PROCESSING AND UTILIZATION OF THE WINGED BEAN IN THE FORMULATION OF WEANING FOODS

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Abstract

The winged bean had been successfully processed into winged bean flour, grits, seed coat powder and winged bean oil in our laboratories. The flour with protein content of 58.6 - 60.0gm per 100g was successfully utilized in combination with another flour produced from a locally available oilseed (Cucumeropsis edulis) as a methionine supplier in the formulation of weaning foods. The weaning foods formulated were biologically tested and the observation had been made that the formulated diets were capable of producing growth in rats just as good as a control diet with 16% protein content based on milk powder. The potential of the winged bean as a basis for weaning foods for tropical countries with low milk production is discussed.

Introduction

The incidence of Kwashiorkor was first described by Cecily Williams from the Gold Coast (Ghana) in 1933. Since then many attempts have been made by the government to combat or control the the problem. Unfortunately, the problem is still with us. From a study done at the Kotobabi Polyclinic, from our Laboratories, information collected on socio-economic background of families of children with kwashiorkor, revealed that although nutritional education of the public has been going on for some time now at various nutrition rehabilitation centres and clinics in the country, mothers of malnourished children are unable to afford the high protein foods recommended to them. They could also not find time to prepare special dishes for their children in addition to cooking meals for other members of the family. Most of the women are traders and therefore move about a lot. As a result the incidence of recurrent malnutrition in the same child is increasing.

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The problem, therefore, is not so much the lack of knowledge on the part of mothers, of proper child feeding practices, but the lack of cheap high protein foods in the country which can be easily purchased at a sufficiently low price and used as a convenient weaning food for the child (Kordylas 1974). The winged bean programme, is therefore, an attempt to make available to the Ghanaian public (with special emphasis on the low income group), a well balanced cheap weaning food, and/or a high protein vegetable flour that can be incorporated into a weaning formular or used as a protein supplement to local food products.

Reasons for Choosing the Winged Bean

The Winged Bean has been chosen, not only on account of the high protein content of the seeds (30 - 37% wet basis, 58 - 60% defatted) but also for the fact that the seeds, like the soyabeans, contain 15 - 20% oil. Of the fatty acids in the oil, 71% are unsaturated, which makes the oil commercially valuable when extracted. In addition to this, the plant produces tuberous roots which are also rich in protein (12 - 15% wet basis; over 20% dried wet basis, higher than the protein content of any tuber known). Such a high-protein edible root could easily be incorporated into the Ghanaian diet. Like all other parts of the plant, the foliage has a high protein content (5 - 15%), this can also be easily incorporated into animal feed (National Academy of Sciences 1975).

Unlike other locally produced oilseeds, the winged bean is not well known and therefore, not yet commercially exploited. Because of its tough seed coat, direct utilization of the dried seeds as human food is problematic, since it can only be cooked with great difficulty (Kordylas 1976). Processing of the dried matured seeds into winged bean flour for the production of weaning foods and protein supplement would, therefore, be

without much competition, and thus regular supply of seeds for processing could be assured if and when the production of the seeds is started.

Background Work Done on the Winged Bean

Although the winged bean is a relatively new crop to Ghana, a lot of work has been done by various workers in Ghana on it. The agricultural aspects of the bean have been adequately dealt with by Karikari (1969). Pospisil et al (1971) and Karikari (1972). The nutritional properties of the seeds were studied at our laboratories at Korle Bu, and the values were found to compare favourably with those of the soyabean (Cerny et al (1971). Later, Cerny and Addy (1973) used the winged bean as a milk substitute in the treatment of kwashiorkor at the PML Hospital in Accra.

A winged bean programme group has been formed in Ghana since 1974. This group is composed of a team from the University of Ghana's Agricultural Research Station at Kade, another team from the Crops Research Institute's Station at Bunso and a team from the Food Research Institute. The group has been doing collaborative work on various aspects of the Winged Bean. The team from the University of Ghana led by Mr. Karikari, has been working on the ecological requirements, cultural practices and agronomy of the bean. The experimental station of the Crops Research Institute at Bunso has been conducting work on seed multiplication and field trials and the team at the Food Research Institute, led by Mrs. J.M. Kordylas, has been working on processing, formulation of weaning foods, production of protein concentrate, nutritional evaluation and trial feeding of the winged bean products.

