輔.Q10 作為功能性食品之應用

花敏昌、吳淑姿 ; 余世宗

E-mail: 9800901@mail.dyu.edu.tw

摘 要

每一個生物細胞內都含有粒線體，進行電子傳遞，生合成能量物質-ATP，以維持細胞之基本生命現象。粒線體內含有Co Q10 (coenzyme Q10)協助電子傳遞的工作。

Co Q10 為一無臭無味、脂溶性、橘黃色或淡澄黃色結晶或粉末。在生理功能扮演多項功能，除了協助能量的產生 (ATP)外，亦具有清除自由基 (free radical)的功能，且為一良好的抗氧化劑。體內若缺乏Co Q10，則可能會產生神經系統之病變，包括巴金森氏症、阿茲海默氏症、亨丁頓氏症和唐氏症等。心血管疾病，包括慢性心臟病、充血性心臟病、心臟衰竭和心肌性心臟病等。亦會對腫瘤產生影響。若適當補充，則有助於這些症狀的改善，可見Co Q10在醫藥市場的潛力。

根據NPIC (Natural Products Industry Center)的資料顯示，2004年全球Co Q10的使用量約140-150公噸，預估全球對Co Q10的年需求成長率為20-25 %，以此成長速度至2010年需求量達420-550公噸。

Co Q10的商業生產方式有：⑴動物器官組織萃取；⑵微生物發酵生產；⑶化學合成。目前日本最知名三大製造廠的方法，以微生物發酵生產萃取Co Q10，此法可以大量生產且純度亦較高。

