt, P.A., Feron, V.J., Janzowsky, C., Koeman, J.H., Speijers, G.J.A., et al. 1994. Nitrate, nitrite and *N*-nitroso compounds. Eur J Pharmacol 292(1): 1-38.

Garner, R.C., Miller E.C., and Miller, J.A. 1972. Liver microsomal metabolism of aflatoxin B_1 to a reactive derivative toxic to *Salmonella typhimurium* TA 1530. Cancer Res 32: 2058-2066.

Gatehouse, D. and Wedd, D. 1983. The bacterial mutagenicity of three naturally occurring indoles after reaction with nitrous acid. Mutat Res 124: 35-51.

Georgé, S., Brat, P., Alter, P., and Amiot, M.J. 2005. Rapid determination of polyphenols and vitamin C in plant-derived products. J Agric Food Chem 53: 1370-1373.

Gladwin, M.T. 2004. Haldane, hot dogs, halitosis, and hypoxic vasodilation: the emerging biology of the nitrite anion. J Clin Invest 113(1): 19-21.

Gonzalez, C.A., Pera, G., Agudo, A., Palli, D., Krogh, V., Vineis, P., et al. 2003. Smoking and the risk of gastric cancer in the European prospective investigation into cancer and nutrition (EPIC). Int J Cancer 107(4): 629-634.

Griffin, S.P., and Bhagooli, R. 2004. Measuring antioxidant potential in corals using the FRAP assay. J Exp Mar Biol Ecol 302: 201-211.

Gross, G.A., and Grüter, A. 1992. Quantization of mutagenic/carcinogenic heterocyclic amines in food products. J Chromatography 592: 271-278.

Grosse, Y., Baan, R., Straif, K., Secretan, B., El Ghissassi, F., Cogliano, V., et al. 2006. Carcinogenicity of nitrate, nitrite, and cyanobacterial peptide toxins. Lancet Oncol 7(8): 628-629.

Ha, T.Y., Park, S.H., Lee, C.H., and Lee, S.H. 1999. Chemical composition of pigmented rice varieties. Kor J Food Sci Technol 31: 336–341.

Hagiwara, A., Miyashitaa, K., Nakanishia, T., Sanoa, M., Tamanoa, S., Kadota, T., et al. 2001. Pronounced inhibition by a natural anthocyanin, purple corn color, of 2-amino-1-methyl-6-phenylimidazo[4,5-*b*]pyridine (PhIP)-associated colorectal carcinogenesis in male F344 rats pretreated with 1,2-dimethylhydrazine. Cancer Lett 171(1): 17-25.

Handa, T., Yamauchi, T., Ohnishi, M., Hisamatsu Y., and Ishii, T. 1983. Detection and average content levels of carcinogenic and mutagenic compounds from the particulates on diesel and gasoline engine mufflers. Envir Inst 9: 335-341.

Hartman, P.E., Hartman, Z., Stahl, R.C., and Ames, B.N. 1971. Classification and mapping of spontaneous and induced mutations in the histidine operon of Salmonella. Adv Genet 16: 1-34.

Hartman, Z., Hartman, P.E., Barnes. W.M., and Tuley, E. 1984. Spontaneous mutation frequencies in Salmonella: enhancement of G/C to A/T transitions and depression of deletion and frameshift mutation frequencies afforded by anoxic incubation. Envir Mol Mutag 6: 633-650.

Hayatsu, H. and Hayatsu, T. 1989. Mutagenicity arising from boiled rice on treatment with nitrous acid. Jpn J Cancer Res 80(11): 1021-1023.

Heflich, R.H., Howard, P.C., and Beland, F.A. 1985. 1-Nitrosopyrene: an intermediate in the metabolic activation of 1-nitropyrene to a mutagen in *Salmonella typhimurium* TA1538. Mutat Res 149: 25-32.

Hirose, M., Lee, M.-S., Wang, C.Y., and King, C.M. 1982. Induction of rat mammary gland tumors by 1-nitropyrene, a recently recognized environmental mutagen. Cancer Res 44: 1158-1162.

Hites, R.A., Laflamme, R.E., and Windsor, J.G. 1980. Polycyclic aromatic hydrocarbons in marine/aquatic sediments; their ubiquity. In: Petrakis T, and Weiss FT (Eds.), Petroleum in the marine environment, pp. 289-311, Advances in Chemistry Series, American Chemical Society, Washington D.C.

Horn, C.H., du Preez, J.C., and Kilian, S.G. 1992. Fermentation of Grain Sorghum Starch by Co-cultivation of *Schwanniomyces occidentalis* and *Saccharomyces cerevisiae*. Bioresource Technol 42: 27-31.

Hotchkiss, J. 1988. A review of current literature on N- nitroso compounds. In: Chichester, C. O., and Schweigert, B. S., (Eds.), Advances in Food and Nutrition Research, pp. 53-115, Academic Press, London.

Howard, P.C., Beland, F.A., and Cerniglia, C.E. 1983a. Reduction of the carcinogen 1-aminopyrene by intestinal bacteria. Carcinogenesis 4: 985-990.

Howard, P.C., Heflich, R.H., Evans, F.E., and Beland, F.A. 1983b. Formation of DNA adducts in vitro and in *Salmonella typhimurium* upon metabolic reduction of the environmental mutagen 1-nitropyrene. Cancer Res 43: 2052-2058.

Htwe, N.N., Srilaong, V., Tanprasert, K., Uthairatanakij, A. and Kanlayanarat, S. 2009. Characterization of bioavailable compounds in black and red pigmented rice cultivars in Thailand. Acta Hort (ISHS) 837:65-72.

Hu, C., Zawistowski, J., and Kitts, D.D. 2002. Phytochemical characterization and bioactivities of anthocyanins from pigmented rice. Annual Meeting and Food Expo-Anaheim, California Session 84, Nutraceuticals & Functional Foods.

Hu, C., Zawistowski, J., Ling, W., and Kitts, D.D. 2003. Black rice (*Oryza sativa* L. *indica*) pigmented fraction suppresses both reactive oxygen species and nitric oxide in chemical and biological model systems. J Agric Food Chem 51: 5271-5277.

Hung, Y.-H., Huang, H.-Y., and Chou, C.-C. 2007. Mutagenic and antimutagenic effects of methanol extracts of unfermented and fermented black soybeans. Int J Food Microbiol 118(1): 62-68.

IARC (International Agency for Research on Cancer). 1989. 1-Nitropyrene. IARC Monogr Eval Carcinog Risk Chem Hum 46: 321-358.

Ichikawa, H., Ichiyanagi, T., Xu, B., Yoshii, Y., Nakajima, M., and Konishi, T. 2001. Antioxidant activity of anthocyanin extract from purple black rice. J Med Food 4(4): 211-218.

Ishihara, M. 1984. Effect of γ-oryzanol on serum lipid peroxide level and clinical symptoms of patients with climacteric disturbances. Asia-Oceania J Obstetric Gynaecol 10(3): 317-323.

Jacob, J.W., Karcher, T.A., Belliardo, J.J, and Wagstaffe, P.J. 1986. Polycyclic aromatic hydrocarbons of environmental and occupational importance. Fresenius Z Anal Chem 323: 1-10.

Jakszyn, P., and Gonzalez, C.A. 2006. Nitrosamine and related food intake and gastric and oesophageal cancer risk: a systematic review of the epidemiological evidence. World J Gastroenterol 12(27): 4296-4303.

Kado, N.Y., Langley, D., and Eisenatadt, E. 1983. A simple modification of the Salmonella liquid incubation assay: increased sensitivity for detecting mutagens in human urine. Mutat Res 122: 25-32.

Kahlon, T.S., Saunders, R.M., Sayre, R. N., Chow, F.I., Chiu, M.M., and Betschart, A.A. 1992. Cholesterol-lowering effects of rice bran and rice bran oil fractions in hypercholesterolemic hamsters. Cereal Chem 69(5): 485-489.

Kaloustian, J., Alhanout, K., Amiot-Carlin, M.-J., Lairon, D., Portugal, H., Nicolay, A., et al. 2008. Effect of water cooking on free phytosterol levels in beans and vegetables. Food Chem 107(4): 1379-1386.

Kaneda, I., Kubo, F. and Sakurai, H. 2006. Antioxidative compounds in the extracts of black rice brans. J Health Sci 52: 495-511.

Kaneda, I., Kubo, F., and Sakurai, H. 2006. Antioxidative compounds in the extracts of black rice brans. J Health Sci 52: 495-511.

Kangsadalampai, K., and Peerawong, K. 1997. Mutagenic potentialof various chicken extracts sold in Thailand after nitrite treatment with excess nitrite in the acid condition. Mahidol J 5(1): 5-8.

Kangsadalampai, K., Butryee, C., and Manoonphol, K. 1996. Direct mutagenicity of the polycyclic aromatic hydrocarbon-containing fraction of smoked and chacoal-broiled foods treated with nitrite in acid solution. Food Chem Toxicol 35: 213-218.

Kappers, W.A., Och, F.M.M., Groene, E.M. and Horbach, G.J. 2000. Comparison of three different in vitro mutation assays used for the investigation of cytochrome P450-mediated mutagenicity of nitro-polycyclic aromatic hydrocarbons. Mutat Res 466: 143-159.

Katalinić, V., Milos, M., Modun, D., Musić, I., and Boban, M. 2004. Antioxidant effectiveness of selected wines in comparison with (+)-catechin. Food Chem 86(4): 593-600.

Kato, T., Tadokoro, N., Tsutsui, M. and Kikugawa, K. 1991. Transformation of arylamines into direct-acting mutagens with nitrite. Mutat Res 249: 243-254.

Khan, M.R., Bertus, L.M., Busquets, R., and Puignou, L. 2009. Mutagenic heterocyclic amine content in thermally processed offal products. Food Chem 112: 838-843.

Kier, L.E., Brusick, D.J.,Auletta, A.E., Von Halle, E.S., Brown, M.M., Simmon, V.F., et al. 1986. The *Salmonella typhimurium*/mammalian microsomal assay. Areport to the U.S. Environmental Protection Agency Gene-Tox program. Mutat Res 168: 69-240.

Kikugawa, K., and Kato, T. 1991. Prevention of nitrosamine formation. In: Hayatsu, H. (Ed.), Mutagens in food: detection and prevention, pp. 205-214, CRC Press, Inc. U.S.A.

King, L.C., Kohan, M.J., Ball, L.M., and Lewtas, J. 1984. Mutagenicity of 1- nitropyrene metabolites from lung S9. Cancer Lett 22: 255-262.

