Effect of Microwave Drying on Nutritional and Antinutritional Factors of Dolichos Lablab Beans

Ashok Kumar, Aditya Lal, A D Semwal

Abstract

Effect of microwave drying on dolichos lablab seeds (green coloured seed) at various doses (600 and 750 watts) on the proximate composition, vitamins (thiamine, riboflavin) and antinutritional factors were investigated. Significant changes were observed in the chemical characteristics of microwave treated seeds. Microwave drying resulted in a significant increase of protein at all doses, while the crude lipid and ash content showed a dose dependent decrease. Raw seeds were rich in vitamins (thiamine, riboflavin); when the seeds were dried, significant decreases were reported. Microwave drying processing significantly reduces the levels of phytic acid, tannins, trypsin inhibitor activity, and total phenols content.

Keywords: Dolichos lablab, microwave drying, antinutritional factors, vitamins, proximate composition

Introduction

The ubiquity of legume crops as an integral part of both primitive and advanced agricultural systems. Lablab purpureus (lablab beans) is an under-utilized legume that has potential as human food. *L. purpureus* is reported to have certain medicinal properties. Within India, Field bean is mostly confined to the peninsular region and cultivated to a larger extent in Karnataka, Tamil Nadu, Andhra Pradesh and Maharashtra. Field bean is a marginally known legume having the potential of reducing protein deficiency in developing poorer nations. In spite of their good nutritional qualities, legume consumption is declining worldwide.

Hyacinth seed contains an average of 17% protein with *in vitro* protein digestibility of 80% (Murphy and Colucci, 1999) (20). These nutritional characteristics coupled with the other environmental benefits make hyacinth bean a suitable food and fodder crop for the tropics.

Processing normally affects factors, such as trypsin inhibitors and phytic acid contents, which in turn can enhance or reduce the bioavailability of proteins and minerals. Some antinutritional factors may exert beneficial health effects at low concentrations. Thus, the manipulation of processing conditions and removal or reduction of certain unwanted components of food may be required.

Untreated Field bean has been reported to possess high levels of anti-nutritional factors; such as trypsin inhibitors, tannins and phytic acid. High trypsin inhibitor activity in Field bean prevents protein metabolism while phytate phosphorous compromises mineral absorption. In order to utilize the bean effectively as human food, it is essential to inactivate or remove these anti-nutritional may lead to wider use of this legume in the food industry factors. A better understanding of the effect of different traditional processing methods on the nutritive value and anti-nutritional factors, may lead to wider use of this legume in the food industry.

The information on microwave drying effects on the antinutritional factors in lablab beans is scarce. With this prospect, an attempt has been made to find out the effects of microwave drying on certain antinutritional factors (trypsin inhibitor, phytic acid, and tannins) in lablab beans.

Materials and Methods

The raw seeds are procured from the local market. The beans were dried with microwave dryer under two power levels i.e. 600 and 750 watts. The dried beans are powdered and kept in sealed polypropylene packets for analysis.

The proximate composition (moisture, protein, fat and ash) of beans are analyzed by AOAC(1990) (5) methods.
Phytic acid was determined according to the method described by Haug, Hj Lantzsch (1983) (27). 1gm of sample weighed and extract with 25ml of 0.2N HCl for 1hour with mechanical shaker. After shaking filter and 0.5ml of filtrate was taken, making the final volume with distilled water to 1ml. Add 1ml ammonium iron III solution and boiled in water bath for 30 min, cooled in ice bath and allowed to come room temperature. After cooling centrifuged at 3000rpm for 30min, and take 1ml centrifuge in a test tube add 1.5ml 2-2’ Bipyridal solution. Take O.D. at 519 immediately against distilled water.

**Analysis of tannins** Tannins contents of the seed flours were determined by the procedure of AOAC (1990) (5). Two hundred milligrams of the sample was extracted with 10 mL of 70% aqueous acetone (v/v) for 24 h at room temperature. The extracts were centrifuged at 3000 × g for 20 min and the supernatant was analyzed tannins. In a test tube 0.5 mL of the tannins extract and 1 mL of saturated sodium carbonate solution were added to 0.5 mL Folin- Denis reagent. The volume was made up to 10 mL with distilled water. After 30 min the tannins content was measured at 760 nm with the spectrophotometer against experimental blank adjusted to zero absorbance. Tannic acid was used as a standard compound.

