KVERTSETIN PREPARATINING ATEROSKLEROZNI OLDINI OLISHDA VA DA'VOLASHDA QO'LLANILISHINING ISTIQBOLLARI

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flavanoidlar, endotelial disfunksiya, kvertsetin, sitokin, ateroskleroz, patogenez.

Annotatsiya. Flavanoidlar o'simliklar olamida keng tarqalgan. Xususan flavanoidlarga boy o'simliklarga gulli o'simliklar, atirguldoshlar oilasi (har xil turdagi do'lana, qora mevali chetan), dukkaklilar oilasi (yapon saforasi, shirinmiya), grechixaning har xil turlarida, murakkabguldoshlar oilasi va boshqalarda ko'p uchraydi. Kvertsetin - tabiiy flavonoid bo'lib, antioksidant va yallig'lanishga qarshi xususiyatlari bilan ajralib turadi. Ateroskleroz patogenezida oksidlovchi stress, yallig'lanish jarayonlari va endotelial disfunktsiya muhim o'rin tutadi. Kvertsetin ushbu mexanizmlarga ta'sir etib, erkin radikallarni neytrallash, proinflammmator sitokinlarni kamaytirish, endotelial funksiyani yaxshilash va oksidlangan LDL hosil bo'lishini kamaytirish orqali aterosklerotik jarayonni sekinlashtirishi mumkin. Preparatning bioo'zlashtirilishi past bo'lgani uchun fitosom, liposomal va nanoformulyatsiyalar istiqbolli yo'nalish hisoblanadi. Shunday qilib, kvertsetin ateroskleroz profilaktikasi va davosida qo'shimcha vosita sifatida istiqbolli bo'lib, kelgusida keng qamrovli klinik tadqiqotlar zarur.

Keywords:
flavonoids, endothelial dysfunction, quercetin, cytokines, atherosclerosis, pathogenesis.

Abstract. Flavonoids are widely distributed in the plant kingdom. In particular, flavonoid-rich plants include flowering species, the Rosaceae family (various species of hawthorn, black chokeberry), the Fabaceae family (Japanese sophora, licorice), different species of buckwheat, the Asteraceae family, and others. Quercetin is a natural flavonoid characterized by its antioxidant and anti-inflammatory properties. Oxidative stress, inflammatory processes, and endothelial dysfunction play an important role in the pathogenesis of atherosclerosis. Quercetin influences these mechanisms by neutralizing free radicals, reducing pro-inflammatory cytokines, improving endothelial function, and decreasing the formation of oxidized LDL, thereby slowing the progression of atherosclerosis. Due to the low bioavailability of the compound, phytosomal, liposomal, and nanoformulations are considered promising approaches. Thus, quercetin represents a potential adjunct in the prevention and treatment of atherosclerosis, requiring further large-scale clinical studies.

Kvertsetin tabiiy flavonoid bo'lib, antioksidant faollikni namoyon qiladi. Flavanoidlar yoki aniqroq qilib aytganda bioflavanoidlar o'simliklarda uchraydigan polifenollarning bir sinfi hisoblanib, keng miqyosda biologik faollik namoyon qiladi hamda o'simliklar rangini belgilab beradi [1]. Ma'lum bo'lishicha, kvertsetin va uning hosilalarining antioksidant faolligi ularni antiateroskleroz faollik namoyon qilishiga ham sabab bo'ladi [2]. Polifenollar, xususan, kvertsetin asosidagi ko'p sonli dietik tadqiqotlarga muvofiq shuni aytish mumkinki, kvertsetin hozirgi kunda rivojlangan mamlakatlarda keng tarqalgan qon-tomir va bosh miyaning ishemik shikastlanishi kabi kasalliklarni yuzaga chiqish ehtimolligini pasaytiradi [3].

Kvertsetin va uning hosilalarini bunday himoyalash mexanizmi uning hozirgi kunda ko'p o'rganilayotgan antiateroskleroz faolligiga bog'liq. Biz quyida bu mexanizmga batafsil to'xtalib o'tamiz.

