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Studies on physical and processing quality characterstics of chickpea [*Cicer arietinum* L] varieties/genotypes grown in Uttar Pradesh

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Abstract
The present investigation reports their variability in Physical and Processing characteristics. Fifteen chickpea genotypes/varieties viz. K-3256, KWR-108, KGD-1145, KPG-59, KGD-1250, Avrodhi, Radhey, KGD-1918, KGD-93, IPC-71, IPC-310, GNG-2144, GNG-2171, KGD 2011 and KGD-1913 were taken from legume Breeder, Department of Genetics and Plant breeding, CSAUAT. Physical and processing quality characterstics was in overall range of variability of dhal recovery percent, percentages of husk recovered, broken dal percentage, percentage loss in processing, test weight, grain yield quintal/ha, moisture content, no. of pod per plant, maturity period was 71.45-82.62%, 7.50-17.75%, 2.00-5.61%, 1.87-9.46%, 9.45-28.84 g, 11-26 q/ha, 67-120, 118-134 days, respectively in chickpea varieties/ genotypes. It is clear from the results genotype KGD-1250 appeared best in two physical characterstics (test weight and no. of pod per plant). In terms of grain yield (q/ha) genotype KGD 1913 performed best among all genotypes/varieties.

Keywords: Methionine content, protein content, treatment, tryptophan content, varieties/genotypes

Introduction
Chickpea commonly known as gram or bengal gram (*Cicer arietinum* L.), a member of family Leguminaceae and subfamily Papilinoceae, is an important self-pollinated leguminous crop, diploid annual (2n = 16 chromosomes). It is the most important crop of India grown during Rabi season. Among the pulses, Chickpea is grown since 7000 BC, in different areas of the world but its cultivation is mainly concentrated in semi-arid environments. India ranks first in the world in respect of production as well as acreage of chickpea crop followed by Pakistan (Anonymous, 2021) [1]. The kabuli type seeds have a slight seed coat ranging in colour since white to cream and 100-seed weight is 28-70 g. Desi type chickpea seeds have a thicker skin, irregular shaped seed coat ranging in colour from light to black, with 100-seed weight up to 28 g (Segev *et al.*, 2010) [2]. There are two types of chickpea: the small angular "desi"; and the large rounder "kabuli". Most kabuli and about 30% of desi chickpeas are soaked (hydrated) before cooking and soaking is important for both domestic use as well as industrial processing, so the process of soaking and cooking can reduce gas production in humans and monogastric animals from anaerobic degradation/fermentation of oligosaccharides by intestinal bacteria (Hagir *et al.*, 2007) [3]. Pulses are mostly consumed in the form of dehusked splits, commonly known as dal. The outer layer of the grain (husk) is attached to the protein and starch bearing cotyledons of the pulse grains. This outer husk layer is required to be separated from the cotyledons and subsequently split in two halves before consumed as dal. The process of removal of husk from the cotyledons is calleddehusking and the entire process of dehusking and subsequent splitting of cotyledons, its cleaning, polishing and grading is known as milling. Dehusking improves product appearance, texture, product quality, palatability and digestibility. A substantial amount of avoidable loss takes place at different stages of milling (Vasudeva and Vishwanathan, 2010) [4].

Materials and Methods
Chickpea (*Cicer arietinum* L.) seeds from fifteen distinct genotypes and varieties were used in the experiment, which was conducted using a Complete-Randomized Design (CRD) with three replications and standardised agronomic conditions. The Chandra Shekhar Azad University of Agriculture and Technology, Kanpur's legume department provided the seeds.

All of the seed grain samples were ground in a kitchen grinder and put through a 20 mesh sieve after being oven dried at 70 °C for an entire night. When and as needed (40-60 °C), petroleum ether was used to defattify flour samples. The flour was stored in screw-capped vials in desiccators at room temperature before being used for biochemical analysis. The chemicals used in this study were all of the analytical variety.

