Original Research Article

"Physico-Biochemical Evaluation of Certain Promising Varieties of Chickpea (Cicer arietinum L.)"

ABSTRACT

Chickpea (Cicer arietinum L.), often known as gramme or Bengal gramme, is a self-pollinated leguminous crop with diploid annual (2n = 16 chromosomes) that belongs to the family Leguminosae and subfamily Papilionaceae. During the Rabi season, it is the most significant crop in India. Chickpeas are a high-energy, high protein, and low carbohydrate food. Gram is a grain that is utilised for both human consumption and animal feed. It comes in flour, whole grain, roasted, and cocked varieties. The most common forms consumed by people are salted Dahl or sweet concoctions, as well as green foliage and grain as vegetables. In the Rabi season, 60% of pulses are grown, and 40% in the Kharif season. Chickpeas are high in calories, protein, minerals, vitamins, and fibre that may be useful to one's health. For biochemical characteristics on selected potential genotypes/varieties of chickpea [Cicer arietinum (L)], seeds of chickpea genotypes/varieties were obtained from legume Breeder, Department of Genetics and Plant breeding, CSAUAT, Kanpur. The experiment was planned in the Department's Research Laboratory in order to achieve the goals of their research. Dhal percent, husk percentages, broken dal, percentage loss in processing, protein, test weight, grain yield quintal/ha, were 71.40-82.92g, 7.50-17.74 percent, 2.00-5.60 percent, 20.85-23.95 percent, 21.45-27.70g, 21-30q/ha, respectively. In genotypes K3256, Avrodhi, KGD1296, KGD2021, K3256, K3256 of the varietal trail, lower husk percentage, broken percentage, and processing loss were identified, as well as greater nutritional elements such as protein content also identified.

Key words: *Protein, dhal processing, test weight and yield*

Introduction

The chickpea, or Cicer arietinum L., is a self-pollinated leguminous plant with a diploid annual (2n = 16 chromosomes) that is a member of the subfamily Papilinoceae in the family Leguminosae. It serves as India's most major crop throughout the Rabi season. Since 7000 BC, chickpeas have been grown all throughout the world, but semiarid locations are where they are most commonly farmed. There are many different hues, sizes, and forms of chickpea seeds. Chickpea seeds are classified as Kabuli (Mediterranean and Middle Eastern origin) or desi (Indian origin) based on this distinction (Nizaket et al., 2007). The Kabuli type seeds have a light seed coat that ranges in colour from white

to cream and weigh 28-70g per 100 seeds. The importance of pulses in Indian agriculture cannot be overstated. India is a leading producer of pulses.

Pulses are a primary source of vegetable protein that provide important amino acids (methionine, cysteine, and cystine) that are required for optimal human growth and development. These are the cheapest and best sources of protein in our country, accounting for 18-25 percent of total dietary protein. Grain legumes are valuable to humanity in two ways: first, as a low-cost source of protein in the human diet, and second, by increasing soil fertility by fixing atmospheric nitrogen in low-fertility soils. Pulses have long been utilised as a nutritional supplement in various agricultural systems around the world, not just for protein and minerals, but also for B-complex vitamins. Chickpea seeds of the Desi variety have a thicker skin and an irregularly formed seed coat that ranges in colour from light to black, with a 100-seed weight of up to 28g (Segev et al., 2010).

