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Research Article

Screening for market price, protein and sugar contents in ten different varieties of pulse produced and consumed in Bangladesh

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Abstract: Ten common Pulse varieties namely Lentil, Chick pea, Pigeon pea, Cow pea, Green gram, Chickling vetch, Garden Pea, Black Gram, Hyacinth bean and Soybean produced and consumed in Bangladesh were studied to compare their market price (Tk/Kg) and determine the protein as well as sugar contents during September 2013- August 2014. The highest market price was found to be 160 Tk/Kg (soybean) and the lowest was 50 Tk/Kg (Chick pea) and followed the sequence as Soybean >Pigeon pea> Hyacinth Bean> Green gram>Black gram>Lentil>Cow pea>Garden pea>Chickling vetch>Chick pea. Protein content varied from 2.68% (Hyacinth bean) - 35.31% (Soybean) and consequently followed the sequence as Soybean >Cow pea> Black gram > Chickling vetch> Lentil> Green gram> Chick pea> Pigeon pea > Garden pea > Hyacinth Bean. In respect to sugar content Soybean (6.96%) was found to be superior among the studied varieties of pulse and may therefore, be ranked as Soybean > Green gram> Garden pea> Chick pea> Pigeon pea>Lentil > Hyacinth Bean> Chickling vetch> Black gram >Cow pea. Present study concludes that the market price of all the studied varieties of pulse does not depend on their protein and sugar contents rather it depends on their exceptional uses in traditional food habit. Diabetic patients should avoid the varieties of pulse enriched with sugar content.
Keywords: Market price, protein, sugar, pulse varieties, Bangladesh

INTRODUCTION

Legumes/pulses are considered to be a very important group of plant food stuffs, particularly in the developing world, as a cheap source of protein when animal protein is scarce. A significant part of human population relies on legumes as staple food for subsistence, particularly in combination with cereals [1]. They are unique foods because of their rich nutrient content including starch, protein dietary fibre, oligosaccharides, soluble sugars, phytochemicals and minerals [2]. Their nutritional contents contribute to many health benefits to humans [3, 4]. Pulse starch contributes to slow glucose release, inducing a low glycemic index [5], whereas dietary fiber is involved in gastrointestinal health [6]. The World Health Organization estimates that up to 80% of heart disease, stroke, and type 2 diabetes and over a third of cancers could be prevented by eliminating risk factors, such as unhealthy diets and promoting better eating habits, of which pulses are an essential component.

Increasing population pressure, fast depletion of natural resources, poverty and low agricultural production are some of the problems faced by the developing countries. It is well documented that the developing countries do not produce enough food and of the right nutritional quality to meet daily needs [7]. The prevalence of hunger and protein malnutrition in the tropical and subtropical areas of the world is well recognized and appreciated [8]. The dearth in food supply especially of protein is of such magnitude the developing nations have to depend mostly on cereals, grains, starch roots, and tubers for energy and protein need [9]. The net effect of this protein deficit in the developing countries is manifested in the prevalence of various forms of protein calorie malnutrition (PCM) diseases such as Kwashiorkor, marasmus and mental deficiencies [10].

The carbohydrate–oligosaccharide fraction of pulses includes starch, soluble sugars and dietary fiber. Many health benefits are attributed to these components of pulse seeds. Pulse starch contributes to slow glucose release, inducing a low glycemic index [11, 5], whereas dietary fiber is involved in gastrointestinal health [6]. The soluble sugar fraction of pulses includes monosaccharides (ribose, glucose, galactose and fructose) and disaccharides (sucrose and maltose). The major oligosaccharides of pulses belong to the α-galactosides group where galactose is present in a α- D -1,6-linkage. Galactosides derived from sucrose, such as raffinose, stachyose and verbascose, represent the most studied sugars in pulses. Another group of a-galactosides in pulses is the glucose galactosides (melibiose and manninotriose) and inositol galactosides (galactinol, galactopinitol and ciceritol). Ciceritol is a trisaccharide (D-galactopyranosyl-6-α-D-galactopyranosyl-2-(1D)-4-O-methyl-chiro-inositol) and has been reported to be the most abundant sugar in chickpea [12, 13, 14]. Raffinose and stachyose, in particular, have been shown to have beneficial physiological effects, such as those of dietary fiber. These compounds tend to normalize bowel function, increase lactobacilli and bifidobacteria and decrease enterobacteria in the intestinal microflora, and reduce potentially carcinogenic N-nitroso compounds levels in the gut [15].

