THE EFFECT OF VARIOUS FORMS OF SUPPLEMENTATION ON THE NUTRITIVE VALUE OF MAIZE FOR CHILDREN*

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As a staple cereal food, maize is of particular importance in South Africa. It is the largest cereal crop in the Union and among rural populations 52 - 75% of human calorie consumption is derived from it.[1] The association of predominantly maize diets with a high incidence of kwashiorkor is well known both in Africa and in South and Central America.[2,3] Although an excellent source of calories, maize is deficient in niacin, vitamin B_{12}, vitamin C, folic acid, calcium, and sodium. The protein of maize is deficient in the 2 essential amino-acids, lysine and tryptophan, and the amino-acid leucine is present in excess. As a source of protein, maize has the further disadvantage that its total protein content is only 9%. This necessitates the consumption of a large daily quantity of maize to cover minimal daily protein requirements. A 25 lb.-child, for example, would need to eat ½ lb. of dry maize (approximately 60 - 70 oz. of porridge) to receive sufficient protein for growth and maintenance.

* Abstract of paper presented at Research Forum, University of Cape Town, 27 July 1960.

In the supplementation of maize all its deficiencies should be taken into account.[4] In this study the supplementation of maize with respect to its protein content in particular has been investigated. Mineral and vitamin supplements were provided for all children who were on the trial diets so that the nutritive value of the protein alone could be evaluated. Convalescent cases of kwashiorkor, aged 1 - 4 years, were used as test subjects 15 - 100 days after admission to hospital. Nutritive value was measured by means of 3-day nitrogen balance periods. Methods used were as previously described.[5]

Supplementation of maize with lysine and tryptophan. The synthetic amino-acids lysine and tryptophan were added to give a mean increase of 176 mg. per g. nitrogen of lysine and 47 mg. per g. nitrogen of tryptophan to maize protein. Nitrogen retention was significantly increased over that of unsupplemented maize protein. Although the utilization of maize protein is improved by synthetic amino-acid supplementation, its practical usefulness is limited if total protein intake cannot also be increased.

Supplementation of maize with pea flour (Pisum sativum var. arvense). A mixture of ⅔rds maize to ⅓rd pea-flour has a protein content of 14%. Feeding of this mixture resulted in nitrogen retentions equivalent to milk at intakes of protein above 2·5 g. per kg. per day. At intakes between 1·9 and 2·5 g. of protein per kg. per day, the nitrogen retentions were significantly less than that of an isonitrogenous milk diet and no better than an unsupplemented maize diet.

Supplementation of maize with pea flour and fish flour. A mixture made up in the following proportions — maize 60%, pea flour 30%, and fish flour 10% — has a protein content of 20%. Feeding of this mixture resulted in nitrogen retention that was not different from that of a pure milk diet at levels of protein intake both above and below 2·5 g. per kg. per day.

Supplementation of maize with pea flour and milk powder. A mixture made up in the following proportions — maize 60, pea flour 30, and skimmed milk powder 18 — has a protein content of 18%. Feeding of this mixture resulted in nitrogen retentions that were not different from that of a whole-milk diet at all levels of protein intake.

Conclusions

Vitamin, mineral, and protein requirements must all be taken into account when the supplementation of maize is contemplated. These studies have demonstrated that relatively small amounts of fish flour (10%) or milk powder (18 parts) need be added to a 2 : 1 maize/pea mixture to give a protein with a nutritive value not demonstrably different from that of whole-milk diet at all levels of protein intake. The practical implication of these findings is that among protein-deficient populations available supplies of animal protein such as milk, egg or fish flour can be stretched much further if combined in proper proportion with staple cereal or vegetable diets.

This work was carried out in the Clinical Nutrition Unit of the South African Council for Scientific and Industrial Research at the University of Cape Town. Special thanks are due to the Fishing Industries Research Institute, Cape Town, for the supply and analysis of the fish flour. Hind Brothers supplied the pea flour, and Vereeniging Consolidated Mills, the maize.

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