



## Research Article

### EFFECT OF TRADITIONAL PROCESSING METHODS OF AYURVEDA ON PROXIMATE COMPOSITION OF YAVA (*HORDEUM VULGARE*) FLOURS

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#### ABSTRACT

This paper aimed to demonstrate the proximate composition of Yava (Barley) when subjected to traditional processing methods explained in Ayurveda (i.e. Roasting, Boiling, germination, Bhavana with triphala) and change in properties in terms of Nutritive Value. Raw ingredients were obtained, cleaned and divided into five batches. The first batch of material was raw barley flour and considered as control. The second Third, Fourth and fifth batch samples were Roasted, Germinated, Boiled and Triphala Barley respectively. Proximate composition such as moisture, ash, protein, fat, fiber, carbohydrate and energy, Vitamins and Minerals were determined using the standard procedures. Increase in Ash, Fibre, Fat and Mineral content was seen in *Triphala barley* and Protein, Vitamin and Mineral content in Sprouted barley. There was decrease in the Moisture, Protein, Fat and Fibre content of fried barley and decrease in the Fat, Fibre and Carbohydrate content of Boiled Barley. Traditional processing methods explained in Ayurveda greatly influenced the nutritional composition of Barley flours. This study concluded that the Barley have great nutritional values that could be harnessed by roasting, germination, Boiling and Mixing with herbal drugs to meet nutritional needs and may be used in formulation of various foods.

**Key Words:** Processing, Yava (Barley), Nutritional composition

#### INTRODUCTION

Food processing is termed as Samskara in Ayurveda. According to Acharya Charaka the word 'Samskara' refers to the processing which causes transformation in a substance during which there takes place the contribution of Gunas (Properties) and elimination of Doshas (Impurities). The Samskara (Processing) causes transformation in Swabhavika Gunas (natural attributes). Samskara refers to the process of

transformation in the natural qualities of a food substance by the treatment through water, application of heat and other factors like washing/cleaning, churning, place of storage, time factor, flavouring, Levigation and the utensils used<sup>1</sup>.

*Hordeum vulgare* (Barley) is also called *Yava* in Ayurveda. It is main food grain well known to the present era since *Vedic kala*. It is considered as the most ancient cereal in Atharvaveda. Yava (Barley) has been subjected to different processing methods and

used in the form of diet or mixed with other herbal drugs viz, Yava churna (Raw yava powder), Brusta yava churna<sup>2</sup> (Fried Yava powder), Ankurita yava churna<sup>3</sup> (Germinated yava powder), Swinna yava<sup>4</sup> (boiled yava) and Tripala bhavita yava<sup>5</sup> where the properties are changing.

Food preparation methods applied to cereals improves their texture, palatability and nutritive value by gelatinization of starch, denaturation of proteins, increased nutrient availability, inactivation of heat labile toxic compounds and other enzyme inhibitors<sup>6</sup>

Based on above facts the comprehensive Analytical study was done to know the change in the properties of Yava in terms of Nutritive Value after subjecting to different Samskara (Processing Methods) and to compare the Nutritive values of Raw Yava with Processed Yava.

## MATERIALS AND METHODS

### Source of drug

*Hordeum vulgare* (Yava) was procured from the field at Sangli (Maharashtra) and identified with the help of department of Dravya guna, Govt Ayurveda Medical College, Mysore, Karnataka, India

### Preparation of samples

In present study five forms of yava (Barley) were prepared for the nutritive value analysis as shown in Figure 1.

1. **Yava churna** (Raw Barley Flour) RBF: Yava (Barley) was de husked and put in grinder and made in to fine powder.
2. **Ankurita yava churna** (Germinated Barley Flour) GBF: Yava was soaked in water for 12hrs and taken out and tied in a cloth and kept for 24hrs. After germination dried and made in to fine powder
3. **Brusta yava churna** (Fried Barley Flour) FBF: Yava was fried and dehusked and made in to fine powder
4. **Swinna yava** (boiled yava Flour) BYF: Dehusked yava was boiled for 45min, Dried and powdered.
5. **Triphala bhavita yava** (TBF): At first triphala churna was prepared, to these 16 parts of water is added and reduced to 1/8<sup>th</sup> part. Once the kashaya was ready it was filtered and after that barley Flour was immersed in it and kept overnight. Next day it was filtered and dried in sunlight and after that made in to fine powder.

### Determination of Proximate Composition of Raw and Processed Barley Flours

The samples of the five forms of Barley were separately analysed for proximate composition using the official standard methods. Moisture content of the Barley was determined by Association of Official Analytical Chemists method<sup>6</sup>. The gross energy values were estimated by multiplying the crude protein, fat and carbohydrate by their at water values of 4, 9 and 4 kcal/g respectively. Protein content was estimated from the crude nitrogen content of the sample determined by the MicroKjeldhal method ( $N \times 6.25$ ) [19]. Fat content of the samples was estimated by Soxhlet method given by <sup>6</sup>. Carbohydrate was calculated by difference method. Crude fiber and ash content of the samples was determined by the procedure given by Association of Official Analytical Chemists<sup>6</sup>. Vitamins were estimated out by HPLC Method and Mineral analysis was done by using ICP-AES (Inductively coupled plasma atomic emission spectroscopy) method.