Laboratory Processing of the Seed

Processing of the winged bean into winged bean flour, grits, oil and coat flour is accomplished at the laboratory by first destroying the trypsin inhibitor by application of moist heat (direct steam in an autoclave) for 10 minutes at 130°C after soaking the beans overnight. The cooked beans are then skinned, dried, flaked and the oil removed by solvent extraction. The defatted flakes are dried in a forced air over at 60°C to drive out any residual solvent before grinding into flour and sifted through 11xx and 10xx mesh sieves to obtain the flour and the grits. The seed coat is also dried and ground into powder. The solvent used for defatting is redistilled to recover the solvent and the remaining oil is boiled over water to drive out any residual solvent before washing, drying and collection into bottles as crude oil. Through the laboratory processing the products obtained have the following composition:

		Flour	Grits	Seed Coat
Water	gm	7.7	4.9	46.3
Protein	gm	58.6 - 60.0	42.4	7.0
Fat	gm	1.1	2.2	0.7
Ash	gm	3.6	3.8	1.8

Formulation and Biological Evaluation of the Diets

Nutritional quality of the proteins of the winged bean previously tested in our laboratories showed it to be comparable to that of soybean in its digestibility and composition with methionine as the limiting amino acid just as with soybean (Cerny et al 1971). In order to counteract the methionine limitation, various other local oilseeds were analyzed for their amino acid content and the methionine value of melon seed or agushie (Cumcumeropsis edulis) was found to be almost as good as that of skimmed milk with a value of 2.5g/16gN as compared with 2.7g/16gN for skimmed milk.

Various feed formulations were therefore prepared and tried using winged bean flour (WB), melon seed flour (MS), milk powder (M) and corn meal (C) as the ingredients. These formulations were fed to hooded rats against skimmed milk control diets containing 10 and 16% protein. The milk powder in the weaning formulations was systematically replaced by melon seed flour basing the replacement on the methionine content of the milk powder in the formulations. Some of the results obtained are as follows:

Table 1

Results of the Biological Testing of Weaning Formulations based on the Winged Bean

Formulations	Diet No.	Total Protein(%)	Total Wt. Gained(gm)	PER
WB,MS,M(2%)C	16	18	377.0	2.03
- - M(12%)C	8	16	341.9	2.27 (control)
- - M(6%)C	7	10	332.1	2.98 (control)
WB - - C	15	20	280.8	1.74
WB,MS,M(2%)C	14	10	273.6	2.82
WB - - C	10	14	218.7	1.88
WB - - C	9	12	216.2	2.03
WB,MS,- C	4	18	350.5	
WB,MS,- C	5	16	325.7	
WB,MS,M(2%)C	2	18	342.2	
- - M(12%)C	7	16	384.1	(control)

Discussion

It can be seen from the total weight gained by the experimental animals in the first batch (Table 1) that the winged bean based formulation with melon seed flour containing 2% milk powder with a total of 18% protein gave as good growth as that of the control diet based on milk with 16% protein content. The same formulation with 10% protein content also confirmed the capability of the WB, MS based formulation to support good growth when compared with the milk control diet at the 10% protein level.

Since milk is not produced in appreciable quantities in Ghana, it became clear that commercial production of the identified formulation which contained 2% milk powder may have some constraints. A second set of formulations were, therefore, prepared and tested where the milk component was replaced by melon seed flour and these were tested against milk control diet at 16% protein level. It can be seen from Table 1 that the total weight gained by the experimental

animals on Diet 4 (WB, MS and C) at 18% protein level showed as good a growth as those on Diet 2 (WB, MS, 2% milk and C) also at 18% protein level. The respective total weight gains were 350.5gm, 342.2gm as compared with 384.1mg, the total weight gained by the rats on the milk control diet at 16% protein level. These results had since been confirmed in subsequent trials, and it has been firmly concluded that the winged bean in combination with melon seed flour can be utilized as basis for the formulation of weaning foods for Ghanaian children.

Follow-Up

In order to make it possible for these research results to be translated into meaningful benefits for the country, the Food Research Institute has been producing and storing large quantities of seeds which can be easily utilized as planting material for farmers for large scale production of winged beans for processing. In collaboration with the Central Food Technology Research Institute (CFTRI), Mysore, which is affiliated with the United Nations University system, a joint project has been proposed to the UNU for funding. This project if accepted would enable the staff of CFTRI to design and fabricate an equipment for the dehulling of the winged beans before processing. The equipment would then be shipped to Ghana to be installed at the FRI pilot plant. Complementary equipment to enable full production of winged bean flour, grits, oil and seet coat powder and blending of the identified weaning formulations have also been requested for to enable pilot production and test trial of the weaning formulations at our hospitals and rehabilitation centres.

Preliminary work has also been undertaken to utilize the winged bean grits as protein supplement to fortify gari in order to bring the protein content from 1.2gm% to about 10gm%, the level of the protein content of cereals. The work is still in progress. The seed coat powder has also been tested as component of our stock diet for the experimental animals. It has been observed to improve the seed coat quality of the rats. Work for its inclusion in animal feed formulation has also been planned.

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