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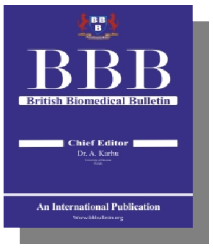


Original

# Horse Milk; the Composition, Equine Milk Proteins, Milk Allergy and Homology between Mammal Species with Horse

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ABSTRACT

Horse milk has long been a popular gourmet food with an exceptionally delicious flavor and subtle nuances found in no ordinary dairy product in central Asia. Equine milk has important nutritional and therapeutic properties that can benefit the diet of the elderly, convalescent or newborn. Horse milk seems with regard to composition on milk of people. It has a sweet taste because it contains a lot of lactases. Beside that the taste is very gentle and a little watery in comparison with cow milk. Horse milk contains less casein than cow milk as a result of which it is better digestible. In this study, we investigated the composition, equine milk proteins, milk allergy and Homology between mammal species with horse.

## Introduction

Horse's milk, in addition to being the most important nutritional resource for foals during the first months of life, is also one of the most important basic foodstuffs for the human populations in those areas of central Asia (Mongolia and southern states of the former Soviet Union, e.g., Kazakhstan, Kyrgyzstan and Tajikistan.), where a lactic-alcoholic beverage called Koumiss is traditionally produced through fermentation[1], they have been traditionally important dairy animals Because equine milk resembles human milk in many respects and is claimed to have special therapeutic properties[2]. Koumiss is used in Russia and Mongolia for the management of digestive and cardiovascular diseases in Italy, equine milk is recommended as a substitute for bovine milk for allergic children[3]. Estimates that more than 30 million people worldwide drink equine milk regularly, with that figure increasing significantly annually. However, in comparison with bovine milk, equine milk is very expensive to produce[4].

## Horse milk Usage

The characteristic composition of horse milk explains a large part of the functioning. People drink horse milk, because they have charge of cow milk allergy, but also in relation to other aspects of their health people benefit from the effects of horse milk. Especially for people with skin problems, stomach-and bowel problems horse milk seems to have a positive influence. By reinforcing the bowel flora and by promoting the metabolism, horse milk has a positive influence on your health. Because of this it is stamina enlarging. Horse milk is recommended at metabolism problems, irregular chair pace, skin problems, too high cholesterol value, stiff joints, and cancer and menopause symptoms.

## Composition of Horse's Milk

The composition of equine milk differs considerably from that of the milk of the principal dairying species, i.e., the cow, buffalo, goat and sheep. In comparison with bovine milk, equine milk contains less fat, protein, inorganic salts but more lactose, with a concentration close to that in human milk. Equine milk, with a composition close to that of human milk, may be a good nutritional source for the neonate when breast milk is unavailable[5].

## Equine Milk Proteins

However, while the caseins are the predominant class of proteins in bovine milk (w80% of total milk protein), equine milk contains less casein and more whey proteins. The major whey proteins in equine milk are *β*-lactoglobulin (*β*-Lg), α-lactalbumin (*α*-La), immunoglobulins (Igs), blood serum albumin (BSA), lactoferrin (Lf) and lysozyme (Lyz)[6], which is similar to bovine milk. Except for *β*-Lg, all these proteins are also present in human milk. Casein micelles are primarily a source of amino acids, calcium, phosphate and bioactive peptides for neonates[7]. The casein fraction of most milk types consists of four gene products: *αs*1-, *αs*2-, *β*- and *κ*-caseins, of which the first three are calcium-sensitive. *β*-Lg is the major whey protein in the milk of most ruminants and is also present in milk of monogastrics and marsupials, but is absent from the milk of humans, camels, lagomorphs and rodents. Two isoforms of equine β-Lg have been isolated, *β*-Lg I and II, which contain 162 and 163 amino acids, respectively. The extra amino acid in equine *β*-Lg II is a glycine residue inserted after position 116[8]. *α*-La, a unique protein in the milk of mammals, is homologous with the well-characterized c-type lyz. It is a calcium metalloprotein, in which $Ca^{2+}$ plays a crucial role in folding and structure. Equine *α*-La

occurs as three genetic variants, A, B and C, which differ by only a few single amino acids[9]. Lf is an iron-binding glycoprotein; Equine Lf contains 689 amino acid residues, which is similar to bovine Lf and two more than human Lf[7].