關鍵詞 : Co Q10、抗氧化劑、自由基、電子傳遞鏈

目錄

參考文獻

1.胡淼琳，Coenzyme Q10的生化營養性質以及它的醫療功效，自由基生物學與醫學，1994，2，46-53。2.劉昌峰，2001，探討不同培養基組成對光合菌Rhodobacter sphaeroides生產Coenzyme Q10之研究，碩士論文國立中央大學，中壢.3.梁健成、楊啟宏，2008，淺談老化與阿?海默症，藥學雜誌，96, 75-78.4.陳立材、曹明正，2008，淺談CoQ10於心臟衰竭之功效 藥學雜誌, 95, 44-47.5.李仁愛、李貽琳、張學偉，2005，生物化學生命的分子基礎第三版，P333.6.Arroyo, A., F. Navarro, C. Gomez-Diaz et al., 2000, Interactions between ascorbyl free radical and coenzyme Q at the plasma membrane, J. Bioenerg. Biomembr., 32, 199-210.7.Baker, S. K., M. A. Tarnopolsky, 2005, Statin-associated neuromytoxicity, Drugs Today (Barc.), 41, 267-293.8.Bast, A. and G..Haenen, 2002, Pharmaceutical compounds with antioxidant activity. In: J. Tardif, M. G. Bourassa, eds. Antioxidants and Cardiovascular Disease. Dordrecht: Kluwer.9.Beal, M. F., D. R. Henshaw, B. G. Jenkins, B. R. Rosen and J. B. Schulz, 1994, Coenzyme Q10 and nicotinamide block striatal lesions produced by the mitochondrial toxin malonate, 36, 882-888.10.Beal, M. F. and R. T. Matthews, 1997 Coenzyme Q10 in the central nervous system and it ’ s potential usefulness in the treatment of neurodegenerative diseases, 18, s169-s179.11.Beal, M. F., R. T. Matthews, A. Tieleman and C. W. Shults, 1998, Coenzyme Q10 attenuates the 1-methyl-4-phenyl-1, 2, 3, 6-tetrahydropyridine (MPTP) induced loss of striatal dopamine and dopaminergic axons in aged mice, Brain Res., 783, 109-114.12.Beal, M. F., 2002, Coenzyme Q10 as a possible treatment for neurodegenerative disease, free radic. Res., 36, 455-460.13.Beal, M. F., 2003, Bioenergetic approaches for neuroprotection in Parkinson ’ s disease, Ann. Neurol., 53, s39-s48.14.Belardinelli, R., A. Mucaj, F. Lacalaprice et al., 2005, Coenzyme Q10 improves contractility of dysfunctional myocardium in chronic heart failure, Biofactors, 25, 137-145.15.Belardinelli, R., A. Mucaj, F. Lacalaprice et al., 2006, Coenzyme Q10 and exercise training in chronic heart failure, Eur. Heart J., 27, 2675-2681.16.Berman, M., A. Erman , T. Ben-Gal et al., 2004, Coenzyme Q10 in patients with end stage heart failure awaiting cardiac transplantation: a randomized, placebo-controlled study, Clin. Cardiol., 27, 295-299.17.Berthold, H. K., A. Naini, S. Di Mauro et al., 2006, Effect of ezetimibe and/or simvastatin on coenzyme Q10 levels in plasma : a randomized trial, Drug Saf., 29, 703-712.18.Bleske, B. E., R. A. willis, M. Anthony, N. Casselberry, M. Datwani, V. E. Uhley, S. G. Secontine and M. J. Shea, 2001, The effect of pravastatin on coenzyme Q10 Am. Heart J., 142, E2.19.Buettner, G. R., C. F. Ng, M. Wang, V. G. Rodgers and F. Q. Schafer, 2006, A news paradigm: Manganese superoxide dismutase influences the production of H2O2 in cells and thereby their biological state, Free Radic. Biol. Med., 41, 1338-1350.20.Caliskan, S., M. Caliskan, F. Kuralay and B. Onvural, 2000, Effect of simvastatin therapy on blood and tissue ATP levels and erythrocyte