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CHILE

Monitoring Report

To evaluate the progress made on Contract AID/csd 1587 between A.I.D. and the University of California on "Effect of Extrusion Processing Variables on the Nutritive Quality of Inexpensive High Protein Mixtures" it is helpful to untangle the origins and requirements of the two precursor contracts PH 43-65-272 and AID/csd 1587 that were merged into the surviving project.

Both of the original projects were spawned by the Nutrition Survey of Chile conducted in August, 1960 by the ICNND of the Public Health Service.

The nutrition survey found (a) a high incidence of malnutrition in Chile, (b) non-utilized protein sources in the country, and (c) the existence of groups concerned with the problem of infant malnutrition.

The proposal was made that the research group in pediatric nutrition at the University of Chile be encouraged to study the problem of infant malnutrition more fully and to determine whether a food material based upon indigenous food supplies could be developed to combat infant malnutrition. It was further suggested that initial experiments in developing food materials be conducted with Fish Protein Concentrate (FPC) since this was available from a pilot-plant facility funded by UNICEF.

A PASA was written between A.I.D./Washington and ICNND to carry out such studies. A contract PH-43-65-272 was in turn negotiated between PHS and the University of California to carry out these investigations.

PHS Contract Requirements

This contract required the following:

(a) The investigation of the effects of early malnutrition in the pre-school population in Chile.

(b) The testing of FPC, first in animals and then in human infants, to determine nutritional effectiveness.

(c) The measurement of nutritional effectiveness of sunflower meal in animals and subsequently in humans.

(d) The development of a food supplement for pre-school children which would decrease dependence upon powdered milk distributed by the Chilean Public Health Service.

Encl. #3

A second proposal (approximately one year later) was submitted to A.I.D. to study the production of infant foods utilizing "extrusion" processing. It was hoped that this rapid "cooking" procedure in which a cereal mixture is forced under elevated pressure and temperature through a die would produce bacteriologically safe, easily digestible and readily supplemented food products. The technological feasibility of producing such products was to be jointly determined by the University of California and the University of Chile. The Chilean group was to be the Institute of Food Science and Technology, an FAO supported instituted. This project was funded in June, 1967 by A.I.D. (AID/csd 1587). The Institute was required to do the following:

(a) Produce foods by extrusion processing from a variety of mixtures made from sunflower seed meal, rape seed meal, FPC, raw fish, corn, wheat and milk.

(b) Determine optimum processing conditions for a number of these mixtures.

(c) Produce enough of these products to supply the Department of Pediatrics for evaluation of nutritional effectiveness first in animals and then in infants.

(d) Produce enough of the most promising mixtures for larger scale testing in selected pre-school populations.

(e) Develop suitable packaging for these products.

(f) Determine storage stability, under Chilean conditions, of mixtures chosen for large scale testing.

(g) Determine the best techniques for enriching extruded foods with vitamins and minerals.

(h) Establish pilot plant facilities for producing these new foods.

(i) Train Chilean Nationals at the University of California in work related to the contract.

This arrangement of two separate contracts for such closely interwoven studies was a source of confusion in handling funds and in 1969 both phases of the work were combined into the existing contract AID/csd 1587 and placed under the aegis of TA/N.

Results

The two phases of this work have not progressed equally well. The nutritional, toxicological and acceptability studies have moved apace. The technological aspects of the study have progressed more slowly.

The University of Chile exprienced a student strike during 1967 and 1968 which shut down the campus including the area which the Food Technology studies were to take place. The Pediatrics Department under the guidance of Dr. Monckeberg, was not housed on University Land, and continued working. Rather than delay the studies to be made by the Pediatrics Department food mixtures were prepared by Dry Mixing techniques rather than by extrusion. These dry mixed products were evaluated even though it was realized that these products would not possess the best characteristics of extrusion processed foods. The inability to work at the University has now been resolved. CORFO, the Chilean Government's corporation for technical development has created a Technical Institute (InTech), separate from the University of Chile. The headquarters and laboratories of the Institute are located away from the University grounds on the outskirts of Santiago.