Chickpeas are high in calories, protein, minerals, vitamins, and fibre, as well as minerals and vitamins that may be useful to one's health. Protein levels ranged from 18.46 to 24.46 g/100g, oil levels from 5.68 to 9.01 g/100g, and ash levels from 3.55 to 4.46 g/100g (Nobile et al. 2013). Cattle eat both the husks and the fragments of the 'dal.' As a vegetable, fresh green leaves are utilised (sag). Chickpea straw is a great livestock feed. Grain can also be used as a vegetable (chhole). Besan (chickpea flour) is a flour made from chickpeas that is used to make a variety of desserts. Dehusked splits, also known as dal, are the most popular form of pulse consumption. The protein and starch-bearing cotyledons of pulse grains are connected to the outer layer of the grain (husk). Due to the existence of a layer of gums between the husk and the cotyledons in some grains, such as pigeon pea, mungbean, and urdbean, this bonding is strong. These are referred to as difficult-to-mill materials. Dehusking is the process of removing the husk from the cotyledons, and milling is the process of dehusking and subsequent splitting of the cotyledons, as well as cleaning, polishing, and grading. Dehusking increases the look, texture, quality, palatability, and digestibility of the product. This can range from 10-15% depending on the quality of grain milled. It's crucial to consider all aspects of milling so that the right method and machinery are utilised to get the best quality dal out of the grain and corrective steps are taken to keep milling losses to a minimum. After rice and flour milling, pulse milling is the third largest food processing business. In mills of various capacities, an estimated 75% of pulses produced are processed to make dal.

Chickpea (Cicer arietinum L.) Is one of the most readily produced and consumed pulses (grain legumes) worldwide, particularly in the Indian subcontinent and Mediterranean countries (FAO 2004). In addition to proteins, it is a good source of carbohydrates, minerals and trace elements like, calcium, magnesium, zinc, potassium, iron, phosphorus and vitamins like, thiamine and niacin required to human body (ziaulhaq et al., 2007) Legumes are commonly eaten after soaking, cooking, or heating since these processing processes boost the nutritional quality of legumes and grains to varying degrees (Vasudeva and Vishwanathan,2010). (Hagir et al., 2007) Cooking and soaking foods might lessen the gas that results from intestinal bacteria's anaerobic oligosaccharide breakdown and fermentation in humans and other monogastric animals. Before cooking, most Kabuli and 30% of Desi chickpeas are soaked (hydrated), and this step is crucial for both home consumption and industrial processing.

Material and methods

During the Rabi season of 2019-2020, the current study was conducted in the laboratories of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, in the Department of Agricultural Biochemistry. The materials and methods used to achieve the various objectives of the study "Physico-Biochemical evaluation of certain promising genotypes/varieties of Chickpea [Cicer arietinum (L.)" embodies comparative studies on the biochemical determination of certain physical, processing, and nutritional characteristics of certain genotypes/varieties of chickpea. This study used chickpea seeds from twenty genotypes/varieties.

Statistical Analysis

Preparation of samples:

All the sample of dhal were oven dried at 70 ^{0}C overnight, cold at room temperature and were grind by domestic grinder and passed through 20 mesh sieves. As and when required flour samples were defatted using petroleum ether (40-60 ^{0}C). The flour was stored in screw capped vials in desiccators at a room temperature and was subsequently used for biochemical analysis.

(A) Processing characteristics:

Dhal, broken dhal, husk recovery and percentage loss in processing (in flour):

Dhal was prepared by soaking 50 g of seed in 100 ml of water for one hour. Water was drained off. Moist seed were kept at room temperature for 24 hours and then dried in electro oven for 4 hours at 70 ^{0}C. A light roller / hand chakki was applied for splitting the grains into dhal and husk. The husk was separated mechanically and weighed. The broken dhal was passed through one mm sieve to separate it from whole dhal. The whole dhal fraction and broken dhal fraction were weighted separately and their percentage calculated. Combined weights of dhal and husk were deducted from weight of seed to obtain the percentage loss in processing.

Chemical and reagents:

All the laboratory chemical reagent grade or analytical reagent were obtained from standard commercial firm.

(B) Biochemical Characteristics

Protein content:

Protein content of the sample was determined by biuret method as described by (Williams, 1961). It was standardized by determining nitrogen content in twenty chickpea genotypes by the modified microkjeldhal method suggested by AOAC (1965). The nitrogen (%) was then multiplied by the factor 6.25 (Pellett. L.P. and Young, V.R. 1980) for obtaining the protein content. These samples were also run along with rest of the samples during biuret method.