Pulses are the most important protein in the diet of the majority of the people in Bangladesh. The agro-ecological environment of Bangladesh is very suitable for the cultivation of pulses. Most of the people of Bangladesh are poor so, pulses are their main proteinacious food. Pulses are a very important dietary component of the people of Bangladesh and considered as "the meat of the poor". With this view in mind, in the present study, a laboratory experiment of ten different varieties of pulse produced and consumed in Bangladesh was done to determine as well as compare the Market price, protein and sugar status.

MATERIALS AND METHODS

A total of 10 (ten) common varieties of pulse namely Lentil, Chick pea, Pigeon pea, Cow pea, Green gram, Chickling vetch, Garden Pea, Black Gram, Hyacinth Bean and Soybean were collected from the local market as well as recorded their price (Tk/Kg) and carried to the laboratory. Then these were labeled, oven dried at 45^{o}c for 12 hours and stored in double lid white plastic container for laboratory analysis. The impure substances were removed from the pulse grains manually. Then the pulse grains were grinded with the help of grinder into powdery masses. The powder of each variety of pulse was sieved with a fine muslin cloth. The samples were dried for 24 hours at 65^{o}c before weighting them chemical analysis.

Determination of sugar:

Preparation of stock solution from pulse samples:

1.0gm dried and powdered pulse grain from each samp1e was weighted by using a sensitive balance. Each of the weighted samples was taken in separate glass tube, 20 ml distilled water was added and mixed thoroughly. After one hour each sample was filtered through filter paper (Whatman.43) into another test tube. Then 0.75 ml concentrated HCl was added drop wise by constant shaking. The mouths of the test tubes were stopped by polythene sheets. The contents were then heated in a water bath maintained at 100±2°C for 10 minutes. After hydrolysis, the solutions were neutralized with 12N NaOH by adding drop wise. Total volume of the extracted solutions were adjusted to 25 ml and treated as stock solutions.

Table-1: Selected varieties of pulse for chemical analysis.

Serial No.	Local Name	English Name	Scientific Name
1.	Masoor dal	Lentil	*Lens culinaris*
2.	Cholar dal	Chick pea	*Cicer arietinum*
3.	Arhor	Pigeon pea	*Cajanus cajan*
4.	Felon	Cow pea	*Vigna unguiculata*
5.	Mung bean	Green gram	*Vigna radiata*
6.	Khesari	Chickling Vetch	*Lathyrus sativus*
7.	Motor daal	Garden Pea	*Pisum sativum*
8.	Mash kalai	Black Gram	*Phaseolus mungo*
9.	Hyacinth Bean	Hyacinth Bean	*Dolichos lablab*
10	Soybean	Soybean	*Glycine max*

Construction standard calibration curve for total sugar analysis:

For standard calibration curve a series of different concentration e.g. 8µg/ml, 16µg/ml, 24µg/ml, 32µg/ml, 48µg/ml and 64µg/ml of standard glucose solutions in 0.2% benzoic acid were prepared. From the above mentioned stock solutions with different concentrations, 2 ml from each were taken in separate test tubes. An equal volume of alkaline copper reagent was added and was mixed throughly. Then the tubes with loosely fitted glass stoppers are transferred in a water bath and heated for 10 minute at 100±2°C. After that the solutions were cooled and 1.0 ml arsenomolybdale color reagent was added. After thorough mixing, the solution in each test tube was diluted to 10 ml and allowed to stand for 30 minutes. The solutions gave blue coloration of various intensity and optical density (OD) of these solutions the different test tubes were measured in spectrophotometer (model name) by taking absorbance at 500 nm. The absorbance value (OD) of each standard solution was recorded and the values of OD were plotted on the ordinate line of an mm graph paper against the respective concentration of standard solution as put on the abscissa line. The points on the graph paper were joined which gave a straight line. From this straight line on the graph, a mean co-efficient was calculated for determining the concentration of sugar present the extract of different pulse varieties. Co-efficient was calculated following the formula:

$$\text{Co} - \text{efficient} = \frac{\text{Concentration of the standard solution}}{\text{OD for standard solution}}$$

Estimation of sugar:

2 ml of each stock solution (pulse grain extract) was taken in test tube. The other procedures and precautions were the same as mentioned in the preparation of standard curve.