The Wenger extruder provided by A.I.D. and the key personnel responsible for its operation have been transferred from the University to Intech. Although the laboratories are still in the process of completion the extruder has been installed in its own facility and is in operating condition. The day we were there a demonstration run using wheat flour was carried out. The Wenger extruder at the Institute can turn out about 500 pounds per hour of "Leche Alim", a mixture of sunflower meal, FPC, NFDM and wheat flour. This mixture currently being evaluated and has been given the highest priority. The "Leche Alim" study has also been slowed down since FPC is not available. However, 37 tons of FPC from Alpine will soon be received and 4 tons have been allotted to this project. This will be used to prepare 28 tons of the Leche Alim mixture, enough for two projected studies in two different sections of the country.

Recent Progress

(1) The extruder has been modified to operate at lower die-plate temperatures and to measure the actual product temperature rather than the jacket temperature. These changes now make it possible to maintain uniform high PER values for processed mixtures. (A 10-15°C change in jacket temperature could lower PER values by as much as 12 percent.)

(2) These changes have permitted optimum extrusion processing conditions to be determined for maintaining nutritional value and acceptability for a number of formulations. The PER values for such mixtures have been determined under different conditions of temperature, pressure and time.

(3) In the processing of cereal grains for the production of formulated foods for infants and pre-school children raw starch, which is difficult to digest must be converted to gelatinized products. It has been found that low-temperature gelatinization by extrusion at 110°C of the Leche Alim formulation gave a completely gelatinized product with a PER of 3.12 as compared to 2.58 for the raw mix. Equivalent results were obtained with corn-milk and sunflower-wheat mixtures.

(4) The physical characteristics of extruder processed products such as Leche Alim are superior to those of the non-extruded products. In particular the dispersion characteristics of the extruded product are better and the denatured proteins remain in suspension when rehydrated. This not only makes for a more acceptable product, such as a drink, but no protein residue remains in the container when the product is consumed.

(5) Extrusion techniques have also been used to incorporate flavors and colors into the products. Sensory evaluation of flavored and colored Leche Alim by a panel of 12 - 14 year old school children showed increased acceptability for the flavored and colored products.

(6) Microbiological assays of extruded versus non-extruded products show a major reduction of viable micro-organisms in the processed product as compared to the non-processed mix.

(7) Infant foods should be of high caloric density. Extrusion runs with Leche Alim plus 4-5% added fat gave excellent results. The addition of either hydrogrenated fish oils or hydrogenated vegetable oils not only gave a better nutritional product but increased the throughput by about 30% and gave a well-expanded flake that was more easily ground in subsequent operations.

(8) A distribution program of non-extruded dry-mixed Leche Alim has been conducted in the province of Curico for the past 8 months and will be completed in another 4 months. As part of the distribution program data on the acceptance of Leche Alim and on the effect of its use on the height and weight of children is also being collected. For the past 5 months a control group which receives skim milk instead of Leche Alim has been incorporated into this study. The main thrust of the study is to determine whether a product such as Leche Alim is acceptable to the population on a long-range basis.

The distribution program is being carried out at four centers. Eleven hundred children between 1-5 years old are in the study. Distribution of Leche Alim is made once a month at the Maternal Child Health Centers

(Centros de Madres). One and one-half kilos are given for each pre-school child and at the time of distribution weight and height measurements of the children are made. The program is supervised by a pediatrician who is directly responsible for the program. His staff consists of four field assistants, two part-time nutritionists and a manager in charge of the storing, delivery and distribution of food. The local population provides additional help at the distribution centers. Preliminary results indicate that compared to dried milk powder a far higher proportion of Leche Alim reaches the target group i.e. pre-school children. In most cases the 1.5 kilo package of Leche Alim lasts four weeks. The equivalent amount of distributed milk on an average last about a week. Since most family members use the milk, Leche Alim is considered primarily a product for children and is fed only to the child.