Kinouchi, T., Tsutsui, H., and Ohnishi, Y. 1986. Detection of 1-nitropyrene in yakitori (grilled chicken). Mutat Res 171: 105-113.

Kinouchi, T.M., Morotomi, M., Mutai, M., Fifer, E.K., Beland, F.A., and Ohnishi, Y. 1987. Metabolism of 1-nitropyrene in germfree and conventional rats. Gann 77: 356-369.

Kong, J.M., Chia, L.S., Goh, N.K., Chia, T.F., and Brouillard, R. 2003. Analysis and biological activities of anthocyanins. Phytochem 64: 923-933.

Kong, S., and Lee, J. 2010. Antioxidants in milling fractions of black rice cultivars. Food Chem 120(1): 278-281.

Kukam-oo, A., Noenplab, A., Immark, S., and Chankasem, L. 2008. Evaluation on Nutritional Values of Colored Rice. Proceedings of rice and temperate cereal crops annual conference 2008 volume 2/2, Bangkok (Thailand): 336-351.

Kuo, M., Lee, K., and Lin, J. 1992. Genotoxicities of nitropyrenes and their modulation by apigenin, tannic acid, ellagic acid and indole-3-carbinol in the Salmonella and CHO systems. Mutat Res 270: 87-95.

Lala, G., Malik, M., Zhao, C., He, J., Kwon, Y., Giusti, M.M., et al. 2006. Anthocyanin-rich extracts inhibit multiple biomarkers of colon cancer in rats. Nutr Cancer 54: 84-93.

Larrauri, J.A., Ruperez, P., and Saura-Calixto, F. 1997. Effect of drying temperature on the stability of polyphenols and antioxidant activity of red grape pomace peels. J Agric Food Chem 45(4): 1390–1393.

Layton, D.W., Bogen, K.T., Knize, M.G., Hatch, F.T., Johnson, V.M., and Felton, J.S. 1995. Cancer risk of heterocyclic amines in cooked foods: an analysis and implication of research. Carcinogenesis 16: 39-52.

Lee, I.H. and Chou, C.C. 2006. Distribution profiles of isoflavone isomers in black bean kojis prepared with various filamentous fungi. J Agric Food Chem 54: 1309-1314.

Lee, J., Koo, N., and Min, D.B. 2004. Reactive oxygen species, aging, and antioxidative nutraceuticals. Comp Rev Food Sci Food Saf 3: 21-33.

Levin, D.E., Hollstein, M.C., Chrismas, M.F., Schwiers, E.A., and Ames, B.N. 1982. A new Salmonella tester strain (TA102) with A:T base pairs at the site of mutation detects oxidative mutagens. Proc Natl Acad Sci USA 79: 7445-49.

Lichtenstein, A.H., Ausman, L.M., Carrasco, W., Gualtieri, L.J., Jenner, J.L., Ordovas, J.M., et al. 1994. Rice bran oil consumption and plasma lipid levels in moderately hypercholesterolemic humans. Arterioscler Thromb 14: 549-556.

Lijinsky, W. 1999. *N*-Nitroso compounds in the diet. Mutat Res 443(12): 129-138.

Lijinsky, W., and Shubik, P. 1964. Benzo(a)pyrene and other polynuclear hydrocarbons in charcoal-broiled meat. Science 145: 53-55.

Lin, J.-K., Cheng, J.-T., and Lin-Shiau, S.-Y. 1992. Enhancement of the mutagenicity of IQ and MeIQ by nitrite in the Salmonella system. Mutat Res 278: 277-287.

Lin, J.-Y., and Tai, M.-W. 1980. Mutagenicity of Chinese wine treated with nitrite. Food Cosmet Toxicol 18(3): 241-243.

Ling, W.H., Cheng, Q.X., Ma, J., and Wang, T. 2001. Red and black rice decrease atherosclerotic plaque formation and increase antioxidant status in rabbits. J Nutri 131: 1421-1426.

Liu, R.H. 2004. Potential synergy of Phytochemicals in cancer prevention: mechanism of action. J Nutri 134: 3479S-3485S.

Lu, C.L., Liu, Y.D., Zhong, R.G., and Wang, Y.H. 2007. Theoretical studies on the *N*-Nitrosodimethylamine formation from dimethylamine and nitrous acid. Acta Chimic Sin 65: 1568-1572.

Lundberg, J.O., Weitzberg, E., and Gladwin, M.T. 2008. The nitrate–nitrite–nitric oxide pathway in physiology and therapeutics. Nat Rev Drug Discov 7(2): 156–167.

MacPhee, D.G., and Jolly, L.D. 1985. Mutagenesis of anaerobic cultures of *Salmonella typhimurium* by nitrosoguanidine, diethyl sulfate and 9-aminoacridine. Mutat Res 143: 181-186.

Malling, H.V. 1971. Dimethylnitrosamine: formation of mutagenic compounds by interaction with mouse liver microsomes. Mutat Res/Fundam Mole Mech Mutag 13(4): 425-429.

Margolin, B.H., Risko, K.J., Shelby, M.D., and Zeiger, E. 1984. Sources of variability in Ames's *Salmonella typhimurium* tester strains: analysis of the international collaborative study on "Genetic Drift". Mutat Res 30: 11-25.

Markakis, P. 1982. Anthocyanins as Food Colors. New York: Academic press.

Maron, D.M., and Ames, B.N. 1983. Revised methods for the Salmonella mutagenicity test. Mutat Res 113: 173-215.

Maron, D.M., Katzenellenbogen, J., and Ames, B.N. 1981. Compatibility of organic solvents with the Salmonella/microsome test. Mutat Res 88: 343-350.

Marquardt, H., Rufino, F., and Weisburger, J.H. 1977. Mutagen activity of nitrite-treated food; human stomach cancer may be related to dietary factors. Science 196(4293): 1000-1001.

Matsumoto, T., Yoshida, D., and Tomita, H. 1981. Determination of mutagens, amino-α-carbolines in grilled foods and cigarette smoke condensate. Cancer Lett 12: 105-110.

McCann, J., Choi, E., Yamasaki, E., and Ames, B.N. 1975a. Detection of carcinogens in the *Salmonella*/microsome test: Assay of 300 chemicals. Proc Natl Acad Sci USA 72: 5135-5139.

McCann, J., Spingarn, N.E., Kobori, J., and Ames, B.N. 1975b. Detection of carcinogens as mutagens: bacterial tester strains with R factor plasmids. Proc Natl Acad Sci USA 72(3): 979-983.

Mermelstein, R., Kiriazides, D.K., Butler, M., McCoy, E.C., and Rosenkranz, H.S. 1981. The extraordinary mutagenicity of nitropyrenes in bacteria. Mutat Res 89: 187-196.

Milardovic, S., Grabaric, B.S., and Ivekovic, D. 2006. A novel amperometric method for antioxidant activity determination using DPPH free radical. Bioelectrochem 68: 175–180.

Miller, E.C., and Miller, J.A. 1981. Searches for ultimate chemical carcinogens and their reactions with cellular macromolecule. Cancer 47: 2327-2345.

Miller, N.J., Rice-Evans, C., Davies, M.G., Gopinathan, V., and Milner, A. 1993. A novel method for measuring antioxidant capacity and its application to monitoring the antioxidant status in premature neonate. Clin Sci 84: 407-412.

Mirvish, S.S. 1995. Role of *N*-nitroso compound (NOC) and *N*-nitrosation in etiology of gastric, esophageal, nasopharyngeal and bladder cancer and contribution to cancer of know exposures to NOC. Cancer Lett 93: 17-48.

Mortelmans, K., and Cox, M. 1992. Evidence that inhibitor(s) are formed which may interfere with the growth of revertant colonies in the Ames Salmonella and the *E. coli* tryptophan reverse mutation assays when strict anaerobic conditions are used. Envir Mol Mutag 20: 44-52.

Münzner, R., and Wever, J. 1984. Investigations on the detection of mutagenic activity of beef extract in rats after oral administration. Cancer Lett 23(1): 109-114.

Naczk, M., and Shahidi, F. 1989. The effect of methanol-ammonia-water treatment on the content of phenolic acids of canola. Food Chem 31: 159-164.

Nakornriab, M., Sriseadka, T., and Wongpornchai, S. 2008. Quantification of carotenoids and flavonoid components in brans of some Thai black rice cultivars using supercritical fluid extraction and high-performance liquid chromatography-mass spectrometry. J Food Lipid 15(4): 488-503.

Nam, S.H., Choi, S.P., Kang, M.Y., Koh, H.J., Kozukue, N., Friedman, M. 2006. Antioxidative activities of bran extracts from twenty one pigmented rice cultivars. Food Chem 94(4): 613-620.

National Health and Medical Research Council. 2006. Nutrient reference values for Australia and New Zealand. Department of Health and Ageing.

Nicolosi, R.J., Rogers, E.J., Ausman, L.M., and Orthoefer, F.T. 1994. Rice bran oil and its health benefits. In: Marshall, W.E. and Wadsworth, J.I. (Eds), Rice Science Technology, Food Science Technology (59), pp. 421-438.

Nilsson, J., Pillai, D., Önning, G., Persson, C., Nilsson, A., and Akesson, B. 2005. Comparison of the 2,2'-azino-*bis*-3-ethylbenzothiazoline-6-sulphonic acid (ABTS) and ferric reducing antioxidant power (FRAP) methods to asses the total antioxidant capacity in extracts of fruit and vegetables. Mol Nutri Food Res 49: 239-246.

Ochiai, M., Wakabayashi, K., Sugimura, T. and Nagao, M. 1986. Mutagenicities of indole and 30 derivtives after nitrite treatment. Mutat Res 172: 189-197.

Oguri, A., Suda, M., Totsuka, Y., Sugimura, T., and Wakabayashi, K. 1998. Inhibitory effects of antioxidants on formation of heterocyclic amines. Mutat Res 402: 237-245.

Ohgaki, H., Matsukura, N., Morino, K., Kawachi, T., Sugimura, T., Morita, K., et al. 1982. Carcinogenicity in rats of the mutagenic compounds 1-nitropyrene and 3-nitrofluoranthene. Cancer Lett 15: 1-17.

Ohshima, H., Friesen, M., Malaveille, C., Brouet, I., Hautefeuille, A., and Bartsch, H. 1989. Formation of direct acting genotoxic substances in nitrosated smoked fish and meat products: identification of sample phenolic precursors and phenyldiazonium ions as reactive products. Food Chem Toxicol 27: 193-203.

Orthoefer, F.T., and Eastman, J. 2004. Rice bran and oil. In: Champagne, E.T. (Ed.), Rice Chemistry and Technology, pp. 569-593, AACC, St. Paul, Minnesota, U.S.A.