Calculation: calculation percentage of nitrogen as fallow:

$$n = \frac{(\text{ml HCL in determination} - \text{ml blamk})X \text{ normality X } 14.007}{\text{mg samle}} X\ 100$$

Protein % = N% x 6.25

Biuret method: -

Principle:

The CONH-group in protein molecule reacts with dilute copper sulphate solution in alkaline medium in presence of roschelle salt gives purple colour. The intensity of colour is measured by spectrophotometer at 575nm

Reagent:

Solution A: CuSO4 solution (4%)

Solution B: 10N NaOH-40gm in 100ml distilled water

Solution C: Weigh exactly 2.5 gm sodium potassium tartrate crystal and dissolve in 500 ml of distilled water .15 ml solution B and 30 ml solution A added in solution C.

The solution C was then diluted to 1000ml. If kept for more than 40 hours, the reagent tends to give out a gram Cu containing precipitate, and should be discarded.

Solution D: Carbon tetra chloride (CCL4)-1to 2ml.

Procedure:

0.5g material weighed in Erlenmeyer flasks of 100-150ml capacity, 1ml CCl4 is added, followed by exactly 50ml of reagent C. The flasks are stoppered, shaken for 10 minutes and set aside for one hour.

After a brief agitation, about 10-20 ml of the purple suspension is centrifuged at 3000 rpm for 10 minutes.

The clean supernatant solution is decanted off and colour measured at 575 nm on UV-spectrophotometer.

A standard variety whose protein content has already been determined by conventional Kjeldhal's method is also run with each set of samples for Biuret method.

(C) Physical characteristics: -

Grain yield(q/ha): The data of grain yield expressed in q/ha.

Test weight: To observe the extent of grain filling 1000 seed of each replication were weight out.

Result and discussion

The finding of present investigation has been shown are being discussed, elucidated and interpreted in the light of accepted principles of Biochemistry and supported by literature cited. The whole gamut of discussion is grouped into following heads:

(A) Processing characteristics: -

The whole grain of chickpea genotype/varieties were dehusked to yield dhal which were separated from husk and broken dhal to calculate dhal recovery percent.

Data on dhal recovery percent in whole grain as influenced by different genotype/varieties of chickpea graphically depicted in Fig 1. It was evident from the data presented in table-1 that the dhal recovery in whole grain of chickpea was significantly influenced by different genotype/varieties of chickpea. The dhal recovery in whole grain in different genotype/varieties of chickpea ranged from 71.40% to 82.92%. The chickpea genotype KGD-1296 recorded highest dhal recovery percentage (82.92%) the lowest dhal recovery was recorded in chickpea genotype K-850 (71.4%).

The varieties of chickpea showed variation in husk percent from 7.50 to 17.74%. The variety K-3256 (7.50%) gave lower mean value for husk than other while Avrodhi (17.74%) gave higher mean value for husk than the other varieties of chickpea.

Broken dhal recorded from whole dhal sample by passing through sieve. The broken dhal recovery ranged from 2.00% to 5.60% and highest percent of broken dhal was obtained in variety K-850 (5.60%), whereas the variety Avrodhi (2.00%) recorded lowest value of broken dhal percent.

The result of percent loss in dhal processing (in flour) was ranged from 0.24% to 10.38% and the lowest percentage loss was obtained from KGD-1296(0.24%) whereas the highest % loss was recorded in the variety of KGD-99-9 (10.38%).

(B) Nutritional characteristics

In general, legume crops are mainly recognized because of their major contribution in producing body building substances proteins of human diet. Protein is the most important biochemical component in chickpea. Dhal prepared by removing the husk and broken pieces and by separating the cotyledon by dhal mills, is a relished food material for the largest segment of Indian population. The range of protein content of dhal (20.46-23.95%) has observed in different genotypes/varieties of chickpea. It was found that the significantly highest protein content in dhal (23.95%) was obtained KGD-2021 as compared to the other varieties and the minimum protein was recorded in KGD-2035 (20.46%). It is evident from the data that the variation in protein content in dhal due to different genotypes/varieties of chickpea were statistically significant.