Three months after the study started, 56% of the mothers said they would buy the product if free distribution was stopped. Twenty percent of those who said they would not buy it stated they couldn't afford to make the purchases.

The results of this study should soon be available. Future plans call for the extension of this study using extruded products to two other areas in Chile during 1970.

(9) Sunflower and rapeseed meal studies have resulted in the development of some interesting processes for their utilization.

Sunflower and rapeseed are responsible for over 95% of the edible oils produced in Chile. Sunflower seed meal has been used for animal feed; rapeseed meal has not been utilized because it contains a thyrogenic toxic principle. Rapeseed accounts for about 60% of the total oilseed meal produced in Chile. If the rapeseed can be rendered non-toxic and acceptable for animal feed the liberated sunflower meal could be used for human consumption.

(a) Sunflower meal protein has an amino acid profile low in lysine but high in sulfur containing amino acids. Mixtures of sunflower seed protein with FPC (as in Leche Alim) have excellent biological value. Toxicity studies of sunflower meal in six generations of rats have produced no evidence of toxicity. A procedure has also been developed by which the 12% fiber present in the sunflower press-cake meal is readily reduced to 2%. The protein content of the defibered sunflower meal is approximately 45%. The defibered sunflower meal is currently being used in the Leche Alim acceptability studies.

(b) Rapeseed protein has an excellent amino acid profile. The protein has an adequate level of lysine, and sulfur containing amino acids. Because of the toxic factors the biological value and digestibility of the protein are poor. In fact, when rapeseed meal is the sole source of protein in the diet of rats the animals die within 5 days. Thioglucosides and their toxic hydrolysis products are present in high concentration.

A number of methods have been proposed to remove the toxic factors from rapeseed meal but none have been completely successful. As a result of the present investigation a two stage water extraction procedure that produces a non-toxic rapeseed meal has been developed. The detoxification procedure yields 2 products (a) an 85-90% protein isolate containing about 20% of the original protein and (b) a second product that contains another 65% of the original protein in a form useful for animal feed. A pilot plant for the production of these two products will be constructed at the InTech Laboratory. The biological value, in rat tests, of these detoxified proteins is equal to that of FPC. To check on non-toxicity assays will be conducted on other animal species.

Evaluation

(1) There are positive aspects to this project that go beyond the immediate requirements of the contract.

(a) Dr. Chichester received warm praise from the several Chilean officials and nutritionist we met. In meetings with the Minister of Agriculture and the Minister of Health, kind words for Dr. Chichester's contribution to advances in Food technology in Chile were voiced; a desire that the current A.I.D. supported studies be continued was also evident.

(b) Dr. Chichester has trained a number of Chileans in Food Technology at the University of California at Davis, by means other than through this contract and these young men now form a highly motivated and capable nucleus of food technologists in Chile.

(c) Nutrition research and programs for applying the results of research to real-life situations is an accepted government policy. This attitude is probably in some degree a result of Dr. Chichester's efforts and persuasiveness.

(d) New nutrition institutes and laboratories designed to improve the nutritional status of Chilean are being developed. Again some credit for these developments can be traced back to the A.I.D. contract and Dr. Chichester's effective proselytizing.

(2) Dr. Monckeberg has done an outstanding job in building a highly capable and respective pediatric group at Hospital Manuel Arriran.

Dr. Darby who accompanied me on the "monitoring trip" had nothing but praise for the program, the capabilities and the expertise of Dr. Monckeberg and his staff. The work done on evaluation of toxicity of new products, the nutritional evaluation of new food formulations and the large scale acceptability studies for Leche Alim, all integral parts of this contract have been solidly done. Dr. Monckeberg has done a remarkable job. He started literally in an abandoned building and has in less than 10 years built up a group that has gained world-wide respect.

