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# Effect of Processing on Component Oligosaccharides of Cowpea (Vigna unguicustala)

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## Short Communication

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**ABSTRACT**

This study was carried out to investigate the effect of incorporating germination as a unit operation in cowpea food processing, on the flatulence factors attributed to the oligosaccharides component of cowpea. A substantial proportion of the dry matter of cowpea was lost on germination and processing. Germination produced significant reductions in the oligosaccharides of cowpea during sprouting and processing, which in turn reduces the flatulence factor in the cowpea meal. This being an anti nutritional factor in legume was found to have been totally eliminated . Germination in our findings can easily be incorporated as a unit operation in legume processing to eliminate anti nutritional factors in legumes especially cowpeas. It was also found to aid in reducing trypsin inhibitors in cowpeas by our findings.

## INTRODUCTION

Legumes are a second to cereals as a source of protein in terms of intake for **most** developing countries. Legumes, unlike cereals, have a high content of protein (20-30%). Among these legumes an important species is the cowpea (*Vigna unguiculata*), an ancient crop grown throughout the tropics and subtropics. The choice of cowpea is because it is high in protein relatively in expensive and therefore a very desirable source of protein. Apart from groundnut, which is cultivated primarily for oil and export, cowpea is the most important food legume in many parts of Africa, where the cost of protein can be one-tenth that of milk.

The cowpea is consumed in various ways. It may be cooked with maize and eaten with meat or fish stew. It is often used in the preparation of traditional dishes such as “moinmoin” or “akara”. Moinmoin is traditionally made by soaking beans overnight, followed by removal of the seed coat and washing. The washed beans are milled down into mash, ingredients being invariably added to the slurry, which is finally steamed. Akara is the fried mash. They are both relished dishes in West Africa.

Despite the high protein content of cowpea, their maximum potential and contribution to nutrition has not been fully exploited in many parts of the world because of the presence of anti-nutritional factors, such as trypsin inhibitors and flatulence factors caused by the presence of oligosaccharides in cowpea [1].

Germination is widely claimed as a means of correcting nutrient deficiencies of seeds, especially through alterations in the amino-acid balance of proteins and enhancement of the content of vitamins [2,3,4].

Sprout from soybeans are actually described by Block and Bolling [5], as perfect, because all the life-giving proteins, carbohydrates, oils, vitamins and minerals necessary to support life are stored within seeds. Their work showed that when seeds begins to sprout, their vitamin content accelerates at a remarkable rate. They recorded an increase of about 700 percent of vitamin C after sprouting of soybeans. Useful increases were also recorded for vitamins A, B, and E.

From ancient times grain have been germinated under more or less controlled conditions to provide malt for the preparation of beverages. Sprouting of grains has been advocated from time to time and practiced in animal husbandry as a means of promoting succulent greenstuff for winter feed. Information of quantitative nature is most available with reference to the malting of barley. The maltster makes use of the natural germination process but allows it to proceed only so far as is necessary for the optimal development of enzymic activity and then further growth of the grain is stopped by kilning. Loss in weght occurring as a result of the respiratory and growth activities of the grains is reduced to the barest minimum as a result of the standardized and controlled conditions imposed by the maltster. Information on changes in composition of barley during malting can be used as indications of possibilities in other applications of the germination process to produce alternative foods or animal feeds from cereals and legumes

## PROCESSING OF LEGUME FOODS

There are perhaps three critical elements upon which the successful planning of the industrial processing of any major food commodity must depend. These are:

1. The preparation and supply statistics of foodstuff
2. The nutritive value of the processed foodstuff in relation to similar ones in the national diet
3. The consumption patterns of the main lines of traditional food resources of the country.

Olayide et al., [6] reported a systematic analysis of the supply and demand patterns of the main food resources of Nigeria spanning the period of 1968-1985. In this report, they stressed the importance of cereal grains (ranking highest) in supplying Nigerians with their daily protein and calorie requirements. This is followed by starchy roots and tubers and then grain legumes.

The same study of Olayide et al., [6] also provided a breakdown of the crop usage patterns in terms of animal feed, seed, human food and waste. For cereals and grain legumes, waste was estimated to vary between 5 and 15 percent.

About 25% of available groundnuts were processed into edible oil and cake, and about 2% of sorghum was used in native beer brewing, but the amount industrially processed of the remaining crop lines of cereals especially maize and legumes, was negligible.

One can therefore identify a number of very specific needs to which the processing of legumes in developing country, especially Nigeria, can purposefully be directed:

1. There is the need to improve the utilization of the available supply of these foodstuffs by processing them into forms that will not only make them available all the year round, but also will introduce variety as well as convenience into the menu of consumers.
2. There is need to preserve and, where necessary, to revive traditional food forms through the introduction of new processing techniques, which can make economical and can their social acceptability among the masses.
3. There is, finally, the need to improve the nutritional value of foodstuffs by processing, and thereby increase the contribution of food industry to the improvement of the national health.

It seem possible that the incorporation of germination as a unit operation in the preparation of processed legume food might well fulfill these criteria.

## MATERIALS AND METHODS

The cowpea grains used were obtained from the National Cereals Research Institute, Badegi, from their Ibadan office, Nigeria, designated FARV 34. All samples were cleaned by passing the grains over screens to remove broken grains and debris.

### Soaking of Seeds

Prior to germinating the seeds, the cleaned seeds were soaked in 4-5 times volume of water at room temperature for 18 hours. Soaking prior to incubating the seeds proved to give more uniform germination.

