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NUTRITIONAL AND FOOD PRODUCTION EXPERIMENTS IN CHILE.

The work reported here concerns two projects, Contract No. AID/csd-1587 and Contract PN-43-65-572. Contract No. AID/csd-1587 was proposed for a three-and-a-half-year period. Its primary objective was to develop food material on a technological level for use as infant and preschool food. The first two years of the project were funded in June 1967 and the remainder committed. The second project, Contract PN-43-65-572, has been operational for approximately four years and in fiscal 68 the project was refinanced on the basis of a three-year study. The first year was funded, and the second two committed.

In Contract No. AID/csd-1587 advantage was to be taken of the technique of expander-processing foods. By this process a mixture of food materials may be converted to a homogenous food, the starch in any plant food can be gelatinized and the final product made readily rehydratable in even cold water. The process also lends itself to the enrichment or fortification of foods with vitamins, minerals, etc. The contract was designed to test a number of processed food mixtures in Chile with respect to their acceptability, cost and feasibility. Most of these would have as a major protein source fish protein concentrate. The fish protein concentrate would be intermixed with vegetable protein sources and carbohydrates, the vegetable protein sources chosen from those available in Chile.

Initial work in this area showed that the control of such processing was moderately critical and it was necessary to hold processing temperatures in the expander below 250°F (despite the fact that the residence time in the unit was very short) to retain high nutritive value.

The materials which can be utilized economically in Chile as protein sources are as follows: Fish protein concentrate (whose possible expansion would offer an extremely large good source of protein) and sunflower seed cake, which is the second largest oilseed crop in Chile and whose protein is a moderately good one. Wheat is a very acceptable item of the Chilean diet and possesses a moderately good protein, although not in as high a percentage as the previously mentioned materials. Although milk is distributed widely, it is in short supply and a large proportion of the supply must be imported. Milk, how-

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ever, has been considered as a portion of the ready-to-eat foods, because of the substantial program for its distribution to the preschool and school-age children. Politically, it was also felt that the milk supply available was sufficient to supply a portion of the total protein requirement and thus it was not proposed to completely eliminate milk from the food mixtures, at least at the present time.

Progress in this contract since its initiation July 1, 1968 has been moderately good. At the time of the initiation of the contract, an Anderson Expander was proposed in the contract. This was the only expander available at that time which was of pilot-scale size. After the contract was let, the Wenger Corporation, the largest manufacturer of expander units in the United States, announced the availability of a pilot-scale unit. This particular unit is extremely adaptable and allows the variation of many parameters in the processing of food materials. A Wenger unit was therefore purchased, despite the fact that its initial cost was somewhat higher than that of the Anderson. The unit was shipped to Chile, where it has now been put into operation in the Department of Food Science and Technology, University of Chile. Figures 1 and 2 show the installed unit in Chile. Because of difficulties in shipment, delivery, and internal difficulties in Chile from strikes (both at the University and in the public sector), the installation and operational readiness of this unit was delayed approximately six months. In October, 1968 the unit was made operational and will be utilized to produce mixtures mentioned above.

Prior to this time in order to determine operating parameters on products which might be acceptable to Chile, runs were made on an identical unit installed in Los Angeles. Operating parameters were defined for a mixture of wheat, defibered sunflower meal and fish protein concentrate fortified with vitamins and minerals. The materials which were produced by this unit were judged by taste panels to be bland and quite acceptable. Nutritional evaluation at the University of California showed that its protein efficiency ratio was roughly equivalent to milk and to the mixture of the raw products, thus demonstrating no detriment from the nutritional qualities during processing.

Further runs on a mixture containing wheat, sunflower seed meal, fish protein concentrate and dried milk have been made. The product so produced is bland but retains some of the organoleptic qualities of milk. Wheat has

been purposely included in these products, since a traditional product utilized by the mother in Chile for the feeding of children is called ulpo, a gruel made with toasted wheat flour. By using toasted wheat in the products it is possible to produce a food which has a history of high acceptability in the Chilean family.

