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Organoleptic evaluation of the product developed by using flour of an underutilized legume: *Mucuna* beans

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Abstract
Apart from common legume seeds, this research effort revealed the sensory evaluation of the products prepared from the incorporation of the flour of a legume, *Mucuna pruriens*. It is a legume, grown in many parts of South Asia as a green manure cover crop. In the present study, we used two varieties of *Mucuna* beans i.e. white & black. The seeds were found to have high nutritive value but due to the presence of enormous phytochemicals, we have used different processing methods to remove these compounds. The processing methods were used i.e. soaking in $NaHCO_3$, $CaCl_2$ and distilled water followed by cooking, autoclaving and roasting. To check the acceptability of the seeds we have prepared two products i.e. biscuits and idli by incorporation of seed flour at various percentages such as 5%, 7%, 10% and 12% of both varieties. Adoption of such viable processing methods will enhance the utilization of velvet bean seeds as an alternative additional protein source for human beings.

Keywords: *Mucuna pruriens*, organoleptic evaluation, underutilized legume

Introduction
Large segments of the human population and animals in developing countries suffer from protein malnutrition; about 800 million peoples are consuming less than 2000 calories a day and are living under conditions of permanent or intermittent hunger so that they are chronologically undernourished. Most of the hungry are women & young children. Several reports indicate protein deficiency is common, particularly in regions where diets are mainly based on roots & tuber crops.

In view of prevalent food shortages, attention is currently being focused on the exploidating of lesser known non-traditional plant resources. Many of them contain appreciable amounts of protein & nutrients. Development of inexpensive alternative source of protein for humans could clearly reduce malnutrition.

In India, legumes constitute an important food study & are en economic source of protein in the diets of economically weaker sections of population.

One crop identified in this context is *Mucuna*, herbaceous legume, commonly known as 'the cowhage' or 'velvet bean' & 'atmagupta' in India.

It is one of the underutilized legumes. The seed of *Mucuna* beans are not only rich in proteins but also in carbohydrates, fats, minerals and other nutrients. Its seeds are good source of protein (26-30%) having desirable amino acids, fatty acids & starch (34-40%). The seeds of *Mucuna* beans also constitute as a good source of several alkaloids, antioxidants, antitumor & antibacterial compound. The seeds are major source of L-DOPA which serves as a potential drug in providing symptomatic relief from Parkinson's disease.

The *Mucuna* bean is also used in Indigenous Ayurvedic medicine. The beans were also employed as a powerful aphrodisiac in Ayurveda & have been used to treat nervous disorders & arthritic. The bean, is applied as a paste on scorpion stings, is presumed to absorb poison.

Methodology
The methodological aspects of the study have been discussed as under:-

1. Removal of antinutrients with different processing treatments like Soaking in
2. $NaHCO_3$, $CaCl_2$& distilled water followed by cooking, autoclaving & Roasting.
3. Product development by incorporating *Mucuna* bean flour in different proportion
4. Statistical analysis of the data.

Collection of Seed Sample
Both the white & black seeds were collected from the local market of Aligarh, India. After removing immature & damaged seeds the mature seeds were dried in the open sunlight for 2 days & stored in plastic containers for further use.

Processing methods
(A) Soaking followed by cooking
The whole seeds of velvet beans were soaked in distilled water,0.2% $NaHCO_3$ solution, 1% $CaCl_2$ Solution, separately for 4h at room temperature in the bean to water ratio of 1:10 (w/v). after soaking the water was drained & the seeds were rinsed with distilled water and then all presoaked seeds were taken separately in the bean to water ratio of 1: 10 (w/v) in a metal container & cooked at 90 – 95°C on gas stove for 1 hr. after cooking the water was drained and seeds were rinsed with distilled water & dried at 55°C for 6hr in a hot air oven.

(B) Autoclaving
A set of seeds were taken in the bean to water ratio of 1: 10 (w/v) in a metal container & autoclaved at a 15 lab pressure (121°C) for 30 mm. After autoclaving, the water was drained and the seeds were rinse with distilled water & dried at 55°C for 6h in a hot air oven.

(C) Roasting
The raw seeds were roasted for 30 mm at 100-110°C in an iron pot along e clean fine sand to prevent the burning of the seed coat & to ensure the uniform distribution of heat, after roasting, the beans were separated from the sand by using a sieve and al1owed to cool at room temperature.

Preparation of Seeds Flour
All the processed seeds were powdered and all the samples were stored in plastic containers in refrigerator until further use.