(3) The food technology aspects of this project have been slow in developing but progress is now rather rapid. Techniques for providing protein from sunflower and rapeseed meal have been developed to the pilot plant stages. The wenger extruder has been modified and is now functioning. The optimum processing condition for a variety of cereal mixtures are being determined. The acceptability of one formulation Leche Alim is being tested on a large scale.

Recommendations:

(1) The work initiated under this contract should not be permitted to lapse at the end of the contract period.

(2) The present contract should not however be funded past the December 31, 1970 termination date. The merger of the two former contracts has produced a hybrid that does not adequately describe the scope of the present project.

(3) A proposal should be submitted describing the new directions of contemplated research based on experiences and insights gained during the life of the present contract(s).

(4) If a new contract is signed TA/N should be kept better informed regarding both progress and changes in research emphasis.

(5) USAID in Chile should in turn be kept better informed of progress on this contract. It was suggested that if this particular study were continued, it would be desirable to meet a year or so later with Dr. Chichester and mission personnel and review progress on this project.

Other Observations

(1) General Oceanography (GO) Feasibility Study. The delay in receiving any reports on this 3 part study on marketing of FPC, dietary habits and nutritional needs has apparently become a constant irritant to Chilean officials. One of our first visits was with Mr. Hugo Trivalli,

the Minister of Agriculture; one of our last with Dr. Valdivieso, the Minister of Health. Both of these gentlemen expressed annoyance at the delay in receiving any reports from GO. Between these visits other Chilean officials expressed the same irritation. More important than the delay in receiving the report is the apparent belief on the part of Chilean officials that if the report is favorable A.I.D. would either (a) fund the construction of an FPC Plant in Chile, (b) insure the construction of a plant, or (c) purchase 80% of the plant output. The greatest concern expressed was whether we would honor this commitment which they think A.I.D. has made.

The submission as soon as possible of a preliminary draft of GO's report on FPC would be most welcome to Chilean officials.

(II) Institutional Developments

(1) Institute Technologico de CORFO (InTech). CORFO, the Chilean Corporation for development, which coordinates Technological Development in Chile and has the funds to initiate a multiplicity of projects has set up this institute for applied research. At present research groups exist in

(a) electronics (communications and instrumentation)
(b) extractive metallurgy
(c) chemical engineering (polymers, plastics and food technology)
(d) mechanical engineering

The chemical engineering group (food technology is centered here) has 16 high level personnel, there are 60 in the entire institute. Staff is currently being recruited. Food technology will have available 500 square meters for a pilot plant and 1500 sq. meters for laboratories. Some proposed projects include studies on (a) food dehydration, (fruit and vegetables), (b) protein production from non-conventional sources and (c) stabilization of oils and related compounds. As mentioned the Wenger extruder provided by A.I.D. is now installed at the Intech labs. This Institute is to be self-supporting. It will be modeled along the lines of the Batelle Institute. The Institute will promote applied research and development by industry using industry's own resources. Where this isn't feasible research contracts paid for by the industry will be entered into. Under this arrangement the Institute will operate as the research and development department of the sponsor, i.e. industry will specify the specific aims of a project, the cost, time allowed, etc. Basic investigations will also be supported. Funds for basic research may come from the National Commission for Scientific and Technology Research (NCSTR), from foreign organizations, foundations, etc.

The key scientists I met appeared to be highly motivated, enthusiastic, capable and relatively young.

(2) Institute de Fomento PESQUERO (IFOP), the institute of Fisheries Development, is also an arm of CORFO and was created in 1963. The institute is supported by copper funds (a percent of total copper profits). Private funds for specific objectives are also available. About 200 people are employed, included are biologist, technologists, economists and sociologists. Most of the effort is concentrated on marine foods.