1. **Grain yield (q/ha):** The data of grain yield expressed in q/ha. Each plot's grain yield was recorded following the threshing and winnowing of the harvested seeds. Finally, it was calculated for each genotype/variety in terms of q/ha.
2. **Test weight:** To observe the extent of grain filling 100 seed of each replication were weight out.100 seeds from each replication were weighed out in order to determine the degree of grain filling. However, the results were given as 1000 grains weight by multiplying by 10.
3. **Maturity period:** Maturity can be determined when one half to two thirds of the pods are mature.
4. **Total no. of pod per plant:** Numbers of pod bearing were counted at maturity stage for certain promising cultivars.
5. **Dhal recovery:** The whole grain of mung bean varieties were dehusked with dehusker to yield dhal which were separated from husk and broken dhal to calculate dhal recovery percent.
6. **Husk recovery:** Moist seed were kept at room temperature for 24 hours and then dried in electro oven for 4 hours at 70 °C. A light roller / hand chakki was applied for splitting the grains into dhal and husk. The husk was separated mechanically and weighed.
7. **Broken dhal recovery:** When passed through sieve broken dhal was recovered from whole dhal sample. 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
8. **Percentage loss in processing:** Combined weights of dhal and husk were deducted from weight of seed to obtain the percentage loss in processing.

Results and Discussion

1. **Grain yield (q/ha):** It was evident from the table-1 that the grain yield of chickpea with different varieties/genotypes was ranged from 11-26 q/ha with a mean value of 18.93. Significantly highest grain yield (26 q/ha) of chickpea was recorded with KGD-1913 followed KGD-93(23 q/ha), GNG-2011,as compared to rest of the varieties of chickpea. The minimum grain yield was recorded with genotype K-3256 (11 q/ha).
2. **Test weight:** Data on test weight of chickpea as influenced by certain genotypes/varieties of chickpea presented in table-1 and graphically depicted in fig.1. It was evident from the table that test weight of chickpea with different varieties/genotypes ranged from 9.45 g to 31.56 g with a mean value of 20.49. Significantly highest test weight 31.56 g of chickpea was recorded in KGD-1250 (31.56 g) followed by GNG -2171(28.84 g) and K-3256 (26.46 g). The minimum test weight was recorded with IPC- 310 (9.45 g). The similar findings were also reported by (Tripathi *et al*., 2018) [5] which was reported the test weight ranged from 13.61 to 24.70 g.
3. **Maturity period:** A perusal data depicted in table-1 and graphically represented in Fig.1 on maturity period of chickpea. The Maturity period of chickpea with different varieties/genotypes were varied from 118-134 days with a mean value of 126 days. The highest maturity period was recorded in genotype KGD-1913 (134 days) followed by genotype GNG-2171(131 days). The minimum maturity period recorded in genotype KPG-59 (118 days).
4. **No. of pod per plant:** Data on number of pod per plant of chickpea given in table-1 as influenced by different varieties/genotypes of chickpea recorded that it was evident from the data that number of plant per plant was significantly influenced by different varieties of chickpea. Highest number of pod per plant (120) was recorded in chickpea genotype KGD-1250 followed by GNG-2171 (113) and KGD-1145 (110) with a mean value of 89.2.The minimum number of pod per plant recorded in genotype KGD -93 (67).
5. **Dhal Recovery (%):** Data on dhal recovery percent in whole grain as influenced by different genotype/varieties of chickpea graphically depicted in Fig 2. It was evident from the data presented in table-2 that the dhal recovery in whole grain of chickpea was significantly influenced by different genotype/varieties of chickpea. The chickpea genotype KGD-2011 recorded highest dhal recovery percentage (82.62%) followed by K-3256 (81.94%) and the lowest dhal recovery was recorded in chickpea genotype IPC-310(71.45%). Similar results have been reported by several workers such as (Tikle *et al.,* 2018) [6] reported that the range varied from 70.69% to 71.04%.
6. **Husk Recovery (%):** The data presented in table-2 on husk percentage showed that the range of variation in husk percentage was from 7.50% to 17.75% with a mean value of 14.58%. The higher value of husk percentage was recorded in variety-Avrodhi (17.75%) followed by KGD-59 (16.80%) and while lower value of husk was recorded in genotype/varieties K-3256 (7.50%) as compare to other genotype/varieties of chickpea. The husk percent of chickpea was depicted graphically in Fig1.
7. **Broken dhal Recovery (%):** The data shown in table-2 on broken dhal percentage observed that the broken dhal recorded from whole grain sample by passing through sieve. The broken dhal recovery ranged from 2% to 5.6% with a mean value of 3.60% and the highest percent of broken dhal was obtained in genotype GNG-2144 (5.6%) followed by KWR -108 (5.32%), KGD-1250(5.12%). The variety Avrodhi (2.00%) recorded least value of broken dhal percent. The broken dhal percent graphically was depicted in Fig. 2.
8. **Loss in Processing (%):** Data on percentage loss in dhal processing as influenced by different varieties/genotypes of chickpea presented in table-2 that the percentage loss in processing ranged from 1.87% to 9.46% with a mean value of 5.13 %. The highest percentage loss was obtained from KWR-108(9.46%) followed by IPC-310. The lowest percentage loss in processing was recorded in the variety of KGD-2011 (1.87%). The percentage loss in dhal processing was depicted graphically in Fig 2.