A process was developed to defiber sunflower meal. The meal usually has 12-17% fiber when it is delivered from the mill. This fiber content, particularly when combined with wheat, would probably be too high for the feeding of infants, and consequently in conjunction with a commercial manufacturer a method was developed to remove the fiber to below 5%. This results in a mixture whose total fiber content is of the order of 2-3%.

Under Contract PH-43-65-572 a fairly large-scale experiment was designed to determine the acceptability and the nutritional adequacy in preschool children and school children of food mixtures that had been developed under the contract which would be produced by the Department of Food Science and Technology of the University of Chile. Previous work using captive populations of preschool children and school children at orphanages indicated that a mixture of sunflower meal, FPC, milk and wheat was acceptable and nutritionally effective in the older child. A study was therefore set up involving 3,000 preschool children in an area south of Santiago, Chile. This area has a high proportion of very low income families which routinely receive supplemental food for children from the Public Health Service. The usual distribution was one kilo of powdered milk per child per month. In this area a statistically selected sample of 4,000 families were selected and these were given a mixture consisting of powdered milk, wheat, sunflower seed meal, and fish protein concentrate.

Due to the fact that there had been a delay in installing the processing equipment in Chile, it was decided to proceed with work in the evaluation of mixtures such as those described by using an alternate method of production, e.g. a dry mix. A plan for the distribution of a food mix for preschool children was developed under Contract PH-43-65-572. The mixture for the trials was designed on the basis of earlier nutritional work and acceptability trials and is being distributed at the present time. The package and instructions for use shown in Figures 3 and 4 were developed with the aid of a Chilean

psychologist to enhance the acceptability of the package. It is to be noted that no mention is made of fish protein concentrate and implication is that the material is more nutritious than milk alone. Milk is not considered, at least in Chile, as one of the most nutritious products for children.

The materials were distributed in competition with powdered milk. Distribution of the dry blend was initiated in October 1968. The study at the present time is planned for a one-year period. Normal nutritional evaluations of the recipients will be made, such as height, weight, limited biochemistry, and limited blood biochemistry. Figures 5 and 6 show distribution and typical distribution center; figure 7 shows weighing of a child participant. Additionally, acceptability of the ration will be determined in comparison with dried milk by the use of interviews in depth. These interviews and questionnaires were developed on the basis of psychological help. The program, although recently initiated, appears to be highly successful, although one cannot tell whether repeat acceptability will continue over the entire period. It is planned to switch the product to expander-processed product in March 1969. Nutritional effectiveness will be equivalent, form will be slightly different and the newer product should have better rehydratability, bacteriological and flavor attributes.

Earlier work under Contract PH-43-65-572 has been concerned with the evaluation of the protein efficiency and toxicity of sunflower meal, rapeseed meal, and fish protein concentrate in human infants. This work was combined with work supported under Contract PH-43-65-572 of the evaluation in populations of the effect of malnutrition on mental development. A portion of this work has recently been reported at the Second Western Hemisphere Conference on Food and Nutrition, Puerto Rico, August 1968. Reprints of the work supported under this particular grant have been sent previously to the supervising agency.

In all of these projects a committee consisting of representatives of CORFU, Servicio de Salud, Ministry of Health, Institute of Food Science and Technology (University of Chile), Department of Pediatrics (School of Medicine, University of Chile), Ministry of Agriculture and the University of California supervise the coordination and integration of the two phases of the overall program.

Future Plans

Under Contract No. AID/csd-1587 other formulations of the food material will be processed and optimum conditions for processing them investigated. It is planned to produce six different variations of food mixtures that would be adaptable to child feeding and to test their acceptability in moderate-scale feeding experiments. These products would be tailored to different population segments of Chile. By decreasing the percentage of milk while maintaining an equivalent amino acid balance, nutritional quality would be retained and the demand on a limited supply of powdered milk would be decreased. It is also planned to devise standard mixtures for the enrichment of commonly utilized wheat products with fish protein concentrate. A close liaison is being maintained with industrial interests in Chile, who would contemplate the manufacture of these mixtures on a large scale once the technological techniques have been worked out and they are proved acceptable to the populations.