Kvertsetin va uning hosilalarini kimyoviy tuzilishi. Kvertsetin va uning hosilalari ham boshqa flavanoidlar kabi ikkita benzol halqasi (A va B), ular orasida esa uchta ugleroddan iborat ko'prik bo'lgan, ko'p sonli guruhlarga bo'linuvchi tabiiy faol moddalardir. Bog'lovchi propan ko'prigi kattaroq flavanoidlarda halqada kislorodi bo'lgan geterosikllar, ya'ni piran yoki pironni hosilalariga o'zgaradi. Superoksid radikali (O2–), gidroksil radikali (OH-), va lipidlarning peroksid radikalining elektron yoki vodorod atom donorlik xususiyati tufayli kvertsetin va uning hosilalari antiradikal faol moddalar hisoblanadi [4].

Fenoldagi gidroksil guruhi pH ga bog'liq holda dissotsiyalanadi va buning oqibatida u antiradikal faollik namoyon qiladi. Shuning uchun uning antiradikal faolligi pH muhitga muvofiq ravishda o'zgaradi [5]. Suvli sistemalarda o'tkazilgan tajribalar asosida flavanoidlar molekulasidagi eng ko'p antiradikal faollik ko'rsatuvchi elementlar sifatida quydagilar aniqlanildi:

C3 va C4 holatdagi 2 ta OH guruhlari,

2- va 3- uglerod atomlari orasidagi qo'sh bog'ning C4 holatidagi karbonil guruhi bilan kon'yugatsiyalangan holatda bo'lishi tufayli B halqadagi toq elektronni delokallanishi,

C3 va C5 holatdagi OH-guruhlarning karbonil guruhi bilan o'zaro ta'sir etishi [6].

Kvertsetin bilan bir qatorda digidrokvertsetin (taksifolin) ham keng qo'llanilmoqda. Uning kvertsetindan farqi 2- va 3- uglerod atomlari orasida qo'shbog' mavjudligidadir. So'nggi vaqtlarda kvertsetinning bir qancha yangi hosilalari olinmoqda, xususan uning xlorid kislota bilan bog'lanishi bunda

kvertsetinning antioksidant faolligi ortadi, masalan KN-8 (3,3 ,4',5,7-penta-O-nikotinoilgidroxlorid-2,3-digidrikvertsetin) [7].

Kvertsetinga birikkan xlorid kislota qoldig'i elektron zichlikni o'ziga tortishi oqibatida uning erkin radikalga o'tishi osonlashadi [8].

FOYDALANILGAN ADABIYOTLAR

1. Nijveldt, R. J., van Nood, E., van Hoorn, D. E., Boelens, P. G., van Norren, K., & van Leeuwen, P. A. (2001). Flavonoids: a review of probable mechanisms of action and potential applications. *The American Journal of Clinical Nutrition*, *74*(4), 418–425.

2. Boots, A. W., Haenen, G. R., & Bast, A. (2008). Health effects of quercetin: from antioxidant to nutraceutical. *European Journal of Pharmacology, 585*(2–3), 325–337.

3. Larson, A. J., Symons, J. D., & Jalili, T. (2012). Quercetin: A treatment for hypertension?—A review of efficacy and mechanisms. *Pharmacological Research*, *65*(3), 237–246.

4. Rice-Evans, C. A., Miller, N. J., & Paganga, G. (1996). Structure-antioxidant activity relationships of flavonoids and phenolic acids. *Free Radical Biology and Medicine*, *20*(7), 933–956.

5. Leopoldini, M., Russo, N., & Toscano, M. (2011). The molecular basis of working mechanism of natural polyphenolic antioxidants. *Food Chemistry, 125*(2), 288–306.

6. Heim, K. E., Tagliaferro, A. R., & Bobilya, D. J. (2002). Flavonoid antioxidants: chemistry, metabolism and structure-activity relationships. *The Journal of Nutritional Biochemistry, 13*(10), 572–584.

7. Kostyuk, V. A., Potapovich, A. I., & Strigunova, E. N. (2004). Experimental study of quercetin derivatives: antioxidant and anti-inflammatory properties. *Phytotherapy Research, 18*(7), 509–514.

8. Formica, J. V., & Regelson, W. (1995). Review of the biology of quercetin and related bioflavonoids. *Food and Chemical Toxicology, 33*(12), 1061–1080.