Övervik, E., Kleman, M., Berg, I., and Gustavsson, J.A. 1989. Influence of creatine, amino acids and water on the formation of the mutagenic heterocyclic amines found in cooked meat. Carcinogenesis 10: 2293-2301.

Pais, P., Salmon, C.P., Knize, M.G., and Felton, J.S. 1999. Formation of mutagenic/carcinogenic heterocyclic amines in dry-heated model systems, meats and meat drippings. J Agric Food Chem 47: 1098-1108.

Paking, D.M., Bray, F., Ferlay, J., and Pissani, P. 2005. Global cancer statistics, 2002. CA Cancer J Clin 55: 74-108.

Palli, D. 1996. Epidemiology of gastric cancer. Ann Ist Super Sanita 32: 85-99.

Park, J.K., Kim, S.S., and Kim, K.O. 2001. Effect of milling ratio on sensory properties of cooked rice and on physicochemical properties of milled and cooked rice. Cereal Chem 78: 151-156.

Park, S.-J., Shin, W.-H., Seo, J.-W., and Kim, E.-J. 2007. Anthocyanins inhibit airway inflammation and hyperresponsiveness in a murine asthma model. Food Chem Toxicol 45(8): 1459-1467.

Pedreschi, R., and Cisneros-Zevallos, L. 2006. Antimutagenic and antioxidant properties of phenolic fractions from Andean purple corn (*Zea mays* L.). J Agric Food Chem 54: 4557-67.

Pengket, W. 2005. Effcet of some bean sprout extracts on mutagenicity induced by nitrite treated soy sauce/seasoning sauce in Ames test. Master's Thesis, Department of Nutrition, Faculty of Graduate, Mahidol University.

Pfau, W., and Skog, K. 2004. Exposure to β-carbolines norharman and harman. J Chromatography B 802: 115-126.

Phillips, D.H. 1999. Polycyclic aromatic hydrocarbons in the diet. Mutat Res 443: 139-148.

Piacek-Llanes, B.G., and Tannenbaum, S.R. 1982. Formation of an activated *N*-nitroso compound in nitrite treated fava beans (*Vicia Faba*). Carcinogenesis 3(12): 1379-84.

Piegorsch, W.W., and Zeiger, E. 1991. Measuring intra-assay agreement for the Ames Salmonella assay. In: Hothorn, L. (Ed.), Statistical Methods in Toxicology, Lect Notes Med Informatics, volume 43, pp. 35-41, Springer, Heidelberg.

Pietta, P., Simonetti, P., and Mauri, P. 1998. Antioxidant activity of selected medicinal plants. J Agric Food Chem 46: 4487-4490.

Prior, R.L., and Cao, G. 1999. In vivo total antioxidant capacity: comparison of different analytical methods. Free Radical Biol Med 27(11-12): 1173-1181.

Purchase, I.F.H., Longstaff, E., Ashby, J., Styles, J.A., Anderson, D., Lefevre, P.A., et al. 1978. Westwood, An evaluation of 6 short-term tests for detecting organic chemical carcinogens. Br J Cancer 37: 873-959.

Raat, N.J.H., Shiva, S., and Gladwin, M.T. 2009. Effects of nitrite on modulating ROS generation following ischemia and reperfusion. Adv Drug Delivery Rev 61(4): 339-350.

Rechner, A.R., and Kroner, C. 2005. Anthocyanins and colonic metabolites of dietary polyphenols inhibit platelet function. Thrombosis Res 116(4): 327-334.

Rice-Evans, C., and Miller, N.J. 1994. Total antioxidant status in plasma and body fluids. Methods Enzymol 234: 279–293.

Rosenkranz, H.S., and Mermelstein, R. 1983. Mutagenicity and genotoxity of nitroarenes, all nitro-containing chemicals were not created equal. Mut Res 114: 217-267.

Rukmini, C., and Raghuram, T. C. 1991. Nutritional and biochemical aspects of the hypolipidemic action of rice bran oil: a review. J Am Coll Nutri 10(6): 593-601.

Ryu, S.N., Park, S.Z., and Ho, C.T. 1998. High performance liquid chromatographic determination of anthocyanin pigments in some varieties of black rice. J Food Drug Anal 6: 729-736.

Sasagawa, C. and Matsushima, T. 1989. Mutagenicities of indole derivatives after nitrite treatment. Mutat Res/Envir Mutag Related Subj 252(1): 104.

Sasagawa, C., Muramatsu, M., and Matsushima, T. 1988. Formation of direct mutagens from amino-imidazoleazaarenes by nitrite treatment. Mutat Res 203: 386.

Seetharamaiah, G.S., and Chandrasekhara, N. 1989. Studies on hypocholesterolemic activity of rice bran oil. Atherosclerosis 78(2-3): 219-223.

Serafini, M., Bellocco, R., Wolk, A., and Ekström, A.M. 2002. Total antioxidant potential of fruit and vegetables and risk of gastric cancer. Gastroenterology 123(4): 985-991.

Shanabruch, W.G., and Walker, G.C. 1980. Localization of the plasmid (pKM101) gene(s) involved in recA+lexA+-dependent mutagenesis. Mol Gen Genet 179(2): 289-297.

Sharma, O.P., and Bhat, T.K. 2009. DPPH antioxidant assay revisited. Food Chem 113: 1202-1205.

Singh, S., Dhaliwal, Y.S., Nagi, H.P.S., and Kalia, M. 1998. Quality characteristics of six rice varieties of Himachal Pradesh. J Food Sci Technol Mysore 35: 74-78.

Skog, K. 1993. Cooking procedures and food mutagens: a literature review. Food Chem Toxic 31: 655-675.

Skog, K., and Jägerstad, M. 1991. Effect of glucose on the formation of PhIP in a model system. Carcinogenesis 12: 2297-2300.

Skog, K., and Jägerstad, M. 1993. Incorporation of carbon-atoms from glucose into the food mutagens MeIQx and 4,8-DiMeIQx using ^{14}C-labelled glucose in a model system. Carcinogenesis 14(10): 2027-2031.

Smith, D.W.E. 1966. Mutagenicity of cycasin aglycone (methylazoxymethanol), a naturally occurring carcinogen. Science 152(3726): 1273 – 1274.

Solyakov, A., and Skog, K. 2002. Screening for heterocyclic amines in chicken cooked in various ways. Food Chem Toxicol 40: 1205-1211.

Srianujata, S. 1985. Vitamin C and nitrosamines. Intern Med 1: 249-255.

Stanton, C.A., Chow, F.L., Phillips, D.H., Grover, P.L., Garner, R.C., and Martin, C.N. 1985. Evidence for *N*-(deoxyguanosin-8-yl)-1-aminopyrene as a major

DNA adduct in female rats treated with 1-nitropyrene. Carcinogenesis 6: 535-538.

Stoner, G.D., Morse, M.A., and Kelloff, G.J. 1997. Perspectives in cancer chemoprevention. Envir Health Perspect 105(Suppl 4): 945-954.

Stoner, G.D., Wang, L.S., and Chen, T. 2007. Chemoprevention of esophageal squamous cell carcinoma. Toxicol Appl Pharmacol 224: 337-349.

Sugano, M., and Tsuji, E. 1997. Rice Bran Oil and Cholesterol Metabolism. J Nutri 127(3): 521S-524S.

Sugimura, T., Sato, S., Nagao, M., Yahagi, T., Matsushima, T., Seino, Y., et al. 1976. Overlapping of carcinogens and mutagens. In: Magee, P.N., Takayama, S., Sugimra, T., and Matsushima, T. (Eds.), Fundamental of Cancer Prevention, pp. 191-215, University Park Press.

Swain, T., and Hillis, W.E. 1959. The phenolic constituents of prunus domestica: I. The quantitative analysis of phenolic constituents. J Sci Food Agric 10: 63-68.

T. Deguchi, M. Yoshimoto, R. Ohba and S. Ueda, Antimutagenicity of the purple pigment, hordeumin, from uncooked barley bran-fermented broth. Biosci. Biotechnol. Biochem. 64 2 (2000), pp. 414–416.

Tananuwong, K. and Tewaruth, W. 2010. Extraction and application of antioxidants from black glutinous rice. Food Sci Tech 43(3): 476-481.

Taylor, R.T., Fultz, E., and Knize, M.G. 1985. Mutagen formation in a model beef boiling system III: Purification and identification of three heterocyclic amine mutagens-carcinogens. J Envir Sci Health A20: 135-148.

Tedesco, I., Russo, G.L., Nazzaro, F., Russo, M., and Palumbo, R. 2001. Antioxidant effect of red wine anthocyanins in normal and catalase-inactive human erythrocytes. J Nutr Biochem 12: 505-511.

Teltathum, T., Pongpiachan, P., and Pongpiachan, P. 2004. Effect of gamma oryzanol on immune response in male mice. J Agric 20(2): 103-110.

Tennant, R.W., Margolin, B.H., Shelby, M.D., Zeiger, E., Haseman, J.K., Spalding, J., et al. 1987. Prediction of chemical carcinogenicity in rodents from in vitro genetic toxicity assays. Science 236: 933-941.

Tewaruth, W. 2007. Antioxidant activity of black glutinous rice *Oryza sativa* L. Master's Thesis, Food Technology, Faculty of Science, Chulalongkorn University.

Tiedink, H.G., Davies, J.A., van Broekhoven, L.W., van der Kamp, H.J., and Jongen, W.M. 1988. Formation of mutagenic *N*-nitroso compounds in vegetable extracts upon nitrite treatment: a comparison with the glucosinolate content. Food Chem Toxicol 26(11-12): 947-954.

Tokiwa, H., and Ohnishi, Y. 1986. Mutagenicity and carcinogenicity of nitroarenes and their sources in the environment. CRC Crit Rev Toxicol 17: 23-60.

Tokiwa, H., Nakagawa, R., and Horikawa, K. 1985. Mutagenic/carcinogenic agents in indoor pollutant; the dinitro pyrenes generated by kerosene heaters and fuel gas and liquefied petroleum gas burners. Mutat Res 157(1): 39-47.

Totsuka, Y., Ushiyima, H., Ishihara, J., Sinha, R., Skipper, P.L., and Tannenbaum, S.R. 1999. Quantification of the co-mutagenic β-carbolines, norharman and harman, in cigarette smoke condensate and cooked foods. Cancer Lett 143(2): 139-143.

Toyokuni, S., Itani, T., Morimitsu, Y., Okada, K., Ozeki, M., Kondo, S., et al. 2001. Protective effect of colored rice over white rice on Fenton reaction-based renal lipid peroxidation in rats. Free Radic Res 36: 583-592.

