Research Article

CAMEL AND DONKEY MILK BASED NUTRITIVE POWDER: A CHEAPER ALTERNATIVE OF HUMAN MILK

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ABSTRACT

Existing milk based product causes various health implications on infants and new born. Hence in the present work, camel milk and ass milk was studied for their nutritive value. Both are already known for their various medicinal properties. Study suggested that both milk have good protein and easily digestible sugar. In addition both were observed to be good in mineral content. Hence milk powder composed of camel and ass milk could be best nutritive alternative of human milk and other baby foods and could be employed after clinical trials.

KEY WORDS: Camel milk, ass milk, nutritive, baby food, therapeutic, milk powder

INTRODUCTION

Camel and ass milk have been reported for their therapeutic properties (qna.rediff.com; Mal et al., 2006). Camel and donkey produces nutritious milk for human consumption. This milk is naturally available in Rajasthan. This milk has not any side effect on children and newborn baby. These are very cheap in cost. It is a new nutritive source of proteins for human. So the development of these proteins powder is very important. This is the new milk protein source for the children ands human health. This is renewing source of Immunity against many diseases in new born baby and human health.

Appreciable amounts of essential fatty acids were present in camel milk. It can be concluded that camel milk can be considered as a good food of high nutritive and therapeutic applications. Meanwhile, the high content of antimicrobial agents in camel milk may explain its potential as an antiviral activity especially against diarrhea-causing viruses. (Shamsia S, 2009). Camel milk is very similar to goat milk and compares very favorably with human milk (Davis and McDonald, 1953). Recent clinical studies confirm ass's milk feeding as a safe and valid treatment of most complicated cases of multiple food intolerance (Carroccio *et al*., 2000). However, information on ass's milk composition (Coppola *et al*., 2002; Iacono et al, 1992; Oftedal and Jenness, 1988; Schryver *et al*., 1986) is more limited. Modified cow's milk preparations are the most used substitutes for human milk (Posati and Orr, 1976). However, many nutritional problems were reported from its use for infant feeding due to cow's milk allergy (El-Agamy, 2007; El-Agamy et al*.,* 2009). Other types of milk has been proposed as substitute of human milk such as goat (Park and Haenlein, 2006), sheep (Haenlein and Wendorff, 2006), buffalo (Shamsia, 2005), but little information are available on the use of camel milk for its purpose. Camel and ass milk proteins have unique patterns that are completely different from human milk proteins. Camel and ass milk proteins can be considered an important criterion from the nutritional and clinical points of view, since These milk sources might be suggested as a new protein source for nutrition for children allergic to cow milk and can be used as such as or in a modified form.

MATERIALS AND METHODS

Collection of raw milk (Camel and Donkey milk): Milk samples were collected in sterile container and stored at –40°C until analysis. The samples taken at the same stage of lactation were thawed, pooled, and portions were taken for analyses. Camel (*Camelus dromedaries*) milk (20 samples) was procured from farms at Sikar; Donkey *(Equus asinus)* milk (20 samples) was get from healthy donkey at Sikar (Rajasthan).

Biochemical analysis of milk samples: Camel and Donkey milk samples (twenty individuals' samples of each) were analyzed for pH, fat, total protein (casein, whey protein), lactose, and mineral content. Biuret (Wikipedia.com) and Xanthoproteic tests (Wikipedia.com) were done for detection of presence of peptide bonds and protein respectively. Mineral content like calcium and phosphorus was also determined by standard methods. Milk samples were also checked for adulteration of formalin, pulverized soap, detergent and benzoic and salicylic acid.

ISOLATION AND PURIFICATION OF CASEIN

Casein was precipitated by adding dilute glacial acetic acid. For this purpose, 100 ml of milk heated on sand bath to about 40° C. At this temperature acetic acid was added drop by drop and stir the solution gently using a small spatula. Precipitated casein push onto the side of the beaker using the spatula so that most of the liquid drains from the solid. Acetic acid was added until complete casein protein precipitated.

0.2 g of calcium carbonate was then added to the milk in the beaker. Stir this mixture for a few minutes and save it for use in the isolation of lactose below. Further casein was dried by vacuum evaporation and then carefully collected in paper to take percent weight.

Isolation of the Sugar, Lactose and ß –lacto globulin, alpha-lactalbumin Proteins from Milk:

After removal of casein, remaining milk mixture were further incorporated for isolation sugar, lactose and ß –lacto globulin, alpha-lactalbumin proteins. Milk mixture was heated to about 75°C for about 5 min. on a sand bath. Heating results in a nearly complete denaturization and precipitation of the albumins from the solution.

Resulting mixture was centrifuge to separate liquid from solid albumin. Heat this mixture to 75^0C to minimize the loss of lactose that may have crystallized along with the albumin precipitate.

15 ml of 95% ethanol was added to the beaker to precipitate the solids. Then solution was heated to 60^0C to dissolve some of solids. Solution then incorporated to centrifuge to prevent premature crystallization of the lactose. A considerable quantity of solid material is deposited on the bottom of the centrifuge tubes. Liquid was removed from flask and allowed the lactose to crystallize for at least two days. An obtained granular crystal was subjected to vacuum filtration. 3 mL of 95% ethanol was added to transfer and wash the product. α-Lactose crystallizes with one molecule of water of hydration per molecule of lactose. The product was weighed after it is thoroughly dry. Percent weight of α –Lactose was taken after isolation.