Calculation

The total sugar content of the pulse samples were calculated by multiplying (sample reading - blank reading) by co-efficient following the formula given bellow:

$$\text{Total sugar, mg/g D.Wt.} = \frac{\text{R x Co} - \text{eff. x } V_1 \text{ x D}}{V_2 \text{ x Wn}}$$

Where, R = Sample reading — blank reading, Co-eff. = Mean co-efficient, V_1= Volume of the extract, D =Dilution Factor, V_2 =Volume of extract taken for color development, W = Dry weight of the sample in gm [16].

Determination of protein:

Construction of standard curve:

Bovine serum albumin was taken as standard. For standard curve 0.2 mg/ml albumin solution was prepared. From this stock solution 0.5, 1.0, 1.5 and 2.0 ml solution were taken in separate 10 ml volumetric flasks containing 5 ml alkaline solution and was allowed to stand at room temperature for 10 minutes. Then to each flask was added 0.5 ml diluted Folin - Ciocalteau reagent rapidly with immediate mixing. Volume was made up to the mark by distilled water. The protein was measured by taking absorbance at 750 nm in the spectrophotometer after 30 minutes. A standard curve was constructed on a mm graph paper where the absorbance value (OD) were plotted (on y-axis) against the respective concentration of the standard solution (on x-axis). From the standard curve coefficient was determined as Co-efficient = Concentration of the standard solution/OD for each standard solution. A mean co-efficient was determined from these for the calculation of protein in the test solution.

Estimation of protein:

For this purpose 5 ml of alkaline solution (mixture of solution A and solution B) was taken in a 10 ml volumetric flask for each sample and then to it added 1 ml stock solution (pulse grain extract). The solution was mixed thoroughly and left for 10 minutes at room temperature (25°C). Then to it added 0.5 ml diluted Folin - Ciocalteau reagent with immediate and quick mixing. Blank sample was prepared without stock solution (pulse grain extract). After 30 minutes absorbance (OD) was taken at 750 nm against the appropriate blank.

Calculation

The protein content of rice varieties is calculated by multiplying (sample reading -blank reading) by a mean co-efficient derived from the standard curve where bovine albumin was taken as standard. Concentration of protein in the extract of pulse grain was determined with the help of the formula given below and was expressed in mg/g fresh weight of pulse grain.

$$\text{Concentration of protein} = \frac{\text{R x co} - \text{eff. x V x D}}{\text{F. Wt}} \text{mg/g}$$

Where, R= Sample reading - blank reading, Co-eff. = Calculated mean co-efficient, V = Volume of the sample, D = Dilution Factor, F. Wt= Fresh weight of plant sample in g [17].

RESULTS AND DISCUSSION

The pulse varieties were collected in small amount (100gm) and their prices were recorded at Tk/kg. The highest price was found for soybean (160 Tk/Kg) and the lowest was for chick pea (50 Tk/Kg). The values for the prices of all studied pulses were followed the sequence as Soybean >Pigeon pea> Hyacinth Bean> Green gram>Black gram>Lentil>Cow pea>Garden pea>Chickling vetch>Chick pea. It is evident from the result that the market price of pulse varieties does not depend on their protein and sugar contents rather it depends on their exceptional uses in traditional food habit.