(a) A new FPC process has been developed and a pilot plant to evaluate the method will be set up at Intech. The FPC results from a carefully controlled enzymatic hydrolysis. The process is essentially a water extraction of proteins. The product has good texture and flavor and can be incorporated into infant foods. The amino and pattern is good. In fact lysine concentration is quite high and a mixture of this product and sunflower meal makes an excellent nutritional combination. Toxicity tests, product formulation and marketing studies are underway. The product is not considered as another type of FPC but rather as a complimentary product. It has some interesting properties, for example, normal FPC cannot be utilized to feed calves while this product can. This skim milk currently used to feed calves could be replaced by this material and about 10,000 tons of skim milk would be released for human use. It is estimated that one year will be required to obtain data on toxicity, product formulation and marketing potentialities.

(b) IFOP has been developing minimum standards for fish products. This is vital particularly for export business. One example, in South Chile mussels are canned but standards must be developed before appreciable amounts can be exported. Regional quality control laboratories have been established. Standards for quality control of fish meal have been set-up and have met with industry acceptance.

(c) IFOP also supports programs ranging from basic to applied at several Universities. Some of the problems are being used as subjects for Ph.D theses.

(d) A wide variety of small laboratories working on practical problems concerned with subjects ranging from algae to sea weed are also supported by IFOP.

IFOP too is an organization dominated by young, technically capable, highly motivated individuals. The big technical need is for more specific expertise. This can be gained by training their own people overseas and by bringing in top scientific specialists for consultation. At the moment, they would like to bring in Dr. Tannenbaum of M.I.T. for a 2-week study on a specific problem. We were asked if A.I.D. could support this trip.

(3) Department of Nutrition - School of Medicine - University of Chile.

Dr. Sergio Valiente is the Director of the Department. He is a protege of Dr. Julio Santa Maria (Ministry of Health). The department has just moved into a huge, new medical school building and is in the process of organization. Plans for the future are highly ambitious. The Department's aims are (a) to study the nutritional problems of the country (b) to promote nutrition education and (c) to work with governmental authorities in order to improve the nutritional status of the population. They hope to work with the Ministry of Health, other university groups (e.g. pharmacy and agriculture), other universities and international agencies. Initially this department will be essentially a teaching institute.

In the course of our conversations Dr. Julio Santa Maria pointed out how difficult it was to publish papers from Chile in English journals. One organization SLAN (Society Latin American Nutrition) needs about $15,000 to publish "Archives of Nutrition." A.I.D. help was solicited.

(4) Laboratory of Pediatric Investigations - Hospital Manuel Arriran.

Dr. Fernando Monckeberg is the head of this laboratory and is the key Chilean figure associated with the A.I.D. contract we were monitoring. The activities of this group range from the nutritional studies associated with our contract to the isolation of placenta proteins that act as hormones to control the onset of lactation and the growth of the uterus. The department contains a 20-bed metabolic unit, the caliber of research is excellent, and the staff includes 9 medical doctors and 8 biochemists all trained in the States.

We discussed the types of programs supported by the National Health Service, and how this tied in with the A.I.D. contract. The Chilean Government distributes free milk to all children

under 5 years. This program costs $8,000,000. Only 10% of this milk gets to the children, as mentioned, the rest may be diverted to other members of the family or sold. The Leche Alim formulation being tested promises to be a milk substitute that is as good nutritionally and is lower in price than NFDM. A second program supported by the Government costs $9,000,000 and provides breakfast and lunch for school children. A third program just established provides for building kindergartens in slum areas and keeping pre-school children there all day. The price tag for this project is $7,000,000.

(5) Department of Pediatrics - Hospital Roberto del Rio.

Cornell Medical School has been working with this group and Dr. Myron Winick had approached us with the idea that we could help fund, in part, a study already underway. We had arranged this interview to learn as much as we could about their program.

The Chief of the Department of Pediatrics is Dr. Julio Meneguello. We did not meet Dr. Meneguello but spoke with his colleague Dr. Georgio Solimano.

