EXTENSION GOAT HANDBOOK

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INTRODUCTION

This handbook was developed at the request of leaders of the goat industry to provide an up to date and comprehensive source of information on goats. Initial funding for the Handbook was provided by an Extension Service-USDA special project grant to the University of Delaware. George Haenlein, Extension Dairy Specialist - Delaware, was project leader with Don Ace, Extension Dairy Specialist - Pennsylvania, serving as co-editor.

To keep this Handbook updated, a committee of Extension specialists and goat industry leaders will be asked to review its contents annually and recommend fact sheets for development, revision or deletion. Newly printed fact sheets will be made available to each State Cooperative Extension Service at cost. Handbook owners may secure updates by contacting the Cooperative Extension Service in the State. Additional orders for Handbooks should be directed to your State Extension Specialist. See fact sheet for the contact in your State. State Extension Specialists should monitor suggestions for changes and the need for updated fact sheets and complete Handbooks and keep the Extension Goat Handbook Committee informed.

Much credit is due the authors, reviewers, and those that supplied photographs and information for the fact sheets included in this Handbook. A list of these other sources, as well as the original committee that spearheaded the successful effort to secure funding for this project, was included in the -initial printing of this Handbook.

The gratitude of all that are concerned with goats is due the editors, George Haenlein and Don Ace, for their leadership, perseverance, patience, and just plain hard work to make this Handbook a reality.

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Extension Goat Handbook

GOAT MILK VERSUS COW MILK

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To most people today, especially in the more developed countries, the term milk is synonomous with cow milk, as if cows alone possess a singular ability to produce mammary secretions. Perhaps nowhere has the feeling been more prevalent than in the US, where over 10 million cows are maintained to provide an abundant. clean source of nourishment and refreshment to our country, producing more than 125 billion pounds of milk annually. Yet on a world wide basis, there are more people who drink the milk of goats than from any other single animal Over 440 million goats (world wide) produce an estimated 4.8 million tons of milk that is predominantly consumed locally, or processed into various types of cheeses.

Here in the US, which historically has been one of the staunchest denigrators of the "stinking" goat, there are approximately a million dairy goats actively producing milk. Most of the upsurge in goat popularity has been the result of a growing trend towards attaining some measure of selfsufficiency on the part of many people, for both economic and aesthetic purposes. A goat will eat little, occupy a small area and produce enough milk for the average family (a good milker4ill produce about a gallon a day); whereas the prospect of maintaining a cow in a surburban backyard is usually more than the homeowner is willing or able to cope with. Hence the growing popularity of the “poor man's cow”.

As the interest in dairy goats and their products continues to rise, it is apparent that many misconceptions, discrepancies and exaggerated claims are being perpetuated. A comparison of cow and goat milk seems to be in order, so that some prejudices against goat milk may be erased. Also, while goat milk is somewhat unique, it is certainly not a magical elixir.

One of the primary misconceptions concerning goat milk is that it has a peculiar “goaty” odor or taste to it. This effect is produced by the presence of the buck, whose scent glands are rather odoriferous and may indeed cause the “goaty” type of milk people object to if he is present among the herd, especially at milking time. Does, however, do not have the powerful odor of the buck and milk produced in the absence of a buck should bear no objectionable odor.

Diet also plays a large role in the palatability of goat milk, as well as cow milk. While cows are usually rather closely regulated as to what they may eat and when, goats are often allowed to consume a great variety of materials at any time, including browsing. This kind of feeding may allow a certain "off" taste or smell to be transferred to the milk, just as cows may produce a “garlicky” milk from some spring pastures. What holds true for the cow also holds for the goat; i.e. what comes out is based on what goes in! If goats and cows are similarly managed, the smell and taste of both milks are quite comparable.