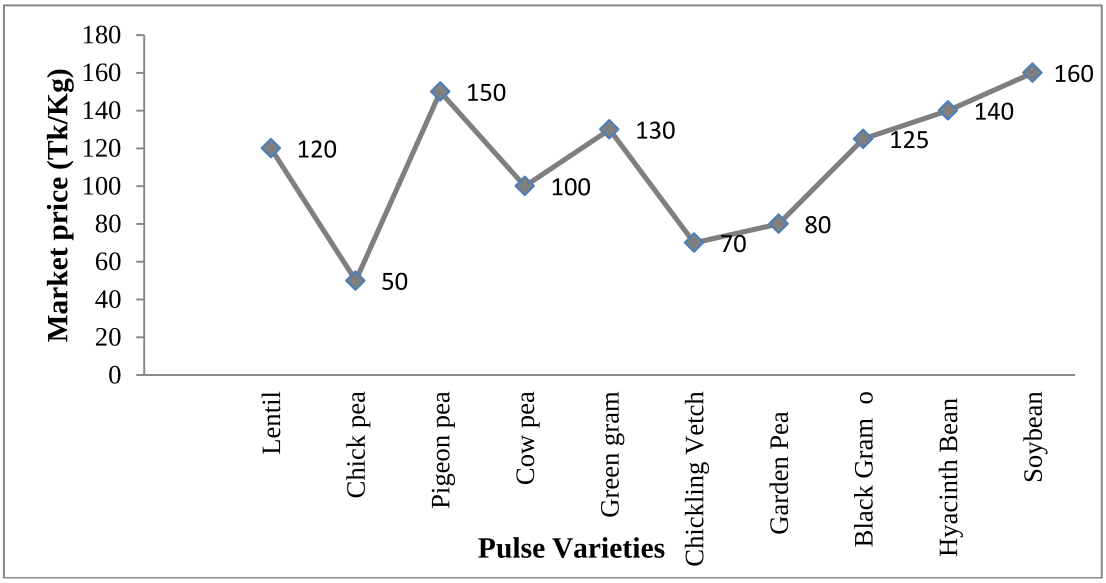

Fig-1: Variation of market price of ten varieties of pulse.

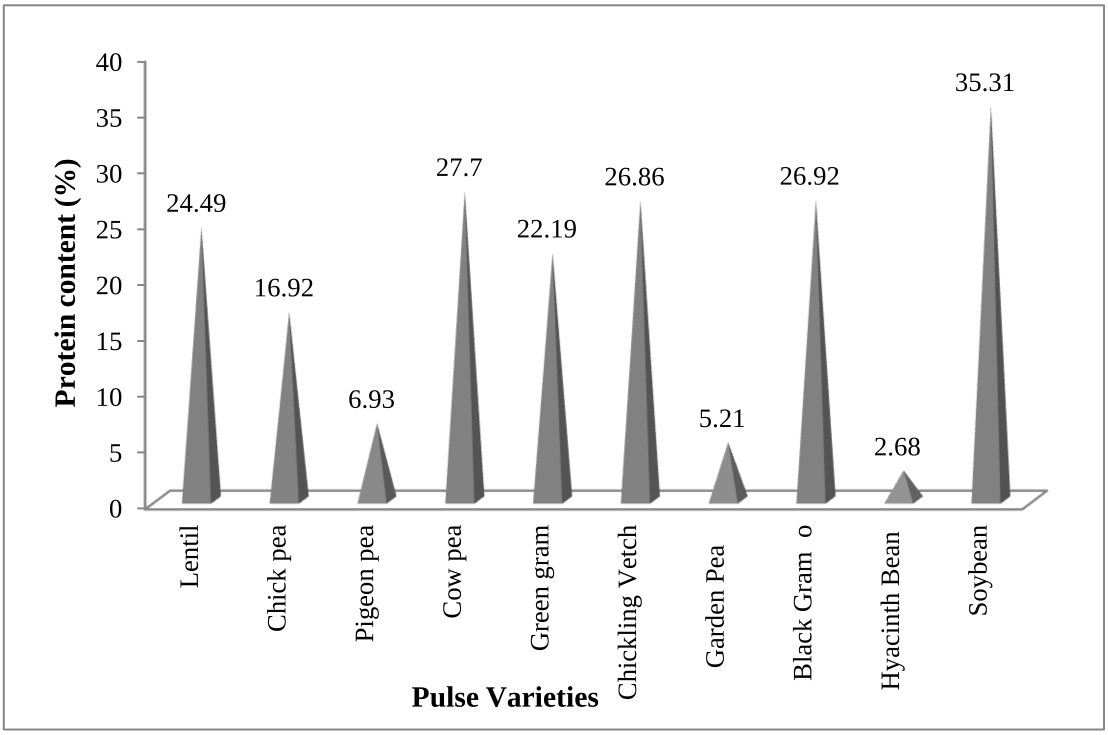

Fig-2: Variation of protein content in ten varieties of pulse.

The results as presented in Fig-2 indicate that the values of protein content varied from 2.68-35.31%. Maximum protein content was determined in soybean (35.31%) and minimum in Hyacinth bean (2.68%) and consequently followed the sequence as Soybean >Cow pea> Black gram > Chickling vetch> Lentil> Green gram> Chick pea> Pigeon pea > Garden pea > Hyacinth Bean. It is also revealed from the results that protein content of pulses does not influence the price of all studied pulse varieties. According to a recent report, protein content in Chickling vetch, Garden Pea, Black Gram, Hyacinth Bean and Soybean were found to be 25.6%, 5.42%, 25.11%, 2.95% and 36.49% respectively in chemical analysis [10, 18]. Furthermore, another report for the chemical analysis of pulse indicates that, protein content in Lentil, Chick pea, Pigeon pea, Cow pea and Green gram were found to be: 26 %, 8.86 %, 7.2 %, 26.10 % and 23.86 % respectively [19]. The results of the present study are resembled with these findings.