Tsugane, S., and Sasazuki, S. 2007. Diet and the risk of gastric cancer: review of epidemiological evidence. Gastric Cancer 10(2): 75–83.

Turkmen, N., Sari, F., and Velioglu, Y.S. 2005. The effect of cooking methods on total phenolics and antioxidant activity of selected green vegetables. Food Chem 93; 713-718.

Ülgen, K.Ö., Saygılı, B., Önsan, Z.İ., and Kırdar, B. 2002. Bioconversion of starch into ethanol by a recombinant *Saccharomyces cerevisiae* strain YPG-AB. Process Biochem 37(10): 1157-1168.

Valko, M., Leibfritz, D., Moncol, J., Cronin, M.T., Mazur, M., and Telser, J. 2007. Free radicals and antioxidants in normal physiological functions and human disease. Int J Biochem Cell Biol 39: 44-84.

Venitt, S., and Bodworth, D. 1988. The bacterial mutagenicity of synthetic *all-trans* fecapentaene-12 changes when assayed under anaerobic conditions. Mutag 3: 69-173.

Venitt, S., and Bosworth, D. 1983. The development of anaerobic mehods for bacterial mutation assays: aerobic and anaerobic fluctuations tests of human faecal extracts and reference mutagens. Carcinogenesis 4: 339-345.

Venitt, S., and Crofton-Sleigh, C. 1981. Mutagenicity of coded compounds in a bacterial assay using *Escherichia coli* and *Salmonella typhimurium*. In: deSerres, F.J., and Ashby, J. (Eds.), Evaluation of short-term tests for carcinogens, Report of the international collaborative program, Progress in mutation research, volume 1, pp. 351-360, Elsevier, New York.

Wakabayashi, K., Nagao, M., Chung, T.H., Yin, M.-Q., Karai, I., Ochiai, M., et al. 1984. Appearance of direct-acting mutagenicity of various foodstuffs

produced in Japan and Southeast Asia on nitrite treatment. Mutat Res 158: 119-124.

Wakabayashi, K., Nagao, M., Ochiai, M., Tahira, T., Yamaizumi, Z., and Sugimura, T. 1985. A mutagen precursor in Chinese cabbage, indole-3-acetonitrile, which becomes mutagenic on nitrite treatment. Mutat Res 143(1-2): 17-21.

Walker, G.C., and Dobson, P.P. 1979. Mutagenesis and repair deficiencies of Escherichia coli umuC mutants are suppressed by the plasmid pKM101. Mol Gen Genet 172(1): 17-24.

Walker, R. 1990. Nitrates, nitrites and *N*-nitroso compounds: a review of the occurrence in food and diet and the toxicological implications. Food Addit Contam 7(6): 717–768.

Wang, J., and Mazza, G. 2002. Effects of anthocyanins and other phenolic compounds on the production of tumor necrosis factor alpha in LPS/IFN-gamma-activated RAW 264.7 macrophages. J Agr Food Chem 50: 4183-9.

Wang, L.S., and Stoner, G.D. 2008. Anthocyanins and their role in cancer prevention. Cancer Letters 269: 281-290.

Wang, S.Y, and Jiao, H. 2000. Scavenging capacity of berry crops on superoxide radicals, hydrogen peroxide, hydroxyl radicals, and singlet oxygen. J Agric Food Chem 48(11): 5677-5684.

Wang, Y.-J., Sheen, L.-Y., and Chou, C.-C. 2010. Storage effects on the content of anthocyanin, mutagenicity and antimutagenicity of black soybean koji. LWT - Food Sci Technol 43(4): 702-707.

WCRF and AICR. 2007. Food, nutrition, physical activity and the prevention of cancer: a global perspective. Washington, DC: AICR.

Weisburger, J.H., and Jones, R.C. 1990. Prevention of formation of important mutagens/carcinogens in the human food chain. In: Kuroda, Y., Shankel, D.M., and Waters, M.D. (Eds.), Antimutagenesis and anticarcinogenesis Mechanisms II, pp. 105–118, New York, Plenum Press.

Whitfield, H.J., Robert, Jr., Martin, G., and Ames, B.N. 1966. Classification of aminotransferase (C gene) mutants in the histidine operon. J Mol Biol 21(2): 335-346.

Wikipedia. 2009. Nitrosation [Online]. Available from: http://en.wikipedia.org/wiki/Nitrosation[2010, Jan 8]

Wilson, T.A., Nicolosi, R.J., Woolfrey, B., and Kritchevsky, D. 2007. Rice bran oil and oryzanol reduce plasma lipid and lipoprotein cholesterol concentrations and aortic cholesterol ester accumulation to a greater extent than ferulic acid in hypercholesterolemic hamsters. J Nutril Biochem 18(2): 105-112.

Xu, G.P., and Reed, P.I. 1993. *N*-Nitroso compounds in fresh gastric juice and their relation to intragastric pH and nitrite employing an improved analytical method. Carcinogenesis 14(12): 2547-2551.

Yahagi, T., Degawa, M., Seino, Y., Matsushima, T., and Nagao, M. 1975. Mutagenicity of carcinogenic azo dyes and their derivatives. Cancer Lett 1: 91-96.

Yamaguchi, K., Shudo, K., Okamoto, T., Sugimura, T., and Kosuge, T. 1980a. Presence of 2-aminodipyrido1,2-a:3',2'-dimidazole in broiled cuttlefish. Gann 71: 743-744.

Yamaguchi, K., Shudo, K., Okamoto, T., Sugimura, T., and Kosuge, T. 1980b. Presence of 3-amino-1,4-dimethyl-5*H*-pyrido4,3-bindole in broiled beef. Gann 71: 745-746.

Yamaizumi, Z., Shiomi, T., Kasai, H., Nishimura, S., Takahashi, Y., Nagao, M., and Sugimura, T. 1980. Detection of potent mutagens, Trp-P-1 and Trp-P-2, in broiled fish. Cancer Lett 9: 75-83.

Yang, C.S., Landau, J.M., Huang, M.T., and Newmark, H.L. 2001. Inhibition of carcinogenesis by dietary polyphenolic compounds. Annu Rev Nutr 21: 381-406.

Yang, D.S., LEE, K.-S., JEONG, O-Y., KIM, K.-J. and Kays, S.J. 2008. Characterization of volatile aroma compounds in cooked black rice. J Agric Food Chem 56: 235–240.

Yano, M., Wakabayashi, K., Tahira, T., Arakawa, N., Nagao, M., and Sugimura, T. 1988. Presence of nitrosable mutagen precursors in cooked meat and fish. Mutat Res/Fundam Mol Mech Mutag 202(1): 119-123.

Yen, G.C., and Chau, C.F. 1993. Inhibition by xylose-lysine maillard reaction products of the formation of MeIQx in a heated creatinine, glycine, and glucose model system. Biosci Biotech Biochem 57: 664-665.

Yen, G.C., and Hsieh, P.P. 1994. Possible mechanisms of antimutagenic effect of maillard reaction products prepared from xylose and lysine. J Agric Food Chem 42: 133-137.

Yen, G.C., and Lii, J.D. 1992. Influence of the reaction conditions on the antimutagenic affect of maillard reaction product derived from xylose and lysine. J Agric Food Chem 40: 1034-1037.

Yen, G.C., Tsai, L.C., and Lii, J.D. 1992. Antimutagenic effect of maillard browning products obtained from amino acids and sugars. Food Chem Toxicol 30: 127-132.

Yokoyama, W. 2004. Nutritional properties of rice and rice bran. In: Champagne, E.T. (Ed.), Rice Chemistry and Technology, pp. 595-609, AACC, St. Paul, Minnesota, U.S.A.

Yoshida, D., Matsumoto, T., Yoshimura, T., and Matsuzaki, T. 1978. Mutagenicity of amino-α-carbolines in pyrolysis products of soybean globulin. Biochemiophysical Res Commun 83: 915-920.

Yoshimoto, M., Okuno, S., Yamaguchi, M., and Yamakawa, O. 2001. Antimutagenicity of deacylated anthocyanins in purple fleshed sweet potato. Biosci Biotechnol Biochem 65: 1652-5.

You, W.C., Zhang, L., Yang, C.S., Chang, Y.S., Issaq, H., Fox, S.D., et al. 1996. Nitrite, *N*-nitroso compounds and other analytes in physiological fluids in relation to precancerous gastric lesion. Cancer Epidemiol Biomarkers Prev 5(1): 47-52.

Youngsuk, L. 2008. Gamma Oryzanol and Tocopheral in some recommended and local rice varieties. Research annual conference 2008: Northeastern Region Rice Research Center Group 138-148.

Zeiger, E. 1985. The *Salmonella* mutagenicity assay foridentification of presumptive carcinogens. In: Milman, H.A., and Weisburger, E.K. (Eds.), Handbook of Carcinogen Testing, pp. 83-99, Noyes Publishers.

Zeiger, E. 1997. Genotoxicity data base. In: Gold, L.S., and Zeiger, E. (Eds), Handbook of Carcinogenic Potency and Genotoxicity Databases, pp. 687-729, CRC Press, Boca Raton, FL.

Zeiger, E., Anderson, B., Haworth, S., Lawlor, T., Mortelmans, K., Spck, W. 1987. Salmonella mutagenicity tests: III. Results from the testing of 255 chemicals. Envir Mlecular Mutag 9(Suppl. 9): 1-110.

Zeiger, E., Anderson, B., Haworth, S., Lawlor, T., Mortelmans, K. 1988. Salmonella mutagenicity tests: IV. Results from the testing of 300 chemicals. Envir Mol Mutag 11(Suppl. 12): 1-157.

Zeiger, E., Anderson, B., Haworth, S., Lawlor, T., Mortelmans, K. 1992. Salmonella mutagenicity tests: IV. Results from the testing of 311 chemicals. Envir Molecular Mutag 19(Suppl. 21): 1-141.

Zeiger, E., Haseman, J.K., Shelby, M.D., Margolin, B.H. and Tennant, R.W. 1990. Evaluation of four in vitro genetic toxicity tests for predicting rodent carcinogenicity: conformation of earlier results with 41 additional chemicals. Envir Mol Mutag 16: 1-14.

Zhang, H.Y., and Chen, D.Z. 2000. Theoretical elucidation on activity differences of ten flavonoid antioxidants. Acta Biochim Biophys Sin 32(4): 317-321.

Zhang, H.Y., and Wang, L.F. 2004. Theoretical elucidation of structure-activity relationship for coumarins to scavenge peroxyl radical. J Mol Struct 673: 199-202.

Zhang, M.W., Guo, B.J., and Peng, Z.M. 2004. Genetic effects on Fe, Zn, Mn and P contents in Indica black pericarp rice and their genetic correlations with grain characteristics. Euphytica 135: 315–323.