Goat milk is similar to cow milk, in its basic composition. In average, cow milk contains about 12.2% dry matter (3.2% protein, 3.6% fat, 4.7 lactose and 0.7 % mineral matter). Goat milk contains about 12.1 dry matter (3.4% protein, 3.8% fat, 4.1% lactose and 0.8 % mineral matter). These figures are only averages of course, as there are considerable differences between breeds, and among individuals of a breed. There are 6 breeds of dairy cows in the US. and 6 breeds of dairy goats producing milk.

The Saanen is best known as the Holstein of the goat world, producing a high quantity of milk with somewhat low fat levels. At the other extreme is the Jersey of the goat world, the Nubian. This breed produces a lesser amount of milk with a high fat content. The Toggenburg, LaMancha, Oberhasli and Alpine fall somewhere in between.

However, there are also differences that give goat's milk a place for special purposes. In summary:

1. Goat milk has a more easily digestible fat and protein content than cow milk.

2. The increased digestibility of protein: is of importance to infant diets (both human and animal), as well as to invalid and convalescent diets.

3. Goat milk tends to have a better buffering quality, which is good for the treatment of ulcers.

4. In - under-developed countries, where meat consumption is low, goat milk is an important daily food source of protein,, phosphate and calcium not available otherwise because of a lack of cow milk.

5. Goat milk can successfully replace cow milk in diets of those who are allergic to cow milk.

Allergies appear to be more common than formerly thought, especially in very young children. In an allergic type reaction, the symptoms are produced by histamines, which are stored in body cells. Histamines are released when triggered by a local stimulus. Antibody-antigen type reactions that manage to find an anchorage on cell walls trigger a release of histamine and produce the allergic symptoms. Such a release brings on a congestion of the capillaries and a flooding of the intracellular spaces by the lymphatic glands. The stimulation of local nerve endings also occurs. People who display an allergic reaction are usually more sensitive to the release of a given amount of histamine and also tend to produce greater numbers of antibodies to certain proteins.

Some of the so called "sudden deaths" of infants seem to be related to allergic type responses, resulting in anaphylactic shock. About 6% of the infants in the US suffer allergic responses to cow's milk. Of this number, however about only 14 % (of the 6 %) react to bovine serum present in cow milk. Most infants are allergic to various constituents of cow milk which may also be present in goat milk. Individuals who are allergic to bovine serum in cow milk will undergo also an allergic reaction to a variety of dairy products that are made with cow milk.

Other types of digestive upsets can result from milk due to a lack of the lactose digesting enzyme. While the presence of lactase is universal in infants (up to 3 years), the presence of this enzyme in adults is somewhat irregular and genetically determined.

Fat

One of the more significant differences from cow milk is found in the composition and structure of fat in goat milk. The average size of goat milk fat globules is about 2 micrometers, as compared to 2½ - 3½ micrometers for cow milk fat. These smaller sized fat globules provide a better dispersion, and a more homogeneous mixture of fat in the milk. Research indicates that there is more involved to the creaming ability of milk than merely physical size of the fat globules. It appears that their clustering is favored by the presence of an agglutinin in milk which is lacking in goat milk, therefore creating a poor creaming ability, especially at lower temperatures.

The natural homogenization of goat milk is, from human health standpoint, much better than the mechanically homogenized cow milk product. It appears that when fat globules are forcibly broken up by mechanical means, it allows an enzyme associated with milk fat, known as xanthine oxidase to become free and penetrate the intestinal wall. Once xanthine,oxidase gets through the intestinal wall and into the bloodstream, it is capable of creating scar damage to the heart and arteries, which in turn may stimulate the body to release cholestrol into the blood in an attempt to lay a protective fatty material on the scarred areas. This can lead to arteriosclerosis. It should be noted that this effect is not a problem with natural (unhomogenized) cow milk. In unhomogenized milk this enzyme is normally excreted from the body without much absorption.

Another significant difference from cow milk is the higher amount of shorter-chain fatty acids in the milk fat of goats.

Furthermore, glycerol ethers are much higher in goat then in cow milk which appears to be important for the nutrition of the nursing newborn. Goat milk also has lower contents of orotic acid which can be significant in the prevention of fatty liver syndrome. However, the membranes around fat globules in goat milk are more fragile which may be related to their greater susceptibility to develop off-flavors than cow milk.