The program of interest was a 5-year study in which severely malnourished children less than 1 year old had been admitted to the hospital. After rehabilitation these children were returned to their homes and their physical and mental progress charted as a function of time. These children received some food and when ill could attend the out-patient clinics of the hospital, but no form of outside stimulation was offered.

The pediatrics unit is developing a second program. Again, severely malnourished children less than 1 year old will be admitted to the clinic and after recovery sent home. But this time some form of mental stimulation would be initiated and maintained until the child was 2 years old. At that stage, the child would be transferred to a nursery school where he would continue to receive outside stimulation till 5 years old. The objective of the study is to try and isolate the effects of malnutrition from the effects of a poor environment. Since this study will be completed 5 years after the initial study it seems desirable to have another control group. Funds for this "new" control group are not available and these are the funds we have been asked to supply at least in part.

Another project that has been initiated has as its purpose to determine "The Effects of Urbanization on Nutrition in Chile."

A workshop to compare notes with others who are conducting similar studies in other countries is being planned. Dr. Darby pointed out that similar workshops were being organized in the United States and thought it would be interesting to have Dr. Solimano attend these and present his findings.

The hospital has a 420 bed pediatrics unit and serves 600,000 people. Nutrition service is delivered through health centers. The staff functions involve teaching, education and research.

The caliber of the work again appears to be high and support of a project here would be useful.

Comments

(a) The government is fully aware of its responsibilities in the field of nutrition. Thus, in the upcoming presidential election in September all three candidates are on record as being concerned with upgrading nutrition. The nutrition programs in Chile are apparently in the hands of energetic, well-trained and highly motivated individuals. There is considerable rivalry between groups but this could be beneficial. Food Science and Food Technology courses are being offered in several of the universities. There is an air of confidence with respect to future progress. One has the feeling that Chile is at the take-off stage in its nutrition programming.

(b) The multiplicity of studies that are under way and were not known to us points up the need for the establishment of a world-wide clearing house for exchange of information on nutrition projects.

(c) We would like to express our thanks to USAID/PERU and USAID/CHILE for the effective schedules and visits they arranged. Their unstinting cooperation made this "monitoring" trip a most useful and informative one.

Irwin Hornstein, TA/N
April 15, 1970

UNIVERSITY OF CALIFORNIA, DAVIS

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COLLEGE OF AGRICULTURAL AND
ENVIRONMENTAL SCIENCES
DEPARTMENT OF FOOD SCIENCE
AND TECHNOLOGY

DAVIS, CALIFORNIA 95616

May 12, 1969

Revised May 27, 1969

Dr. George Parman
Food From the Sea
War on Hunger - A.I.D.
Department of State
Washington, D. C. 20523

Dear Dr. Parman:

I should like to review the two projects PH43-65-572 and AID/csd-1587. PH43-65-572 has been in operation for three years. AID/csd-1587 has been in operation approximately two years. AID/csd-1587 is concerned with the technological aspects of the manufacture of high protein foods utilizing expander and similar techniques. The work is to be done at the Institute of Food Science and Technology in Chile and the Department of Food Science and Technology, University of California, Davis. Mr. Isidro Planella is the Director of the Institute in Chile and has a staff of 18 professionals attached to the Institute. It does not fund extensive laboratory evaluations of the protein products produced, although provision for P.E.R. and amino acid analysis are allowed for at the University of California at Davis. The contract also provides for the general supervision of all work by the University of California and for preliminary technological work at the same institution.

PH43-65-572 has been concerned with the nutritional and toxological evaluation of high protein food mixtures containing FPC. These mixtures are based upon indigenous raw materials. Initially a thorough laboratory evaluation is made in animals for toxicity and for nutritional value. After this screening the mixtures are evaluated in infants and children in a hospital environment. This in turn is followed up by the evaluation in larger non-hospital populations performed in conjunction with the well organized food program of the National Health Service. This program is under the supervision of Dr. Fernando Monckeberg, a U.S.-trained clinical nutritionist. He heads the Laboratory of Pediatrics, which has a staff of 15 M.D.'s, plus 8 graduate biochemists.