Table 1: Physical quality characteristics in dhal of certain genotypes /varieties of chickpea

Sr. No.	Varieties	Test weight (g/100 seeds)	No. of pod per plant	Maturity period (days)	Grain Yield (q/ha)
1	K-3256	26.46	79	128	11
2	KWR-108	20.15	80	125	18
3	KGD-1145	21.75	110	126	17
4	KPG-59	19.30	95	118	14
5	KGD-1250	31.56	120	121	19
6	Avrodhi	20.63	83	126	21
7	Radhey	23.76	79	124	18
8	KGD-1918	20.47	92	127	22
9	KGD-93	24.47	67	124	23
10	IPC-71	14.59	80	126	17
11	IPC-310	9.45	92	123	21
12	GNG-2144	12.74	84	128	19
13	GNG-2171	28.84	113	131	16
14	GNG-2011	18.76	86	129	22
15	KGD-1913	14.55	78	134	26
	S.E.(d)	0.260	3.186	2.792	1.023
	C.D.	0.534	6.537	5.729	2.100

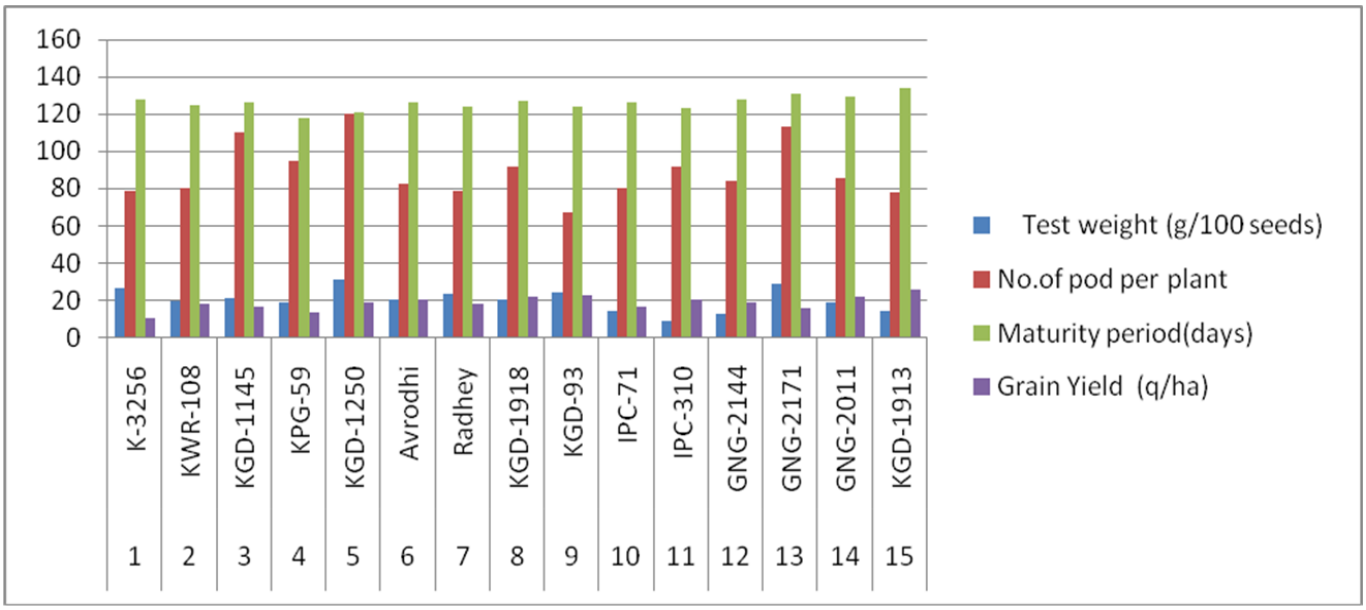

Fig 1: Physical quality characteristics in dhal of certain genotypes /varieties of chickpea (*Cicer arietinum* L.)

