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THIRD MEETING ON FORTIFICATION OF MANDIOCA PRODUCTS

Rio de Janeiro, March 13 through 16, 1972

MINISTÉRIO DA SAÚDE

SECRETARIA DE SAÚDE PÚBLICA E UNIDADE DE PLANEJAMENTO,
AVALIAÇÃO, PESQUISAS E PROGRAMAS ESPECIAIS (PAPPE).

DIVISÃO NACIONAL DE ORGANIZAÇÃO SANITÁRIA / COMISSÃO
NACIONAL DE ALIMENTAÇÃO.

Coordination: MINISTÉRIO DA AGRICULTURA

DEPARTAMENTO NACIONAL DE PESQUISA AGROPECUÁRIA
DIVISÃO DE PESQUISAS EM TECNOLOGIA AGRÍCOLA.

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Condensed brief of sessions

Monday, March 13:

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The session was opened by Dr. Walter B. Mors, Director of the Division of Research in Agricultural Technology and Coordinator of the meeting. After extending his greetings to all present, he invited to speak Dr. Alfredo Norber to Bica, Secretary for Public Health of the Ministry of Health and Chairman of the National Food Commission. Dr. Bica reaffirmed the support of the Ministry he represents to the programs of fortification of staple foods. He referred to the results produced by the Second Meeting, in July, 1971, recalling its recommendations. He also mentioned the agreement between AID/Brazil and the Ministry of Health which has secured the continuity of the program.

At the end of his speech Dr. Bica added: "This time, the meeting will be held under special circumstances, due to the pleasant and honorable presence of experts from other continents who, by invitation of the Agency of International Development, came to make our acquaintance, to learn what in particular has been accomplished by Brazilian researchers, and in turn offer their experience in this field of activity. In the name of His Excellency the Minister of Health, I have the pleasure to extend our welcome to the scientists of countries our friends and to wish them a pleasant sojourn in our country"

Next to speak was Dr. Martin Forman, Director of the Office of Nutrition of the Department of Technical Assistance, AID/Washington, who talked about subjects and international programs of food fortification. Then, again, Dr. Walter Mors explained the agenda of the Third Meeting on Fortification of Mandioca Products.

AGENDA OF THE THIRD MEETING ON FORTIFICATION OF
MANDIOCA PRODUCTS

The five basic subjects were:

1. Technological problems related to mandioca
2. Toxicity of mandioca and its products
3. Nutritional enrichment of mandioca products
4. New products derived from mandioca
5. Economic problems.

The following papers, which had been enrolled in advance, formed the basic program of the meeting:

1. Technological problems related to mandioca.

Edgard Normanha, Instituto Agronômico de Campinas, São Paulo: "Some aspects of farinha de mandioca manufacture in Brazil."

2. Toxicity of mandioca and its products.

Jerome Maner, Centro Internacional de Agricultura Tropical, Cali, Colombia: "The value of Nitrogen fraction in cassava and the effects of HCN in metabolic functions."

3. Nutritional enrichment of mandioca products.

Ludwig Kummer, Tipity - Indústrias Mandioca Ltda.: "Prerequisites for the success of the fortification project."

Antônio de Albuquerque Figueiredo, Centro de Tecnologia Agrícola e Alimentar, Ministério da Agricultura, Rio de Janeiro: "Fortification of farinha de mandioca with soy protein isolate."

Roberto Kohlman, SANBRA, São Paulo: "Acceptability of mandioca flour enriched with Soy Protein Isolate in the institutional feeding."

Tobias José Barreto de Menezes, Instituto de Tecnologia de Alimentos, Campinas, S.P.: "Cultivation of Food yeasts on a substrate of mandioca."

Jacy Silva Nascimento, Instituto de Nutrição da Universidade Federal de Pernambuco, Recife: "Nutritional value of the mixtures feijão macaçar + farinha de mandioca and feijão

mulatinho + farinha de mandioca, supplemented with different levels of methionine."

J.E. Dutra de Oliveira, Faculdade de Medicina de Ribeirão Preto, SP.: "Nutritional value of farinha de mandioca with admixtures" and "Farinha de mandioca as a carrier for nutrients in local diets."

4. New products derived from mandioca.

No communications registered.

5. Economic problems.

Miguel Tavares, Rio de Janeiro: "Study on economic feasibility of fortification of mandioca flour."

