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ORIGINAL ARTICLE

Evaluation of Chickpea products from different Chickpea Varieties for Physico- chemical, Functional and Textural Properties

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ABSTRACT
The Indian snack dhokla was prepared from four chickpea varieties- JG 16, JG 63, JG 218 and Local chickpea. Physical and milling properties chemical composition, mineral contents, functional properties, textural properties of flour and products were evaluated. Variety JG 16 has highest seed weight (16.45 g /100 seed) and seed volume (11.94 ml/100 seeds) and grain density (1.37 g/cc). JG 218 had highest dhal recovery (76.93%). The flour of Local variety had maximum amount of moisture (7.18%), protein (23.78%) and fat (2.35%). while JG 218 was rich in ash (4.07%), crude fibre content (3.57%). Carbohydrate was highest in the flour of JG 63 (59.80%). The flour of JG 16 also exhibited higher WAC (147.00 ml/100g) and FAC (143.6 ml/100g). Dhokla prepared from JG 16 was rich in ash (3.05%) and crude fibre content (3.52%), and was rich in protein content (23.70%) when prepared from the flour of JG 218. The carbohydrate content of dhokla prepared from JG 63 was higher (49.67%) than others. Magnesium (70.83 mg/100g), Phosphorus (159.34 mg/100g) and Copper (7.77 mg/100g) content was comparatively higher in dhokla prepared from the flour of JG 16. Dhokla prepared from JG 63 exhibited highest emulsification capacity (35.00 mg/100g). Maximum sponginess was observed in dhokla prepared from JG 218 (172.51).

Keywords*: Chickpea cultivars, Dhokla, Physical properties, Milling yield, Proximate chemical and mineral contents, Functional properties, Textural properties.*

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INTRODUCTION

Grain legumes interchangeably referred as pulses in the Indian sub-continent occupy an important place in human nutrition. They are the variable sources of protein, minerals and the vitamins in the daily diets of the people, particularly of the low income group [1]. Legumes are recognized as the best source of vegetable protein [2].

In recent year, several high yielding varieties of chickpea have been evolved. Besides yield potential, their physico-chemical characteristics and milling quality are equally important. Physical characteristics such as hull, head recovery of dhal and broken percentage are important for marketing and milling point of view while proximate chemical and mineral characteristics give information on nutritional quality of grain.

Chickpea flour is used as a basic major ingredient for making food products. Due to its nutritional quality, chickpea is one of the most important crop of the world [3]. It is rich source of carbohydrate (64.90%), protein (34.63%), fat (5.62%), fibre (1.85%) and minerals such as calcium, potassium, sodium, magnesium, copper, iron and zinc [4-5]. Functional properties constituent the major criteria for the adoption and acceptability of proteins in food systems [6]. Functionality has been defined as any property of a food ingredient, except its nutritional values that has a great impact on its utilization [7].

Fermentation is one of the oldest forms of food preservation technology in the world. Dhokla is a popular fermented food of India. The popularity of "Dhokla" is due to it's delicate spongy texture and it's digestibility, many workers have substituted various other ingredients to improve it's nutritional quality while maintaining it's acceptability and palatability [8-9].

Demand and consumption of snack foods is increasing day by day. Information about food composition is necessary for the assessment of diet quality and the development and application of food-based dietary guidelines, providing a useful tool for the field of public health nutrition. Therefore, the present study was undertaken to evaluate physico-chemical characteristics of the different varieties of chickpea and organoleptic characteristics of different snacks prepared from these chickpea varieties.

MATERIAL AND METHODS

Pure and healthy seeds of 3 recently varieties of chickpea -JG 16, JG 63 and JG 218 as the released varieties have been procured from the department of Plant breeding and genetics, JNKVV, Jabalpur and Local chickpea was procured from local market of Adhartal, Jabalpur.

Physical characteristics of the selected varieties of chickpea were determined in terms of 100 seed weight, volume/100 seed and bulk density. These varieties were determined by method described by [10]. Milling of chickpea varieties was carried out in a grain testing mill (Akola dhal mill).