### Germination Process

The seeds were germinated at 25% by the jar method of Chen [4,7]. After the soaked seeds had been washed, they were placed in a quart plastic rectangular bowl. A piece of cheesecloth was used to cover the mouth of the bowl and was secured by a rubber band. The

cheese cloth allowed oxygen to enter the jar for the germinating seeds. The seeds were weighed prior to soaking, and after soaking before the germination operation. Sprouting operation was terminated after 2, 3, and 5 days.

After germination, the seeds were dried overnight, at 50$^0$C in flowing air in a forced air oven, and later weighed.

**Grinding of Seeds and Samples Storage**

The dried seeds were ground in cyclone Decator mill using 1mm screen. The dried ground seeds were placed in small sample bottles, sealed with plastic clip lids and stored in a deep until analysed.

**Cowpea Flour Processing**

The cowpea was cooked using steam pressure (121, 15 psi, for 20 minutes in a pressure cooker after the preliminary cleaning, soaking for 18 hours and manually dehulled, as described by Onayemi and Potter (1976), for the ungerminated batch, while the germinated batches were allowed to germinate for 2, and 5 days. They were also subjected to cooking procedures described for the ungerminated batch.

The cooked cowpea mash was blended using a Waring blender to give a slurry of uniform particle size. While the blending proceeded, the puree was diluted to a solid content of 30 percent to facilitate handling on the drum dryer. The slurry was drum dried, using an atmospheric drum drier (Brooks Motors Ltd., Huddersfield Model B.SS 168, 1936) with 15 cm diameter x 20 cm in length. The drum speed were varied between 2-4 rpm with a clearance of approximately 0.04 cm. The drums were heated internally by steam at a pressure of 45 psi (45 lb/in$^2$). The cowpea mash was applied using a peristaltic pumping machine to prevent accumulation and excessive gelatinization, and also to give a regular throughput Samples of the cowpea flakes were crumbled into smaller bits. The flaked cowpea was later milled into flour using a Waring blender, and later sieved through No. 500 British Standard Sieve ( a 1 mm screen), to give a flour of uniform particle size. The flour was packed into air-tight plastic containers, and kept in a deep freezer at a temperature of -16$^0$C.

**Figure 1A: Flow Diagram Of The Process Designed For The Production Of Cowpea Flour Using A Drum Drier**

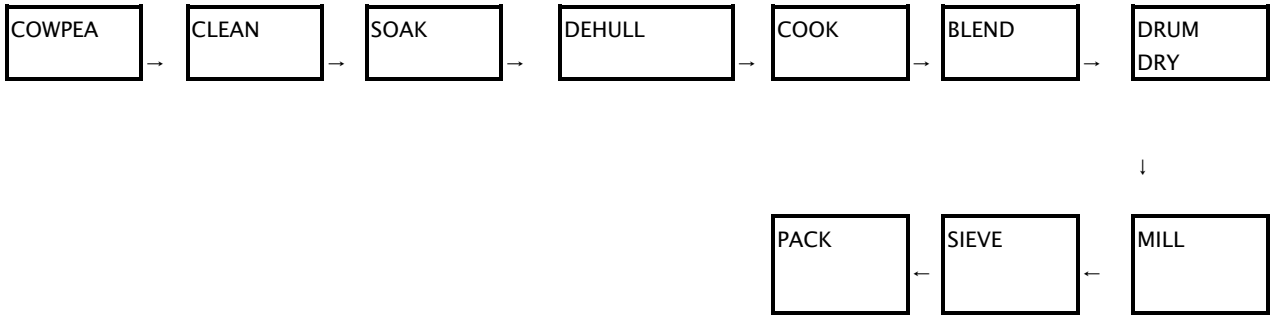


**Figure 2A: Germinated Drum-Dried/Freeze-Dried Cowpea Flour Flow Chart**

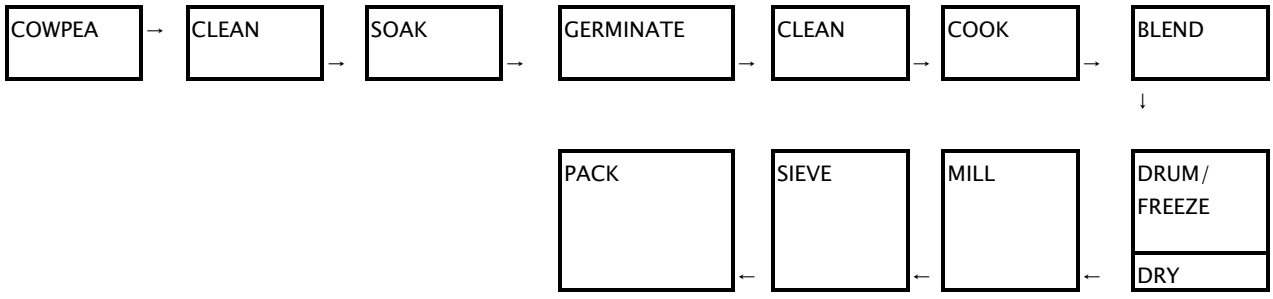

Table 1: Effect of Processing on Component Oligosaccharides of Cowpea

| Processing Operation | (% Dry Matter) Sucrose * | Stachyose * | Raffinose * |
|---|---|---|---|
| Raw cowpea flour | 1.871 | 6.505 | 0.186 |
| Freeze-dried Cowpea flour | +Trace | +Trace | 1.885 |
| Freeze-dried sprouted Cowpea flour | 0.707 | +Trace | +Trace |
| Drum-dried cowpea flour | 2.209 | 2.206 | 0.765 |
| Drum-dried sprouted cowpea flour | 1.661 | +Trace | +Trace |
| Standard Error of Difference (SED) | 0.02 | 0.24 | 0.10 |
| Variance Ratio (F) | 2922.4 | 238.1 | 116.4 |

**Means of two Replicates*
*+Trace < 0.05*

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