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Antioxidant Properties Of Milk And Milk Products

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Abstract: *Antioxidant properties of milk and milk products. Antioxidant compounds in milk: vitamins: A, E carotenoids, zinc, selenium, enzyme systems, superoxide dismutase, catalase, glutathione peroxidase, milk oligosaccharides. Antioxidant properties of caseins. Antioxidant properties of whey proteins: Based on the casein content of cow, buffalo, goat and sheep milk.*

Key words: Milk, antioxidant, vitamin A, E, zaedob protein, casein, cow, buffalo, goat, β-lactoglobulin, α-lactalbumin, Aspartic acid, Threonine, Serine, Lutamic acid

INTRODUCTION

Milk and milk products are an integral part of human nutrition, they are proteins of high biological value, calcium, essential fatty acids, amino acids, fats, water-soluble vitamins, and are essential for a number of biochemical and physiological processes. is a carrier of a number of bioactive compounds. functions. In recent years, foods containing natural antioxidants have become popular all over the world, because antioxidants can neutralize and purify the free radicals that are constantly produced in the biological body and their harmful effects. Uncontrolled activity of free radicals can cause oxidative stress, which leads to the breakdown of vital biochemical compounds such as lipids, proteins, DNA, which can lead to diabetes, accelerated aging, carcinogenesis and cardiovascular diseases. The antioxidant capacity of milk and milk products is mainly due to sulfur-containing amino acids, such as cysteine, phosphate, vitamins A, E, carotenoids, zinc, selenium, enzyme systems, superoxide dismutase, catalase, glutathione peroxidase, milk oligosaccharides and peptides. depends and is formed during fermentation and cheese ripening.

Dairy products make up about 25-30% of an average person's diet [1] (Figure 1). Milk and milk products are nutritious food products containing many important nutrients such as oleic acid, conjugated linoleic acid, omega-3 fatty acids, vitamins, minerals and biologically active compounds such as antioxidants [2] . Antioxidants are chemicals capable of neutralizing and cleaning free radicals that are constantly produced in the body [3]. Oxidation to generate energy is indispensable for biological processes in living organisms. However, oxidative stress can seriously damage biological systems. Reactive oxygen species are scientifically proven to be continuously produced in the human body. Uncontrolled free radicals in the body can cause oxidative stress, which can lead to atherosclerosis, diabetes, accelerated aging, cardiovascular disease, and breakdown of vital

biochemical compounds [4]. Taking antioxidants in the form of antioxidant-rich food supplements can protect the body from oxidative stress and damage [5]. Metabolic diseases are closely related to lifestyle, and changes in lifestyle have a great impact on disease patterns, about 20-30 years ago, infectious diseases were more common than non-infectious diseases, but now infectious diseases non/metabolic diseases. on the upper side. In the current scenario, healthy/functional food should be chosen to prevent or minimize non-communicable diseases such as diabetes, cancer and cardiovascular diseases [6]. The demand for foods containing natural antioxidants is increasing worldwide. Many foods and dairy products are fortified with natural antioxidants [7]. The antioxidant capacity of milk and milk products is related to sulfur-containing amino acids cysteine, vitamins A, E, carotenoids, enzyme systems, superoxide dismutase, catalase and glutathione peroxidase [8]. Milk also contains significant amounts of equol, a polyphenolic metabolite of daidzein, the antioxidant activity of which has been scientifically proven [9]. Superoxide radicals, hydroxyl radicals and peroxide radicals can be inhibited by the antioxidant systems of milk [10]. The human body has mechanisms for neutralizing and purifying reactive oxygen species. An important line of defense against reactive oxygen species consists of enzymes such as glutathione peroxide, catalase and superoxide dismutase, ubiquinol, and uric acid.[11] Lipid oxidation is a major cause of chemical spoilage of food and dairy products, leading to undesirable changes in the nutritional value, taste, and texture of food [12] . A review of the literature has shown that milk and milk products have antioxidant capacity, but data on the antioxidant capacity of milk and milk products have not been compiled before. This article briefly describes the antioxidant capacity of milk and milk products.