Purification of protein

Protein was purified by cation ion exchange chromatography. By using cationic resin,1x equilibration buffer, 1xwash buffer and 0.5-1M sodium or potassium chloride solution to elute the proteins. Eluent was washed with 10 ml 1x regeneration buffer before storage. The purity of milk protein was checked by SDS-PAGE.

Confirmation of purity of protein

Purity of protein was confirmed by SDS-PAGE.

Development of protein powder

Liquid camel and ass milk was subjected to freeze drying in which milk heated to 135 degrees F or so in a vacuum chamber to get it boiling. This evaporated milk was then sprayed through very fine nozzles to mist it in air at high temperature..

RESULTS AND OBSERVATIONS

Results of Biochemical analysis showed that considerable amount of protein (especially casein) is found in these milk samples. In addition to this, tested sample were found enriched with Ca, Mg, P, K, Na and lactose. However mineral content of camel milk was observed to be lower than donkey milk (Table 1). pH observed for both sample was between 6.6-6.8. Sugar content observed for camel milk was found to be lower than human milk while it was higher in donkey milk; it was concluded by comparing recorded data with observed one. No adulteration was recorded in collected sample milk.

After purification, protein was subjected to native gel. After running, the stained gel was observed under Gel-Doc. Purified protein band was observed.

Furthermore after complete profiling and protein content determination, this milk samples together dried under vacuum to get dried nutritive milk powder. Further clinical trials experiments are in progress.

Table no.1 comparison of nutrient content of camel, donkey and human milk

Constituents	Camel milk	Donkey milk	Human milk
Fat	4.0 %	0.38 g·100 g–1	2.1%
Protein	3.46%	1.72 g·100 g–1	1.94%
Casein	2.65%	0.87 g·100 g–1	0.63%
Whey protein	0.81%	0.68 g·100 g–1	1.31%
Lactose	4.86%	6.88 g·100 g–1	6.45%
Ca	109 mg/100ml	676.6 mg.kg-1	34 mg/100ml
P	76 mg/100ml	487.0 mg.kg-1	16 mg/100ml
K	179 mg/100ml	497.2 mg.kg-1	62 mg/100ml
Na	58 mg/100ml	218.3 mg.kg-1	10 mg/100ml
Mg	14 mg/100ml	37.3 mg.kg-1	3 mg/100ml

DISCUSSION

Milk is a nutritive beverage obtained from various animals and consumed by humans. Most milk is obtained from dairy cows; although milk from Goats, Camel, Donkey, water Buffalo, and Reindeer is also used in various parts of the world It is well known that the best nutritional option for newborns is their mother's milk: however, some infants may not be exclusively breast fed during the first months of life. Therefore, there is a need for another substitute of close composition and properties as human milk. In such cases, when breast feeding is not possible, a cow’s milk free diet often resolves symptoms, although some infants can present intolerance to the foods used as alternatives (Carroccio, 2000),including formulas containing soy or hydrolyzed protein (Iacono, 1992). Results showed that camel milk contain high protein and less lactose as compare to human milk hence easily digestible by newly born babies it is also known for various therapeutic properties. Similarly study also suggested the nutritive content of ass’s milk is almost similar to breast’s milk hence beneficial for babies that could not feed on mother milk due to diseases like AIDS, improper milk formation etc. Reports are available on medicinal properties of camel milk(Yagil, 1982).This milk contains protective proteins and also contains higher amount of zinc. The role of Zn in the development and maintenance of a normally functioning immune system has been well established (Hansen *et al*., 1982). Antibacterial and antiviral activities of these proteins of camel milk were studied (El-Agamy *et al*., 1992).In addition, camel milk is known for its glycemic control effect (Agrawal *et al*., 2002).Camel milk is known for high content of protein, casein, potassium and Vitamin C, this milk can be the sole dietary source for a human, or a camel for that matter for a long period of time providing the minimum balance of nutrition. It contains less lactose than human's milk, making it fairly easy to digest as well. Fat content is low, while water content is high, to sustain a person being in a

dry, hot environment where where water, not fat, is needed to live (camelmilk.cherrytaco.com).

Similarly, according to H.Y.Guo et al", the donkey milk was shown to be poor in protein and fat and rich in lactose, which is more similar to human milk than to other mammalian milk. It was also characterized by a low CN content and a particularly a high whey protein content that was rich in β-LG and lysozyme. The percentages of 8 essential amino acid in the protein of donkey milk were higher than those of mare and cow milk; the milk also had higher levels of Ser, Glu, Arg, and Val and a lower level of Cys. As a result, donkey milk exhibited unique nutritional characteristics and has optimal potential to be used as a new dietetic food and breast milk substitute.

Hence it is suggested that milk powder based on both camel and ass milk could be good alternative for all those infants or new borns remain deprived from mother's milk. Deprivation might be either due to mother's health reasons or due to female conciousness.

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