Roberto Kohlmann, SANBRA, S. Paulo: "Some considerations on the economic and commercial feasibility of enriched foods."

The procedures were reopened at 1:30 p.m. As chairman served Dr. Oswaldo Lopes da Costa, Director of the National Department of Sanitary Organization and Vice-chairman of the National Food Commission of the Ministry of Health.

The participants having introduced themselves, Dr. Oswaldo Costa explained the position of the Ministry of Health with regard to the consumption of farinha de mandioca by the different population groups in Brazil, speaking about the possibilities of its qualitative and quantitative enrichment.

The opening words of the working sessions were pronounced by Dr. Barry Nestel, Associate Director of the Canadian Center for International Research and Development. In his introduction, entitled "Global Research on Cassava," he explained the interest of his organization in supporting work on this subject. Approximately \$3,000,000 are involved in a five-year program for supporting cassava. The center of this program is based at CIAT (International Center for Tropical Agriculture) in Cali, Colombia, but it has linkages to both Canadian Institutions and to research center in developing countries not only in Latin America but also in Asia and Africa.

The establishment of outreach linkages to cassava programs in other parts of the world is an important point in this program. The first such link is a bridge between CIAT and the Agronomic Institute at Campinas, to study various approaches to heat and chemical treatment of cassava cuttings to free them

from the mosaic virus. Discussions are underway to link this work with virus studies in Africa and Asia.

Concerning the nutritive value of cassava, Dr. Nestel pointed out that only 40-50% of the nitrogen in the root appears to be in the form of protein nitrogen. Finally, he referred to the work underway to breed new varieties of cassava.

The chairman thanked Dr Nestel and called upon Dr. C.H. Obihara, representative of Nigeria, who explained that in his country the danger of poisoning is relatively low, due to the kind of processing to which the cassava is subjected.

Dr. Nestel mentioned the work published by the Nigeria Medical School, where cases of chronic poisoning are mentioned.

Also Dr. Amara Bhumiratana, representative of Indonesia, made some remarks about toxicity. Dr. Walter Mors called attention to the fact that this subject belonged to a different session of the meeting.

Next, Dr. Edgard Normanha of the Instituto Agronômico de Campinas was invited to speak about "Some aspects of farinha de mandioca manufacture in Brazil." He showed different angles of mandioca technology, particularly in the Amazon region.

Dr. Mário Guimarães of the School of Chemistry of Belém, Pará, made some clarifying remarks on the manufacture of the so-called "farinha do Pará." He explained that this product has its origin in the agricultural zone of the Bragança railroad. It is a mixed flour, which results from a blend of "massa ralada" (the unfermented grated mass used to produce the "farinha seca") with a fermented mass (the initial stage for obtaining "farinha d'água"). The two ingredients enter in different proportions, the "massa ralada" predominating. The fermented mass contributes with 15 to 25%. The result is a good quality farinha, which predominates on the Belém Market. There were still other commentaries about difficulties and differences in farinha processing.

Dr. Leon Pahka, Director of the Institute for Nutritional Research of Zaire, told about a typical dish from his country in which cassava flour is mixed with corn flour. He also explained the preparation of "fou-fou." This is a flour made by drying and pounding the cassava roots which have been previously macerated.

After a short interval spoke Dr. Amara Bhumiratana,

Director of the Institute of Food Research and Product Development of Thailand, on "Tapioca Products in Thailand." He referred to the exportation of cassava chips from his country, especially to Germany. He also mentioned numerous dishes of local use, made from cassava, including sweets and colored confectioneries. Asked about the technique of enrichment through fermentation, he commented briefly on this subject.

After a few enlightening remarks by the chairman, Dr. B. Lartey from Ghana was welcome to speak about "The mechanization of cassava processing with special reference to Ghana." He stressed the necessity for machines to allow for standardization of the products and for the centralization of the initial processing in the rural zones, a practice which would avoid transporting to the urban centers the approximately 60% water eliminated through the processing. He spoke also about enrichment through fermentation and by means of additives. He proceeded by explaining the preparation of "gari" and the differences between this product and "fou-fou." Gari is a food very common in West Africa and Nigeria. It is obtained through the fermentation of the grated cassava root, followed by a semi-dextrinization by means of heat and, finally, drying until a flour results. The fermentation liberates much of the hydrocyanic acid and develops the characteristic flavor of "gari."