## RESULTS

Food processing may affect the functionality and nutritional quality of the food products. Effect of processing methods on nutritional composition of Barley flour is given in Table 1.

The total Ash content of RBF (RBF Barley Flour) was 1.44%.After processing Ash content of TBF (Triphala Barley Flour) BBF (Boiled Barley Flour), FBF (Fried Barley Flour) Increased to 2.34%, 2.11% and 1.86%respectively.Ash Content of GBF (Germinated Barley Flour) decreased to 1.07% compared to Raw Barley.

The Moisture content of RBF was 5.12%.After processing Moisture content of BBF, GBF and TBF Increased to 11.57%, 7.33% and 6.71% respectively. Moisture Content of FBF decreased to 4.20% compared to Raw Barley.

The Crude Fibre content of RBF was 4.76%.After processing Fibre content of BBF, GBF and FBF decreased to 3.15%, 3.85% and3.16% respectively. Not much loss is seen in Fibre Content of TBF decreased to 4.06% compared to Fibre content of Raw Barley.

The Crude Fat content of RBF was 1.15%.After processing Fat content of BBF, GBF and FBF decreased to 0.87%, 1.10% and 1.05% respectively. Fat Content of TBF Increased to 2.07% compared to fat content of Raw Barley.

The Crude Protein content of RBF was 2.60%.After processing Protein content of GBF increased to 3.27% and BBF, and FBF

decreased to 2.28% respectively. Protein Content of TBF decreased to 1.93% compared to Protein content of Raw Barley.

The Carbohydrate content and Calorific Value of RBF was 84.98% and 360.46 Kcal. After processing Carbohydrate content of GBF, BBF, and TBF decreased to 83.38%, 79.85% and 82.90% respectively and Calorific value decreased to 356.50 Kcal, 348.57 Kcal and 357.87 Kcal. Carbohydrate Content of FBF increased to 87.4% and 368.37 Kcal compared to Carbohydrate content of Raw Barley.

The Vitamin C, B1, B2, B6 and B7 content of PBF was 3.78, 7.32, 21.96, 55.87 and 89.69 Mg/100g. After processing Vit C, B1, B2, and B9 content of GBF increased to 12.04, 15.84, 57.79 and 197.25Mg/100gm respectively except Vit B6 which

decreased to 46.31 mg/100gm. There is decrease in all the vitamins after boiling, frying and Bhavana with triphala except Vit B9 which increased in Fried and Triphala Barley compared to raw barley Flour as shown in Table 2.

Calcium, Iron, Zinc, Sodium, Phosparus, Magnesium and copper content of RBF was 32.32, 2.7, 2.1, 4.1, 296, 180 and 0.4 Mg/kg. After processing, Calcium, Iron, Zinc, Sodium, Phosparus, Magnesium content of GBF increased to 37.13, 4.7, 4.1, 11.3, 311 and 221 Mg/kg respectively. There is decrease in all the Minerals after boiling and frying and increase in mineral content after Bhavana with triphala as shown in Table 3.



Yava (Barley)



Germinated yava



Brusta yava (Fried Barley)



Swinna yava (Boiled Barley)



Triphala bhavita yava

Figure 1: Raw and Processed Barley Samples

**Table 1: Proximate Composition of Raw and Processed Barley samples**

Properties	Control (RBF)	FBF (Fried Barley)	GBF (Germinated)	BBF (Boiled)	TBF (Triphala Barley)
Ash (%)	1.44±0.13	1.86±0.049	1.07±0.02	2.11±0.007	2.34±0.28
Moisture (%)	5.12±0.21	4.20±0.072	7.33±0.064	11.57±0.054	6.71±0.043
Protein (%)	2.60±0.24	2.28±0.247	3.27±0.289	2.28±0.247	1.93±0.247
Fat (%)	1.15±0.07	1.05±0.51	1.10±0.254	0.87±0.742	2.07±0.342
Fibre (%)	4.76±0.95	3.16±0.162	3.85±0.48	3.15±0.063	4.06±0.077
Carbohydrate (%)	84.94	87.45	83.38	77.56	83.38
Calorific Value (Kcal)	360.46	368.37	356.50	348.57	357.87

**Table 2: Vitamin Content of Raw and Processed barley Samples**

Sample Name	Vitamin C Mg/100g	Vitamin B1	Vitamin B2	Vitamin B6	Vitamin B9
Raw Barley	3.78	7.32	21.96	55.87	89.69
Sprouted Barley	12.04	15.84	57.79	46.31	197.25
Fried Barley	3.14	12.41	42.34	15.5	163.6
Boiled Barley	0.34	1.39	3.22	0	45.22
Triphala Barley	3.21	4.76	0	10.89	140.87

**Table 3: Mineral Content of Raw and Processed barley Samples**

Sample Name Mg/100gm	Ca	Fe	Zn	Na	Ph	Mg	Cu
Raw Barley	32.32	2.7	2.1	4.1	296	180	0.4
Sprouted Barley	37.13	4.7	4.1	11.3	311	221	0.3
Fried Barley	30.1	2.17	2.66	1.4	238	240	0.29
Boiled Barley	11	1.3	1.32	2.3	54.2	145	0.1
Triphala Barley	35.26	2.2	2.7	4.2	302	212	0.42

## DISCUSSION

Based on the Results obtained after the nutritional analysis of different forms of *Yava* (Barley), Raw Barley Flour (RBF) was taken as a control as such no processing was done on raw barley. Nutritive values of processed Barley Samples were compared with Raw Barley. Changes in the Nutritional Values were discussed with Reasons.