The increase in protein content in dhal in different genotypes/varieties of chickpea might be due to genetic variability. Seema et.al., (2018) reported the crude protein content in different varieties of chickpea ranged from 21.22-21.88%. Tiznado et. al., (2012) reported protein content in chickpea ranged from20.12% to 28.85%. Singhai et.al., (2006) reported the crude protein content in different varieties of chickpea ranged from 21.11-21.68%. Kaur et. al., (2019) reported protein content in chickpea ranged from20.12% to 27.05%. Pankaj et al. (2011) observed the crude protein content ranged from 19.98% to 25.23% in different varieties of chickpea. Srivastava et. al., (2004) which was reported the protein content ranged from 20.88-27.44% which was also similar that of our results of protein content in different varieties of chickpea. The Protein % of chickpea was depicted graphically in Fig.4.

(C) Physical characteristics: -

It was evident from the data that the test weight of whole grain of chickpea was significantly influenced by different varieties of chickpea. The test weight of chickpea with different varieties was ranged from 18.60g to 28.70g. Significantly higher test weight (28.70 g) of chickpea was recorded in genotype KGD-99-9 as compared to rest of the varieties/genotypes of chickpea. The minimum test weight was recorded with genotype-KM-2348 (18.60g). The similar findings were also reported by (Tripathi et. al., (2018) which was reported the test weight ranged from 13.61 to 24.70 g. The test weight (g/1000seeds**)** of chickpea was depicted graphically in Fig.2.

Grain yield (q/ha) content revealed that the range of grain yield varied from 21q/ha to 30q/ha. The highest grain yield was recorded in the genotype of KGD-99-5 (30q/ha) as compared to other varieties of chickpea. The minimum grain yield was obtained with chickpea genotype KGD-1296 (21q/ha). The Grain Yield (q/ha**)** of chickpea was depicted graphically in Fig.3

Table- 1 Effect of "Physico-Biochemical Evaluation of Certain Promising Varieties of Chickpea (Cicer arietinum L.)" on Dhal recovery%, Husk%, Broken Dhal% and Loss in Processing%.

Sr.No.	Varieties	Dhal recovery %	Husk%	Broken Dhal %	Loss in processing %
1	K-850	71.40	13.08	5.60	9.92
2	K-3256	81.94	7.50	2.76	7.80
3	KPG-59	76.52	16.80	3.62	3.06
4	KGD-1168	74.72	15.92	4.08	5.28
5	Avrodhi	73.52	17.74	2.00	6.74
6	KGD-1170	75.74	15.44	4.22	4.60
7	KGD-2021	79.94	15.84	3.10	1.12
8	KGD-1320	79.72	16.56	2.56	1.16
9	KGD-1315	79.42	13.72	2.72	4.14
10	KGD-1322	81.56	15.28	2.92	0.24
11	KGD-1321	75.66	14.00	3.56	6.78
12	KGD-1355	80.46	14.32	3.32	1.90

13	KGD-99-5	81.80	15.64	2.14	0.42
14	KGD-1288	74.18	15.16	4.86	5.80
15	KGD-99-9	71.70	13.74	4.18	10.38
16	KGD-1296	82.92	14.58	2.26	0.24
17	KGD-2012	75.80	12.90	4.90	6.40
18	KGD-1316	78.96	12.40	4.20	4.44
19	KGD-2035	78.62	15.28	3.14	2.96
20	KGD-2088	74.60	13.76	3.86	7.78
	S.E.(d)	2.283	0.431	0.107	0.162
	C.D. at 5%	4.630	0.874	0.217	0.328