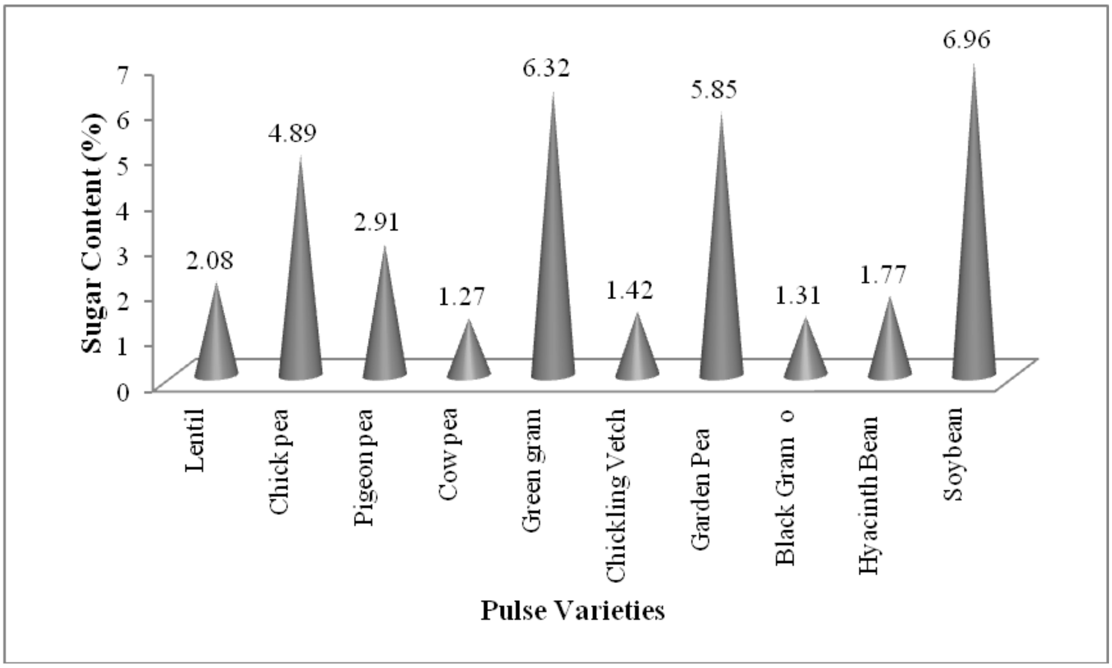

Fig-3: Variation of sugar content in ten varieties of pulse.

The results as shown in Fig-3 reveal that the values of sugar content ranged from 1.27-6.96%. The highest value of sugar was obtained in soybean (6.96%) and the lowest in Cow pea (1.27%). In case of sugar content all the studied pulses followed the sequence as Soybean > Green gram> Garden pea> Chick pea> Pigeon pea>Lentil > Hyacinth Bean> Chickling vetch> Black gram >Cow pea. It is evident from the result that the cost of pulse varieties does not depend on sugar content. It is reported that sugar content in Chickling vetch, Garden Pea, Black Gram, Hyacinth Bean and Soybean were found to be 1.67%, 5.67%, 1.12%, 2.12% and 7.33% respectively in laboratory analysis [20]. According to another report, sugar content in Lentil, Chick pea, Pigeon pea, Cow pea and Green gram were found to be 2 %, 4.8 %, 3.10 %, 1.41 % and 6.6 % respectively [21]. The results of the sugar content of the present study are similar to these findings. As the diabetic patients should be conscious in taking excessive sugar content in their daily meal, so they can choose the pulses for their daily food that are rich in protein with lower sugar content.

CONCLUSION

The present study concludes that the market price of all the studied varieties of pulse mainly varied from (50-160 Tk/Kg) which in fact does not depend on the sugar or protein content. In respect to protein and sugar contents, Soybean was found to be superior and in contrary, Hyacinth bean and Cow pea were found to be inferior among all the studied varieties of pulse respectively. So diabetic patients should avoid the pulses enriched with sugar content.

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