

ESSAY ON COW'S MILK ALLERGY

THESIS

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I. Introduction and Historical Background:

Throughout time breast milk continues to be " the best natural food" for all babies. Although most physicians encourage breast-feeding due to its variable and enormous advantages, many infants are artificially fed.

Cow's milk in the whole state or in some modified form is the basis for most formulas, (Barness, 1979) . As cow's milk becomes a standard food in infant nutrition and with the progressive decline of breast-feeding, the problem of cow's milk allergy increases proportionately.

Until recently and "despite the substantial and cumulating literature on milk allergy, physicians continue to miss its diagnosis" (Bahna and Gandhi, 1983 a) due to its multiple symptomatology and the absence of an appropriate laboratory diagnostic test.

The development of the modern infant formula can be traced back to pre-Christian times, (Mettler ,1982). Hippocrates (460-370 B.C.) was one of the first to record that cow's milk could cause gastric upset and urticaria.

Since early times, human milk was the major food available to infants. When the mother was unable to nurse her baby, a wet nurse was the only alternative. The demand for wet nurses grew considerably during the seventeenth and eighteenth centuries. About the middle of the eighteenth century, animal milk for infant feeding rose in popularity, (Bahna and Heiner, 1980).

Later, in the mid 19th century, a scientific approach to feeding infant formulae was adopted due to the more detailed analytical information becoming available. The different researches recorded, then after, were in the aim "to produce an infant formulae which resembles mother's milk more closely", (Mettler, 1982).

By the beginning of the 20th century, reports on milk allergy began to appear in the German, the French , the American and the British medical literature.

In recent years, many articles have been published confirming that cow's milk allergy is a real problem due to the widespread affection of several organs of the human body.

This study will discuss in detail the problem of cow's milk allergy which increases progressively in severity with the progressive decline in breast-feeding.

Symptoms due to cow's milk ingestion can be attributed to a case of "intolerance", "hypersensitivity" or "allergy". Bahna and Heiner(1980) restricted the use of the term intolerance to situations in which the underlying mechanism is non immunologic and the use of the term hypersensitivity and allergy when the evidence suggests an immunologic cause.

And as "the terms atopic and allergic are frequently interchanged", this disease is described as an atopic disorder as explained by the presence of " immune response genes " and " antigen specificity ".

The present assay will discuss the etiology, the pathogenesis, the manifestations, the management and treatment as well as the different methods of prevention of allergy to cow's milk which is one of the most common allergens during infancy, this period in which allergic diseases are more prevalent.

EPIDEMIOLOGY

II. Epidemiology

1. Prevalence of Cow's Milk Allergy :

Figures on the prevalence of cow's milk allergy vary widely from one study to another, being influenced by:

- 1- Nature of infant feeding, whether cow's milk feeding starts from birth or later in life.
- 2- Diagnostic criteria which, according to Goldman, et al., (1963), consist of disappearance of symptoms, due to cow's milk ingestion, on milk elimination and their recurrence again on milk challenge, at three separate occasions.
- 3- Type of study, whether prospective or retrospective.
- 4- Duration of study, the longer the duration of follow-up, the more frequent and detailed the examination, (Bahna and Heiner, 1980).

Recent studies suggest that, in the USA, 0.3% to 0.7% of infants are sensitive to cow's milk protein, (Taylor, 1980). Whereas the true prevalence, in the general pediatric population of Western countries, lies between 1 and 3%, (Bahna and Gandhi, 1983 a).

On the other hand, Barreli (1980) stated that, in a child with proved food hypersensitivity, the probability of affection of subsequent siblings is increased up to 50%. Bahna (1978) and Deamer (1983) have seen several families which have high incidence of cow's milk allergy and in which family members may show either the same or different symptoms.

However, Bahna and Heiner (1980) stated that cow's milk allergy is more likely to be overdiagnosed when the diagnosis depends exclusively on symptoms disappearing after a single trial of eliminating milk from diet.

2. Age at onset :

Cow's milk allergy is essentially a disease of infancy and early childhood. It usually appears within the first 2 or 3 months of life ; and as the course of the disease is self-limiting, it often disappears by the age of 2 or 3 years, (Bahna and Gandhi, 1983 a).