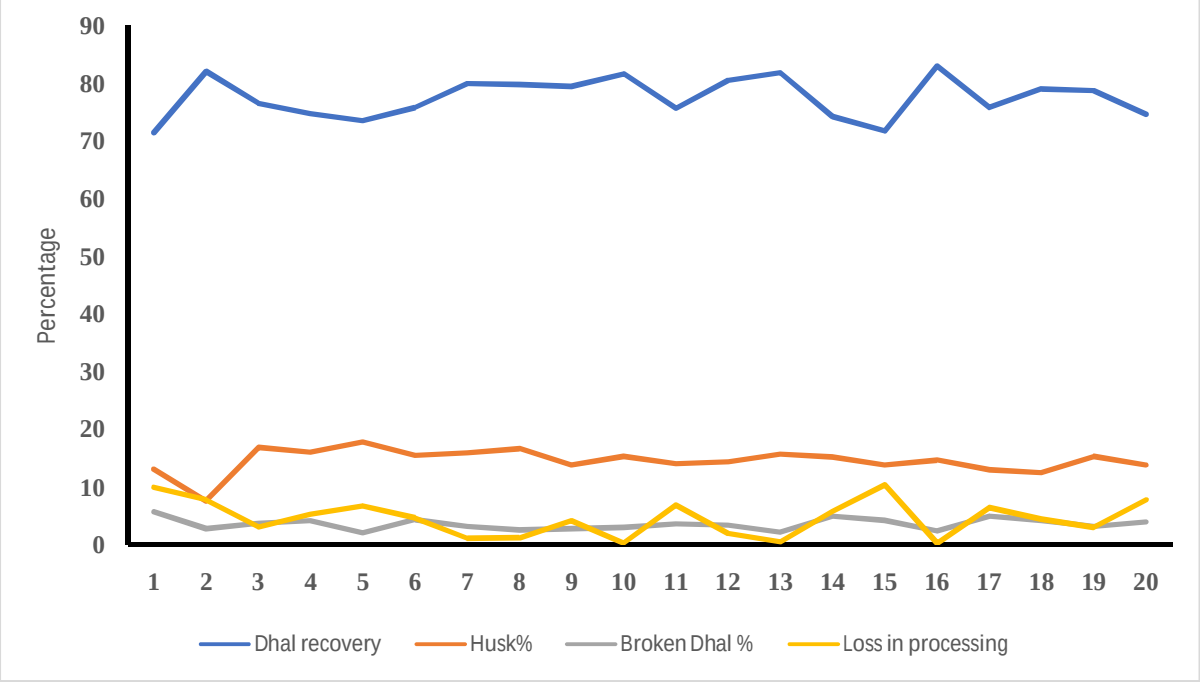

Figure: - 1 Effect of Certain Promising Varieties of Chickpea (*Cicer arietinum* L.) on Dhal recovery%, Husk%, Broken Dhal% and Loss in Processing%.

Table- 2 Effect of "Physico-Biochemical Evaluation of Certain Promising Varieties of Chickpea (Cicer arietinum L.)" on Test weight, Grain Yield and Protein%.

S.N.	Varieties	Test weight (g/1000 seeds)	Grain Yield (q/ha)	Protein %

1	K-850	25.70	29	23.37
2	K-3256	27.10	24	23.88
3	KPG-59	22.20	27	21.14
4	KGD-1168	21.70	23	23.00
5	Avrodhi	23.90	24	23.80
6	KGD-1170	21.00	28	23.47
7	KGD-2021	20.90	28	23.95
8	KGD-1320	19.60	24	20.85
9	KGD-1315	20.10	22	22.25
10	KGD-1322	18.60	23	21.92
11	KGD-1321	20.60	22	22.79
12	KGD-1355	21.20	25	22.96
13	KGD-99-5	28.70	30	23.74
14	KGD-1288	21.80	28	22.28
15	KGD-99-9	27.70	26	22.28
16	KGD-1296	27.10	21	21.81
17	KGD-2012	28.50	27	23.33
18	KGD-1316	28.20	24	20.82
19	KGD-2035	28.40	26	20.46
20	KGD-2088	28.00	27	21.06
	S.E.(d)	0.716	0.751	0.662
	C.D.	1.451	1.524	1.343