It is also contemplated to produce some of these foods with a variation in flavor. One of the problems of utilizing toasted wheat is the problem of incipient staling and loss of flavor if stored for a period of time. By the utilization of artificial flavors and gelatinized wheat, staling would be avoided to a very large extent. The development of toasted flavors is to be carried out in conjunction with the International Flavors and Fragrances Company. It is planned to produce a series of flavors and mixtures for preschool children acceptability. The flavors to be used are those which have the highest desirability in Chile.

Under the continuation of Contract PH-43-65-572 additional research is contemplated to determine the motivation of Chilean mothers towards nutrition. Such studies will allow a much more effective campaign to obtain utilization of the foods produced for this segment of the population. Additionally, further development is contemplated on the detoxification of rapeseed meal. This meal has not been utilized in feeding even for animals, since it normally contains a thyrogenic factor and is toxic in nonruminant animals at comparatively low levels. A technique has been worked out to detoxify the meal. At the present time toxicity studies are being carried in animals over a number of generations to determine whether the contemplated method truly reduces the toxicity to negligible levels. At the completion of this work the technological

details of the laboratory method will be further developed under Contract No. AID/csd-1587 at the Institute of Food Science and Technology. This is a particularly promising line of research since there is a vast quantity of rapeseed available in Chile at essentially give-away prices. If nothing else, the rapeseed meal could be detoxified for use in the feeding of nonruminant animals, thus releasing the entire supply of sunflower meal to the human population.

Other work planned under Contract PH-43-65-572 is a study involving the enrichment of the wheat supply with fish protein concentrate in an isolated city in the north of Chile. This work would allow determination of enrichment levels which could be utilized in normal distribution channels without interfering with the properties of the flour as it is normally used. In addition, the mixtures which are produced under Contract No. AID/csd-1587 in the next two years will be studied in a hospital environment to determine the nutritional quality of the foods under a metabolic balance condition and then tested in the field for acceptability and nutritional value in larger populations.

It is thus apparent that both of these projects are linked intimately. One is the technological investigation of the production and distribution of food materials; the other is basically a backup initiating study at the laboratory level and the assessment in the field of the nutritional effectiveness of the technological developments. Both of these projects are showing excellent progress and it is likely that a uniquely integrated approach of this type will allow the establishment of an effective nutritional feeding program in Chile based upon indigenous protein sources. It should go far to alleviate the dependence of Chile upon imported powdered milk and to effect a substantial improvement in the nutritional status of the Chilean population. Reductions in the mortality of preschool children, and better mental development can be contemplated.

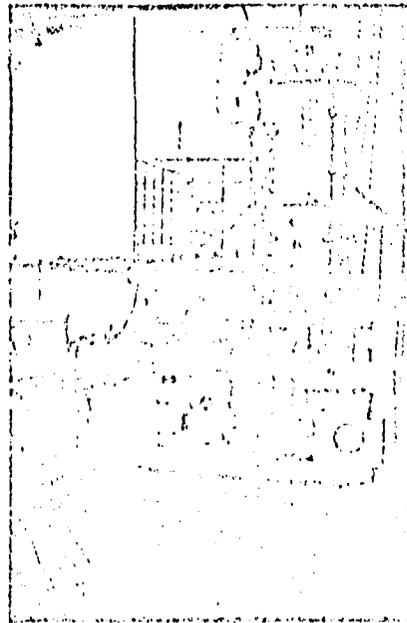


Fig. 1. Wenger pilot-scale expander unit installed in the Department of Food Science and Technology, University of Chile, Santiago.



Fig. 2. Another view of the Wenger pilot-scale expander unit installed in the Department of Food Science and Technology, University of Chile, Santiago.



LECNE-ALIM

(LECNE CON ALIMENTO)

Este producto, resultado de estudios y pruebas efectuados por la Universidad de Chile y Servicio Nacional de Salud, facilita el crecimiento y da más vivacidad al niño.

Prepararlo como ULPO, en agua hervida fría o caliente y agregarle azúcar a gusto.

ALIMENTO PROTEICO CONCENTRADO A BASE DE
PROTEINAS ANIMALES Y VEGETALES.

Propiedad del Servicio Nacional de Salud.
Venta penada por la ley.