membrane lipid composition, Res. Exp. Med. (Berl.), 199, 189-194.21.Caso, G., P. Kelly, M. A. McNurlan and W. E. Lawson, 2007, Effect of coenzyme Q10 on myopathic symptoms in patients treated with statins, Am. J. Card. (www.AJConline.org), 1409-1412.22.Christen, Y., 2000, Oxidative stress and Alzheimer diseases, Am. J. Clin. Nutr., 950, 10-20.23.Crane, F. L., Y. Hatefi, R. I. Lester, C. Widmer, 1957, Isolation of a quinone from beef heart mitochondria, Biochimica et Biophys. Acta., 25, 220-221.24.Cummings, J. L. and G. Cole, 2002, Alzheimer?s diseases, J. A. M. A., 287, 2335-2338.25.Dallner, G. and P. J. Sindelar, 2000, Regulation of ubiquinone metabolism, Free Radic. Biol. Med., 29, 285-294.26.Davidson, M., J. McKenny, E. Stein et al., 1997, Comparsion of one-year efficiency and safety of atorvastatin versus lovastatin in primary hypercholesterolemia, Atorvastatin Study Group I., Am. J. Cardiol., 79, 1475-1481.27.Dexter, D. T., C. J. Carter, F. R. Wells, F. Javoy-Agid, Y. Agid, A. Less, et al., 1989, Basal lipid peroxidation in substantia nigra is increased in Parkinson ’ s disease, J. Neurochem., 52, 381-389.28.Diebold, B. A., N. V. Bhagavan and R. J. Guillory, 1994, Influences of lovastatin administration on the respiratory burst of leukocytes and the phosphorylation potential of mitochondria in guinea pigs, Biochim. Biophys. Acta, 1200, 100-108.29.Digiesi, V., F. Cantini and B. Brodbeck, 1990, Effect of coenzyme Q10 on essential hypertension, Curr. Ther. Res., 47, 841-845.30.Digiesi, V., F. Cantini, A. Oradei et al., 1994, Coenzyme Q10 in essential hypertension, Mol. Aspects Med., 15(suppl), s257-s263.31.Ernster, L. and G.. Dallner, 1995, Biochemical, physiological and medical spects of ubiquinone function, Biochim. Biophys. Acta., 1271, 195-204.32.Feldman, H. H. and C. Jacova, 2007, Primary prevention and delay of onset of AD/dementia, Neurol. Sci., 34 (supp 11), s84-s89.33.Ferrant, R. J., O. A. Andreassen, A. Dedeoglu, K. L. Ferrante, B. G. Jenkins, S. M. Hersch and M. F. Beal, 2002, Therapeutic effects of coenzyme Q10 and remacemide in transgenic mouse models of Huntington ’ s disease, 22, 1592-1599.34.Folkers, K., S. Vadhanavikit and S. A. Mortenson, 1985, Biochemical rational and myocardial tissue data on the effective therapy of cardiomyopathy with coenzyme Q10, Proc. Natl. Acad. Sci., 82, 901-904.35.Folkers, K., P. H. Langsjoen, R. Willis, P. Richardson, L. Xia, C. Ye, and H. Tamagawa, 1990, Lovastatin decrease coenzyme Q levels in humans, Proc. Natl. Acad. Sci., 87, 8931-8934.36.Gaby, A. R., 1996, The role of coenzyme Q10 in clinical medicine: part I. Alternative Med. Rev., 1, 11-17.37.Ghirlanda, G., A. Oradei, A. Manto, S. Lippa, L. Uccioli, S. Caputo, A. V. Greco and G. P. Littarru, 1993, Evidence of plasma CoQ10—lowering effect by HMG-CoA reductase inhibitors, J. Clin. Pharmocol., 33, 226-229.38.Guyton, K. Z. and T. W.

