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MEMORANDUM

TO: TA/RIG, M. Rechigl
AA/TA, E. Long

FROM: TA/N, Irwin Hornstein

SUBJ: Progress Report: Texas A&M University Contract-AID/csd-2804, Development of a Process for the Preparation of Coconut Protein Products for Use in Foods

A report by Texas A&M University analyzing the economics of coconut protein was submitted to the Research Advisory Committee (RAC) at its meeting on December 12, 1973 in fulfillment of the RAC requirement that:

> "Approval for a two-year extension of the Texas A&M University contract is contingent on the condition that within one year a report will be submitted that contains a "ball-park" analysis of the economics of the technology".

RAC acknowledged receipt of the report on economics and the contract with Texas A&M University was extended accordingly. However, during discussion of the contract RAC expressed interest in having (a) a more comprehensive economic analysis, and (b) a report on the nutritional qualities of the coconut protein products as related to food uses.

After the above mentioned RAC meeting, Texas A&M University has carried out further work on analysis of the economics of coconut protein technology and has collected additional information on the nutritional qualities of coconut protein products. A summary of these additional findings is given below. Relevant reports and publications on the subject are given in the Appendix together with a report covering an overall review of the contract by an expert panel on February 3, 1975.

(A) Economics of Technology for Production of Coconut Protein Products

Texas A&M University has supplemented earlier analyses of the economics of producing coconut products which have been reported to RAC with an analysis of the costs, returns, and pricing of coconut skim milk products made by aqueous processing. Based on a projected plant size of 250 tons per day of dehusked coconuts, it was estimated that annual production would be 8,700 tons of oil and 2,750 tons (dry weight basis containing 25% protein) of concentrated coconut skim milk (30% moisture). Fixed capital costs for the operation were estimated at $1,910,000 and working capital at $800,000. Taking the value of coconuts at $35 per ton, crude oil at $275 per ton, and skim milk solids at $500 per ton, (significantly lower than NFDM) it was estimated that the plant would yield a pretax return on investment of 20 percent. A sensitivity analysis was carried to examine the effects of plant size, selling prices, project life, etc. on the rate of return. Details of the total analysis are given in the article in the appendix Aqueous Processing of Coconuts: An Economic Analysis.

(B) Nutritional Properties of Coconut Protein Products

The nutritional qualities of coconut protein have been determined through analyses of composition and through animal feeding tests. The composition of coconut milk products is shown in tables I and II; protein, fat, carbohydrate, mineral, and amino acid distribution are listed. A more comprehensive description of the products is given in the article in the Appendix entitled Dehydrated Coconut Skim Milk as a Food Product: Composition and Functionality. The Protein Efficiency Ratio of coconut products were found to be 2.0 for coconut skim milk concentrate; 1.7 for spray dried coconut skim milk; and 2.1 for coconut meal, all normalized to 2.5 for casein. (For details see the report in the appendix entitled Nutritive Value and Food Uses of Coconut Skim Milk Solids). These results provide a basis for considering nutritional qualities for specific food uses of coconut protein are somewhat less than those of cows milk, just as proteins from soy and other vegetable protein are, it appears suitable for use as a milk replacement and for other food application. More work on nutritional qualities is clearly needed including human feeding tests when specific food applications have been identified and information is available on which to design appropriate tests.

Attachments:
a/s

Table 1—Chemical analysis of spray-dried coconut skim milk

	% Composition[b]		
	Coconut water used in processing	Tap water used in processing	Standard dev
Protein			
Crude Protein (N × 6.25)	25	30	0.8%
Low Molecular Wt. N (as % of N)	8	7	0.5
Fat			
Crude Fat	5	7	1
Free Fatty Acids (as % of Oil)	[illegible]	1.4	0.3
Non-saponifiables (as % of Oil)	[illegible]	–	0.5
Iodine Value (as % of Oil)	6.3	–	0.7
Carbohydrates			
Reducing Sugars	2.8	2.0	0.2
Reducing Sugars after inversion	45	37	1.5
Sucrose	33	–	1.5
Crude Fiber	0.03	0.03	0.02
Minerals			
Phosphorus	0.5	0.5	0.05
Calcium	0.17	0.06	0.01
Magnesium	0.26	0.36	0.03
Potassium	3.6	3.3	0.2
Sodium	0.9	1.4	0.3
Chloride	1.6	1.6	0.2
Ash accounted for[a]	8.2	9.3	0.4
Ash (by analysis)	8.8	9.2	0.5

[a] By calculation from stated mineral contents
[b] At level of 3% moisture

Table 2—Amino acid composition of spray-dried coconut skim milk

Amino acid	g/16g N[a]	Ratio to egg values[b]	Ratio to FAO pattern[b]
Essential			
Isoleucine	2.6	39%	60%
Leucine	5.4	61%	110%
Lysine	4.6[c]	71%	106%
(Total Aromatic)	(6.1)	(61%)	(106%)
Phenylalanine	3.8	65%	132%
Tyrosine	2.3	55%	80%
(Total Sulfur Containing)	(3.0)	(54%)	(70%)
Cysteine	1.7	71%	84%
Methionine	1.3	41%	56%
Threonine	2.4	47%	83%
Tryptophan	0.9	56%	62%
Valine	4.0	55%	93%
Nonessential			
Histidine	2.2		
Arginine	15.5		
Aspartic Acid	7.1		
Glutamic Acid	22.0		
Serine	3.7		
Proline	3.5		
Alanine	4.1		
Glycine	3.8		
TOTAL	90.3	–	

[a] Standard deviation is ca 0.1g/16g N
[b] Each amino acid content was divided by amino acid content of egg or 1957 FAO provisional pattern, for same amount of nitrogen. Egg and FAO values used were as reported in FAO/WHO, 1965, Protein Requirements
[c] Available lysine was 4.3g/16g N for samples freeze dried or spray dried at air outlet temperatures of 88–105°C, decreasing to 3.8g/16g N at air outlet temperatures of 107–116°C. Available lysine was determined by the method of Carpenter (1960)