Elaborado por Atilio Zampighi & Cia. Ltda.
10 de Julio 200 - SANTIAGO.

Res. S. N. S. N° 10105 del 5-X-66 V Zona.

LECHE - ALIM

SEÑORA: Esta es una nueva leche, que lleva alimento.

Para prepararlo solo debe colocar:

8 cucharaditas de té rasadas de Leche-Alim

2 cucharaditas chicas de azúcar

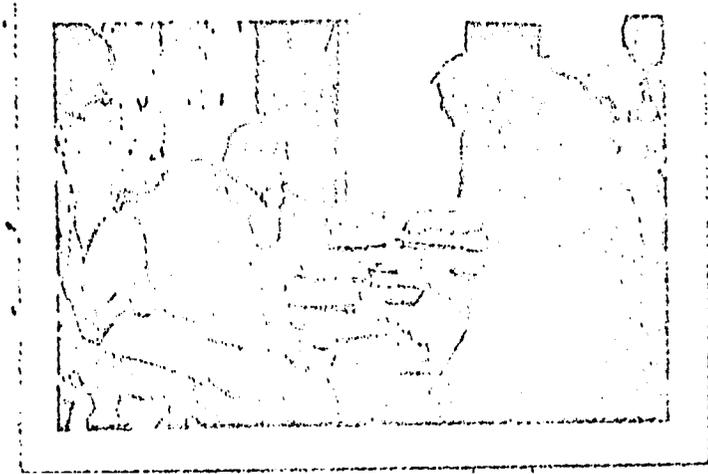
y agregarle una taza de agua hervida tibia
(también puede ser fría)

Revolver y dar al niño

GUARDE LA LECHE - ALIM EN LA BOISA
BIEN CERRADA Y EN LUGAR FRESCO

Esta Leche es enriquecida
con alimento.

Fig. 4. Instructions from package of food mix now being distributed.



· Fig. 5. Distribution of food mix.

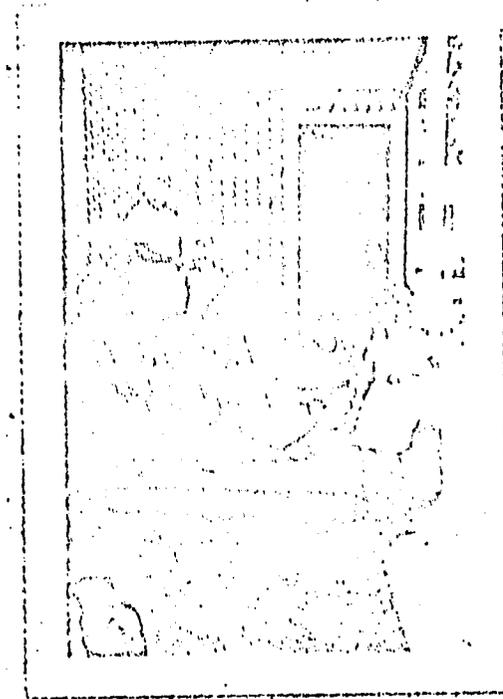


Fig: 6. Typical distribution center.

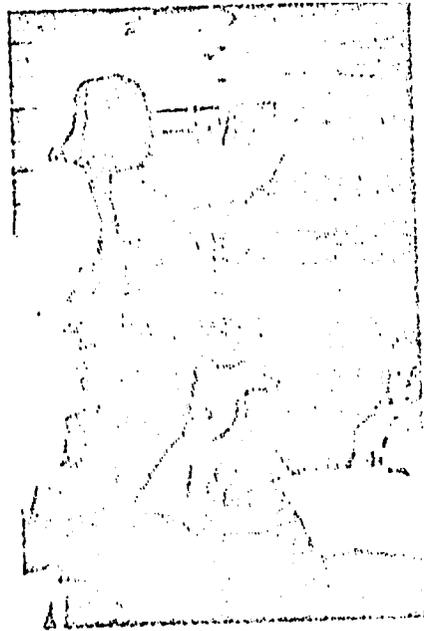


Fig. 7. Weighing of a child participant