Figure: - 2 Effect of Certain Promising Varieties of Chickpea (*Cicer arietinum* L.) on Test Weight

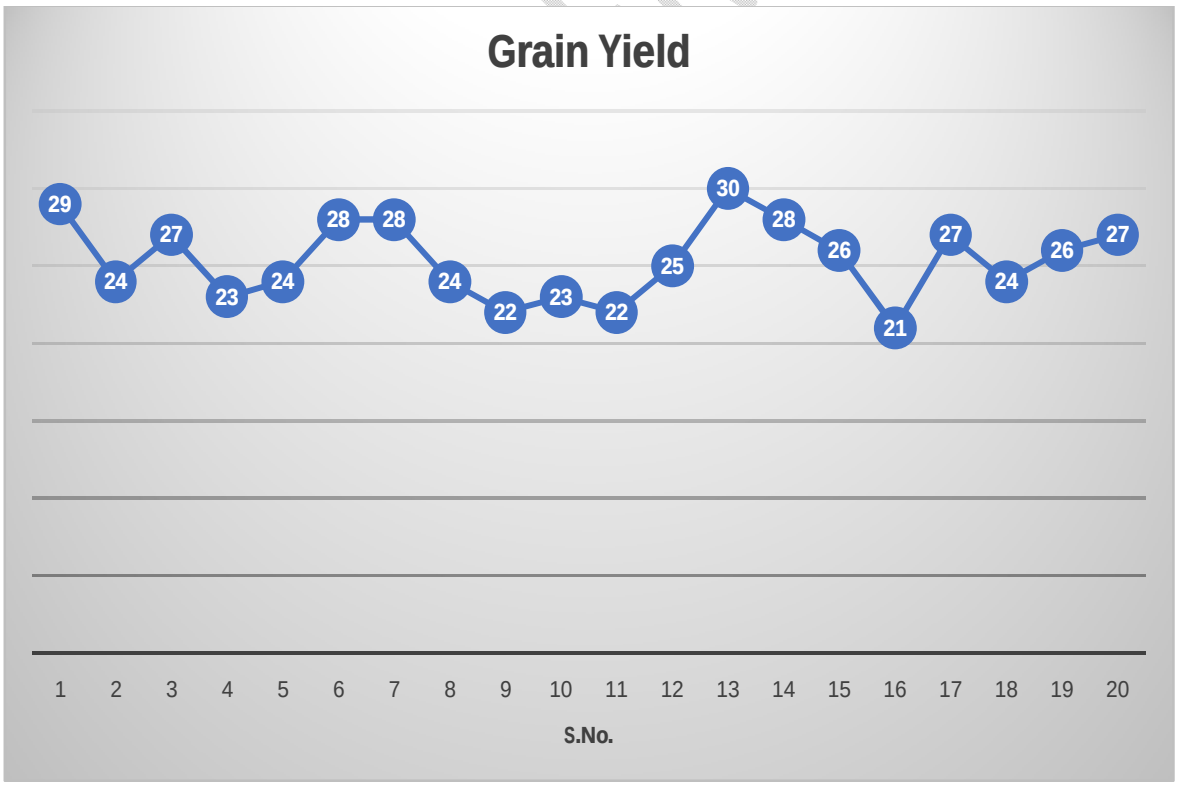

Figure: - 3 Effect of Certain Promising Varieties of Chickpea (*Cicer arietinum* L.) on Grain Yield