Next, Mr. José Coelho, director of Industria Granfino, was asked to explain a few points in the processing of mandioca. He showed that, in general, the preliminary processing is done in the rural areas, and later completed by industries located in urban districts.

Dr. Manoel Ferreira of PAPPE, Ministry of Health, commented on the central theme, "Nutrition and the fortification of mandioca products," showing his optimism with regard to the results. In this attitude he was supported by Dr. Forman.

Dr. Walter Mors commented on the great diversity between mandioca products in Brazil and in the African countries. He extended his support of some of the exposed viewpoints on rural/urban industrialization and stressed the usefulness of the exchange of ideas between Brazilians and representatives of other countries interested in the cultivation of mandioca.

The chairman thanked all participants for their collaboration and closed the session.

Tuesday, March 14:

Dr. Walter Mors opened the session and invited, to preside, Dr. Hélio Correia, Deputy Director of the Agricultural Research Institute of the Center-East at Sete Lagoas, State of Minas Gerais, and Chairman of the National Mandioca Commission of the National Department of Agricultural Research.

First to speak was Dr. Jerome Maner of CIAT, Cali, Colombia, who discussed the "Value of the nitrogen fraction in cassava and the effects of HCN in metabolic functions"

The speaker talked about protein evaluation in some mandioca varieties. He referred to the variety "llanera" which possesses approximately 6% crude protein. He mentioned experiments made with the feeding of pigs. Talking about toxicity, Dr. Maner said that the poison can be eliminated almost completely by boiling for 30 minutes.

The chairman thanked the speaker and Dr. Mors asked whether the composition of the non-protein nitrogen fraction of mandioca was known. Dr. Maner replied that this is made up mainly of nitrates. Other questions were made. Dr. Obihara asked what factors make up the distinction between "sweet" and "poisonous" varieties. Dr. Maner said that more than one factor is actually involved. These include not only the presence of HCN, but also free sugars, which are liable to mask the usual characteristics. Other factors were also mentioned, such as soil, humidity, climate. Referring again to the elimination of HCN through heat, Dr. Maner said that humidity is also an important factor in this operation. Fermentation or sun-drying eliminate free HCN, but not the part which is present in glycoside form. Dr. Nestel added that he knew of cases of gradual poisoning from cassava with the appearance of neurological disturbances. Next, Mr. Ludwig Kummer spoke about the prerequisites which, in his view, are essential for the success of the program. He also discussed problems concerning the technology, packaging and fortification of farinha de mandioca. Comments are made by Dr. Lartey, Dr. Maner, Dr. Walter Santos, Dr. Normanha, and others. According to Mr. Coelho, the increase in price resulting from fortification will not affect the sales of the product.

Chairman of the afternoon session was Dr. Walter Santos, representative of the Associação Brasileira da Indústria de Alimentos (Brazilian Association of the Food Industry, ABIA).

First speaker was Dr. Antonio de Albuquerque Figueiredo, of the Centro de Tecnologia Agrícola e Alimentar, whose subject was "Nutritional enrichment of farinha de mandioca with isolated soy protein." Tests conducted in different proportions showed incorporation to be viable, either directly, or by means of a "premix." He explained how experiments had been made with the scope of correcting the soy protein's deficiency in methionine. Addition of this amino-acid results in diminished acceptability by the consumer. Biological tests performed by Dr. Dutra de Oliveira proved the necessity of adding methionine, the absence of which jeopardizes the biological value of the fortified farinha. Work is being continued, to find a solution for this problem. The chairman thanked Dr. Figueiredo, and several questions were raised. Concerning the increase in price which would result from this enrichment, it was informed that this would be of the order of 15%. The taste and final aspect of the product were also discussed. Mr Hans Keunecke, of SANBRA, mentioned that toasted soy flour had a darkening effect on the finished product. Dr. Pahka added that in some regions of his country cassava flour is consumed mixed with toasted soy flour or corn flour. Also discussed was the necessity of governmental organs to help in the solution of the economic difficulties brought about by the fortification plan.

Dr. Irwin Hornstein, of AID-Washington, commented on the relatively low levels of methionine which are adequate for its biological utilization; therefore, new levels, even still lower ones, should be tried out. Other comments and suggestions were made, concerning conservation and palatability tests. With respect to this subject, Mr. Roberto Kohlmann, of SANBRA, spoke about "Acceptability of mandioca flour enriched with soy protein isolate in institutional feeding." He showed the experience obtained in the company cafeteria, where fortified farinha, even containing methionine, was very well accepted by all.