Kensler, 1993, Oxidative mechanism in carcinogenesis, Br. Med. Bull., 49, 523-544.39.Halliwell, B. and J. M. C. Gutterage, 1989, Role of free radicals and catalytic metal ions in human disease: an overview, methods Enzymol., 186, 1-85.40.Hanaki, Y., S. Suglyama, T. Ozawa and M. Ohno, 1991, Ratio of low-density lipoprotein cholesterol to coenzyme Q10 as a coronary risk factor, N. Engl. J. Med., 325, 814-815.41.Hardy, J. and D. J. Selkoe, 2002, The amyloid hypothesis of Alzheimer?s diseases: process and problems on the road to therapeutics, Science, 297, 353-356.42.Harman, D., 2006, Alzheimer?s diseases pathogenesis: Role of aging, Ann. NY Acad. Sci., 1067:454-460.43.Ishiyama, T., Y. Morita, S. Toyama, et al., 1976, Aclinical study of the effect of coenzyme Q on congestive heart failure. Jpn. Heart J., 17, 32-42.44.James, A. M., R. A. Smith and M. P. Murphy, 2004, Antioxidant and prooxidant properties if mitochondrial coenzyme Q, Arch. Biochem. Biophys., 423, 47-56.45.Judy, W. V., J. H. Hall and D. D. Toth, 1984, Influence of coenzyme Q10 on cardiac function in congestive heart failure, Fed. Prog., 43, 358.46.Kalen, A., E. L. Appelkvist and G. Dallner, 1989, Age related changes in the lipid composition of rat and human tissues, Lipids, 24, 579-584.47.Kaplan, P., A, I. Kucer and V. Dadak, 1993, Effect of oxygen on ubiquinone-10 production by Paracoccus denitrificans, Biotech. Lett., 15, 1001-1002.48.Koroshetz, W. J., B. G. Jenkins, B. R. Rosen and M. F. Beal, 1997, Energy metabolism defects in Huntington ' s disease and effects of coenzyme Q10, Ann. Neurol., 41, 160-165.49.Korsunskii, O. F., 1987, U. S. S. R. SU 1, 353, 808.50.Kuratsu, Y., M. Sakurai and H. Hagino, 1984, Aeration-agitation effect on coenzyme Q10 production by Agrobacterium species, J. Ferment. Technol., 62, 305-308.51.Langsjoen, P. H., S. Vadhanavikit and K. Folker, 1985, Effective treatment with coenzyme Q10 of patients with chronic myocardial disease, Drug Exp. Clin. Res., 11, 577-579.52.Langsjoen, P. H., K. Folker, K. Lyson et al., 1988, Effective and safe therapy with coenzyme Q10 for cardiomyopathy, Klin. Wochenschr, 66, 585-590.53.Langsjoen, H., P. Langsjoen, P. Landsjoen et al., 1994, Usefulness of coenzyme Q10 in clinical cardiology: a long-term study, Mol. Aspects Med., Suppl 15, s165-s175.54.Langsjoen, P., P. Langsjoen, R. Willis and K. Folkers, 1994, Treatment of essential hypertension with coenzyme Q10, Mol. Aspects Med., 15 (suppl), s265-s272.55.Langsjoen, P., A. Langsjoen, R. Willis and K. Folkers, 1997, The aging heart: Reversal of diastolic dysfunction through the use of oral CoQ10 in the Elderly. In: Anti-aging medical therapeutics. Klatz, R. M. and R. Goldman (eds.). Heallh Quest Publication, 113-120.56.Langsjoen, P. H. and K. Folkers, 1990, A six-year clinical study of therapy of cardiomyopathy with coenzyme Q10, Int. J. Tissue React, 12, 169-71.57.Langsjoen, P. H., S. Vadhanavikit and K. Folkers, 1985, Response of patients in classes III and IV of cardiomyopathy to therapy in a bind and crossover trial with coenzyme Q10, Proc. Natl. Acad. Sci. USA, 82, 4240-4244.58.Langsjoen, P. H. and A. M. Langsjoen, 2003, The Clinical use of HMG CoA-reductase inhihitors and the associated depletioc of coenzyme Q10. A review of animal and human publications, Biofactors, 18, 101-111.59.Langston J. W. , P. Ballard, J. W. Tetrud and I. I.Chronic, 1983, Parkinsonism in humans due to a product of meperidine-analog synthesis. Science, 219, 979-980.60.Lieberman, A., K. Lyons, J. Levine and R. Myerburg, 2005, Statins, Cholesterol, co-enzyme Q10, and Parkinson ' s disease, Parkinsonism & Related Disorders, 11, 81-84.61.Littarr, G. P., L. Ho and K. Folkers, 1972, Deficiency of Coenzyme Q10 