CHAPTER IV

หอสมุดกลาง จุฬาลงกรณมหาวิทยาลัย

DISCUSSION

In the present studies, the folic acid content in milk represents the amount of active material of folic acid that supports the growth of Lactobacillus casei. Only the free form of folic acid and the conjugated form after being treated with conjugase would be available to Lactobacillus casei assay. The free folate content represents not only monoglutamyl derivatives but also the di- and triglutamyl folates as well (Tamura et al., 1972). Herbert (1973a) had suggested that animals and man could utilize conjugated folic acid as a source of pteroylglutamic acid because the enzyme conjugases presented in vegetable and mammalian tissues could liberate pteroyldiglutamates and pteroylmonoglutamates which were available for absorption. However Ghitis and Tripathy (1970) found that "free" folate in milk was equal to pteroylglutamic acid in its ability to overcome megaloblastic anemia. This was in agreement with the earlier suggestion of Herbert (1963) that, in food, Lactobacillus casei activity without conjugase digestion approximates folate available to man. Therefore, it appears that "free" folate in milk as reported in the present study represents the mininum available folate in the product. If it is subsequently demonstrated that higher conjugates of folate in milk are efficiently utilized, then this data can be readily converted to total folate.

1. Human Milk.

Results in the present study showed that folic acid content in human milk varied considerably, i.e. from 0.11 to 3.73 µg/100ml which was in accordance with the result reported earlier. Matoth (1965) found that folate level in 35 samples of breast milk varied from 0.74 to 6.10 µg/100ml. The variation was partly due to the dietary intake of this vitamin by human and the different lactation period. Ramasastri (1965) found that folate activity in human milk increased with the progress of lactation. He also showed that the mean value of folic acid activity in colostrum (up to 5 days post partum), transitional (6-14 days post partum) and mature milk (more than 15 days post partum) were 0.44, 0.84 and 1.65 µg/100ml respectively. Results in the present study showed that the folic acid content in the colostrum (2-4 days after delivery) and transitional milk (5-12 days after delivery) were 0.90 and 1.42 µg/100ml respectively. There were no statistically significant difference between the folic acid content in these samples ($p > 0.05$).

The mean value of free folic acid content in 100 samples of human milk (1.08 ± 0.89 µg/100ml) in the present study was in accordance with results reported previously by various authors as shown in Table 21. An infant with a daily consumption of 800 ml milk would obtain about 8 µg of folic acid per day which was not sufficient for his daily requirement of 40 µg per day as recommended by FAO/WHO Expert Group (1970).

2. Cow's Milk.

2.1 Fresh, Pasteurized and Sterilized Cow's Milk.

Fresh cow's milk contained free folic acid 4 folds higher than that of human milk. The variation was also found among the different samples obtained from different cows. This may be due to various factors such as the intake of folic acid, stage of lactation, environmental status, and other individual factors. It has been shown that cow's feed could influence the milk folate concentration either through its folate content or by stimulation of folate production by rumen microorganisms. (Dong and Oace, 1975).

In the present study, the free folic acid content of fresh cow's milk was found to be 4.01 ± 2.00 µg/100ml. This was in accordance with results reported by Ghitis et al. (1965; 1966); Matoth (1965) and Dong and Oace (1975) but was lower than those reported by Naiman and Oski (1964); Luhby and Cooperman (1963) and Areekul et al. (1978). Results in the present study also showed that after heating fresh cow's milk at 62.8°C for 30 minutes (pasteurization) and at 121°C for 5 minutes (sterilization), the free folic acid content decreased about 41 % and 38 % respectively. There were the highly statistical significant difference ($p < 0.01$) between the free folic acid content in fresh cow's milk before and after pasteurization and sterilization. This finding confirmed the results reported by Ghitis (1966) and Areekul et al. (1978). Results in the present study also showed that the free folic acid content in pasteurized and sterilized cow's milk samples bought from the market were lower than that of fresh cow's milk, i.e. only 3.97 µg/100ml and 1.18 µg/100ml respectively. These values were in the same order of magnitude of results reported earlier as shown in Table 21.

2.2 Evaporated Milk.

Folic acid content in evaporated milk was found to be 4.02 µg/100ml which was identical to the value in fresh cow's milk. However, one part of evaporated milk was generally diluted with one part of water before giving to infants, so the folic acid content in the sample would be only half of this value. The mean value of folic acid content in evaporated milk in the present study was nearly the same as that reported by Vongyuthitham (1977) but higher than that reported by Hodson (1949) (i.e. 1.3 µg/100ml) and lower than that reported by Naiman and Oski (1964) which was found to be 8.47 µg/100 ml. This may be due to the different strains of cow and the different methods of processing and the storage of evaporated milk.

2.3 Sweetened Condensed Milk.

The mean value of free folic acid content in sweetened condensed milk was found to be 6.14 µg/100g which was higher than that of the fresh cow's milk. However, as the sweetened condensed milk usually diluted with water at least 5 folds because of its sweetness, therefore the folic acid content would be decreased to 1.23 µg/100ml.

2.4 Powdered Milk.

Results in the present study showed that the powdered whole milk and powdered humanized milk contained free folic acid 30.06 µg and 84.00 µg per 100 g respectively. If 5 g of powdered milk was diluted in 30 ml of water, they would contain folic acid 5.01 µg/100 ml and 14.00 µg/100ml respectively. These values were higher than that of fresh cow's milk. This was probably due to the folic acid fortification in the powdered milk by the manufacturing company. Accordingly, infants who took about 800 ml of milk reconstituted from powdered whole milk or powdered humanized milk would obtain about 40 µg or 112 µg of free folic acid per day respectively. This would be adequate for their daily requirement as recommended by FAO/WHO Expert Group (1970).

In the present study, the free folic acid content in Similac and Klim powdered milk were found to be 7.68 µg/100ml and 3.71 µg/100ml respectively. These values were in the same order of magnitude as those reported by Naiman and Oski (1964) and Ghitis (1966). Folic acid content in Nan powdered milk was found to be 19.90µg/100ml which was higher than the result reported by Ghitis (1966).(5.2 µg/100ml) The difference may be due to the folic acid fortification in the sample of the present study.

2.5 Butter and Cheese.

Results in the present study showed that butter contained the lowest value of free folic acid i.e. only 0.41 µg/100g. This value was in accordance with the result reported by Hurdle et al. (1968). The low folic acid value in the samples may be due to the loss of this vitamin during processing especially when the butter-milk (liquid) was drained off and the butter granules were churned with fresh water to remove the remainder of the butter milk. Folic acid, a water soluble vitamin, could possibly be drained off with water during the stage of processing.

Free folic acid content in 9 brands of cheese samples in the present study ranged from 1.36 µg/100g to 67.78 µg/100g with a mean value of 10.99 µg/100g. The wide variation of folic acid content in different cheese samples was possibly due to the different methods of processing of cheese particularly during the ripening process.

Generally, milk is the only source of nutrition for infants The folate intake of the infant is therefore depend on the folate content, the amount taken and the method of preparation of the milk. Infant consumed 800 ml of milk per day would obtain free folic acid 8 µg from human milk, 32 µg from cow's milk, 40 µg from powdered whole milk, 112 µg from powdered humanized milk. Accordingly, free folic acid from human milk and cow's milk would not be sufficient for the daily requirement of the infant as recommended by FAO/WHO

Expert Group (1970) i.e. 40 μg per day. On the other hand, powdered milk seems to supply adequate folate for infant. However the process of powdered milk preparation for feeding the infant would also destroy a considerable amount of folate.