Dr. Tobias José Barreto de Menezes, of ITAL, Campinas, was asked to talk about "Cultivation of food yeasts on a substrate of mandioca." This is an attempt to enrich farinha de mandioca by growing yeasts on a culture medium made up fundamentally of mandioca starch, according to researches conducted by the North-American expert, J. Strasser. More detailed studies will be necessary, in order to attain the optimum conditions for de-

velopment. The substrate and yeast, after centrifuging, washing and drying, produced yeast in 17.5% yield calculated on the total sugars. 50% would be considered good, and the ideal yeasts are those which directly hydrolyze the starch, thus dispensing with the preliminary hydrolysis. The chemical composition of the product remains to be determined, as well as the technique of incorporating it into the farinha.

Dr. Dutra de Oliveira, of the Faculty of Medicine of Ribeirão Preto, commented on this possibility of obtaining protein through fermentation on mandioca starch. But he insisted on the necessity of conducting biological tests for evaluating the product from a nutritional stand-point.

Next invited to speak was Dr. A.C. Mosha of Tanzania, who talked about "Production, utilization and fortification of cassava products in Tanzania." He referred to the nutritional situation in his country, pointing to the deficiencies of cassava as a food. He also mentioned the use of cassava leaves as a traditional food in West Africa.

Dr. Nestel asked whether there exists any relation between the glycoside content of the leaves and that of the roots, and if leaves, when used as food, are taken from sweet or bitter varieties. Dr. Mosha said that no distinction was made in this case. He added that in his country a flour is also prepared from the leaves, but this is not customarily mixed with cassava flour proper. Dr. Nestel commented on the fortification with protein concentrate. Dr. Lartey, of Ghana, referred to the enrichment of cassava products with carrots and other complements, to which Dr. Mosha added that this was a practice in his country as well. Dr. Mario Guimarães, of Belém, Pará, explained the nature of "maniçoba," a traditional dish in the Amazon region in which mandioca leaves are used.

The next speaker on the agenda was Miss Jacy Silva Nascimento, of the Institute of Nutrition of the Federal University of Pernambuco, who exposed the results of biological tests conducted with rats, with several diets of proteins from different sources and farinha de mandioca. She showed how an efficient use of protein from beans can only be achieved by means of adding methionine. If this is done, the protein efficiency reaches the level of fish meal. The subject was discussed and commented upon.

The chairman thanked Miss Nascimento and called upon Dr. Dutra de Oliveira, who spoke about several aspects of fortification. He stressed the importance of methionine in securing an efficient utilization of proteins. His suggestion was toward the search of adequate solutions, according to different regions. He explained his experiments performed with beans enriched through cooking with methionine. With concentrations of 0.2 to 0.3% there was little alteration in taste; but the smell was objectionable during the cooking. In view of the presence of all other essential amino acids in the vegetable protein diets which are customary in S. Paulo state, his principal suggestion was to use farinha de mandioca simply as carrier for methionine. Asked, whether he had undertaken any study on children's diets, he answered that he had not. Dr. Guimarães mentioned that the presence of Aspergillus flavus in farinha de mandioca stored in places of high humidity, had already been verified.

The session closed for the day.

Wednesday, March 15:

First to speak in this session was Dr. Charles Slater professor of Market Research at the University of Colorado. He talked about his experience with cassava in Zaire. On the same subject spoke Dr. Pahka, of Zaire, discussing the cultivation, conservation, food habits and traditional enrichment of cassava products in his country. He asked what the true toxic factors in cassava were known to be, and how they could be attenuated or eliminated. Dr. Antonio Figueiredo of CTAA commented on this point, discussing the acid and enzymatic hydrolysis of linamarin and the optimum conditions for both to occur. He also commented on the heat factor in relation to eliminating the toxic principle.

Next, Dr. Akinrele talked about the socio-economic situation of his country, as well as on technological aspects and questions of enrichment. The matter was discussed extensively, mainly concerning the possibilities of counteracting the price increase which would be consequence of fortification.

In the afternoon, Dr. Oswaldo Costa was called upon to preside over the last session of the meeting. Dr. Sediautama made a comparison between the nutritional properties of rice and cassava and explained the habits of consuming the latter, in his country. He also spoke about the technology of sweet and bitter

cassava, as well as the transportation problems. He showed how in Indonesia confectionary is made from cassava starch, and how a special kind of fermentation produces an increase in crude protein. The species of yeast which is involved has not been determined, however.

