TOCOPHEROLS (VITAMIN E) IN MILK: THEIR CHEMICAL DETERMINATION AND OCCURRENCE IN HUMAN MILK*

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(Received for publication, April 25, 1947)

The method of Quaife and Harris (1, 2) for the estimation of vitamin E in blood plasma has been adapted to the determination of total tocopherols in milk.

The quantities of milk, ethanol, and purified Skellysolve B (SS₂B) used in the extraction mixture are increased proportionately as needed. For cow's milk the increase is 6-fold. An aliquot of the SS₂B layer (e.g., five-sixths of the total) is evaporated to dryness under nitrogen and the residue dissolved to a total volume of 10 ml. with a 1:1 mixture of ethanol-cyclohexane. This is hydrogenated, as previously described for blood plasma (2), for 1 to 3 minutes as needed to saturate the carotenoids with hydrogen, so that they do not interfere in the colorimetric assay for tocopherols. The tube is corked and centrifuged to separate the catalyst. 8 ml. of the supernatant are assayed by the Emmerie and Engel reaction, according to the technique previously described (1). 8 ml. of the same solvent are used for a blank. The vitamin E content is calculated from calibration data obtained with a solution of pure, natural d-α-tocopherol dissolved in 1:1 ethanol and cyclohexane.

Satisfactory recoveries (95 per cent) were obtained on adding α-tocopherol to the extraction mixture and assaying. This recovery, despite the large amount of fat contained in the Emmerie and Engel reaction solution, indicates little or no inhibition of the colorimetric reaction. This was confirmed by direct comparison of the colorimetric reaction mixture containing α-tocopherol with and without comparable amounts of butter fat. No color inhibition was found. Tocopherol cannot be concentrated from butter fat according to the molecular distillation technique as from other food fats (3) because of the large proportion of low molecular weight triglycerides which distil with it.

Values for a number of samples of winter cow's milk were determined by Swanson,¹ who found a range of 0.08 to 0.15 mg. of tocopherol per 100 ml. This corresponded to 17 to 30 γ per gm. of butter fat. A group of summer milks (4) had a mean of 42 γ per gm. of butter fat (about 0.17

¹ Swanson, W. J., unpublished data.
mg. per 100 ml.). These values are in agreement with others in the literature which range from 25 to 44 \( \gamma \) per gm. of butter fat (5-7).

Fifteen samples of human milk, which were collected within 1 week after parturition, were assayed for vitamin E. The values found range from 0.13 to 3.6 mg. per 100 ml. of milk or 76 to 1800 \( \gamma \) per gm. of fat. Twelve of the fifteen levels exceeded 200 \( \gamma \) per gm. of fat. Four composite samples of later human milk (from fourteen mothers in the 1st to 8th months of lactation) showed levels of 0.11 to 0.15 mg. of tocopherols per 100 ml. of milk, or 37 to 58 \( \gamma \) per gm. of fat. Thus the majority of the early milk samples assayed had much higher vitamin E levels than those of later samples of either human or cow’s milk. Kofler has reported vitamin E levels in human milk on three samples, with the time of collection unspecified, to be 0.5, 1.6, and 3.6 mg. per cent (6).

SUMMARY

A simple method for the determination of vitamin E in milk is given which is a modification of the plasma method of Quaife and Harris (1, 2). Human milk samples which were obtained during the 1st week after parturition showed values of 0.13 to 3.6 mg. per 100 ml., the majority being much richer in vitamin E than the later milk samples, which had a mean level of 0.14 mg. per 100 ml.

BIBLIOGRAPHY


The samples were obtained through the courtesy of Dr. W. J. Darby of Vanderbilt University School of Medicine, Nashville, Tennessee.
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