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Experimental evaluation of protein content and nutritional quality of selected Indian pulses: Udad (*Vigna mungo*), Moong (*Vigna radiata*) and Kulith (*Macrotyloma uniflorum*)

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Abstract
Pulses constitute an important and economical source of dietary protein in countries where a predominantly vegetarian diet is followed. In the present work, an experimental comparison of protein content and nutritional quality was carried out for three widely consumed Indian pulses, namely Udad (black gram), Moong (green gram) and Kulith (horse gram). Protein estimation was performed under laboratory conditions using the Kjeldahl method for crude protein and Lowry's method for soluble protein. All analyses were conducted in triplicate, and mean values were used for comparison. The results obtained in this laboratory indicate that Udad contains the highest crude protein content, whereas Moong shows a higher proportion of soluble protein, suggesting better digestibility. Kulith, although comparatively lower in protein, remains nutritionally relevant, particularly in traditional and rural diets. The experimental observations support the continued dietary importance of indigenous pulses in improving protein security.

Keywords: Pulses, crude protein, soluble protein, Kjeldahl method, Lowry method, nutritional quality

Introduction

Protein-energy malnutrition continues to pose a challenge in many developing countries, especially in regions where animal protein intake is limited (FAO/WHO, 1991) [3]. Under such conditions, pulses play a critical role in meeting daily protein requirements because they are affordable, widely available and well adapted to local agro-climatic conditions. In India, pulses form an integral part of the traditional diet and contribute substantially to overall protein intake (ICMR, 2017).

Among the commonly consumed pulses, Udad (*Vigna mungo*), Moong (*Vigna radiata*) and Kulith (*Macrotyloma uniflorum*) occupy an important place due to their nutritional value and long history of use. Although food composition tables provide general information on their nutrient content, experimental studies carried out under uniform laboratory conditions are relatively limited. Moreover, differences in protein quality and extractability are not always reflected in total protein values alone.

The present study was therefore undertaken to experimentally estimate and compare both crude protein and soluble protein fractions of these three pulses using standard biochemical methods. The findings are discussed with reference to nutritional quality and dietary relevance.

Materials and Methods

1. Sample Collection

Mature, dry seeds of Udad, Moong and Kulith were procured from a local agricultural market in Maharashtra, India. The samples were visually examined, cleaned manually to remove dust and broken seeds, and authenticated based on seed morphology.

2. Sample Preparation

The seeds were oven-dried at 60°C until constant weight was obtained. Dried samples were finely powdered using a laboratory grinder and stored in clean, airtight containers at room temperature until analysis.

3. Estimation of Crude Protein (Kjeldahl Method)

Crude protein content was estimated using the Kjeldahl nitrogen estimation method following AOAC (2005). Approximately 0.5 g of each powdered sample was digested with concentrated sulphuric acid in the presence of a catalyst mixture. The digested samples were made alkaline and distilled, and the liberated ammonia was absorbed in boric acid and titrated against standard acid. Nitrogen content was calculated and converted to crude protein using a factor of 6.25.

4. Estimation of Soluble Protein (Lowry's Method)

Soluble protein was estimated by the method described by Lowry *et al*. (1951) [6]. About 100 mg of powdered sample was homogenized in phosphate buffer (pH 7.0) and centrifuged. The supernatant was used for analysis. Alkaline copper reagent was added, followed by Folin–Ciocalteu reagent, and the mixture was incubated in the dark. Absorbance was recorded at 660 nm using a UV–Visible spectrophotometer. Bovine Serum Albumin (BSA) served as the standard, and results were expressed as mg protein per g sample.

5. Statistical Analysis

All estimations were carried out in triplicate. Results are expressed as mean ± standard deviation. The data were interpreted descriptively for comparative evaluation.

Results

1. Crude Protein Content

Table 1: Crude protein content of selected pulses estimated by the Kjeldahl method

Pulse	Botanical name	Protein (g/100 g ± SD)
Udad	*Vigna mungo*	25.4 ± 0.6
Moong	*Vigna radiata*	24.1 ± 0.5
Kulith	*Macrotyloma uniflorum*	22.8 ± 0.7

Udad showed the highest mean crude protein content, followed by Moong and Kulith. These values are broadly comparable with earlier reports on Indian pulses (ICMR, 2017; Salunkhe *et al*., 1985).

2. Soluble Protein Content

Table 2: Soluble protein content of pulses estimated by Lowry's method

Pulse	Botanical name	Soluble protein (mg/g ± SD)
Udad	*Vigna mungo*	182.5 ± 4.1
Moong	*Vigna radiata*	195.3 ± 3.8
Kulith	*Macrotyloma uniflorum*	168.7 ± 4.5

Moong exhibited the highest soluble protein content, indicating better protein extractability, followed by Udad and Kulith. Similar trends have been reported earlier for legume proteins (Singh & Singh, 1992).