The representative of Thailand spoke about cassava consumption in his country. He also explained that in Thailand rice, enriched with methionine, has been introduced.

Dr. Miguel Tavares was now invited to speak about the economic viability of protein fortification of farinha de mandioca. He started out with an analysis of offer and demand and of prices, as well as a global appreciation of production. The different alternatives for fortification (isolated soy protein, calcium caseinate, fish protein concentrate) were studied in great detail, from the economic point of view. He discussed the problems related with the production, importation and taxing of the different products. The area chosen for this study was Greater Rio. Even if there were other Brazilian areas which could serve as a basis for a project such as envisaged, Greater Rio was chosen mainly for its proximity between the center of decision and the agents intervening in the process. According to the estimates, the fortified farinha will weigh on the family budget of the consumer of the lowest income level. To solve this problem, two alternatives present themselves: a) achieving a price reduction through rationalizing the product process; b) fiscal incentives through the reduction or elimination of taxes (industrial goods and merchandise circulation).

Dr. Tavares considered the first hypothesis rather unviable, which leaves then only the fiscal incentives. Summarizing, the following conclusions were suggested:

- a) to proceed, first of all, with the enrichment with Proteimax, without any price increase for the consumer;
- b) to furnish dealers with samples of the product which is to be launched;
- c) during the test period, ordinary and enriched farinha should be sold at the same price, without any promotion of the latter;
- d) the geographical area of the test should encompass principally the satellite towns of Rio, since these are the main consumer centers of Greater Rio;

- e) after launching the fortified product, it will be necessary to evaluate the results from a technical-economical viewpoint;
- f) on a national scale, it would be necessary to find the best way of reaching the consumer of lowest income level: whether through centralization of processing or through cooperatives which would buy the product and resell it after enrichment.

The chairman thanked Dr. Tavares for his contribution. Dr. Manoel Ferreira asked about price fluctuation of farinha de mandioca during the last years.

Dr. Tavares having raised the possibility of a shortage of ISP for nation-wide fortification of farinha, Mr. Kennecke, representing SANBRA, explained that production would be a consequence of the demand. A considerable increase would be viable according to the necessities of the market. Dr. Tavares added some details about the high cost of the equipment for the production of ISP, explaining that 350,000 tons of ISP (Proteimax) per year would be necessary if fortification were to be made compulsory.

Still other comments followed, including a criticism of the choice of the area on which the study was undertaken. Dr. Tavares explained that this area had the distinction of containing both processing plants and organized commercialization, two factors not to be found in other areas of low development.

Mr. Kennecke declared that it would be unnecessary to present the next paper enrolled by SANBRA, since the subject of economic viability had already been covered in masterly fashion by Dr. Miguel Tavares.

The chairman thanked and called upon Dr. Francisco Villela, representative of the Ministry of Finance, in order to give some comments about possible fiscal incentives to be given to manufacturers of enriched products.

Next, Dr. Martin Forman proceeded to give a general analysis of the papers presented at the meeting. He showed himself optimistic with respect to a practical and efficient solution. He was confident that, in a short time, the solution to the problem of fortification would be found through a technologically and economically viable product which would

both be acceptable in taste and contain a significant increase in nutritional value.

The last speaker of the meeting was Dr. Manoel Ferreira, who thanked all participants for their collaboration and urged them to proceed with the search for an adequate solution for each geographical area.

After, in turn, extending his thanks to all, the chairman closed the meeting.

Thursday, March 16:

A churrasco was offered the participants, at the Federal Rural University of Rio de Janeiro, in the backyard of the residence of the Rector, Prof. Fausto Aita Gai. The guests were welcomed by Dr. Layette Estellita Maranhão, Director of the Institute of Technology of the University. The group visited the factory of farinha de mandioca of the mentioned Institute, as well as the experimental plots of new mandioca varieties at the IPEACS. Drs. Luiz Edmundo Rangel de Souza Britto, Dinah Menezes, Altanir Gava, Romeu Vianni and others volunteered as guides.

The excursion finished with a visit to the Indústrias "GRANFINO" at Nova Iguaçu, State of Rio de Janeiro, where the participants were cordially received by Mr. José Coelho. The foreign delegates showed themselves most impressed with the advance of the Brazilian technology.

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