Protein

The protein composition of cow and goat milk is fairly similar, although the typical major alpha-s-1-casein in cow milk is absent in goat milk and the formation of casein curd under rennin action is different. The quality of curd is judged on two criteria:

1. Curd tension - a measure of the hardness or softness of the curd. The softer the material, the more easily digestible it is. This tension is largely a breed characteristic. Holsteins generally have the softest curd in the bovine family. Cow range = 15-200 g. avg = 70 g. Goats range = 10-70 g, avg = 36 g.

2. Relative size of flakes - formed by the addition of strong acid to milk, causing curd flakes to precipitate. It can be seen that goat milk forms finer flakes more rapidly than cow milk, which tends to form large lumps and more slowly. This test tends to

duplicate reactions that occurs in the stomach, and demonstrates why goat milk is more easily and rapidly digested.

Vitamins

Goat milk has greater amounts of vitamin A than cow milk. Also, goats convert all carotenes into vitamine A, creating a white type of milk.

Vitamin B levels are a result of rumen synthesis in goats and cows,. and are somewhat independent of diet. Goat milk is higher in B levels especially riboflavin, but vitamin B_6 and B_{12} are higher in cow milk. Niacin levels are also higher in goat milk.

The milk levels of vitamin C and D are low and roughly the same for cows and goats.

Lactose

Cow milk is higher in lactose levels, although the difference is minor.

Ash (Minerals) and Buffering

Goat milk is higher in minerals, calcium, potassium, magnesium, phosphorus, chlorine and manganese; but it is lower in sodium, iron, sulphur, zinc and molybdenum.

Cow and goat milk is slightly on the acid side, with a pH range of 6.4-6.7. The principal buffering components of milk are proteins and phosphates. The good buffering capability of goat milk appears lo make it ideal for treatment of gastric ulcers.

Goat milk has also less of certain enzymes, ribonuclease, alkaline phosphatase, lipase and xanthine oxidase. Thus, some differences exist but their nutritional significances in human nutrition have yet to be researched and documented. The goat probably will never replace the cow for commercial production of milk, but there seems to be a great potential for diligent efforts in practice and research to improve production and marketing of goat milk and its products. The value of goat milk as an alternative food for children and sick people, because it is easier digested, extends also to feeding animals, young dogs, foals, even calves. Experience in the field indicates that calves can consume large quantities of goat milk while similar amounts of cow milk may result in scouring calves. Goat milk can, therefore, have a value not only for growing veal but also for raising valuable dairy replacement heifers, which will benefit from the high milk intake and show superior growth.

Reviewed by D. L. Ace, Pennsylvania State U., University Park.

Table 1. Comparative Average Composition of Milks

Item	Goat	Cow	Human
Fat, %	3.8	3.6	4.0
Solids-not-fat, %	8.9	9.0	8.9
Lactose, %	4.1	4.7	6.9
Nitrogen x 6.38, %	3.4	3.2	1.2
Protein, %	3.0	3.0	1.1
Casein, %	2.4	2.6	0.4
Albumin, globulin, %	0.6	0.6	0.7
Non-prot. nitr. x 6.38, %	0.4	0.2	0.1
Ash, %	0.8	0.7	0.3
Calcium, (CaO), %	0.19	0.18	0.04
Phosphorus, (P205), %	0.27	0.23	0.06
P_20_5/CaO	1.4	1.3	1.4
Chloride, %	0.15	0.10	0.06
Iron (P/100,000)	0.07	0.08	0.2
Copper (P/1000,000)	0.05	0.06	0.06
Vitamin A (i.u./g fat)	39	21	32
Vitamin B (ug/100 ml)	68	45	17
Riboflavin (ug1100 ml)	210	159	26
Vitamin C (mg asc. a./100 ml	2	2	3
Vitamin D (i.u./g fat)	0.7	0.7	0.3
Calories/100 ml	70	69	68