Table 2: Processing quality characteristics in dhal of certain genotypes /varieties of chickpea

Sr. No.	Varieties	Dhal recovery %	Husk Recovery %	Broken Dhal recovery %	Loss in processing %
1	K-3256	81.94	7.50	2.76	7.80
2	KWR-108	72.40	12.82	5.32	9.46
3	KGD-1145	74.72	15.92	3.92	5.44
4	KPG-59	76.52	16.80	3.62	3.06
5	KGD1250	75.71	14.92	5.12	4.25
6	Avrodhi	73.53	17.75	2.00	6.72
7	Radhey	77.84	15.21	2.49	3.46
8	KGD-1918	78.68	15.92	2.34	3.06
9	KGD-93	80.48	14.59	2.86	2.07
10	IPC-71	79.68	13.45	3.68	3.19
11	IPC-310	71.45	15.34	4.12	9.09
12	GNG-2144	72.74	14.82	5.61	6.83
13	GNG-2171	73.54	15.92	3.19	7.35
14	KGD-2011	82.62	13.23	2.28	1.87
15	KGD-1913	77.23	14.64	4.73	3.40
	S.E.(d)	0.572	0.353	0.248	0.318
	C.D. at 5%	1.659	0.724	0.509	0.654

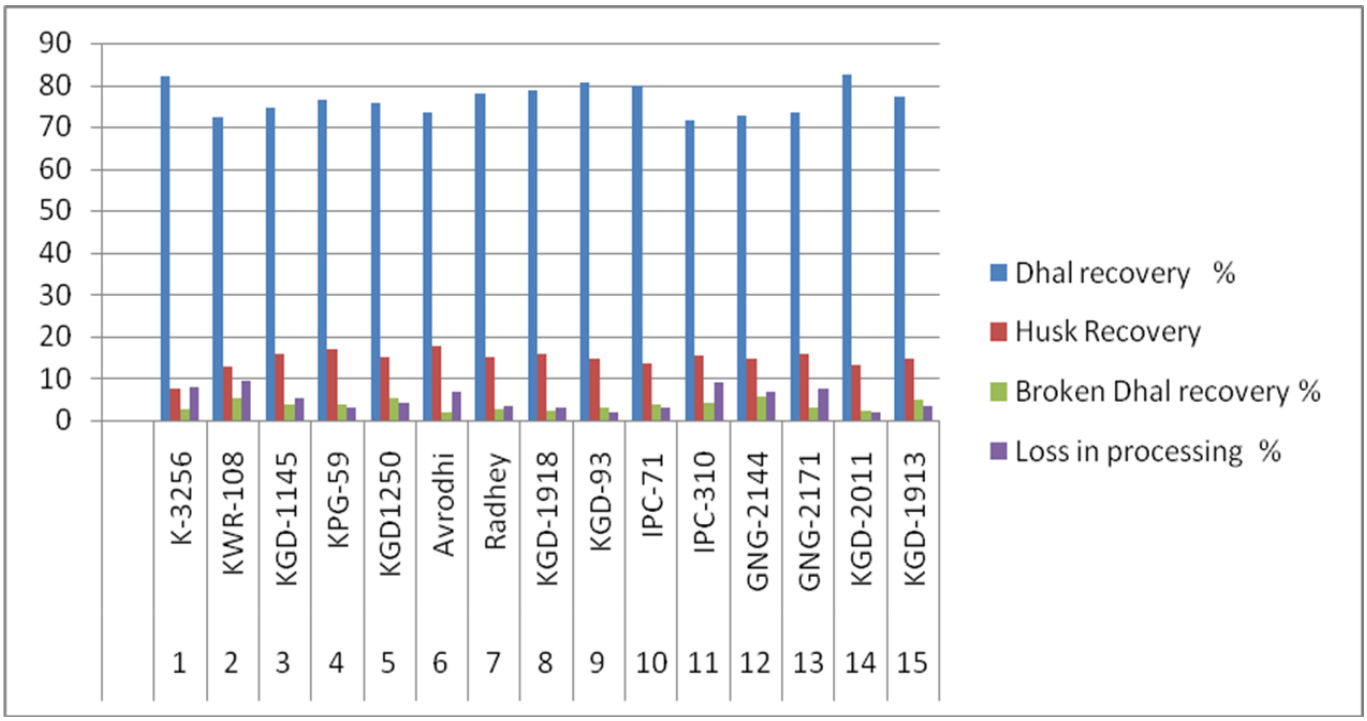

Fig 2: Processing quality characteristics in dhal of certain genotypes /varieties of chickpea (*Cicer arietinum* L.)

Conclusion

Based on the findings of the current study, it can be said that of the 15 varieties and genotypes of chickpea, in physical characteristics KGD- 1250 is the best variety/genotype. KGD -2011 genotype was best genotype among fifteen genotypes/varieties in terms of processing quality characterstics.

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