## Horse Milk – A Rare and Expensive Commodity

Far higher in nutrients than cow milk, horse milk has long been a gourmet delicacy. Scientific studies prove that horse milk is far more nutritious than any other milk. Horse milk contains only 44 calories per 100grams (or 3.5273 oz.), compared to 64 for cows and 70 for human. Additionally, lactose (milk sugar) is higher in horse milk than in cow and human milk due to albumin, the latter of which is very beneficial for improving digestibility. In contrast to horse meat, horse milk tastes very mild and light. Even new born babies can drink it. In these health conscious times, it seems made for success. Horse milk is extremely rich in vitamins and minerals, but has a very low fat percentage (%1.25) compared with cow milk (%3.7), therefore it is easily digested. It is extremely creamy and rich, and displays a slight yellow color from the rich butterfat, Horse milk has a great almost unlimited income potential.

## Horse's Milk Allergy

Allergy to milk is caused by proteins in milk. Milk contains 21.4gram of protein per lit. The proteins in milk can be divided into the so called caseins (56%) and a group of proteins called the whey proteins (44%). $\beta$-Lg, $\alpha$-La, proteose-peptones and the blood proteins serum albumin and Igs belong to the whey proteins. $\alpha$-La, $\beta$-lg and Caseins are regarded as the most important allergens in milk.

Horse's milk protein allergy (HMPA) is an adverse clinical reaction associated with the binding of immunoglobulin E (IgE) to antigens capable of eliciting an immune response. Where allergy is not mediated by IgE, other classes of immunoglobulin, immune complexes, or a cell-mediated reaction have been proposed to be involved[10]. HMPA results from an immunological reaction to one or more milk proteins, and it may be IgE or non-IgE associated and clinical manifestations can be divided respectively in immediate clinical reactions (IgE mediated) and delayed reactions (non-IgE or cell-mediated). IgE-mediated allergic reactions typically occur within 10–20 min of exposure, the onset of symptoms is rapid, occurring within minutes to an hour after allergen exposure. Non-IgE-mediated reactions tend to be delayed, with the onset of symptoms occurring from 1 hour to several days after ingestion of milk[11].

IgE-mediated reactions usually present with immediate responses like urticaria and angioedema but severe anaphylaxis can also occur and fatalities have been reported[12]. Some of these reactionscan occur with the ingestion of very small amounts of milk or with contact alone. Identification of the specific IgE-binding epitopes for casein and whey allergens explains these clinical phenomena and can also predict the likelihood of tolerance or persistence in individual patients[13].

In SDS-PAGE of milk from different mammalian species. Horse (mare) and donkey milks have different protein distributions from cow's milk, with a lower proportion of caseins and a higher number of electrophoretic bands of whey proteins[11].

## Homology between Mammal Species

The highest homologies observed between the milk proteins of cows and other Bovidae, being on average 96.1% for buffalo, 91.1% for sheep and 87.6% for goat. Lower sequence similarities are associated with the milks from Suidae (pigs and boars, 64.2%), Equidae (horse 62.4% and donkey 62.8%),

Camelidae (dromedary 60.0%) and humans (58.4%)[14]. Good clinical results were obtained for treatment allergy using milks from mammals that are more phylogenetically distant from bovidae, such as horse, donkey and camel. Businko et al. Showed that mare's milk was a good dietetic substitute in 24/25 children with severe cow's milk allergy[14].

## Conclusions

In fact, the composition of horse milk is similar to humans milk, especially concerning the lipid and protein fraction contents .Furthermore, the protein fraction in horse milk is characterized by low casein and *β*-lactoglobulin content, probably responsible for the hypoallergenic characteristics of this milk, and by a quite high lysozime content.Recent clinical studies have demonstrated that feeding with horse milk is a safe and valid treatment for infants affected by protein intolerance to dairy cows milk.

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