in human heart disease, Part I, Int. J. Vitam. Nutr. Res., 42, 291-305.62.Littarru, G. P., S. Lippa, A. Oradei, R. M. Fiorni, L. Mazzanti, 1991, Metaolic and diagnostic implications of blood CoQ10 level, Biomed. Cli. Asp. coenzyme Q, 6, 1-55.63.Lott, T. T., E. Head, E, Doran and J. Busciglio, 2006, Beta-amyloid, oxidative stress and Down syndrome, Curr. Alzheimer Res., 3, 521-528.64.Lyon, W., S. Pepe, S. Marasco et al., 1980, Effect of topical and systemic coenzyme Q10 therapy on cardiac Q10 content and mitochondrial function. In: Y. Yamamura, K. Folkers and Y. Ito, eds. Biomedical and Clinical Aspects of Coenzyme Q. Amsterdam: Elsevier/North-Holland Biomedical Press.65.Marcoff, L. and P. D. Thompson, 2007, The role of coenzyme Q10 in statin-associated myopathy, J. Am. College Card., 49, 2231-2237.66.Matsumura, M., T. Kobayashi and S. Aiba, 1983, Anaerobic production of ubiquinone-10 by Paracoccus denitrificans, Eur. J. Microb. Biotech., 17, 85-89.67.Matthews, R. T., L. Yang, S. Browne, M. Baik and M. F. Beal, 1998, Coenzyme Q10 administration increases brain mitochondrial concentrations and exerts neuroprotective effects, Proc. Natl. Acad. Sci., 95, 8892-8897.68.McKee, T. and J. R. McKee, 2003, Biochemistry, The molecular basis of life, 3th ed., McGraw-Hill Comp., USA.69.Miles, M. V., D. Pharm, J. Bonnie et al., 2007, Coenzyme Q10 (Ubiguinil-10) supplementation improves oxidative imbalance in children with trisomy 21, Pediatric Neurol., 37, 398-403.70.Mochida, K., T. Ohsaki, T. Kobayashi and T. Kimura, 1973, Jpn. Kokai Tokyo Koho JP, 73/21, 519.71.Morand, O. H., J. D. Aebi, H. Dehmlow et al., 1997, Ro 48-8.071, a new 2, 3-oxidosqualene: lanosterol cyclase inhibitor lowering plasma cholesterol in hamsters, squirrel monkeys, and minipigs: comparison to simvastatin, J. Lipid Res., 38, 373-390.72.Morisco, C., B. Trimarco and M. Condorelli, 1993, Effect of coenzyme Q10 therapy in patients with congestive heart failure: a long-term multicenter randomized study, Clin. Investig., 71 (Suppl 8), s134-s136.73.Mortensen, S.A., A. Leth, E. Agner and M. Rohde, 1997, Dose-related decrease of serum coenzyme Q10 during treatment with HMG-CoA reductase inhibitor, Mol. Aspects. Med., 181,S137-S144.74.Morton, R. A., G. N. Festenstein, F. W. Heaton and J. S. Lowe, 1955, J. Biochem., 59, 558-566.75.Nakahara, K., M. Kuriyama, Y. Sonoda et al., 1998, Myopathy induced by HMG-CoA reductase inhibitors in rabbits: a pathological, electrophysiological, and biochemical study, Toxicol. App. Pharmacol., 152, 99-106.76.O ' Brien, P. J., 1994, Antioxidants and cancer, Molecular mechanism, In:Armstrung, D., Ed., Free radicals in diagnostic medicine, PP. 215-239, New York, Plenum Press.77.Ochoa, J. J., J. L. Quiles, M. Lopez-Frias, J. R. Huertas and J. Mataix, 2007, Effect of lifelong coenzyme Q10 supplementation on age-related oxidative stress and mitochondrial function in liver and skeletal muscle of rats fed on a polyunsaturated fatty acid (PUFA)-rich Diet, Biolog. Sci. Med. Sci., 62, 1211-1218.78.Okamoto, H., H. Kawaguchi, H. Togashi et al., 1991, Effect of coenzyme Q10 on structural alteration in the renal membrane of stroke-prone spontaneously hypertensive rats, Biochem. Med. Metabol. Biol., 45, 216-226.79.Page, A. C., P. Gale, H. Wallick, R. B. Walton, L. E. Mcdaniel, H. B. Woodruff and K. Folkers, 1960, Coenzymes Q. XVII. Isolation of coenzyme Q10 from bacterial fermentation, Archi. Biochem. Biophysic., 89, 318-321.80.Paiva, H., K. M. Thelen, R. Van Coster et al., 2005, High-dose statins and skeletal muscle metabolism in humans: a randomized, controlled trial, Clin. Pharmacol. Ther., 78, 60-68.81.Parker, W. D., S. J. Boyson and J. K. Parks, 1989, Abnormalities of the electron