Zhang, M.-W., Guo, B.-J., Zhang, R.-F., Chi, J.-W., Wei, Z.-C., Xu, Z.-H., et al. 2006. Separation, purification and identification of antioxidant compositions in black rice. Agric Sci China 5(6): 431-440.

Zimmermann, F.K. 1977. Genetic effects of nitrous acid. Mutat Res 39: 127-148.

APPENDICES

APPENDIX A

MANIPULATION OF THE TESTER STRAINS

1. Preparation of Stock Solutions and Media (Maron and Ames, 1983)

1.1 Vogel-Bonner Medium E Stock Salt Solution (VB salts)

Use: Minutesimal gar

Ingredient	Per liter
Warm distilled water (45 °C)	670 ml
Magnesium sulfate ($MgSO_4.7H_2O$)	10 g
Citric acid monohydrate	100 g
Potassium phosphate, dibasic (anhydrous) (K_2HPO_4)	500 g
Sodium ammonium phosphate ($NaNH_4HPO_4.4H_2O$)	175 g

Add salts in the order indicated to warm water in a 2-liter beaker placed on a magnetic stirring hot plate. Allow each salt to dissolve completely before adding the next. Adjust the volume to 1 liter and filter the solutions into the glass bottles with screw caps and then autoclave at 121°C for 20 minutes.

1.2 Minimal Glucose Agar Plate

Use: Mutagenicity assay

Ingredient	300 ml
Bacto agar	4.5 g
Distilled water	279 ml
VB salts	6 ml
40% glucose	15 ml

Agar was added to distilled water in a glass bottle and then autoclaved at 121°C for 20 minutes. When the solution has cooled slightly, sterile VB salts and sterile 40% glucose were added, stirred throughtly and poured 30 ml into each sterile petri dish. Minimal glucose agar plates were kept in an incubator at 37°C for 48 hours before using.

1.3 Oxoid Nutrient Broth No. 2

Use: Growing culture

Ingredient	100 ml
Nutrient broth No. 2	2.5 g
Distilled water	100 ml

2.5 g of nutrient broth No.2 was dissolved in 100 ml distilled water. Mixed it until dissolve completely and 12 ml of nutrient broth was transferred into each 50 ml Erlenmeyer flask (covered with sterile gauze). They were autoclave at 121°C for 20 minutes.

1.4 0.1 M L-Histidine HCl Stock

Use: Preparation of 1 mM L-histidine HCl stock

Ingredient	100 ml
L-histidine HCl	2.096 g
Distilled water	100 ml

Dissolve L-histidine HCl (MW 209.63) in distilled water and then autoclave at 121°C for 20 minutes. The solution was stored in a glass bottle at 4°C until use.

1.5 1 mM L-Histidine HCl Stock

Use: Preparation of 0.5 mM L-histidine/biotin solution

Ingredient	100 ml
0.1 M L-histidine HCl	1 ml
Distilled water	99 ml

Dilute 1 ml of 0.1 M L-histidine HCl in 99 ml of distilled water and then autoclave at 121°C for 20 minutes.

1.6 1 mM Biotin Stock

Use: Preparation of 0.5 mM L-histidine/biotin solution

Ingredient	100 ml
Biotin	24.43 mg
Distilled water	100 ml

Dissolve biotin (MW 244.3) in distilled water. Warm it until dissolve completely and then autoclave at 121°C for 20 minutes.

1.7 0.5 mM L-Histidine/Biotin Solution

Use: Mutagenicity assay (add in to Top agar)

Ingredient	200 ml
1 mM L-histidine HCl	100 ml
1 mM Biotin	100 ml

Mix all ingredients and autoclave at 121°C for 20 minutes.

1.8 Top Agar

Use: Mutagenicity assay

Ingredient	100 ml
Bacto-agar	0.6 g
Sodium chloride	0.5 g
Distilled water	100 ml

Dissolve ingredients in distilled water. Store the solution in a glass bottle and autoclave at 121°C for 20 minutes and then add 10 ml of 0.5 mM L-histidine/biotin solution.

1.9 1 M Potassium Chloride (KCl)

Use: Preparation of Na_3PO_4-KCl buffer

Ingredient	per liter
Potassium chloride (KCl)	74.56 g
Distilled water	1000 ml

Dissolve potassium chloride in distilled water and autoclave at 121°C for 20 minutes.

1.10 0.5 M Sodium Dihydrogen Phosphate (NaH_2PO_4)

Use: Preparation of 0.5 M sodium phosphate pH 7.4

Ingredient	500 ml
Sodium dihydrogen phosphate (NaH_2PO_4)	30 g
Distilled water to	500 ml

Dissolve sodium dihydrogen phosphate (MW 120) in distilled water. Stir it until dissolve completely and adjust the final volume to be 500 ml.

1.11 0.5 M Sodium Phosphate (Na_3PO_4) pH 7.4

Use: Preparation of Na_3PO_4-KCl buffer

Ingredient	500 ml
Disodium hydrogen phosphate dihydrate ($Na_2HPO_4 \cdot 2H_2O$)	44.5 g
Distilled water to	500 ml

Dissolve disodium hydrogen phosphate dihydrate in distilled water. Add NaH_2PO_4 until to pH 7.4 and adjust the final volume to be 500 ml. Autoclave at 121°C for 20 minutes.

1.12 Na_3PO_4-KCl Buffer

Use: Mutagenicity assay

Ingredient	330 ml
0.5 M Na_3PO_4 pH 7.4	100 ml
1 M KCl	16.5 ml
Distilled water	213.5 ml

All ingredients were mixed and autoclave at 121°C for 20 minutes.

2. Preparation of Some Reagents

2.1 2 M Sodium Nitrite

Use: Mutagenicity assay (Nitrosation)

Ingredient	10 ml
Sodium nitrite	1.38 g
Distilled water to	10 ml

Dissolve sodium nitrite in distilled water and adjust the final volume to be 10 ml. Store in a glass bottle with a screw cap (wrap the bottle with metal foil to protect from light) and autoclave at 121°C for 20 minutes.

2.2 2 M Ammonium Sulfamate

Use: Mutagenicity assay (Reaction mixture)

Ingredient	10 ml
Ammonium sulfamate	2.28 g
Distilled water to	10 ml

Dissolve ammonium sulfamate in distilled water and adjust the final volume to be 10 ml. Store in a glass bottle with a screw cap and autoclave at 121°C for 20 minutes.

2.3 0.2 N Hydrochloric Acid

Use: Mutagenicity assay (Reaction mixture)

Ingredient	100 ml
Conc. hydrochloric acid	1.66 ml
Sterile distilled water	98.34 ml

Dissolve conc. hydrochloric acid in sterile distilled water and store in sterile glass bottle with screw cap. (Use sterile technique and hydrochloric acid cannot be autoclaved)

2.4 0.075 mg/ml 1-Aminopyrene

Use: Standard solution for mutagenicity assay

Ingredient	2 ml
0.3 mg/ml 1-aminopyrene	500 µl
Acetronitrile	1,500 µl

Dissolve 3 mg of 1-aminopyrene in 300 µl of acetronitrile and mix (3 mg/ml 1-aminopyrene). Subsequently dilute this 300 µl solution in 2,700 µl of acetronitrile (0.3 mg/ml 1-aminopyrene). Then dilute 500 µl of 0.3 mg/ml 1-aminopyrene in 1,500 µl of acetronitrile. Store the solution in sterile glass vial with screw cap in a freezer. (Use sterile technique)

2.5 8 mg/ml Ampicillin Solution

Use: Test of ampicillin resistance (to confirm R-factor strains)

Ingredient	10 ml
Ampicillin (sodium)	80 mg
Distilled water	10 ml

Ampicillin was dissolved into water and stored in glass bottle with screw cap at 4°C. (Use sterile technique)

2.6 0.1% Crystal Violet

Use: Test for crystal violet sensitivity (to confirm *rfa* mutation)

Ingredient	10 ml
Crystal violet	10 mg
Distilled water	10 ml

Crystal violet was dissolved into water and stored in glass bottle with screw cap at 4°C (wrap the bottle with metal foil to protect from light).

3. Procedure for Re-isolation and Growing Culture (Maron and Ames, 1983)

Tester strains, TA 98 and TA 100 were grown in Oxoid nutrient broth No. 2 and incubated overnight in a 37°C in shaking water bath. The growth period should not exceed 16 hours. These cultures were re-isolated by streaking the bacteria on minimal glucose agar plates which the surface were spreaded with 0.1 ml of 8 mg/ml ampicillin, 0.3 ml of 0.1 M histidine HCl and 0.1 ml of 1 mM biotin. These plates were incubated at 37°C for 48 hours. After incubation, the 4 single colonies per strain of TA98 and TA100 were picked up using sterile wire loop and grown in Oxoid nutrient broth No. 2 and shaken overnight at 37°C in shaking water bath. Each culture was confirmed genotypes of the strains and kept the cultures as the source of bacteria for mutagenicity testing. For each 1 ml of culture, 0.09 ml of spectrophotometric grade DMSO was added. Combine the culture and DMSO in a sterile tube and distribute 200 µl of the culture aseptically into sterile cryotube. Store the tubes in a freezer at -80°C.

4. Confirming Genotype of Tester Strains

Broth cultures of TA98 and TA100 were used to confirm genotypes in the following ways.

4.1 Histidine requirement

The his$^-$ character of the strains was confirmed by demonstrating the histidine requirement for growth on the minimal glucose agar plates enriched with histidine and biotin.

Procedure:	plate a	no histidine and biotin
	plate b	0.1 ml of 1mM biotin
	plate c	0.3 ml of 0.1 M his-HCl
	plate d	0.3 ml of 0.1 M his-HCl + 0.1 ml of 1mM biotin

Four minimal glucose agar plates were required for each tester strains and applied on the surface with 0.1 ml of 1mM biotin, 0.3 ml of 0.1 M his-HCl, 0.3 ml of 0.1 M his-HCl plus 0.1 ml of 1mM biotin and no application (plate b, c, d, a respectively). A single streak of each strain was made across these plates. Four strains could be tested on the same plate. The plates were incubated at 37°C for 48 hours. The growing of bacteria on histidine plus biotin plate (plate d) was the result of histidine requirement.

4.2 R-Factor

The R-factor strains (TA97, TA98, TA100 and TA102) should be tested routinely for the presence of the ampicillin resistance factor because the plasmid is somewhat unstable and can be lost from the bacteria.