In order to clarify the relationship between these two projects, AID/csd-1587 and PH43-65-572, I should like to follow a typical product through the sequence to the final testing. As an example let's consider Leche Alim, a mixture of FPC, purified and defibered sunflower meal, toasted wheat and 18%-fat milk solids. First, a tentative formulation of a mixture was developed on paper which represented a good nutritional supplement. Each ingredient was tested in the laboratory for toxicity and nutritional quality in animals. After passing these preliminary screenings the entire mixture was tested in animals for nutritional quality. Slight modifications were made. This was funded under PH43-75-572. Amino acid analysis was done

Encl. 2

under AID/csd-1587 in the Department of Food Science and Technology at the University of California, Davis, California. In order to process the ingredients for human use the sunflower meal had to be defibered. This problem was turned over to the Institute of Food Science and Technology, who developed a defibering technique. This particular work was funded under AID/csd-1587.

The defibered meal was then clinically tested in human infants in a hospital situation under medical supervision. Results indicated the needs for slight modification of the formula from an acceptability standpoint. This work was done under PH43-65-572.

A larger quantity of the product was then produced for testing in children housed in an orphanage (approximately 250 children). The product was produced with the cooperation of the Institute of Food Science and Technology and industry.

Clinical and acceptability testing of this product in the orphanage was carried out under PH43-65-572. A test was then proposed for a larger population of 2,000 to 4,000 children. The manufacturing techniques for the production of Leche Alim designated for this test were devised in consultation with the Institute of Food Science and Technology under AID/csd-1587. The National Health Service of Chile provided the raw materials with the exception of FPC, which had been purchased from funds of PH43-65-572. These tests are now underway in Curico and should last until September 1969.

The Institute of Food Science and Technology is developing techniques for the production of the dry mix, methods for the expander production of this product, techniques of fortification with vitamins and minerals and methods of adding flavors to further enhance acceptability. This work is financed under AID/csd-1587. These manufactured products will be passed on from the Institute of Food Science and Technology to the Laboratory of Pediatrics for evaluation of toxicity and nutritional quality in animals, although amino acid analysis will be performed at the University of California at Davis. Final evaluation will be done in human infants under hospital conditions before going to extensive trials in larger populations. This work will be financed under PH43-65-572. The development of these mixtures has been reported on by publications and reports to the Public Health Service and AID. A copy of an article describing animal and human evaluations is enclosed.

In addition to the mixtures of FPC, sunflower meal, wheat and milk, etc., some work is necessary on the detoxification of rapeseed meal to permit its use in monogastric animals as a substitute seed ingredient for sunflower meal. This will free the sunflower meal for human use without dislocating the animal seed industry. Sunflower and rapeseed are the only two feasible protein sources in adequate supply in Chile.

As we discussed several weeks ago, and in light of the close relationship between these two grants, it is proposed that contract PH43-65-572 not be renewed through the Public Health Service. Instead, this portion of the

work in Chile will be added to the contract AID/csd-1587 so that the administration of both projects will be facilitated. The present contract, AID/csd-1587, is to be extended without additional funds until December 30, 1969. The second period of the contract, which was to run a year and one-half, will then be added to this portion. On a fiscal year basis this would involve a renewal of the contract with funding until March 31, 1960, with additional funding for a six-month period. The contract then, if continued, would be funded for an additional year, until June 1971.

If we add the work under PH43-65-572 to this, the two contracts will then coincide under these conditions in time. We had proposed that the contract PH43-65-572 be renewed for two additional years, which would then, under present circumstances, take it though until June 1971.

The sum total, then, of the renewal we are now discussing ending in March 31, 1970, would consist of a one-year funding of the present PH43-65-572 and a half-year's funding of the second period of AID/csd-1587. As we discussed in Washington, the figures would come to approximately $50,000 for the ensuing period.