Physical and Proximate principle of each variety of chickpea were estimated in triplicate by the standard method by [11] and carbohydrate content was calculated by difference. Sodium, potassium by photometrically using EEL flame photometer, calcium, magnesium by varsenate titration method, phosphorus by vanadomolybdate and micronutrient such as copper, magnese, iron and zinc by Atomic Absorption spectroscopy (Yarian Techron Model AA-120), Functional properties by [12] for obtaining WAC and FAC [13] for EC and FC was occurred by using Bajaj electric blender. Textural properties by textural analyzer system (model : TAXT2i).

RESULTS AND DISCUSSION

Physico-chemical characteristics of the 4 varieties of chickpea are presented in Table-1. The JG 16 variety had a significantly higher value for 100 seed weight (16.45 g), 100 seed volume (11.94ml) and grain density (1.37 g/cc) whereas these characteristics exhibited lower value in JG 63. Grain density (1.29 g/cc) value occurred same in JG 63 and JG 218. It is clear from the Table-1 that the non-significant differences among varieties have been observed regarding to 100 seed volume and grain density. The values of 100 seed weight, grain density and volume observed in present investigation are close to the values reported by [14-16].

The variety JG 218 recorded the highest head recovery of dhal (76.93%) while it contain lowest value for husk (13.77 %) and milling loss (1.55%). Local variety had highest valur for brokens in milling (13.57%) and husk (16.10%). Thus wide varietal differences were observed in all the physical characteristics of chickpea except 100 seed volume (ml) and grain density (g/cc). However, similar values of dhal yield and slightly lower values of husk content were noted by [17-18].

Among the four varieties of chickpea JG 16 and JG 218 were considered to be the best suited varieties for the yield of more amount of dhal as they were found to have relatively more 100 seed weight, seed volume, less husk percentage and milling loss during milling.

Table 1. Physical and proximate chemical characteristics of the three selected varieties and one Local chickpea

Charac./ variety	100 seed wt. (g)	Seed vol. (ml.)	Densiy (g/cc)	Head recovery of dhal (%)	Brokens in milling (%)	Husk (%)	Milling loss (%)	Moisture	Protein	Fat	Ash	Crude fibre	Carbo hydrates
JG 16	16.45	11.94	1.37	74.23	5.10	14.00	6.66	7.14	23.62	2.35	3.97	3.55	59.41
JG 63	15.21	11.65	1.29	73.43	6.45	15.63	4.48	6.82	23.70	2.25	3.92	3.50	59.80
JG 218	15.24	11.84	1.29	76.93	7.75	13.77	1.55	7.02	23.77	2.05	4.07	3.57	59.50
Local	15.58	11.78	1.31	66.70	13.57	16.10	3.63	7.18	23.78	2.35	3.77	3.52	59.39

Table 2. Proximate analysis (%) and mineral composition (mg/100 g) of *dhokla* from different chickpea varieties

Comp./Var.	Moisture	Protein	Fat	Ash	Crude fibre	Carbohydrates	Ca	Mg
JG 16	20.41	21.43	2.32	3.05	3.52	49.27	174.33	70.83
JG 63	19.80	22.37	2.00	2.70	3.40	49.67	162.00	65.50
JG 218	21.17	23.70	1.60	2.50	3.47	47.55	171.66	69.53
Local var.	22.30	22.20	2.40	2.65	3.05	47.52	166.00	69.30
Comp./Var.	**K**	**Ph**	**Na**	**S**	**Mn**	**Fe**	**Zn**	**Cu**
JG 16	353.35	159..34	21.41	94.48	32.41	6.25	0.94	7.77
JG 63	360.28	154.12	22.25	93.59	34.21	5.93	1.25	7.60
JG 218	318.43	157.16	22.18	99.36	31.61	6.45	0.87	7.45
Local.	356.13	156.65	19.76	97.38	34.45	6.08	1.046	7.71

Among the four varieties of chickpea Local chickpea flour had maximum moisture (7.18%), protein (23.78%) and relatively high fat (2.35%) whereas high ash content (4.07%) and crude fibre content (3.57%) were observed in variety JG 218. Local chickpea flour exhibited the lowest value for ash (3.77%), carbohydrate (59.39%) while JG 63 recorded the minimum value for moisture (6.82%), crude fibre (3.50%). Carbohydrate content ranged from 59.80-59.39 % maximum value observed in JG 63. More or less similar values of proximate composition have been reported by [19-20].