### Comparing Nutritive Values of FBF with RBF

The sample roasted for 45 min had the least moisture content of 4.20% which could be as a result of the high temperature and time it was subjected to and it differed from the moisture content of the raw flour. The lowering of fat content could be attributed

to losses during drying and roasting. The significant decrease in protein content could be denaturation of the endogenous proteins in the seed during processing.

Most of the Vitamins are retained when there is less contact with water and less cooking time. This may be the reason for retaining of vitamins in Fried barley and loss of some vitamins like Vit C and B6 May be due to amount of heat applied during processing. Not much loss of Minerals was seen in Fried Barley as heat does not cause loss of Minerals.

### Comparing Nutritive Value of GBF with RBF

**Moisture:** The sprouting treatments increased the moisture content of barley from 5.12 to 7.33%. This increase could be attributed to the hydration of the seeds during soaking, before

the germination. As germination proceeds, cereals took up water from the surroundings in order for the metabolic process to commence. Dry cereals absorb water rapidly, influenced by the structure of the legume. The increase in water uptake with time is due to the increasing number of cells within the seed becoming hydrated.

**Protein:** The increase in protein content could be attributed to the utilization of fats and carbohydrates as energy sources for developing sprouts.

**Fat:** The decrease of crude fat might be due to the increase activity of lipases during soaking and germination.

**Carbohydrates:** The soaking, germination given to barley grains decreased the total carbohydrate contents 84.94 % to 83.38 % in germinated flour of barley due to the active respiration process during soaking and germination

**Ash:** The decrease in ash content from 1.44 to 1.07 % represents loss in minerals due to rootlet and washing of the barley in water to reduce the sour smell during the period of germination.

The Increase in all the Vitamins in Germinated Barley may be due to the metabolic effects of the sprouting process. Sprouting grains causes increased activity of hydrolytic enzymes.

Germination of barley increased all the Minerals this may be due to the several enzyme systems become active and bring about change in Nutritive Value. Germination improves the nutritional quality and digestibility of cereals. Phytic acid and Phytate are degraded, making minerals such as zinc, calcium, phosphorus and magnesium (which are bound to Phytate) available for absorption into the body.

#### **Comparing Nutritive Value of BBF with RBF**

Boiling increased the moisture content from 5.12 to 11.57% due to the absorption of water by the seeds during cooking. After cooking treatments, the crude protein content all had decreased, as well as the crude fat content in boiling samples. These phenomena were related to the protein denaturation and fat oxidation at high temperature both protein and its decomposition products and soluble sugar participated in Millard reaction, and then resulted in their content decline.

The heat treatment and leaching are the factors affecting vitamin

C destruction during processing. The rate of destruction of vitamin C was increased by the action of enzymes. Considerable vitamin C was lost by cooking. Thiamin was readily lost from barley during the processing of milling. Being a water soluble vitamin, B1, B2, B6 and Folic acid could be affected during washing and cooking.

Cooking in water would result in some losses of minerals since many minerals have significant solubility in water. There was loss of all the minerals in the Boiled Barley this may be due to cooking in large amount of water.

#### **Comparing Nutritive Value of TBF with RBF**

The Moisture content of Triphala barley was slightly increased compared to raw barley. The Nutritive values are same as that of Boiled barley except moisture and carbohydrate content. Increase in Ash content may be due to the mineral content of triphala after processing.

Vitamin C content reduced to 0.34% in boiled barley. In Triphala barley there was only slight decrease in Vitamin C 3.21% this can be due to the less temperature applied during *Bhavana Samskara* and due to the presence of amalaki in Triphala which is rich in Vitamin C. Other B vitamins are lost due to the heat applied during processing except folic acid which was increased after processing this may be due to presence of folic acid in Triphala.

There was increase in all the Mineral content of *Triphala* barley compared to Raw Barley. This may be due to Mineral content in the Triphala and retaining the Minerals after processing Barley with *Triphala* and also due to less amount of water content during process.

#### **CONCLUSION**

Traditional processing methods explained in Ayurveda greatly influenced the nutritional composition of Barley flours. By processing there takes place the contribution of Gunas (Properties) which is attributed to increase in Ash, Fibre and Fat content in *Triphala barley*. Protein and Vitamin content in Sprouted barley. By processing there will be elimination of Doshas (Impurities). Potency of unwanted existing *guna* (i.e. *dosa*) will be decreased by *Samskara* i.e. in terms of Nutritive value can be attributed to the reduction of the Antinutrients and making minerals such as zinc, calcium, phosphorus and magnesium (which are bound to Phytate) available after Germination for absorption into the body.

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