EDITORIAL

MILK

... a land flowing with milk and honey. Exodus 3;8

8000 years ago the Neolithic Revolution marked the beginning of civilization. Around the delta of the Nile or perhaps between the Tigris and Euphrates, late stone age man learned to domesticate wild cattle *(Bos taurus)* and to cultivate crops, especially cereals, and so became a farmer. Milk entered the diet. A litre (800 calories) with a loaf of bread (1200 calories) consumed in a few minutes allowed the rest of the day for building a pyramid or, eventually, flying to the moon. By the time (circa 1500 BC) Moses led the exodus from Egypt, a plentitide of milk was a prerequisite of a desirable environment. A strong farming economy has been the spring board of all subsequent advances in civilization.

At the time of the Neolithic Revolution, huge herds of *Bos taurus* subspecies roamed North Africa, the Middle East and Europe. Captured specimens of long horned aurochs *(Bos taurus primigenius),* short horned ox *(Bos taurus brachyceros),* and zebu with their characteristic hump *(Bos taurus indicus)* were domesticated, and with selective breeding represent the origins of all modern dairy cattle(1). The range of B*os taurus* does not appear to have extended to East Africa where the related *Syncerus caffer* (buffalo) grazed the plains. Buffalo like cattle are good grazers, encouraging the growth of a tight sward, unlike goats, domesticated at the same time or even earlier than cattle. The destructive grazing habits of goats have been an important factor in the desertification of much of the Middle East and North Africa. Domesticated cattle spread out from their origins. Short horned cows were imported into Britain around 2500 BC whilst zebu came down the trade routes to the Kenyan Coast around 669 AD. Long horned Ankole cattle, a cross between long horned humpless cattle from Egypt and zebu, reached Uganda via the Nile and Ethiopia at around the same time(2).

Thus cattle and milk have been part of East African culture for well over a thousand years. As elsewhere, cattle have been highly valued. Milk has been appreciated as an almost perfect food. Modern analysis has shown milk to be a good source of calories, with high quality proteins, and most essential vitamins and minerals. Now, during the last few years, there has been an explosion of research into the properties of the various components of milk and milk derivatives. Some of the beneficial qualities that have been identified include:

i. anticancer properties of some milk proteins and fats(3)
ii. value of milk calcium in bone development especially in adolescent girls(4)
iii. value of bovine colostrum in human health(5)
iv. gastro protective effect of lactalbumin(6)
v. pharmacological properties of peptides derived from milk protein(7) including:
   a. ACE inhibition
   b. platelet aggregation inhibition
   c. cholesterol lowering
vi. probiotics - e.g. sour milk, yoghurt-bacterial cultures that improve the intestinal flora.

The literature on recent research is extensive. Only a few examples and references are given. Clearly the value attributed to milk historically included many hidden benefits. Contrarily, over the last 100 years, concerns have been aired about the safety of milk.

The first concern has been the bacteriological safety of milk. Apart from the common food poisoning pathogens that thrive in circumstances of poor dairy and food hygiene, both *Mycobacterium bovis* and *Brucella abortus* can cause chronic mastitis in cows and have been especially important. To combat these pathogens and to improve the safety of milk, pasteurization was introduced in America around 1900 and in England 10 to 20 years later. Uganda's Ankole cattle are susceptible to *Mycobacterium bovis*(2), so that it is customary to boil milk. In 1910 Bruce, who had defined Malta Fever in the 1880's, investigated *muhinyo* around the shores of Lake Edward. He reported that "*Muhinyo* is Malta Fever. *Muhinyo* is conveyed from the goat to man by the drinking of goats' milk"(8). Brucella melitensis is still widespread in goats in East Africa. Bovine tuberculosis does not seem to have been reported in Kenya, but B*rucella abortus* was cultured from cattle in 1934(9), and in the 1950's Clinton Manson-Bahr(8) drew attention to the risk of brucellosis from milk. Perhaps following this, or because milk is boiled in making tea, for the past 50 years or so, particularly in urban areas, milk has been boiled even if it has already been pasteurized. In rural areas, milk is taken as it always has been, fermented or soured. The milk is allowed to stand for a day or two in a gourd or covered vessel. Lactobacilli, naturally occurring bacilli in milk, convert the lactose to lactic acid and when acid enough to the taste, it is drunk. After a few days, it will become perhaps too acid so that further milk is added and so on. The souring process has many advantages:

i. the milk is safer as lactic acid suppresses the growth of pathogenic bacteria
ii. soured milk has a cholesterol lowering effect and is being proposed as a cheaper and safer alternative to statins(10).
iii. the fall in lactose content makes the milk more acceptable to lactose intolerant individuals, some 85% of East African adults. Milk allergy is, of course, quite distinct from lactase deficiency and lactose intolerance and is due to sensitivity to lactalbumin, one of the six main milk proteins.
iv. costs of refrigeration, pasteurization and or boiling are avoided.

Generally, then, in Kenya milk is either taken boiled or soured, minimising the importance of milk transmitted diseases.

The second concern is a possible association between milk and coronary heart disease (CHD). In 1911, Osier reported a CHD epidemic in the USA(11), but CHD did not reach epidemic proportions in England until the 1920's. Semi starvation conditions in Europe during World War II were associated with a reduction in CHD mortality(12), and in the 1950s an increased CHD mortality was associated with high milk diets, including milk drips, for the treatment of duodenal ulcer(13). But the epidemiology was inconclusive. In Kenya, for example, though CHD may now be increasing(14), in the 1960's it was distinctly uncommon. Populations heavily dependent on milk had healthy coronary arteries(15).

As the idea of a specific role for milk in the aetiology of CHD receded, so the idea that obese populations have more CHD has gained acceptance. Excess calorie intake not only leads to obesity but also to hypertension, late onset diabetes mellitus (NIDDM), low levels of HDL cholesterol and even some forms of cancer(16). Additionally, obese populations have also tended to smoke more cigarettes and take less exercise. Conversely lean populations, with calorie intake balancing calorie requirements, have less CHD and less of the other problems associated with obesity.

Recently, though, a hypothesis (17) proposing an aetiological role for a specific milk protein, ß-casein A^1, has been advanced. Additionally, to explain the USA and UK CHD epidemics, the hypothesis postulates that these epidemics followed the introduction of pasteurization(18). Pasteurization may alter ß-casein A^1 in such a way that it becomes atherogenic.

ß-casein is one of the six main milk proteins, and exists in several variant forms. Some European cattle have a high incidence of the ß-casein A^1 allele, e.g. Friesians, whilst others have a low or very low incidence, e.g. Jerseys, Guernseys. Zebu do not have the A^1 allele, so the hypothesis readily explains the absence of CHD in East African nomadic pastoralists. World wide, high national CHD rates are associated with high ß-casein A^1 content of national milk. The incidence of diabetes mellitus (IDDM) in children is also linked in the same way, country by country, to the amount of ß-casein A^1 consumed. Finland has the highest consumption of A^1 milk and the highest incidence of IDDM in under 15 year olds.

An addendum to the hypothesis is the suggestion that lung cancer may also be linked to ß-casein A^1 consumption.

Nutritional epidemiology is notoriously fallible, but if the ß-casein A^1 hypothesis is correct, and recent support(19) suggests that it may be, then important questions concerning cattle with the A^1 allele are raised. Further research is urgently needed(20). The national herds of zebu and European breeds, and the variable use of pasteurization, boiling and souring of milk, make East Africa an obvious choice for such research. Meanwhile, somewhat ironically, it may be safer to drink sour milk than to drink pasteurized and packaged factory milk.

DECLARATION OF INTEREST

The author is a member of the Jersey Cattle Society of Kenya.

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P.H. Rees, OBE, FRCP, Consultant Physician, Nairobi Hospital, P.O. Box 30026-00100, Nairobi, Kenya

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