**Analysis of trypsin inhibitor** Trypsin inhibitor activities were determined using the procedure of Kakade et al. (1974) (16). One gram of defatted seed flour was mixed with 100 mL of 0.009 M HCl. The mixture was shaken at ambient temperature for 2 h and centrifuged (10000 × g, 20 min) and the supernatant was used for inhibitor estimation. The extract from each sample was diluted with distilled water to obtain a dilution whereby 1 mL extract produced trypsin inhibition activity of between 40-60%, such dilution was used. The extract (1 mL) was incubated with 1 mL of trypsin solution at 37°C for 10 min. A 2.5 mL of prewarmed substrate (BAPNA) was added and after exactly 10 min at 37°C the reaction was stopped with 0.5 mL of acetic acid (30%, v/v). The absorbance was measured at 410 nm against a blank using the spectrophotometer.

The mineral content in samples were determined by using atomic absorption spectrophotometer as per the method of Semwal et al 2001. 5g of food samples were taken in a silica crucible and ignited carefully over the flame to completely char the organic matter. After charring, the crucibles were placed in a muffle furcace and heated for 8-10 hr at 550°C to oxidise the organic matter completely. The obtained ash was dissolved 4 mol/L HCl and volume was made to 100 ml with deionised water. The HCl used for sample preparation was taken as a reagent blank.

**Results and Discussion**

Lablab beans microwaved at 600 and 750 watts were analysed for moisture, protein, ash contents and the results were compared with the raw lablab beans proximate composition.

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Composition</th>
</tr>
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<tbody>
<tr>
<td>Moisture</td>
<td>63%</td>
</tr>
<tr>
<td>Protein</td>
<td>3.29%</td>
</tr>
<tr>
<td>Fat</td>
<td>1.99%</td>
</tr>
<tr>
<td>Ash</td>
<td>4.56%</td>
</tr>
</tbody>
</table>

The proximate composition, nutritional and antinutritional factors of lablab beans. The moisture, protein, fat and ash contents of raw lablab beans were found to be 63.0%; 3.29%; 1.99%; and 4.56%; respectively.

Lablab beans microwaved at 600 and 750 watts were analysed for moisture, protein, ash contents and the results were compared with the raw lablab beans proximate composition. It was clear from the table 2, that there was a significant change in moisture content when lablab beans from microwaved at 600 and 750 W. Raw beans...
lablab beans had moisture 63.0%, whereas after drying at different watt powers the moisture content reduced to 7.5 and 6.3% respectively.

There was a significant increase in protein contents in lablab beans dried at 600 watts and 750 watts compared to raw lablab beans. The protein content of raw lablab beans was found to be 3.29%, while after microwaving at 600 and 750 watts the protein content increased to 22.6 % and 23.2% respectively. The increase in protein content may be attributed to the fact that during microwaving some form of chemical transformation of starch fraction into water soluble components might have taken place and also the increase may be due to more efficient extraction.

There were no significant changes in fat, ash contents of lablab beans before processing and after processing was observed.

**Effect of Microwave Drying on Phytic Acid, Tannins, Trypsin Inhibitor and Total Phenols**

The effect of microwave microwave treatment on the antinutritional factors viz phytic acid, tannins and trypsin inhibitor etc. is shown in table 3. It is clear from the table that there was a significant decrease in phytic acid content with the increase in microwave power. Raw lab lab beans contained 800 mg/100g of phytic acid. After microwaving at 600 and 750 W, phytic acid reduced to 535 and 456 mg/ 100g respectively. Earlier also, Habiba, 2002 (14); Fagbemi et al., 2005 (11); Wang et al., 2008 (26) also reported a decrease in phytic acid contents in plant food stuffs when they were subjected to various thermal treatments like autoclave, microwave etc. They attributed the decrease in phytate content due to the formation of insoluble complexes between phytate and other components.

The microwave treatment significantly reduced the tannin content in lablab beans. It is clear from the table that raw lablab beans contained 391 mg/ 100 g of tannins. After microwave treatment at 600 and 750 W, the tannins contents significantly reduced to 376 and 303 mg /100 g respectively. The reductions in tannins contents in lablab beans agree with the earlier reports that thermal treatments significantly reduced the tannin contents in plant food stuffs. The reduction in tannin contents may be due to the fact that during heat treatments there will be a loss of compounds and also may be due to the degradation or interaction with other components of seeds, such as proteins, to form insoluble complexes.