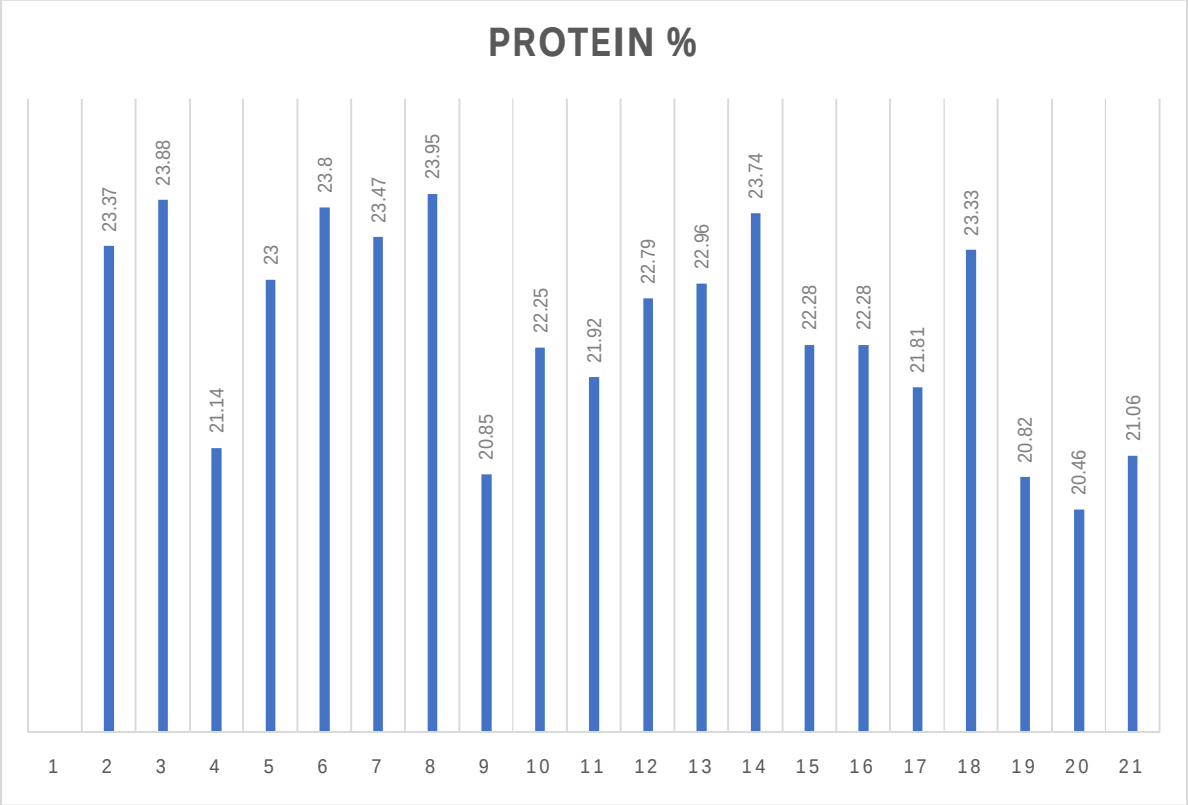

Figure: - 4 Effect of Certain Promising Varieties of Chickpea (*Cicer arietinum* L.) on Protein %

CONCLUSION:

On the basis of results obtained in the present investigation, it may be concluded that out of the 20 genotypes/varieties of chickpea, KGD2021 showed highest value of protein content in dhal. Similarly, highest dhal recovery and lesser husk recovery was obtained in chickpea genotype/variety KGD-1296 and K-3256 respectively as compared to rest of the genotypes/varieties of chickpea. And the significantly minimum broken dhal recovery was recorded in chickpea genotype/variety Avrodhi, whereas KGD-1296 was having lowest percentage loss in processing (in flour) in genotype/variety of chickpea and the genotype/variety, KGD-99-5 gave highest value in test weight and KGD-99-5 gave highest grain yield. In respect of maximum dhal recovery, lowest husk percentage, protein content in genotype/variety K-3256 is superior.

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