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Population Feeding Studies:

The program of the distribution of Leche Alim to controlled and experimental populations of pre-school children is nearing its terminal phases. This project consisted of substituting a mixture of sunflower seed meal, toasted wheat flour, and fish protein concentrate, combined with milk solids. for a 12%-fat dried milk, in a city food distribution program. The formulation, entitled Leche Alim, was distributed through the agency of the National Health Service to mothers for infant feeding to a population of approximately 2,500 in Curico, Chile.

The height and weight of children were measured at monthly intervals in the study, but the main thrust of the experimentation was to determine whether or not a product such as this was acceptable to the population on a long-range basis. The initial population that was selected for the experiment had traditionally used a toasted wheat-flour gruel as a portion of their children's diets.

Preliminary results of this phase of the experimentation indicate that compared to dried milk a far larger proportion of the fabricated food material reaches the target population, namely pre-school children, than does the milk. Since Leche Alim cannot be sold as an ingredient for the manufacture of ice cream, the families are forced to utilize it or to re-sell it to other families, and consequently it has intrinsically less value on the commercial market than dried milk. Additionally, since it resembles a food that is traditionally fed to children, there is less likelihood of its distribution to the adult members of the family. Observation in homes by personnel of the National Health Service showed that both of these supposi-

tions were true. As a consequence, more of the Leche Alim reached the children than the usually distributed dried milk.

The acceptability was measured basically on the number of mothers who were retained in the experimental program of utilization. There was no compunction to continue the utilization of Leche Alim, other than the suggestion that it had good nutritional value. At the end of 7-1/2 months of study at least 80% of the families who initiated the study were continuing to request the Leche Alim formula.

It was also observed that there was some selling of excess formula between families, and the price asked and received was equivalent to dried milk.

The results of the study are being assembled at this time and the complete data should be available and analyzed by April 1970.

The proposed protocol calls for the extension of this study, utilizing expander-produced products, to two other areas in Chile in the coming year. Preliminary arrangements have been made to introduce the material in a controlled fashion to two cities, one in the north of Chile and the other in the south. These cities differ from Curico in that the food habits of the people are substantially dissimilar.

Expander Processing of Formulations:

In the phase directed to the developing of a technology for the production of low-cost high-protein foods it was decided to pursue the expansion technique. In this technology a cereal mixture containing various proteins is forced under high pressure through a die. The pressure causes an increase in temperature to a point where the material exceeds the boil-

ing point of water. As the material emerges from the die, it puffs rapidly and is dried to the loss of moisture. Residence time in the unit is small. The advantages of such processing are that it produces a microbiologically safe product, the resultant products are readily rehydratable, and there is no separation of different materials, as there might be in a simple mixture. In addition there is the opportunity to add to the mixtures being expanded fortification ingredients, including lysine, vitamin A, vitamin D, iron, etc.

The original formulation for which the technology was to be developed was that of Leche Alim, fortified with vitamins A and D and iron. Experiments showed that this could be expanded successfully, provided excessive temperatures were avoided. The protein efficiency ratio of Leche Alim which had been expanded was 2.48 versus a control of unexpanded Leche Alim formulation of 2.58.

As the total fat content of the mixture was rather low, there existed the possibility of increasing the caloric density by the addition of fat. This would also enhance the expandable qualities of the product, and result in a much more friable finished product. Thus formulations utilizing 4% added fat appear at the moment quite promising and preliminary protein efficiency ratios appear to be as good or better than the normal product which has undergone expansion.

In order to produce some variations in the product which might be applicable to commercial distribution, a series of runs was made utilizing different flavoring components and colorings in the mixture. The results of runs utilizing different colorings and flavorants have been extremely encouraging. Since the formulas utilizing fish protein concentrate and sunflower meal are generally fairly dark in color, the addition of a colorant

enhances the appearance of the product. When these products were submitted to taste panels, using as controls the normal Leche Alim formula, there was considerable preference for the flavored and colored products. A series of these products is being produced to determine comparative acceptability and stability of the flavoring components. At the present time the flavoring compounds appear to be quite stable.

The incorporation of vitamins A and D in either the straight Leche Alim formula or the colored and flavored material appears to be quite successful. The exact retention, however, is to be determined chemically under different processing conditions in the forthcoming months.

Feeding studies of the final product are proposed for the beginning of the calendar year 1970 in children, prior to utilization in large-scale feeding studies. These particular studies are under the control of Dr. Fernando Monckeberg of the Department of Pediatrics of the University of Chile.

Detoxification of Rapeseed:

It has been possible to develop a method for the detoxification of rapeseed meal. However, in rats the detoxified material does not have as high a protein efficiency ratio as does the non-detoxified material. A protein isolate was also developed which is comparatively light in color, with a yield of approximately 50%. This appears to have a good amino acid profile, but not equivalent to that of the raw product. A mixture of the isolate, fortified with non-fat milk solids as a supplement, showed a P.E.R. of 2.6 versus 2.5 for casein. The protein quality from rapeseed when fed according to N.A.S. procedures is quite good. Additional work of supplementation with the limiting amino acids will be undertaken.

The utilization of rapeseed in animal feeding in Chile would free sun-

flower meal for human consumption and add significantly to the protein available to the human population.

It is anticipated that the detoxification of rapeseed meal for animal feed will continue over the next 8-month period to determine the economics of the operation.

Summary:

1) The large-scale feeding studies in one area of Chile utilizing the Leche Alim formula are in the process of completion. Data should be available on the nutritional and acceptability facets of this study in three months.

2) Many of the technological problems in the production of Leche Alim and similar formulas have been solved by expansion.

3) A study of the processing variations, such as the addition of flavorings and colorants to the product, is underway.

4) Alternate formulations having a higher caloric density and improved processing characteristics are being developed.

5) Fortification of expander products with vitamins A and D is in the process of evaluation.

6) Detoxification of rapeseed meal in order to make it suitable for animal feed has been successful. Further studies on formulations are underway.

Proposed Work:

1) The analysis of the nutritional data obtained from Curico will be completed.

2) Acceptability studies on flavored, colored and formulated products by expander operation will be undertaken.

3) Additional large-scale feeding of standard processed Leche Alim is underway. Two sites have been selected, one to the north and one to the south of Santiago, Chile.

4) An analysis of the effect of processing on fortified mixtures of Leche Alim is being organized. The retention of fortifying agents vitamins A and D plus iron will thus be determined.

5) Economic analyses of the formulated products are underway and will be completed within the next year.

Budget:

The current status of the project as of October 1969, including obligated funds, is as follows:

<u>Total Appropriated</u>	<u>Obligated</u>	<u>Balance</u>
\$154,000.00	\$97,341.30	\$56,659.70