Sensory evaluation
Method for the selection of panel members
Selection of panel members involves the screening of 20 post graduate students. All of them were subjected to triangle difference test and 15 students having sharp discriminations, discretion and communication power were selected and then preceded for other evolution.

(a) Triangular Difference test
This test was named so because it involved presentation of three samples of the panel members on triangular from but in practice they are kept in a straight line. In the present study, triangle difference test was conducted using ginger paranthe. Among the three samples two were same and one was different. The panel members were asked to pick out in each triangle set the sample which is different. The sample was present in following order using ginger paranthe -
(a) OOX **(b)** OXO **(c)** XOO

Therefore,
O = Control pr duplicate sample (Simple)
X = Treated or odd sample (ginger parantha).
A well – prepared questionnaire for triangle test was provided to the panel members.
Subject was asked to identify the different one.
Reasons for differentiation were also asked by them.
After some time the questionnaire was collected from each member.
Evaluation was done on the basis of discrimination ability of subject.
By this testing l5semi trained panelist were selected who had better sensory attributes and they identified sugar and salt flavor as the difference factors.

Preparation of Seed Flour
All the processed seeds were powdered and all the samples were stored in plastic containers in refrigerator until further use.

Sensory Evaluation by Using 9 points Hedonic scale:-
Evaluation of sensory characteristics of standard recipes prepared by using *Mucuna* beans flour as an ingredient was done by selecting semi trained panel members after using detailed instruction regarding the method of scoring.

Procedure
The test was conducted in a separate room free from noise & odour between 11-12am, as members feel free during this time. Each sample was introduced separately to each of the panel member. The samples were homogeneous & temperature was standardized to deep constant before conducting test.
The members were to given scores according to their preference in the Performa on the basis of crispness, overall acceptability adopted from (amerine, etal, 1965). Water was provided after tasting each sample to remove any effect of after tastes. After sometime the questionnaire was collected & result were documented & evaluated by converting the responses in quantitative terms.
Hence, recipes were selected & made according to the instructions given in the method one sample served as controlled designated as (S) standard & other test recipes i.e, A, B, C, D were made by incorporating concentrate of 5%, 7%, 10% & 12% respectively.

Results and Discussion
- A varied data was collected with the help of various methods in order to put into some definite form because raw data is jumbled from which one can not draw any conclusion.
- In the present study, we were attempt to assess the acceptability of food products (Biscuits & idli) prepared by incorporating the processed *Mucuna* beans flour in different concentration of 5%, 7%, 10% & 12% respectively.

Key Words

STD	=	Standard
Sample A	=	5%
Sample B	=	7%
Sample C	=	10%
Sample D	=	12%

T_1 = Soaking in $NaHCO_3$ + Cooking (Black *Mucuna* beans)
T_2 = Soaking in $NaHCO_3$ + Cooking (White *Mucuna* beans)
T_3 = Soaking in $CaCl_2$ + Cooking (Black *Mucuna* beans)
T_4 = Soaking in $CaCl_2$ + Cooking (White *Mucuna* beans)
T_5 = Soaking in distilled water + Cooking (White *Mucuna* beans)
T_6 = Soaking in distilled water + Cooking (Black *Mucuna* beans)
T_7 = Autoclaving (White *Mucuna* beans)
T_8= Autoclaving (Black *Mucuna* beans)
T_9 = Roasting (Black *Mucuna* beans)
T_{10} = Roasting (White *Mucuna* beans)