Antioxidant properties of caseins

Caseins are the main protein of cow's and cattle's milk and exist in the form of macromolecular aggregates. Due to the difference in phosphate content, there are different casein fractions in milk, for example, the phosphate content of α, β and κ caseins is 10, 5 and 1 mol per casein mol, and phosphate can provide antioxidant activity for casein micelles [13]. Milk proteins have shown antioxidant activity to scavenge reactive oxygen species. Studies have shown that casein inhibited lipid autoxidation catalyzed by lipoxygenase. Free amino acids cannot quench free radicals, and the primary structure of casein molecules acts as a scavenger to scavenge free radicals [14]]. Phosphoserine residues bound to casein molecules and inorganic phosphate can bind non-heme iron present in casein and serum. A previous study found that 72 and 21% of added non-heme iron in skim milk was derived from α- and β-caseins, respectively, and that phosphoseryl-rich peptides of casein phosphatides bind divalent metal and casein-derived peptides inhibit lipoxygenase. . activity [15]. Casein-derived phosphopeptides have been shown to sequester iron in lipid and aqueous food systems [16]]. Browning is a serious problem in many food products, and casein-based coatings are used commercially to prevent oxidative browning of fruits and vegetables. The effectiveness of calcium caseinate and whey powder in delaying enzymatic browning in sliced potatoes and apples was investigated, and the results showed that the milk protein-based food coating effectively delayed enzymatic browning. Whey protein powder showed better antioxidant activity than calcium caseinate, and the differences in antioxidant activity of whey protein and caseinate were related to the difference in amino acid profile [17]. The antioxidant activity of superoxide dismutase, catalase and glutathione peroxidase, casein and some peptides has been well established [18].

Antioxidant properties of whey proteins

In recent years, the use of whey in food and non-food products has been increasing worldwide. Whey protein has a high biological value and approximately 30-35% of whey is still discarded [19]. In the food industry, whey proteins are used as emulsifying, gelling and thickening agents. The antioxidant activity of whey protein has been scientifically proven, and whey antioxidants can effectively inhibit lipid oxidation [20]. The antioxidant activity of whey protein is related to the chelation of transition metals by lactoferrin and scavenging of free radicals by sulfur-containing amino acids [21]. Whey proteins increase the level of glutathione peroxidase, which is one of the most important water-soluble antioxidant systems [22]]. Whey proteins have antioxidant activity and the addition of whey protein to soybean oil emulsion increased the oxidative stability [12]. Antioxidant properties of salmon oil emulsion increased as a function of whey protein addition [20]. Foods containing whey proteins have antioxidant activity. Lactoferrin and casein can inhibit the production of lipid peroxidation, peroxide radicals, thiobarbituric acid reactive substances, oxygen and iron oxide free radicals [23]. Casein fraction, whey protein composition and amino acid profile of cow, buffalo, sheep and goat milk are presented in Tables 1, 2 and 3, respectively.

Table 1 Casein content of cow, buffalo, goat and sheep milk

From: Antioxidant properties of milk and milk products: a comprehensive review of existing knowledge

Parameters	Cow	Buffalo	Sheep	Goat
TPC (g/L)	27.8	49.2	59.4	33.4
aS $_1$ - kazein (%)	37	90	33	99
aS $_2$ - kazein (%)	7	13	14	8.52
b-kazein (%)	42	28	30	63
g-kazein (%)	6	22	9	18
k- kazein (%)	9	7	14	8

1. Total protein content of TPC

2. Source of data

3. Cow's milk: [104]

4. Buffalo milk: [105]

5. Sheep's milk: [104]

6. Goat's milk: [104]

Table 2. Composition of whey proteins in cow, buffalo, goat and sheep milk

From: Antioxidant properties of milk and milk products: a comprehensive review of existing knowledge.