transport chair in idiopathic parkinson?s disease, Ann. Neurol. 26, 719-723.82.Perry, T. K., D. V. Godin and S. Hansen, 1982, Parkinson ' s disease: a disorder due to nigral glutathione deficiency? Neursci. Lett., 33, 305-310.83.Phillips, P. S., R. H. Hass, S. Bannykh et al., 2002, Statin-associated myopathy with normal creatine kinase levels, Ann. Intern. Med., 137, 581-585.84.Portakal, O., O. Ozkaya, M. E. Inal, B. Bozan, M. Kosan and I. Sayek, 2000, Coenzyme Q10 concentrations and antioxidant status in Tissues of Breast cancer patients, Clinic. Biochem., 33, 279-284.85.Przedborski S,Jackson-Lewis V.Mechanisms of MPTP toxicity. Mov Disord.1998;13(suppl 1):35-38.86.Roeper, W., 1985, G. E. R. Offen, DE 3, 416, 854.87.Rundek, T, A. Naini, R. sacco, K. coates and S.DiMauro, 2004 Atorvastatin decreases the coenzyme Q(10) level in the blood of patients at risk for cardiovascular disease and stroke, Arch. Neurol., 61, 889-892.88.Saggu, H., J. Cooksey, D. Dexter, F. R. Wells, P. Lees and C. D. Marsden, 1989, A selective increase in particulate superoxide dismutase activity in Parkinsonian substantia nigra, J. Neurochem., 53, 692-697.89.Sakato, K., H. Tanaka, S. Shibata and Y. Kuratsu, 1992, Agitation-aeration studies on coenzyme Q10 production using Rhodopseudomonas sphaeroides, Biotech. Appl. Biovhem., 16, 19-28.90.Sasaki, K.; Nagai, S., J. Ferment. Technol., 1979, 57, 383-386.91.Sanchez-Ramos, J., E. Overvik. And B. N. Ames, 1994, A marker of oxyradical-mediated DNA damage (8-hydroxy-2 ' deoxyguanosine) is increase in nigro-striatum of Parkinson ' s disease brain, Neurodegeneration, 3, 197-204.92.Sander, S., C. I. Coleman, A. A. Patel et al., 2006, The impact of coenzyme Q10 on systolic function in patients with chronic heart failure, J. Card. Fail, 12, 464-472.93.Sarter, B., 2002, Coenzyme Q10 and cardiovascular disease: A Review, J. Cardiovasc. Nurs., 16, 9-20.94.Satoh, K., A. Yamato, T. Nakai, K. Hoshi and K. Ichihara, 1995, Effects of 3-hydroxy-3-methyglutary coenzyme A reductase inhibitors on mitochondrial respiration in ischaemic dog hearts, Br. J. Pharmacol., 116, 1894-1898.95.Scarpini, E., P. Scheltens and H. Feldman, 2003, Treatment of Alzheimer ' s diseases: current status and new perspectives, Lancet Neurol., 2, 539-547.96.Schapira, A. H., J. M. Cooper, D. Dexter, P. Jenner, J. B. Clark and C. D. Marsden, 1989, Mitochondrial complex deficiency in Parkinson ' s disease, Lancet, 1, 1269.97.Schapira A.H., V.M. Mann, J. M. Cooper et al., 1990, Anatomic and disease specificity of NADH CoQ10 reductase (complex I)deficiency in Parkinson ' s disease, J Neurochem., 55, 2142-2145.98.Schilling, G., M. L. Coonfield, C. A. Ross and D. R. Borchelt, 2001, Coenzyme Q10 and remacemide hydrochloride ameliorate motor deficits in a Huntington ' s disease transgenic mouse model, Neurosci. Lett., 315, 149-153.99.Shepherd, J. A., W. W. Poon, D. C. Myles and C. F. Clarke, 1996, The biosynthesis of ubiquinone: Synthesis and enzymatic modification of biosynthetic precursors, Tetrahedron Letters, 37, 2395-2398.100.Sherer, T.B., R. Betarbet and J. T. Greenamyre, 2001, Pathogenesis of parkinson?s disease,Cur. Opin. Investig., 2, 657-662.101.Sinatra, S. T., 1997, Refractory Congestive Heart Failure Successfully Managed with High Dose Coeznyme Q10 Administration, Molec. Asp. Med., 18, s299-s305.102.Singh, R. B., G. S. Wander, A. Rastogi et al., 1998, Randomized, double-blind placebo-controlled trial of Coenzyme Q10 in patients with acute myocardial