Moreover , some authors described 2 clinical types of intestinal injury due to cow's milk ingestion ; the first early type may appear any time between birth and 6 months of age, usually prior to 3 months ; the second late type appears from 6 months to 2 years of age, (Butler,et al.,1981).

However, no age is exempt, and milk allergy may be first detected during adolescence or adulthood, (Bahna and Heiner, 1980).

3. Sex distribution :

As noted in various studies (Gerrard,et al.,1973; Boat,et al.,1975 ; Walker - Smith,1978) , sex distribution appears to be equal except during early infancy, when more males seem to be affected, especially in the age-group under 4 months. This tendency is similar to that of allergic disorders in general, during early childhood, (Halpern, et al., 1973).

COMPOSITION OF COW'S MILK

III. Composition of Cow's Milk

I. Nutritional Constituents of cow's milk:

1- Water:

The relative amounts of water and solids in human and cow's milks are about the same, each having a water content of about 87 to 87.5 % , (Barness, 1979).

The specific gravity of each is in the range of 1030 to 1032.

2- Calories:

The energy value of each milk may vary slightly but each may be assumed to contain 20 Kilocalories per ounce or 0.67 Kcal/ml, (Barness,1979).

1 ounce = 30 ml ; one calorie is supplied by 1.5 ml of human, humanized or cow's milk,(Abbassy, 1977).

The distribution of calories in human milk and in most formulas, and in a well balanced diet is the same. Approximately, 9 to 15% of calories are derived from

proteins

45 to 55% from carbohydrates and

35 to 45% from fats.

(Barness,1979)

3- Proteins:

- Function: milk is an important source of proteins which are necessary for construction of new tissues and for the supply of amino acids required for different metabolic functions. Proteins play also an essential role in osmotic equilibrium, acid-base balance and with prosthetic groups to form haemoglobin. Besides this "hypersensitivity reactions caused by cow's milk ingestion are largely attributable to the protein components", (Barness, 1979).

NB : The protein content of cow's milk is responsible for the higher plasma amino acids, total serum proteins and blood urea nitrogen values among cow's milk-fed infants, (Krieger, 1982 ; Lakhani, et al., 1983).

- Quantitative differences exist between proteins of human milk and cow's milk, as shown in Table 1.
- Pooled whole cow's milk contains about 2.8 to 4.1 gm/dl (average 3.3 gm/dl), (Bahna and Heiner, 1980).
- Human milk contains about 0.7 to 2.0 gm/dl (average 1.1 gm/dl).

Table 1 : Approximate protein content in
Human milk and cow's milk

Constituent gm/100gm	Human milk	Cow's milk
Protein	1.1	3.3
Casein	0.4	2.7
Lactalbumin	0.4	0.4
Lactoglobulin	0.2	0.2

Data collected from Fomon, S.J.: Infant Nutrition
2nd ed. Philadelphia, W.B Saunders Co., 1974.

The 2 main components of cow's milk protein are:

casein which constitutes about 80% of milk proteins, and whey proteins constituting about 20%.

Whereas in human milk, the protein content consists of about 60% whey proteins (largely lactalbumins and lactoglobulins) and 40% casein.

The increased protein content of cow's milk is almost entirely accounted for by the higher content of casein, (Barness, 1979).

Bovine milk proteins:(Table 2)

1- Bovine caseins:

These are insoluble proteins which exist as a colloidal complex with calcium phosphate. The isoelectric point of casein is about 4.6 and so it is precipitated at an acidic pH. Rennin, an enzyme present in the stomach of infants can precipitate casein to form milk curds or clots, (Khalifa, 1982). These clots are large, thick and tough interfering with digestion unless the milk is modified, (Abbassy, 1977).

According to the decreasing electrophoretic mobility at alkaline pH, 4 major caseins are identified: alpha, beta, gamma and kappa caseins. The molecular weights of these caseins range between 18,000 and 24,000 daltons, (Bahna and Heiner, 1980).

2- Whey proteins:

-B-Latoglobulin is the major whey protein. It is composed of 2 identical polypeptide chains, each having