Parameters	Cow	Buffalo milk	Sheep milk	Goat milk
Whey proteins (g/l)	6.46	6.46	10.76	6.14
b- lactoglobulin (%)	59.3	59.3	61.1	54.2
a- lactalbumin (%)	16.2	16.2	10.8	21.4
Immunoglobulins (%)	15.0	15.0	20.0	11.5
Sarum albumin/laktoferrin (%)	9.5	9.5	8.1	12.8

1. Source of data

2. Cow's milk: [104]

3. Buffalo milk: [105]

4. Sheep's milk: [104]

5. Goat's milk: [105]

Table 3 Amino acid profile of cow, buffalo, sheep and goat milk

From: Antioxidant properties of milk and milk products: a comprehensive review of existing knowledge

Amino acid (g/100 g)	Cow's milk	Goat's milk	Buffalo milk	Sheep milk
Aspartik kislota	7.8	7.4	7.13	6.5
Treonin	4.5	5.7	5.714	4.4
Cool	4.8	5.2	4.65	3.4
Lutamic acid	23.2	19.3	21.4	14.5
Proline	9.6	14.6	12.0	16.2
Sistine	0,6	0,6	0,586	0,9
Glycine	1.8	2.1	1.93	3.5
Alanine	3.0	3.6	3.03	2.4
Valin	4.8	5.7	6.760	6.4

Amino acid (g/100 g)	Cow's milk	Goat's milk	Buffalo milk	Sheep milk
Methionine	1.8	3.5	0,928	2.7
Isolicin	4.2	7.1	5.714	4.6
Leucine	8.7	8.2	9.792	9.9
Triosine	4.5	4.8	3.858	3.8
Phenylalanine	4.8	6.0	4.713	4.3
Histidine	3.0	5.0	2.73	6.7
Lysine	8.1	8.2	7.497	7.8

1. Amino acid has antioxidant activity in milk and milk products
2. Source of data
3. Cow's milk: [106]
4. Goat's milk: [107]
5. Buffalo milk: [108]
6. Sheep's milk: [107]

Abbreviations

DNA:

Deoxyribonucleic acid

DPPH:

2,2-Diphenyl-1-Picrylhydrazyl

FRAP:

Iron-reducing antioxidant power

GSHPx:

Glutathione peroxidase

HPLC:

High performance liquid chromatography

SOD:

Superoxide dismutase

TBA:

Thiobarbituric acid

TPC:

Total protein content; **GTE:** green tea catechins

List of used literature

1.Richmond HD. Sut kimyosi: sut kimyogarlari va sut mahsulotlarini nazorat qiluvchi boshqalar uchun amaliy qo'llanma. AQSh: Cole Press. 2007 yil.
2.Saxelin M, Korpela R, Mayra-Makinen A. Kirish: funktsional sut mahsulotlarini tasniflash. In: Mattila-Sandholm T, Saarela M, muharrirlar. Funktsional sut mahsulotlari. Boka Raton, FL, AQSh.: CRC Press; 2003. b. 1–16.
3.Yazdanparast R, Ardestani A. Cyperus rotundusning in vitro antioksidant va erkin radikallarni tozalash faoliyati . J Med oziq-ovqat. 2007;10:667–74.
4.Kris-Etherton PM, Hecker KD, Bonanome A, Coval SM, Binkoski AE, Hilpert KF, Griel AE, Etherton TD. Oziq-ovqatlardagi bioaktiv birikmalar: ularning yurak-qon tomir kasalliklari va saraton kasalliklarining oldini olishdagi roli. Men J Med. 2002;113:71–88.
5.Vang Y, Yu R, Chou C. Laktik kislota bakteriyalari va bifidobakteriyalar bilan fermentlangan soya sutining antioksidant faolligi. Oziq-ovqat mikrobiol. 2006;23:128–35.
6.Jiang P, Burczynski F, Kempbell C, Pirs G, Avstriya J, Briggs C. Rutin va flavonoid tarkibidagi uchta karabuğday turlari Fagopyrum esculentum, F. Tataricum va F. Homotropicum va ularning lipid peroksidatsiyasiga qarshi himoya ta'siri. Food Res Int. 2007;40:356–64.
7.Santillo A. Kaprin sutida kazein proteolizida mahalliy fermentlarning roli. Inter Dairy J. 2009: 655–60.
8.Usta B, Yilmaz-Ersan L. Sutning antioksidant fermentlari va ularning biologik ta'siri. J Uludag universitetining qishloq fakulteti. 2013;2:123–30.
9.Mustonen EA, Tuori M, Saastamoinen I, Taponen J, Wahala K, Saloniemi H, Vanhatalo A. Sut sigirlari sutidagi Equol qizil yonca kabi em-xashak dukkaklilaridan olinadi. Br J Nutr. 2009;102:1552–6.
10.Tong LM, Sasaki S, McClements DJ, Decker EA. Zardobning yuqori molekulyar og'irlikdagi fraktsiyasining antioksidant faolligi mexanizmlari. J Agri oziq-ovqat kimyosi. 2000;48:1473–8.
11.Karakaya S, El SN, Tas AA. Fenolik birikmalarni o'z ichiga olgan ba'zi oziq-ovqatlarning antioksidant faolligi. Int J Sci Nutr. 2001;52:501–8.
12.Erel Ö. Yangi avlod, yanada barqaror ABTS radikal kationidan foydalangan holda umumiy antioksidant imkoniyatlarini o'lchash uchun yangi avtomatlashtirilgan usul. Clin Biochem. 2004;7:277–85.
13.Cervato G, Cazzola R, Cestaro B. Sut kazeinlarining antioksidant faolligi bo'yicha tadqiqotlar. Int J Food Sci Nutr. 1999;50:291–6.
14.Suetsuna K, Ukeda H, Ochi H. Kazeindan olingan erkin radikallarni tozalash faoliyati peptidlarining izolyatsiyasi va tavsifi. J Nutr Biochem. 2000;11:128–31.
15.Raqib SG, Fornaroli S, Boeriu CG, Wichers HJ. Kazein va kazein gidrolizatlari. Lipoksigenazni inhibe qiluvchi xususiyatlar. J Agric Food Chem. 2001;49:287–94.
16.Kitts DD. Kazein fosfopeptidlarining antioksidant xususiyatlari. Trends Food Sci Tech. 2005;16:549–54.
17.Le Tien C, Vachon C, Mateescu MA, Lacroix M. Sut oqsili qoplamalari olma va kartoshkaning oksidlovchi qizarishi oldini oladi. J Oziq-ovqat fanlari. 2001;4:512–6. 18.Boor KJ. Suyuq sut mahsulotlari sifati va xavfsizligi: kelajakka qarash. J Sutchilik fanlari. 2001: 1–11.
19.Colbert LB, Decker EA. Kislota zardobidan ultrafiltratsiya o'tkazuvchanligining antioksidant faolligi. J Oziq-ovqat fanlari. 1991;5:1248–50.
20.Tong LM, Sasaki S, McClements DJ, Decker EA. Qizil ikra yog'i emulsiyasida zardobning antioksidant faolligi. J Oziq-ovqat fanlari. 2001;8:1325–9.

21.Carthy TLM, Kerry JP, Kerry JF, Lynch PB, Buckley DJX. Xom va pishirilgan cho'chqa go'shti pattilarida sintetik antioksidantlar va E vitamini bilan solishtirganda tabiiy oziq-ovqat / o'simlik ekstraktlarining antioksidant salohiyatini baholash. Go'sht fanlari. 2015; 1:45–52.
22.Clouatre D. Sog'lik uchun zardob. Umumiy salomatlik. 1999;2:65–6.
23.Chen J, Lindmark-Mansson H, Akesson B. Sigir suti va zardobdagi glutation peroksidaza faolligining birlashtirilgan enzimatik tahlilini optimallashtirish. Int Dairy J. 2000: 347–51.