infarction, Cardiovasc. Drugs Ther., 12, 347-353.103.Singh, R. B., M. A. Niaz, S. S. Rastogi, P. K. Shukla and A. S. Thakur, 1999, Effect of hydrosoluble coenzyme Q10 on blood pressures and insulin resistance in hypertensive patients with coronary artery disease. J Hum Hypertension, 13, 203-208.104.Shults, C.W., R.H. Haas, D. Passov and M.F. Beal, 1997,Coenzyme Q10 levels correlate with the activities of complexes I and II/III in mitochondria from parkinsonian and nonparkinsonian subjects, Ann. Neurol., 42, 261-264.105.Shults, C.W., M.F. Beal, D. Fontaine, K. Nakano and R.H. Haas, 1998, Absorption, tolerability and effects on mitochondrial activity of oral coenzyme Q10 in parkinsonian patients, Neurology, 50, 793-795.106.Shults, C.W., D. Oakes, K. Kieburtz, M. F. Beal, R. Hass, S. Plumbs et al., 2002, Effects of coenzyme Q10 in early Parkinson disease, Arch. Neurol., 59, 1541-1550.107.Sohmiya, M., M. Tanaka, N. W. Tak, M. Yanagisawa, Y. Tanino, Y. Suzuki, K. Okamoto and Y. Yamamoto, 2004, Redox status of plasma coenzyme Q10 indicates elevated systemic oxidative stress in Parkinson ' s disease, J. Neurol. Sci., 223, 161-166.108.Staffa, J. A., J. Chang and L. Green, 2002, Cerivastatin and reports of fatal rhabdomyolysis, N. Engl. J. Med., 346, 539-540.109.Stocker, R., V. W. Bowry and B. Frei, 1991, Ubiquinol-10 protects human low density lipoprotein more efficiently against lipid peroxidation than dose alpha-tocopherol. Proc. Natl. Acad. Sci., 88, 1646-1650.110.Sugiyama, S., 1998, HMG-CoA reductase inhibitor accelerates aging effect on diaphragm mitochondrial respiratory function in rats, Biochem. Mol. Biol. Int., 46, 923-931.111.Suo, Z., C. Fang, F. Crawford et al., 1997, Superoxide free radical and intracellular calcium mediate A beta (1-42) induced endothelial toxicity, Brain Res., 762, 144-152.112.Takeshige, K., R. Takayanagi and S. Minakami, 1980, Reduced coenzyme Q10 as antioxidant of lipid peroxidation in bovine heart mitochondria. In: Y. Yamamura, K. Folkers, Y. Ito, eds. Biomedical and Clinical Aspects of Coenzyme Q. Amsterdam: Elsevier/North-Holland Biomedical Press, 2.113.Tanner, C. M. and S. M. Goldman, 1996, Epidemiology of parkinson?s disease, Neurol. Clin., 114, 317-335.114.The Huntington Study Group, A randomized, placebo-controlled trial of coenzyme Q10 and remacemide in Huntington ' s disease, Neurology, 2001,57, 397-404.115.Thompson, P. D., P. Clarkson and R. H. Karas, 2003, Statin-associated myopathy, J. A. M. A., 289, 1681-1690.116.Tomasetti, M., R. Alleva, M. D. Solenghi and G. P. Littarru, 1999, Distribution of antioxidants among blood components and lipoproteins: significance of lipids/CoQ10 ratio as a possible marker of increased risk for atherosclerosis, Biofactors, 9, 231-240.117.Tumer. C. and A. H. Schapira, 2001, Mitochondrial dysfunction in neurodegenerative disorders and aging, Adv. Exp. Med. Biol., 487, 229-251.118.Urakami, T. and T. Yoshida, 1993, Production of ubiquinone and bacteriochlorophyll a by Rhodobacter sphaeroides and Rhodobacter sulfidophilus, J. Ferment. Bioeng., 76, 191-194.119.Vaughan J. R. and M. B.Davis,2001, Wood NW.Genetics of parkinsonism: a review, Ann Hum Genet. 65, 111-126.120.Weant, K. A. and K. M. Smith, 2005, The role of coenzyme Q10 in heart failure, Ann Pharmacother, 39, 1522-1526.121.Zandi, P. P., J. C. Anthony, A. S. Khachaturian et al., 2004, Reduced risk of Alzheimer diseases in users of antioxidant vitamin supplements: The Cache County Study, Arch. Neurol., 61, 82-88.