Studies on Physicochemical and Functional Characteristics of Asparagus bean Flour and Maize Flour

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Abstract—*The objective of this study was to investigate the physicochemical and functional characteristics of asparagus bean flour and maize flour procured from Kashmir valley of India. The physicochemical and functional characteristics studied were, proximate composition, bulk density, true density, porosity, water absorption index (WAI), water solubility index (WSI), foaming capacity (FC) and foaming stability (FS). All the properties showed that both asparagus bean flour and maize flour had better physicochemical and functional characteristics that would enable to use them for the development of nutritionally adequate food formulations with enhanced health benefits.*

Keywords: *Physicochemical, Proximate, Functional Asparagus bean, Maize, India*

1. INTRODUCTION

Maize (*Zea mays* L.) or corn is universal crop grown in the developed and developing countries. It is third most important cereal crop of the world next to wheat and paddy [1]. In 17th century maize was introduced to India. It provides nutrients, serves as a basic raw material for the production of starch, oil, protein, alcoholic beverages, food sweetener and more recently fuel. In traditional medicine, it is used for relieving diarrhea, dysentery, urinary tract disorders, prostatitis, lithiasis, angina, hypertension, tumor and is pharmacologically exploited for hypoglycemic, anti-inflammatory, antioxidant and diuretic properties. It is found to have β carotene, biotin, choline, pantothenic acid, folic acid, pyridoxine, thiamine, riboflavin, vitamin E, and minor amount of vitamin C [2].

Asparagus bean (*Vigna unguiculata subsp. sesquipedalis*) also known as "laung" in Kashmir is an annual vegetable that belongs to the Leguminous family and sub– family of Papilonaceae. The bean is mostly grown for its immature pods and is a vital food resource which contributes to the nutritional well being of humans. Asparagus bean has been found to have functional properties similar to those of cowpea, soy bean and other popular beans. The mature seeds are consumed in a variety of ways such as whole or dehulled seeds, cooked in boiling water for varying period and consumed after addition of salt and other spices [3]. There are nutritional inadequacies of the maize [1]. Therefore mixing of maize with legumes as a protein source will help to solve the deficiency problem of maize, since both legume and cereal proteins are complementary with regard to their essential amino acids [4]. Additionally, legumes are rich in lysine and deficient in sulphur-containing amino acids (cysteine and methionine); whereas cereal proteins are deficient in lysine, but have adequate amounts of sulphur-containing amino acids. Therefore, legumes can be successfully used to obtain a protein-enriched product with improved amino acid balance [5].

The scope of the present study was to study the physicochemical and functional properties of asparagus bean and maize Flour.

2. MATERIALS AND METHODS.

2.1. Asparagus bean and maize collection

The raw materials viz. asparagus bean (*Vigna unguiculata subsp. sesquipedalis*) local cultivar and maize (*Zea mays* L.) C15 variety, were procured from Kashmir valley of India. Asparagus bean seeds were collected from a local farmer from Gangoo area of district Pulwama, J&K and maize was collected from SKUAST Kashmir. The samples were cleaned from soil particles and debris. Both asparagus bean seeds and maize grains were stone milled and passed through the sieve to obtain fine flour. All the reagents used in the study were of analytical grade.

2.2 Physicochemical and functional analysis

Proximate composition of asparagus bean flour and maize flour were determined according to the method of AOAC [6], bulk density by the method of Wang and Kinsella [7], true density by ASAE [8], porosity by Thompson and Issac [9], WAI and WSI of flours were determined by Anderson et al.

[10] while as foam Capacity and stability were determined by the method described by Okaka and Potter [11].

2.3 Statistical analysis

All the samples were analyzed in triplicates. Mean and standard deviation were obtained by using Microsoft excel 2007. One-way analysis of variance (ANOVA) was used to find the significant differences among the means followed by Duncan's multiple range test (DMRT) ($P < 0.05$).

3. RESULTS AND DISCUSSION

3.1. Physicochemical and functional characteristics

Asparagus bean flour and maize flour were analyzed for physicochemical and functional characteristics as shown in (Table 1). Moisture content of asparagus bean flour and maize flour were 8.53% and 10.23 % respectively. Ash content of asparagus bean flour and maize flour were 4.00% and 2.33% respectively. Asparagus bean flour and maize flour showed fat content of 1.91% and 4.57 % respectively. Protein content of asparagus bean flour was 22.57% and 8.84% in case of maize flour. Fiber content in asparagus bean was 2.31% and in maize flour it was found as 2.15%. Total carbohydrate content of asparagus bean flour and maize flour were 60.69 % and 71.88 % respectively.

The bulk density for asparagus bean flour and maize flour were found to be 0.65 g/ml and 0.75 g/ml respectively. The bulk density of a sample could be used in determining its packaging requirements as this relates to the load the sample can carry if allowed to rest directly on one another [12]. True density of asparagus bean flour and maize flour were 1.43 g/ml and 1.31 g/ml respectively. Porosity of asparagus bean flour and maize flour were 54.77% and 42.93 % respectively. The water absorption index (WAI) of asparagus bean flour and maize flour were found as 1.80 g/g and 2.71g/g respectively. Water absorption of flours greatly influences the type of food made from cereal legume mixed flours; addition of some types of legume flour to cereal flour could help maintain the soft texture of the resulting food product [13]. Water solubility index (WSI) of asparagus bean flour and maize flour were found as 40.15 % and 7.07 % respectively. The difference could be because of difference in the starch, protein and fat components in the flours. Foaming capacity (FC) of asparagus bean flour and maize flour were found as 34.67 % and 13.25 %, while as foaming stability (FS) were 39.00 % and 66.95 % respectively. Foaming capacity (FC) refers to the amount of interfacial area that can be created by the protein while as foam stability (FS) refers to the ability of protein to stabilize against gravitational and mechanical stresses. These are a function of the type of protein, pH, processing methods, viscosity and surface tension. It has been reported that the native proteins provide high foam stability than denatured proteins [14].

Table 1: Physico-chemical and functional characteristics of asparagus bean flour and maize flour assessed by Duncan's multiple range test

Parameter	Asparagus bean flour	Maize flour
Moisture (%)	8.53±0.23b	10.23±0.54a
Ash (%)	4.00± 0.00a	2.33 ±1.33a
Fat (%)	1.91 ±0.27b	4.57 ±0.12a
Protein (%)	22.57± 0.48a	8.84± 0.35b
Fiber (%)	2.31 ±0.27a	2.15± 0.18a
Total carbohydrate (%)	60.69± 0.48b	71.88± 1.50a
Bulk Density (g/ml)	0.65± 0.01b	0.74 ±0.01a
True density (g/ml)	1.43 ±0.00a	1.31± 0.10a
Porosity (%)	54.77± 0.40a	42.93± 3.77b
Water Absorption Index (g/g)	1.80± 0.05b	2.71± 0.02a
Water Solubility Index (%)	40.15± 1.32a	7.07± 0.23b
Foaming Capacity (%)	34.67± 2.08a	13.25± 1.09b
Foaming Stability (%)	39.00 ±1.00b	66.95± 1.68a

Results are expressed as mean values ± standard deviations. Means in a row with same superscripts are not significantly different ($P<0.05$)

4. CONCLUSION

The results obtained on the basis of physicochemical and functional characteristics of asparagus bean flour and maize flour suggest that both the flours could be further exploited for the development of healthy and nutritious food product formulations.

5. ACKNOWLEDGMENT

This work was financially assisted by Ministry of Science & Technology, Department of Science & Technology, Technology Bhavan, New Delhi.

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