The addition to AID/csd-1587 would thus consist of the specific aims of the present contract PH43-65-572, and the budget for these. The aims of the contract and the budgets are outlined below.

Specific Aims:

Specific Aims to be added to AID/csd-1587, which would be partially subcontracted to the National Health Service - Department of Pediatrics, University of Chile, would thus be:

1) Nutritional and toxicological evaluation of mixtures containing FPC by laboratory and animal testing followed by clinical and field testing of suitable mixtures. The mixtures that would be furnished the Department of Pediatrics by the Institute of Food Science and Technology would include the following mixtures:

a) Mixture of Fish Protein Concentrate and purified sunflower presscake meal;

b) Ground wheat and FPC;

c) Purified sunflower presscake meal, FPC, medium-fat milk solids and wheat;

d) Purified sunflower presscake meal, FPC, and wheat;

e) Other mixtures of cereal products available in Chile with added FPC.

2) The acceptability ~~of~~ and nutritional effect of products passing laboratory examination will be tested in organized feeding programs in operations of between 2,000 to 4,000 children.

3) The economics of the various mixtures of proteins will be determined in comparison with other foods now being distributed.

4) In addition the nutritional efficiency of detoxified rapeseed meal for monogastric animals will be tested as part of the program to develop a suitable substitute for the sunflower meal presently used in the animal food.

Procedures:

1) Laboratory, clinical and field testing will be done utilizing standard laboratory and acceptability techniques. These will be done under the supervision of clinical personnel.

2) In the large populations nutritional status will first be assayed by a pre-feeding survey utilizing ICNND techniques. The effect of nutritional supplementation will be determined at the end of feeding periods by reiterating the survey.

3) Nutritional status in pre-school children will be determined by measurements of height and weight and selected hemological techniques.

4) Acceptability evaluation will be done under the supervision of trained food scientists and psychologists.

These procedures of evaluation are described in the enclosed publication.

Significance:

The proposed extension of the contract would carry the investigation of the utilization of food from the sea from laboratory experiments with infants and small-scale field studies of pre-school children to consideration of protein supplementation of larger populations. In these studies semi-commercially processed marine protein sources together with cereals and other ingredients would be evaluated as to acceptability, nutritional efficiency and economics. The proposed experiments would thus complete the picture of the possibilities of large-scale utilization of marine and other protein resources in Chile. The results obtained here would be applicable to many countries throughout the world.

It should be pointed out that under AID/csd 1587 the provision for the translation of technology to the industrial segment is provided for. There is a very effective liaison between industry and the Institute of Food Science and Technology concerned with the manufacturing techniques of protein mixtures.

Budget:

The budget for the first year is outlined on the next page.

First Year

1)	Personnel a) Two medical doctors (70%) b) Two chemists (100%) c) One dietitian (100%) d) Two technicians (100%) e) One secretary (100%)	$22,000.00
2)	Consumable supplies	2,500.00
3)	Animal care	500.00
4)	Travel	4,500.00
5)	Equipment (part of amino acid analyzer)	6,000.00
~~6)~~	~~Consultant fees (Dr. L. Voris)~~	~~1,000.00~~
7)	University of California management fee	1,200.00
	TOTAL	$37,700.00 36 700

Second Year

1)	Personnel	$23,500.00
2)	Consumable supplies	2,500.00
3)	Animal care	500.00
4)	Travel	4,500.00
5)	Consultant fees (Dr. L. Voris)	1,000.00
6)	Management fee	1,200.00
7)	Equipment	3,500.00
	TOTAL	$36,700.00

The above budget should be considered in the light of a substantial Chilean contribution of manpower, supplies, transportation and facilities, which already exceeds $50,000 per year.

I hope that this letter will be sufficient to clarify the relationship between the two projects and will allow us to fund the portion of the work previously supported under PH43-65-572. This work is proceeding and it is imperative that it continue.

Sincerely,

C. O. Chichester
Chairman

COC:dlb

Enclosure