

by Marvin P. Thompson

*Agricultural Research Service  
U. S. Department of Agriculture  
Eastern Utilization Research and Development Division  
Philadelphia, Pennsylvania 19118*

The author's first exposure to goat milk came as a result of his research on the variation of cow milk proteins. He wanted to know if goat milk caseins, (the proteins which, along with fat, make milk white) like those of cow milk, are genetically variable. In this connection he sought the assistance and advice of the Pennsylvania Dairy Goat Assn. research group and the regional groups in Pennsylvania and New Jersey. This paper will briefly report some of the important features about goat milk, its use as a food, and some of the research which has been conducted on the product in recent years. An excellent detailed review on goat's milk by Parkash and Jenness has recently been published and for specific scientific details the reader is referred to that article (Parkash, S. and Jenness, R. The composition and characteristics of goat's milk: A review. Dairy Science Abstracts 30: 67-87. 1968).

Estimates on the number of goats in the United States approach about 5 million, 1 million of which serve as dairy goats, the others for meat, mohair, and some for pets. Africa has the greatest number of goats, 99 million, with the Far East second at 84 million. Goat milk is marketed in the U. S. in the form of fluid milk, cheese, evaporated milk, and dried milk, but reliable figures on the total production of goat milk are unavailable. Understandably, goat milk does not comprise a large percentage of the diet of the average American either in the form of fluid milk or by-products, while in Spain 11% of the total cheese is made from goat milk. The market for goat milk in the U. S. has been based largely on its supposed nutritional superiority in special feeding diets or for individuals suffering from cow milk allergies.

What is the composition of goat milk? Goat milk, like cow milk, has a variable composition of fat, protein, and lactose depending upon the season of the year, feeding, stage of lactation, and breed. The average percentages of fat, protein, and lactose will be 4.0, 3.3, and 4.6, respectively, which are very similar to cow milk. As far as breeds are concerned, Nubian, Toggenburg, Alpine, and Saanen in that descending order, produce the greatest amount of fat, but some authors question if a significant fat percentage difference exists between Saanen and Toggenburgs. In solids-not-fat, Nubian are obviously higher than the other breeds. Regardless of breed, goat milk contains reasonable quantities of good quality protein, fat, and carbohydrates.

Now let us consider some important features about the fat, protein, carbohydrates, minerals, and vitamins of goat milk.

*Carbohydrates.* Carbohydrates exist in the milk of most mammals as lactose. Lactose is a potent source of calories for the infant young and is used by the body as an energy food. It also serves to achieve acidity

in the digestive tract, and milk for that reason, while excellent for man, is not desirable in the diets of some mammals, namely, large adult dogs.

*Fats.* The so-called "goaty" flavor of goat milk can be attributed to the presence of the appropriately called goat acids. These acids are butyric, caproic, caprylic, and capric. Goat milk which has not been properly cooled after being drawn or milk which has been contaminated by bacteria characteristically smells "goaty." The condition can be prevented by proper cooling of milk and good sanitation. Pasteurization at 145°F. for 30 minutes is desirable; it does not harm the food value of the milk and is a definite safety factor in prevention of disease. Goat milk fat and cow milk fat are also the same in the total amount of "saturated" versus "unsaturated" fatty acids; for each species about 70% are saturated and 30% unsaturated. One distinctive difference in the milk fat of goat and cow is the size of the fat globules. Those of goat range in size from 1-10 microns with an average of 1-4. Fat globules in cow average close to 6. Because of this smaller size goat milk appears to be "naturally homogenized" although in time fat will rise to the top of a milk bottle.

*Proteins.* While the total percentage of protein in goat and cow milk is nearly the same, the caseins and whey proteins (soluble proteins) are definitely not identical. And while the author does not wish to cite the specific differences among the goat and cow milk proteins, it is safe to say that although differences exist, the proteins from each species are equally valuable nutritionally. With regard to proteins, however, two points of interest arise: (1) goat milk makes a softer curd than cow milk. This is very evident when cottage cheese is made from goat milk and a soft coagulum develops. While it can be suggested that a soft curd is more easily digested than a hard curd, clinical evidence supporting that contention is lacking. (2) goat milk has been suggested as an excellent substitute for cow milk when an infant or other person is allergic to cow milk or suffers from digestive problems. Certainly the reader and author can name several persons who would testify to that observation, but, here again, clinical evidence is not impressive. In laboratory studies scientists have found that the whey proteins of goat and cow milk, while not identical in every detail, are very similar in immunochemical assays. Simply more laboratory and clinical research evidence must be collected to determine if goat milk and cow milk differ in their allergenic behavior in man.

*Minerals and vitamins.* Goat milk and cow milk are excellent sources of calcium and phosphorus needed for bone development. They are also good sources of potassium and fair sources of sodium and magnesium and poor sources of iron. With respect to vitamins, goat milk contains much less B-6 and B-12 than cow milk, but more of these than human milk. Of further interest is the lack of carotene (the yellow colored precursor to vitamin A) in goat milk but it is equally potent in total amount of vitamin A.

*Research being conducted.* It should come as no surprise that very little research has been conducted on goat milk as compared to cow milk since more than 95% of the milk utilized in the U. S. is cow milk. Nevertheless, some basic research is being conducted on goat milk, primarily on the protein and fat portions, with little, as far as this author knows, on clinical studies. Our efforts in the U. S. Department of Agriculture have

been directed to studying the genetic and compositional differences of goat milk with particular emphasis on the caseins and b-lactoglobulins (the major whey protein). Some research is also being conducted with goats at the Pennsylvania State University. The studies are directed to determine the origin of milk fats. Continued research projects, such as those sponsored by the Pennsylvania Dairy Goat Assn., are particularly valuable because they involve the members of the association in learning more about their product, goat milk.