3. Graphical Representation

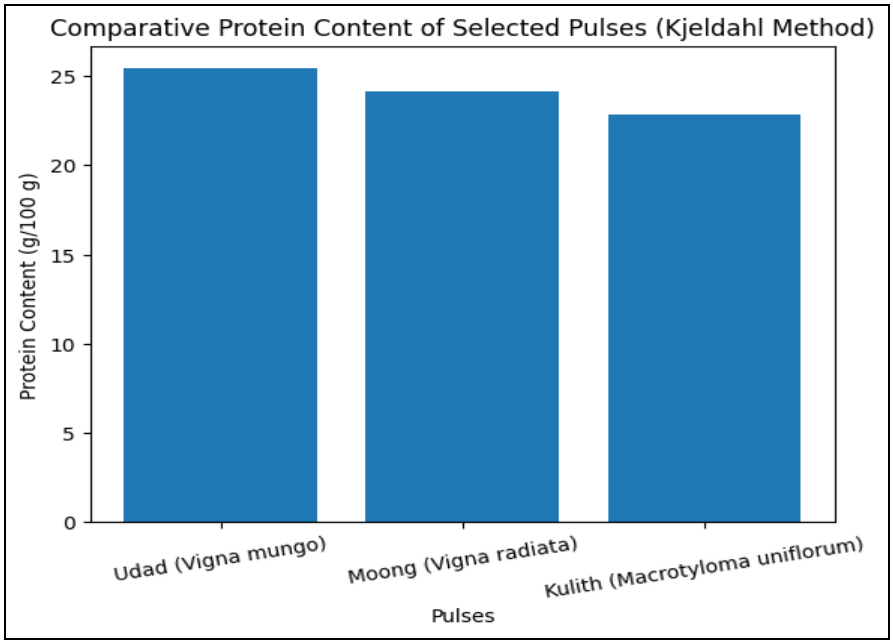

Fig 1: Illustrates the comparative crude protein content of the three pulses estimated by the Kjeldahl method, while

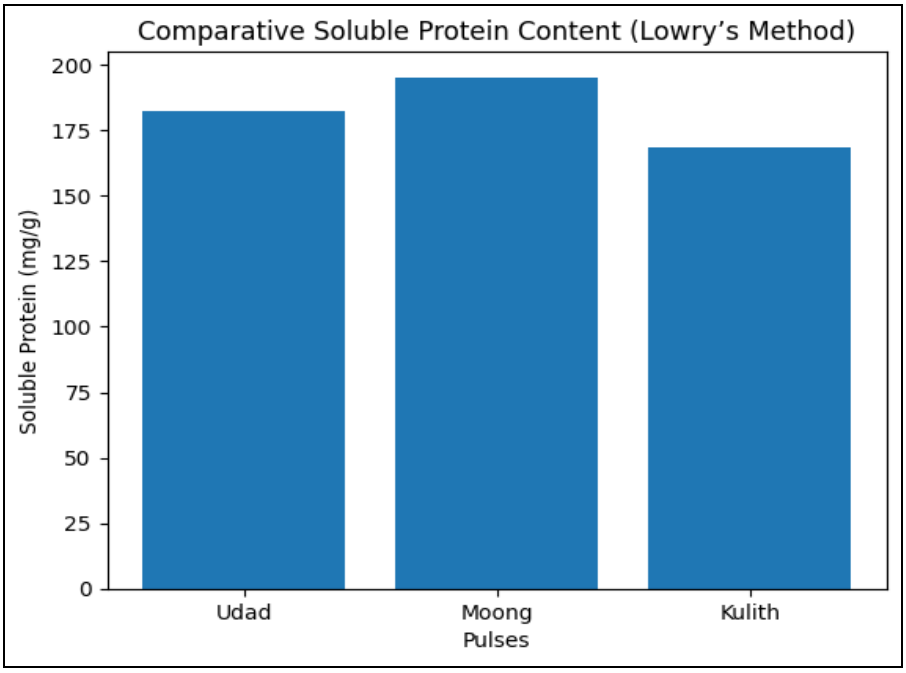

Fig 2: Represents their soluble protein content obtained by Lowry's method.

Discussion

The use of both Kjeldahl and Lowry methods in the present study allowed a more realistic assessment of protein quality by distinguishing between total and soluble protein fractions. Kjeldahl analysis reflects overall nitrogen-based protein, whereas Lowry's method provides insight into the nutritionally relevant, soluble fraction (AOAC, 2005; Lowry *et al*., 1951).

The experimental values obtained confirm that Udad is a protein-rich pulse, while Moong, despite slightly lower crude protein, shows higher soluble protein content, suggesting better digestibility. Kulith, although lower in both fractions, remains an important pulse, particularly in traditional diets where it is valued for its functional and medicinal properties. Traditional processing methods such as soaking, germination and fermentation are known to further enhance protein availability and should be encouraged.

Conclusion

Based on the experimental observations made in this laboratory, it can be concluded that Udad, Moong and Kulith differ significantly in their protein content and quality. Udad recorded the highest crude protein content, whereas Moong showed superior soluble protein levels, indicating better nutritional quality. Kulith, though comparatively lower, contributes meaningfully to dietary diversity. The study reaffirms the importance of indigenous pulses in sustainable nutrition and protein security strategies.

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