Procedure: For each tester strain (TA98 and TA100), 0.3 ml of fresh overnight culture was added to a tube containing 0.1 ml of 0.1 M histidine-HCl, and then 2 ml of molten top agar containing 0.5 mM histidine-HCl and 0.5 mM biotin were added, mixed and poured on a minimal agar plate. The plate was rotated in order to distribute the mixtures and allowed several minutes for agar to become firm. R-factor and *rfa* mutation (see the next section) are performed in the same plate by dividing the plate into 2 parts, one for R-factor and the other for *rfa* mutation. For R-factor, filter paper disc (1/4 inch) containing 8 mg/ml ampicillin was placed on the surface of the agar by using sterile forceps. The disc was pressed lightly to embed in the overlay. The plates were incubated at 37°C for 24 hours. The absence of the clear zones of inhibition around the disc was indicated resistance to ampicillin.

4.3 *rfa* mutation

Strains having the deep rough (*rfa*) character should be tested for crystal violet sensitivity.

Procedure: 0.1µl of 0.1% crystal violet solution was pipetted to the sterile filter paper disc (1/4 inch) and transferred the disc to the seeded plates (the procedure was similar to R-factor). The plates were incubated at 37°C for 48 hours. The clear zone appeared around the disc indicated the presence of the *rfa* mutation (crystal violet transferred into the cell and kill bacteria).

5. Spontaneous Reversion

Spontaneous reversion of the tester strains to histidine independence is measured routinely in mutagenicity experiments and is expressed as the number of spontaneous revertants per plate. The revertant colonies are clearly visible in a uniform background lawn of auxotrophic bacteria. Each tester strain reverts spontaneously at a frequency that is characteristic of the strain. Nevertheless, there is variability in the number of spontaneous revertants from one experiment to another and from one plate to another, and it is advisable to include at least 2-3 spontaneous mutation control plates for each strain in a mutagenicity assay.

Procedure: 0.1 ml of DMSO was added to capped culture tube, then 0.5 ml of Na_3PO_4-KCl buffer pH 7.4 and 0.1 ml of fresh overnight culture of TA98 or TA100 was added. The mixture was incubated in shaking water bath at 37°C for 20 minutes. After that 2.0 ml of molten top agar was added to the mixture, mixed and then poured on the minimal glucose agar plate. Plates were rotated and left it to become harden and incubated at 37°C for 48 hours. The his+ revertants colonies that grown on the minimal glucose agar plate were counted.

6. The Response to Standard Mutagen

Standard mutagens or positive mutagens are used routinely in mutagenicity experiments to confirm the reversion property and specificity of each strain. The standard mutagen, which used in this experiment, was nitrosated-aminopyrene. Tester strains that highly response to positive mutagens will be chosen.

Procedure: 0.01 and 0.02 ml of 0.0375 mg/ml aminopyrene in acetonitrile were pipetted to sterile capped tube. Then, 0.55 ml of 0.2 N HCl were added respectively, and followed by 0.25 ml of 2 M $NaNO_2$. The final concentration of aminopyrene was 0.6 and 1.2 mg respectively, and the final concentration of nitrite was 0.5 M. The solution was mixed and shaked in water bath at 37°C for 4 hours. The tube was placed in an ice bath and 0.25 ml of 2 M ammonium sulfamate ($NH_4SO_3NH_4$) was added and standard for 10 minutes in ice bath. 0.1 ml of each mixture was pipetted to capped culture tube for testing the stock culture TA98 and TA100, equal to 0.06 and 0.12 mg of aminopyrene/plate, respectively). Then, the evaluation of their mutagenicity was tested as described in spontaneous reversion.

The characteristic properties of the stock culture for TA98 and TA100 as the source of bacteria for mutagenic testing are contain R-factor (pKM 101) and *rfa* mutation, his+ requirement, low spontaneous reversion and highly response to standard carcinogen. The experiment was performed only when the characteristic properties of bacterial strain were done.

APPENDIX B
ANTIOXIDANT ASSAY

1. Preparation of the reagents for antioxidant assay

1.1 DPPH Reagent:

Chemicals

1. 150 µl DPPH$^{\bullet}$ (2,2'-Diphenyl-1-Picrylhydrazyl) in 80% Methanol
2. 1.28 mM Trolox in 80% Methanol

Standad Trolox was run in triplicate using several concentrations (1.28, 0.64, 0.32, 0.16 and 0.08 mM).

1.2 FRAP Reagent:

Chemicals

1. 300 mM Acetate buffer (pH 3.6)

   3.1 g of sodium acetate trihydrate ($C_2H_3NaO_2 \cdot 3H_2O$) plus 16 ml of glacial acetic acid and made up to 1 liter with distilled water.
2. 10 mM TPTZ (2,4,6-tripyridyl-s-triazine) solution in 40 mM HCl
3. 20 mM $FeCl_3 \cdot 6\ H_2O$
4. 1,000 µM $FeSO_4 \cdot 7\ H_2O$

Mixing the reagent from 1-3 before use (300 mM acetate buffer: 10 mM TPTZ: 20 mM $FeCl_3 \cdot 6\ H_2O$; ratio 10:1:1) and heated to 37°C. Standard $FeSO_4 \cdot 7\ H_2O$ was run in triplicate using several concentrations (1000, 500, 250, 125 and 62.5 µM).

1.3 Phenolic Reagent:

Chemicals

1. Folin-Ciocalteu reagent
2. Saturated sodium carbonate solution
3. 800 mg/l gallic acid

Standard gallic acid was run in triplicate using several concentrations (800, 400, 200, 100, 50, 25 and 12.5 mg/l).

APPENDIX C
RESULTS OF ANTIOXIDANT ASSAY AND MUTAGENICITY ASSAYS

1. The standard curves of antioxidant assays

1.1 2,2′-Diphenyl-1-Picrylhydrazyl (DPPH) Assay

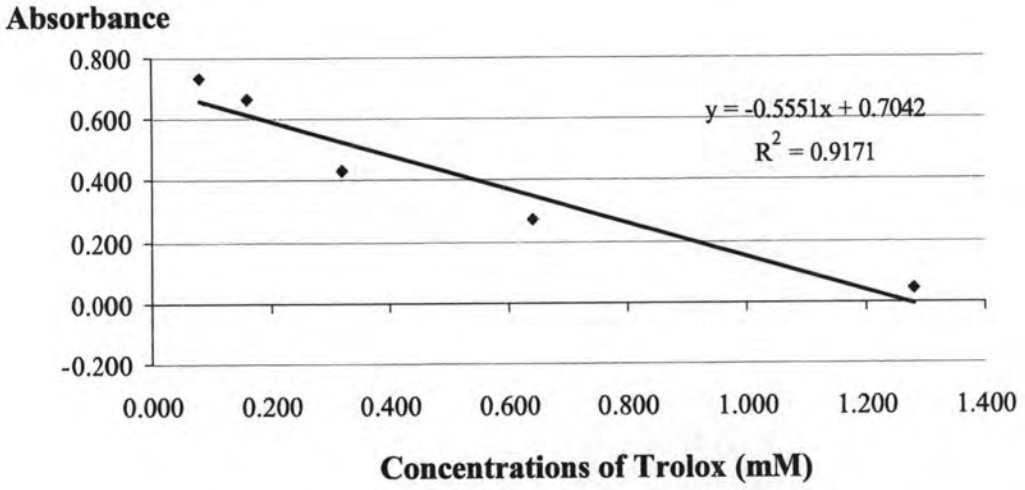

Figure C-1 Standard curves of Trolox

1.2 Ferric Reducing Antioxidant Power (FRAP) Assay

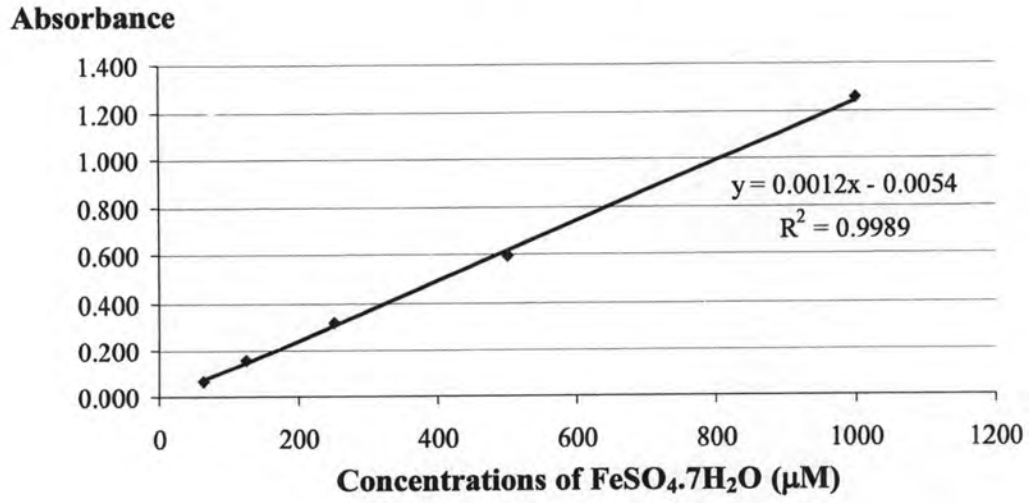

Figure C-2 Standard curves of $FeSO_4.7H_2O$

1.3 Determination of Total Phenolic Contents

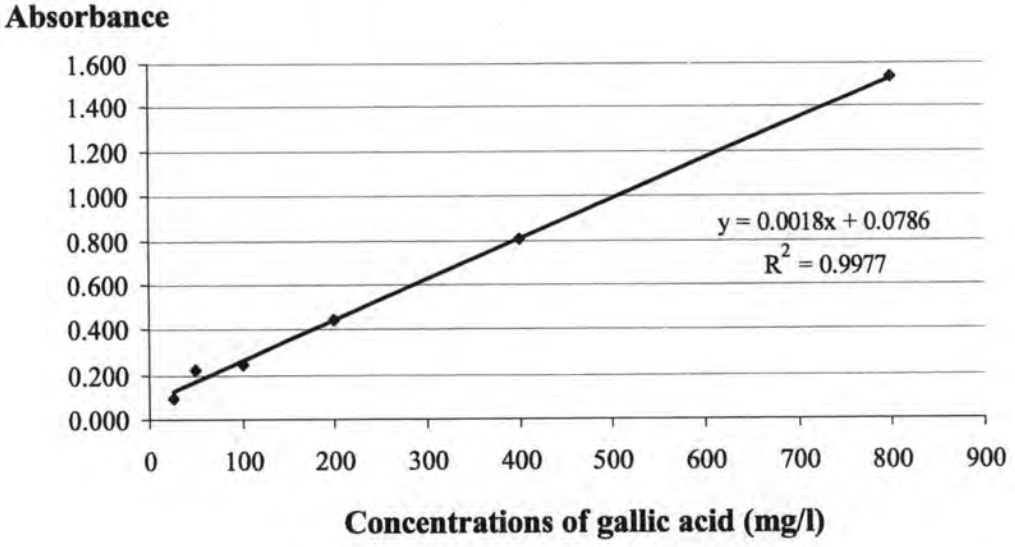

Figure C-3 Standard curves of gallic acid

2. The results of antioxidant assays

Table C-1 Antioxidant activity and total phenolic contents of each sample and extraction yield

Sample	DPPH assay		FRAP [b] value	Total polyphenol content (GAE) [c]	%Yield (dry weight)
	TEAC[a]	% Scavenging			
Hom Nil rice					
Raw	1.189	95.03	5214.44	272.07	0.8
Cooked	1.173	93.99	2744.36	235.42	0.6
Fermented	0.117	24.26	360.87	38.56	27.3
Black glutinous rice					
Raw	1.245	98.41	6797.89	458.37	1.7
Cooked	1.236	98.19	6352.16	452.75	0.6
Fermented	1.032	84.71	1461.40	65.21	12.75

All values are the means of three measurements.