The effect of microwave treatment on the trypsin inhibitor in lablab beans before and after processing is shown in table 3. The presence of protease inhibitors in the diet leads to the formation of the irreversible trypsin enzyme – trypsin inhibitor complex causing a trypsin drop in the intestine and a decrease in the diet digestibility leading to slower growth. Under this situation, the organism increases the secretory activity of the pancreas which could cause pancreatic hypertrophy and hyperplasia (Liener, 1994) (18). From the table 3, it is clear that there was a significant loss of trypsin inhibitor when lablab beans were microwaved at 600 and 750 watts.

The raw lab lab beans contained 48.29 TIU / mg. After microwave processing the trypsin inhibitor was found to reduced to 20.27 and 14.20 TIU /mg respectively. Similar results of similar results of partial inactivation of trypsin inhibitor activity were reported by other workers in roasted legumes (Fagbemi et al., 2005; Osman, 2007). Also, partial and complete inactivation of trypsin inhibitor activity was reported by others in cooked, autoclaved and microwave cooked legumes (Sidduraju and Becker, 2001(23); Habiba,2002 (14);Wang et al., 2008 (26); Martín-Cabrejas et al., 2009 (19); Embaby, 2010 (10). Reactions involving deamidation splitting of covalent bonds, such as hydrolysis of peptide bonds at asparticacid residues, and interchange or destruction of disulfide bonds, might be involved in the thermal inactivation (Alonso et al., 1998) (2).

Microwave treatment of lablab beans reduces the total phenolic contents at a significant level. Raw lablab beans contained 0.25% of total phenols which when microwaved at 600 and 750 W reduced significantly to 0.15 and 0.10% respectively.

**Table 3: Effect of Microwave Treatment on the Retention of Phytic Acid, Tannins, Trypsin Inhibitor, Total Phenol Content of Microwave Treated Lablab Beans**

<table>
<thead>
<tr>
<th>Attributes</th>
<th>Raw</th>
<th>600 watts</th>
<th>750 watts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phytic acid mg/100g</td>
<td>800</td>
<td>535</td>
<td>456</td>
</tr>
<tr>
<td>Tannins mg/100g</td>
<td>391</td>
<td>376</td>
<td>303</td>
</tr>
<tr>
<td>Trypsin inhibitor TIU/mg</td>
<td>48.29</td>
<td>20.27</td>
<td>14.2</td>
</tr>
<tr>
<td>Total phenols %</td>
<td>0.25</td>
<td>0.15</td>
<td>0.1</td>
</tr>
</tbody>
</table>

**Effect of Microwave Treatment on the Mineral Composition of Lablab Beans**

Changes in mineral contents of lablab beans before and after microwave treatment are shown in table 4.
It is clear from the table that microwave treatment of lablab beans resulted increase in mineral contents to a significant level. Sodium, iron, zinc and potassium contents were found to increase significantly after microwave treatment of lablab beans compared to raw lablab beans. Significant changes were also observed in the case of beans microwaved at different watt powers.

Sodium, iron, zinc and potassium in raw lablab beans were found to 186, 3.23, 1 and 276 mg/100g respectively. After microwave treatment they were increased to 496, 15.5, 2.8 and 682 mg/100g when processed at 600 watts and 455, 11.6, 3, 653 mg/100g when processed at 750 Watts. The increase in mineral contents of lablab beans was mainly due to the increase in dry matter content of lablab beans.

The effect of microwave treatment on the retention of vitamins in lablab beans showed that there was a significant decrease in B1 and B2 contents before and after processing of lablab beans. The B1 and B2 contents in raw lablab beans were found to be 1.1 and 0.2 mg/100g. After microwaving at 600 and 750 W, they were found to be 0.86, 0.80 mg/100 and 0.132, 0.10 mg/100g respectively.

**Conclusion**

In this work the proximate composition was determined and results notably said that the protein content was increased in dry matter. The lablab beans are having the higher amounts of phytic acid, tannins and trypsin inhibitors in the raw beans as the antinutritional factors and they were effectively reduced by using microwave treatment at different power levels. It is said to be that without major loss of nutritional factors viz protein, minerals, vitamins the reduction of antinutritional factors occurred. Hence by considering the above results the microwave treatment provides the effective reduction in antinutritional factors and retention of nutritional factors.

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