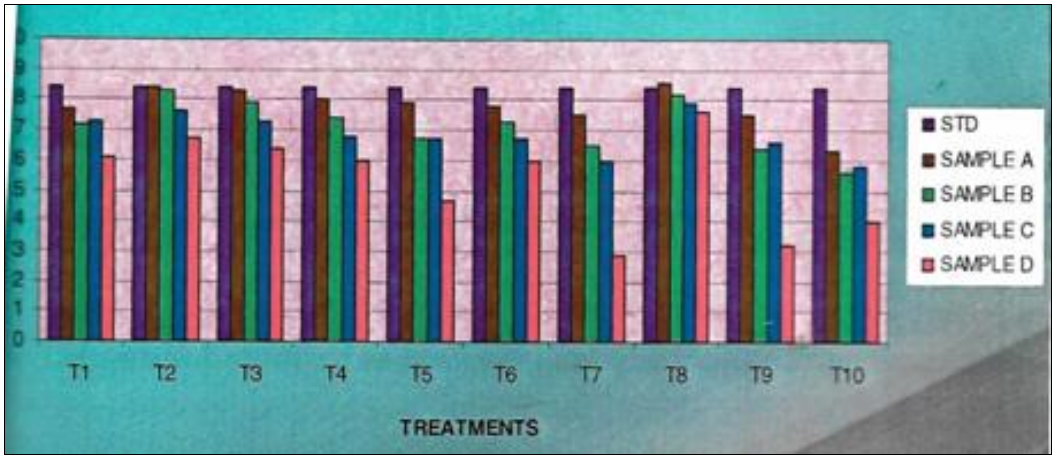

Fig 1: Mean ± SD Values for Biscuits in the Basis of Over All Acceptability

Table 1: Mean ± SD Values for Biscuits in the Basis of Over All Acceptability

Treatments	STD	Sample A	Sample B	Sample C	Sample D
Soaking in NaHCO3 (black)	8.4 ± 0.52	8.0 ± 0.0	8.1 ± 0.73	8.1 ± 0.56	7.0 ± 00
Soaking in NaHCO3 (white)	8.4 ± 0.52	8.0 ± 0.0	7.5 ± 0.52	6.3 ± 0.48	6.0 ± 0.0 *
Soaking in CaCl2 (black)	8.4 ± 0.52	8.3 ± 0.48	7.2 ± 0.40	7.2 ± 0.42	6.2 ± 0.6 *
Soaking in CaCl2(White)	8.4 ± 0.52	8.4 ± 0.48	7.2 ± 0.41	6.7 ± 0.45*	6.4 ± 0.8 *
Soaking in distilled water (White)	8.4 ± 0.52	8.0 ± 0.0	7.9 ± 0.42	62 ± 0.48*	6.0 ± 0.0 *
Soaking in distilled water (Black)	8 4 ± 0 52	8.2 ± 0.60	72 ± 0.41	6.1 ± 0.48*	5.9 ± 0.53*
Autoclaving (White)	8.4 ± 0.52	8.4 ± 0.48	8.4 ± 0.73	7.7 ± .45	6.8 ± 0.4
Autoclaving (Black)	8.4 ± 0.52	8.0 ± 0.0	7.5 ± 0.52	7.0 ± 0.0	6.2 ± 0.6 *
Roasting (Black)	8.4 ± 0.52	8.4 ± 0.48	7.52 ± 0.4	6.3 ± 0.49 *	7.0 ± 0.0
Roasting (White)	8.4 ± 0.52	8.2 ± 0.48	7.2 ± .40	6.2 ± 0.40 -	6.1 ± 0.48 *

Mean scores for acceptability of biscuit based on overall acceptability

Discussion

Table showed that no significant difference was found in the all samples prepared from black *Mucuna* beans soaked in $NaHCO_3$ solution as compared with standard. But significant difference was observed in Sample C and D prepared from white beans soaked in $NaHCO_3$ solution when compared with standard. Sample prepared by all treatments showed no significant difference in sample A and sample B. biscuit prepared from black beans soaked in $CaCl_2$ showed significant difference in Sample D as compared with standard. On the basis of overall acceptability data revealed that as the percentage of incorporation increased from 7% acceptability of products was significantly reduced.