[a]TEAC (Trolox equivalent antioxidant capacity) in mg/g dry weight of sample.

[b]FRAP assay = The FRAP values of the extracts were expressed as mg of ferrous iron (Fe (II))/g dry weight of sample.

[c]GAE (The gallic acid equivalent) in mg/g dry weight (DW) of sample.

3. The results of mutagenicity assays

Table C-2 Mutagenicity of chicken extract without and with sodium nitrite treatment in acid condition (pH 3.0-3.5) on *Salmonella typhimurium* TA98 and TA100

Salmonella typhimurium strains	Amount (mg/plate)	No. revertants/plate[a]		Mutagenicity Index[b] (MI)	
		Without sodium nitrite	With sodium nitrite	Without sodium nitrite	With sodium nitrite
TA98	0[c]	24 ± 4	-	1.00	-
	3.6	21 ± 2	75 ± 12	0.84	**3.10**
	5.4	16 ± 3	107 ± 9	0.64	**4.38**
	7.2	21 ± 3	139 ± 5	0.84	**5.71**
TA100	0[c]	105 ± 3	-	1.00	-
	3.6	112 ± 20	337 ± 25	1.06	**3.20**
	5.4	132 ± 21	432 ± 36	1.25	**4.10**
	7.2	141 ± 51	706 ± 102	1.34	**6.70**

10 μ and 20 μl of 1-aminopyrene (0.075 mg/ml) interacted with excess amount of sodium nitrite induced 2103 ± 95 and 884 ± 64 revertants/plate for TA98 and TA100 respectively.

[a] Data are expressed as mean ± SD of triplicate plates from two independent experiments (N=6)

[b] Mutagenicity Index (MI) is calculated from the average value of a number of histidine revertants/plate of the chicken extract divided by that of spontaneous revertants. Bold number indicates the positive result.

[c] Spontaneous revertants.

Table C-3 Mutagenicity of rice extracts without and with sodium nitrite treatment in acid condition (pH 3.0-3.5) on *S. typhimurium* TA98

Rice extract	Amount[a] (mg/plate)	No. of revertants/plate[b] Without sodium nitrite	With sodium nitrite	Mutagenicity Index[c] Without sodium nitrite	With sodium nitrite
Hom Nil rice					
Raw	0[d]	16 ± 2	-	1.00	-
	0.8	15 ± 4	144 ± 22	0.92	**8.98**
	1.2	17 ± 2	160 ± 16	1.05	**10.01**
	1.6	14 ± 4	162 ± 26	0.86	**10.10**
Cooked	0[d]	23 ± 1	-	1.00	-
	0.8	35 ± 10	165 ± 23	1.50	**7.17**
	1.2	32 ± 4	187 ± 41	1.38	**8.13**
	1.6	36 ± 11	209 ± 39	1.54	**9.07**
Fermented	0[d]	22 ± 1	-	1.00	-
	0.8	23 ± 5	35 ± 7	1.05	1.61
	1.2	24 ± 6	41 ± 35	1.08	1.85
	1.6	24 ± 7	43 ± 9	1.08	1.96
Black glutinous rice					
Raw	0[d]	15 ± 4	-	1.00	-
	0.8	14 ± 2	87 ± 21	0.89	**5.67**
	1.2	15 ± 4	113 ± 18	0.98	**7.38**
	1.6	20 ± 4	116 ± 13	1.32	**7.58**
Cooked	0[d]	19 ± 1	-	1.00	-
	0.8	19 ± 5	64 ± 3	1.02	**3.40**
	1.2	18 ± 5	123 ± 20	0.98	**6.88**
	1.6	18 ± 4	135 ± 16	0.95	**7.23**
Fermented	0[d]	15 ± 1	-	1.00	-
	0.8	16 ± 3	30 ± 4	1.06	1.97
	1.2	16 ± 2	47 ± 5	1.09	**3.10**
	1.6	15 ± 4	50 ± 9	1.01	**3.33**

10 μ of 1-aminopyrene (0.075 mg/ml) interacted with excess amount of sodium nitrite induced 2103±95 revertants/plate for TA98.

[a] Amount per plate of rice extracts.

[b] Data are expressed as mean ± SD of triplicate plates from two independent experiments (N=6).

[c] Mutagenicity Index (MI) is calculated from the average value of a number of histidine revertants/plate of the rice extracts divided by that of spontaneous revertants. Bold number indicates the positive result.

[d] Spontaneous revertants.

Table C-4 Mutagenicity of rice extracts without and with sodium nitrite treatment in acid condition (pH 3.0-3.5) on *S. typhimurium* TA100

Rice extract	Amount[a] (mg/plate)	No. of revertants/plate[b] Without sodium nitrite	With sodium nitrite	Mutagenicity Index[c] Without sodium nitrite	With sodium nitrite
Hom Nil rice					
Raw	0[d]	117 ± 8	-	1.00	-
	0.8	122 ± 12	684 ± 94	1.05	**5.86**
	1.2	120 ± 7	700 ± 73	1.03	**6.00**
	1.6	120 ± 16	793 ± 93	1.03	**6.33**
Cooked	0[d]	144 ± 9	-	1.00	-
	0.8	139 ± 11	819 ± 172	0.96	**5.70**
	1.2	134 ± 12	824 ± 123	0.93	**5.73**
	1.6	130 ± 15	827 ± 126	0.91	**5.76**
Fermented	0[d]	119 ± 15	-	1.00	-
	0.8	109 ± 24	149 ± 14	0.92	1.25
	1.2	101 ± 17	172 ± 34	0.85	1.44
	1.6	120 ± 24	200 ± 42	1.10	1.68
Black glutinous rice					
Raw	0[d]	123 ± 11	-	1.00	-
	0.8	111 ± 18	356 ± 70	0.90	**2.89**
	1.2	128 ± 17	414 ± 39	1.04	**3.37**
	1.6	133 ± 32	447 ± 29	1.08	**3.63**
Cooked	0[d]	127 ± 16	-	1.00	-
	0.8	120 ± 26	379 ± 29	0.95	**2.99**
	1.2	131 ± 14	541 ± 44	1.03	**4.27**
	1.6	123 ± 16	568 ± 77	0.97	**4.49**
Fermented	0[d]	120 ± 6	-	1.00	-
	0.8	109 ± 12	205 ± 14	0.91	1.70
	1.2	110 ± 17	241 ± 19	0.91	**2.00**
	1.6	116 ± 20	299 ± 30	0.96	**2.48**

20 µl of 1-aminopyrene (0.075 mg/ml) interacted with excess amount of sodium nitrite induced 872±14 revertants/plate for TA100.

[a] Amount per plate of rice extracts.

[b] Data are expressed as mean ± SD of triplicate plates from two independent experiments (N=6).

[c] Mutagenicity Index (MI) is calculated from the average value of a number of histidine revertants/plate of the rice extracts divided by that of spontaneous revertants. Bold number indicates the positive result.

[d] Spontaneous revertants.

Table C-5 Antimutagenicity of rice extracts against sodium nitrite treated chicken extract on *S. typhimurium* TA98 and TA100

Rice extract		TA98				TA100			
Name	Amount[a] (mg/plate)	No. of revertants/plate[b]			%Inhibition[c]	No. of revertants/plate[b]			%Inhibition[c]
Hom Nil rice									
Raw	Spontaneous[d]	15	±	1	-	112	±	11	-
	0[e]	144	±	9	-	609	±	45	-
	0.8	128	±	19	+12.72	634	±	36	-5.16
	1.2	133	±	20	+8.52	627	±	55	-3.64
	1.6	137	±	12	+5.47	621	±	47	-2.55
Cooked	Spontaneous	36	±	1	-	110	±	7	-
	0	174	±	3	-	938	±	14	-
	0.8	174	±	22	-0.12	795	±	72	+17.30
	1.2	191	±	7	-12.35	725	±	82	+25.71
	1.6	193	±	16	-13.92	716	±	67	+26.84
Fermented	Spontaneous	21	±	5	-	112	±	1	-
	0[e]	173	±	7	-	891	±	63	-
	0.8	134	±	26	+25.55	804	±	158	+11.24
	1.2	139	±	33	+22.37	788	±	157	+13.25
	1.6	154	±	20	+12.50	699	±	198	+24.71

Table C-5 Antimutagenicity of rice extracts against sodium nitrite treated chicken extract on *S. typhimurium* TA98 and TA100 (continued)

Rice extract		TA98		TA100	
Name	Amount[a] (mg/plate)	No. of revertants/plate[b]	%Inhibition[c]	No. of revertants/plate[b]	%Inhibition[c]
Black glutinous rice					
Raw	Spontaneous[d]	15 ± 5	-	157 ± 18	-
	0[e]	141 ± 15	-	655 ± 10	-
	0.8	138 ± 24	+2.77	507 ± 74	+29.75
	1.2	132 ± 9	+7.78	448 ± 69	+41.51
	1.6	129 ± 15	+9.50	435 ± 46	+44.18
Cooked	Spontaneous	18 ± 3	-	111 ± 12	-
	0	141 ± 9	-	703 ± 37	-
	0.8	140 ± 10	+0.14	674 ± 46	+4.90
	1.2	135 ± 13	+5.04	655 ± 98	+8.16
	1.6	134 ± 17	+5.72	652 ± 47	+8.56
Fermented	Spontaneous	18 ± 3	-	140 ± 17	-
	0[e]	145 ± 5	-	703 ± 41	-
	0.8	110 ± 16	+27.69	447 ± 45	+45.15
	1.2	96 ± 19	+39.24	444 ± 25	+45.65
	1.6	93 ± 20	+41.08	439 ± 68	+46.52

[a] Amount per plate of rice extracts. [b] Data are expressed as mean ± SD of triplicate plates from two independent experiments (N=6). [c] + or – indicates that the extract decreased or increased the mutagenicity of the model respectively. [d] Spontaneous revertants. [e] No rice extract was added to the standard mutagen, namely sodium nitrite treated chicken extract (7.2 mg/plate for *Salmonella typhimurium* TA98 and TA100).

Table C-6 Antimutagenicity of rice extracts against sodium nitrite treated 1-aminopyrene on *S. typhimurium* TA98 and TA100

Rice extract		TA98		TA100	
Name	Amount[a] (mg/plate)	No. of revertants/plate[b]	%Inhibition[c]	No. of revertants/plate[b]	%Inhibition[c]
Hom Nil rice					
Raw	Spontaneous[d]	16 ± 2	-	117 ± 8	-
	0[e]	2543 ± 210	-	764 ± 83	-
	0.8	843 ± 101	+67.27	757 ± 107	+1.08
	1.2	647 ± 110	+75.05	739 ± 154	+3.91
	1.6	643 ± 173	+75.18	683 ± 112	+12.51
Cooked	Spontaneous	23 ± 1	-	144 ± 9	-
	0	2040 ± 63	-	1341 ± 69	-
	0.8	1059 ± 105	+48.63	1201 ± 174	+11.72
	1.2	962 ± 102	+53.43	1055 ± 113	+23.86
	1.6	741 ± 170	+64.40	963 ± 112	+31.60
Fermented	Spontaneous	22 ± 1	-	119 ± 15	-
	0[e]	2088 ± 396	-	888 ± 65	-
	0.8	2031 ± 316	+2.76	826 ± 95	+8.07
	1.2	1851 ± 279	+11.49	806 ± 106	+10.62
	1.6	1739 ± 99	+16.92	769 ± 53	+15.44

Table C-6 Antimutagenicity of rice extracts against sodium nitrite treated 1-aminopyrene on *S. typhimurium* TA98 and TA100 (continued)

Rice extract		TA98		TA100	
Name	Amount[a] (mg/plate)	No. of revertants/plate[b]	%Inhibition[c]	No. of revertants/plate[b]	%Inhibition[c]
Black glutinous rice					
Raw	Spontaneous[d]	15 ± 4	-	123 ± 11	-
	0[e]	2089 ± 410	-	689 ± 63	-
	0.8	987 ± 145	+53.17	465 ± 77	+39.67
	1.2	738 ± 127	+65.16	416 ± 58	+48.26
	1.6	596 ± 157	+71.99	390 ± 56	+52.80
Cooked	Spontaneous	19 ± 1	-	127 ± 16	-
	0	2639 ± 360	-	1060 ± 102	-
	0.8	1414 ± 260	+46.76	827 ± 40	+25.01
	1.2	1110 ± 220	+58.38	726 ± 89	+35.81
	1.6	851 ± 198	+68.24	649 ± 73	+44.09
Fermented	Spontaneous	15 ± 1	-	120 ± 6	-
	0[e]	2300 ± 111	-	1052 ± 106	-
	0.8	891 ± 257	+61.67	784 ± 222	+28.82
	1.2	785 ± 222	+66.33	748 ± 258	+32.63
	1.6	525 ± 180	+77.67	696 ± 204	+38.21

[a] Amount per plate of rice extracts. [b] Data are expressed as mean ± SD of triplicate plates from two independent experiments (N=6). [c] + or – indicates that the extract decreased or increased the mutagenicity of the model respectively. [d] Spontaneous revertants. [e] No rice extract was added to the standard mutagen, namely sodium nitrite treated 1-aminopyrene (0.12 and 0.24 μg/plate for *Salmonella typhimurium* TA98 and TA100 respectively).

Table C-7 Mutagenicity of chicken extract treated sodium nitrite in the presence of each rice extract on *S. typhimurium* TA98 and TA100

Rice extract		TA98		TA100	
Name	Amount[a] (mg/plate)	No. of revertants/plate[b]	MI[c]	No. of revertants/plate[b]	MI[c]
Hom Nil rice					
Raw	Spontaneous[d]	15 ± 1	-	112 ± 11	-
	0[e]	144 ± 9	9.60	609 ± 45	5.44
	0.8	184 ± 10	**12.27**	868 ± 69	**7.75**
	1.2	224 ± 30	**14.93**	933 ± 77	**8.33**
	1.6	235 ± 22	**15.67**	968 ± 86	**8.64**
Cooked	Spontaneous	36 ± 1	-	110 ± 7	-
	0[e]	174 ± 3	4.83	938 ± 14	8.53
	0.8	235 ± 15	**6.53**	1148 ± 135	**10.44**
	1.2	279 ± 14	**7.67**	1157 ± 127	**10.52**
	1.6	296 ± 15	**8.22**	1188 ± 77	**10.80**
Fermented	Spontaneous	21 ± 5	-	112 ± 1	-
	0[e]	173 ± 7	8.24	891 ± 63	7.96
	0.8	155 ± 25	7.38	735 ± 113	6.56
	1.2	160 ± 33	7.62	754 ± 157	6.73
	1.6	162 ± 25	7.71	800 ± 80	7.14

Table C-7 Mutagenicity of chicken extract treated sodium nitrite in the presence of each rice extract on *S. typhimurium* TA98 and TA100 (continued)

Rice extract		TA98		TA100	
Name	Amount[a] (mg/plate)	No. of revertants/plate[b]	MI[c]	No. of revertants/plate[b]	MI[c]
Black glutinous rice					
Raw	Spontaneous[d]	15 ± 5	-	157 ± 18	-
	0[e]	141 ± 15	9.40	655 ± 10	4.17
	0.8	164 ± 22	**10.93**	793 ± 58	**5.05**
	1.2	173 ± 21	**11.53**	931 ± 84	**5.93**
	1.6	253 ± 53	**16.87**	1044 ± 43	**6.65**
Cooked black glutinous rice	Spontaneous	18 ± 3	-	111 ± 12	-
	0[e]	141 ± 9	7.83	703 ± 37	6.33
	0.8	209 ± 6	**11.61**	897 ± 75	**8.08**
	1.2	238 ± 22	**13.22**	955 ± 65	**8.60**
	1.6	245 ± 21	**13.61**	960 ± 97	**8.65**
Fermented black glutinous rice	Spontaneous	18 ± 3	-	140 ± 17	-
	0[e]	145 ± 5	8.06	703 ± 41	5.02
	0.8	134 ± 18	7.44	622 ± 78	4.44
	1.2	135 ± 28	7.50	625 ± 109	4.46
	1.6	153 ± 34	**8.50**	687 ± 40	4.91

[a] Amount per plate of rice extracts. [b] Data are expressed as mean ± SD of triplicate plates from two independent experiments (N=6). [c] Mutagenicity Index (MI) is calculated from the average value of a number of histidine revertants/plate of the rice extracts divided by that of spontaneous revertants. [d] Spontaneous revertants. Bold number indicates the higher result compared with that of no extract. [e] No extract was added to the standard mutagens, nitrite treated chicken extract.

Table C-8 Mutagenicity of 1-aminopyrene treated sodium nitrite in the presence of each rice extract on *S. typhimurium* TA98 and TA100

Rice extract		TA98		TA100	
Name	Amount[a] (mg/plate)	No. of revertants/plate[b]	MI[c]	No. of revertants/plate[b]	MI[c]
Hom Nil rice					
Raw	Spontaneous[d]	16 ± 2	-	117 ± 8	-
	0[e]	2543 ± 310	158.94	764 ± 83	6.53
	0.8	3446 ± 267	**215.38**	1076 ± 75	**9.20**
	1.2	2616 ± 577	**163.50**	917 ± 61	**7.84**
	1.6	2093 ± 535	130.81	912 ± 54	**7.79**
Cooked	Spontaneous	23 ± 1	-	144 ± 9	-
	0[e]	2040 ± 63	88.70	1341 ± 69	9.31
	0.8	1485 ± 142	64.57	1302 ± 198	9.01
	1.2	1125 ± 245	48.91	1123 ± 123	7.80
	1.6	896 ± 118	38.96	983 ± 135	6.83
Fermented	Spontaneous	22 ± 1	-	119 ± 15	-
	0[e]	2088 ± 396	94.91	888 ± 65	7.46
	0.8	5871 ± 516	**266.86**	1690 ± 149	**14.20**
	1.2	5349 ± 585	**243.14**	1502 ± 211	**12.62**
	1.6	5069 ± 429	**230.41**	1392 ± 145	**11.70**

Table C-8 Mutagenicity of 1-aminopyrene treated sodium nitrite in the presence of each rice extract on *S. typhimurium* TA98 and TA100 (continued)

Rice extract		TA98		TA100	
Name	Amount[a] (mg/plate)	No. of revertants/plate[b]	MI[c]	No. of revertants/plate[b]	MI[c]
Black glutinous rice					
Raw	Spontaneous[d]	15 ± 4	-	123 ± 11	-
	0[e]	2089 ± 410	139.27	689 ± 63	5.60
	0.8	3128 ± 493	**208.53**	791 ± 87	**6.43**
	1.2	2830 ± 583	**188.67**	786 ± 79	**6.39**
	1.6	2315 ± 404	**154.33**	765 ± 70	**6.22**
Cooked	Spontaneous	19 ± 1	-	127 ± 16	-
	0[e]	2639 ± 360	138.89	1060 ± 102	8.35
	0.8	3612 ± 264	**190.11**	1030 ± 217	8.11
	1.2	3447 ± 269	**181.42**	1017 ± 115	8.01
	1.6	2852 ± 280	**150.11**	997 ± 155	7.85
Fermented	Spontaneous	15 ± 1	-	120 ± 6	-
	0[e]	2300 ± 111	153.33	1052 ± 106	8.77
	0.8	3683 ± 164	**245.53**	1479 ± 168	**12.33**
	1.2	3262 ± 139	**217.47**	1403 ± 161	**11.96**
	1.6	3171 ± 278	**211.40**	1304 ± 109	**10.87**

[a] Amount per plate of rice extracts. [b] Data are expressed as mean ± SD of triplicate plates from two independent experiments (N=6). [c] Mutagenicity Index (MI) is calculated from the average value of a number of histidine revertants/plate of the rice extracts divided by that of spontaneous revertants. [d] Spontaneous revertants. Bold number indicates the higher result compared with that of no extract. [e] No extract was added to the standard mutagens, nitrite treated 1-aminopyrene.

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