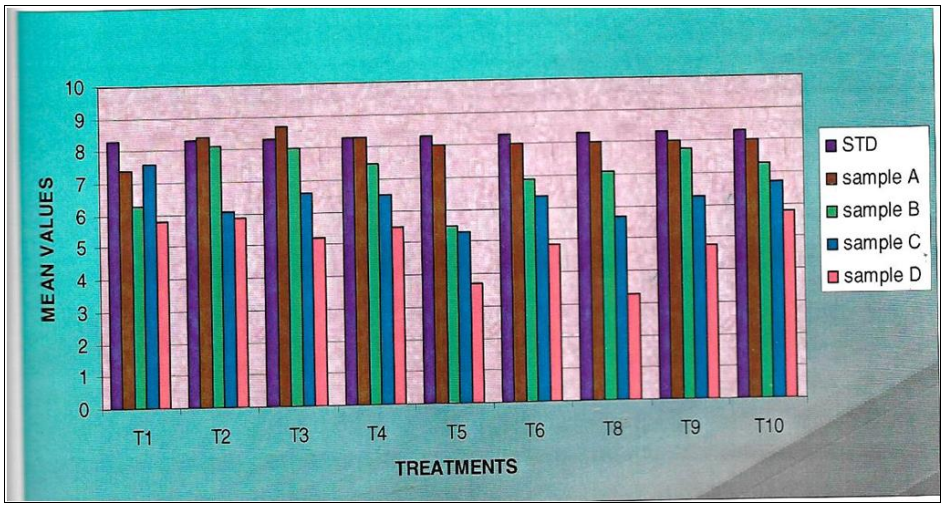

Fig 2: Mean ± SD Scores for Idli on the Basis of Overall Acceptability

Table 2: Mean ± SD Scores for Idli on the Basis of Overall Acceptability

Treatments	Standard	Sample A	Sample B	Sample C	Sample D
Soaking in $NAHCO_3$ (black)	8.4 ± 0.51	7.4 ± 0.80	6.3 ± 0.48 *	7.6 ± 0.51	5.8 ± 0.63 *
Soaking in $NaHCO_3$ (White)	8.4 ± 0.51	8.4 ± 0.50	8.1 ± 033	6.1 ± 0.50 *	5.9 ± 0.87 *
Soaking in $CaCl_2$ (black)	8.4 ± 0.51	8.7 ± 0.45	8.0 ± 0.47	6.6 ± 0.69 *	5.2 ± 0.42 I
Soaking in $CaC1_2$ (White)	8.4 ± 0.51	8.3 ± 0.48	7.5 ± 0.52	6.5 ± 0.52 *	5.5 ± 0.52
Soaking in distilled water (white)	8.4 ± 0.51	8.0 ± 0.00	5.5 ± 0.97 *	5.3 ± 0.67 *	3.7 ± 0.67 *

Soaking in distilled water (black)	8.4 ± 0.51	8.0 ± 0.00	6.9 ± 3.1	6.4 ± 0.51 *	4.9 ± 0.51 *
Autoclaving (White)	8.4 ± 0.51	8.0 ± 0.00	7.1 ± 0.56	5.7 ± 0.48 *	3.3 ± 1.10 *
Autoclaving (Black)	8.4 ± 0.51	8.0 ± 0.00	7.8 ± 0.42	6.3 ± 0.5 *	4.8 ± 0.50 *
Roasting (Black)	8.4 ± 0.51	8.0 ± 0.00	7.3 ± 0.50	6.7 ± 0.6 *	5.8 ± 0.63 0
Roasting (White)	8.4 ± 0.51	7.5 ± 0.60	5.7 ± 0.48 *	3.7 ± 0.67 *	4.0 ± 1.49 0

Mean scores for acceptability of idli based on overall acceptability

Discussion

Data in table revealed that on the basis of overall acceptability idli prepared from black seeds soaked in $NaHCO_3$ was found to be significantly different in sample B and sample D ($p< 0.05$) when compared with standard. On the other hand idli prepared from white seeds was found to be significantly different in sample C and sample D ($p< 0.05$) when compared standard. Seeds soaked in $Cacl_2$ of variety black were found to be non-significant in sample A and sample B. Biscuits prepared from both seeds prepared all processing treatments were found to be acceptable at 5% (sample A) and showed no significant difference with standard whereas at 10% (sample C) and 12% (sample D) showed significant difference with standard.

Summary and Conclusion

In the view of prevalent food shortages, attention is currently being focused on the lesser known and non-traditional plant resources. Many of them contain appreciable amount of protein and nutrients but are restricted largely because of the presence of high concentration of the various phytochemicals this in the present study a cost effective and viable processing methods has been identified for the versatile utilization of velvet bean seeds as a alternative source of protein in the diets of both human beings and the animals.

The present study was aimed to study the sensory evaluation of the products developed by incorporating the flour of processed *Mucuna* beans and the specific findings of the study are as follows:

1. From the various processing treatments selected for the study soaking in $NaHCO_3$ and distilled water followed by cooking were effective in decreasing the phytochemicals from the beans.
2. On the basis of overall acceptability biscuits and idli prepared from processed *Mucuna* beans seed flour were found to be more acceptable at 5% (sample A) and 7% (sample B).

Thus finally to conclude the study among the various processing methods employed in the present study, soaking the seeds in NaHCO3 and distilled water followed by cooking appears to be more effective in reducing the maximum levels of various phytochemicals and also significantly improves the protein digestibility of both white and black seeds of *Mucuna* beans. Adoption of such a viable cost effective processing method could enhance the chances for increased and versatile utilization of this protein rich underutilized legume seed as a food/feed, particularly in the developing countries.

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