Dhokla prepared by Local variety contained higher amount of moisture (22.30%) and fat (2.40%) whereas crude fibre (3.05%) and carbohydrate (47.52%) recorded the lower value. JG 16 variety had the maximum ash (3.05%) and crude fibre (3.52%) while minimum ash content observed in JG 218 (2.50%). Carbohydrate ranged from 49.67-47.52 % whereas JG 63 contained maximum value. Protein content ranged from 23.70-21.43 % were estimated maximum value observed in JG 218 and minimum in JG 16. The values are in agreement with earlier reports [21].

The data depicted in Table 2 indicated that the dhokla prepared by JG 16 contained higher for Ca (174.33 mg/100g), Mg (70.83 mg/100g), Ph (159.34 mg/100g) and copper (7.77 mg/100g) whereas JG 63 contained the lower values for theses mineral except copper content.

Sulphur content ranged from (99.36 to 93.59 mg/100g) and Fe (6.45 to 5.93 mg/100g) whereas Dhokla prepared by JG 218 occur maximum value for theses minerals while minimum value in JG 63. Arithmetically the highest content of K (360.28 mg/100g) Na (22.25 mg/100g) and Zn (1.25 mg/100g) observed in JG 63 and Na (19.76 mg/100g) found minimum in Local variety. Mn content ranged from (34.45 to 31.61 mg/100g) and copper content ranged from (7.77 to 7.45 mg/100 g). Mn content was observed to be superior in Local variety and copper content in JG 16 whereas both minerals was contained lower value in JG 218 variety. The range of values for mineral content observed in the investigation are in conformity with earlier reports by [22-23].

There were non-significant differences were observed between the varieties with respect to all proximate constituent of dhokla except fat content and except potassium all other minerals of dhokla prepared from different varieties were observed to be significantly different from each other.

Table 3. Functional properties of flour and dhokla prepared by chickpea varieties

Variety /Property	Flour				Variety /Property	Dhokla			
	WAC (ml/ 100g)	FAC (ml/ 100g)	FC (%)	EC (ml/ 100g)		WAC (ml/ 100g)	FAC (ml/ 100g)	FC (%)	EC (ml/ 100g)
Local	1128.7	126.7	20.0	45.0	Local	160.0	130.4	35.0	34.0
JG 16	1147.0	143.6	22.0	42.0	JG 16	174.0	150.0	31.0	32.0
JG 63	1140.0	138.3	14.0	38.0	JG 63	164.0	144.3	30.0	35.0
JG 218	1138.0	135.3	18.0	40.0	JG 218	169.0	142.0	38.6	30.0

Water absorption capacity, Fat absorption capacity, Foaming capacity and emulsification capacity of chickpea flour and dhokla of different varieties under study were significant different from each other except Emulsification capacity of dhokla.

Among the four varieties of chickpea flour and it's product dhokla were JG 16 had the highest value with respect to WAC and FAC whereas the lowest values were found in Local variety of flour and dhokla. Foaming capacity of flour was recorded maximum in JG 16 (22.0 %) and foaming capacity of dhokla found maximum in JG 218 (38.6 %) whereas foaming capacity of flour (14.0 %) and dhokla ((30.0 %) had recorded minimum in JG 63. Local variety was found highest emulsification capacity (45.0 ml/g) in flour whereas JG 63 (35.0 ml/g) found in dhokla. However, for all functional properties similar or slightly higher values were reported by [24]in peanut of flour whereas the higher values reported by [25-27].

Table 4. Textural properties of Dhokla of different chickpea varieties

Variety	Sponginess			Cutting strength		
	(g)	(sec.)	(mm)	(g)	(sec.)	(mm)
Local	187.07	3.32	6.70	543.72	6.43	12.84
JG 16	223.84	3.35	6.70	586.12	4.84	9.64
JG 63	249.32	2.79	5.58	549.21	3.10	6.21
JG 218	172.51	2.32	4.64	594.99	6.67	13.35

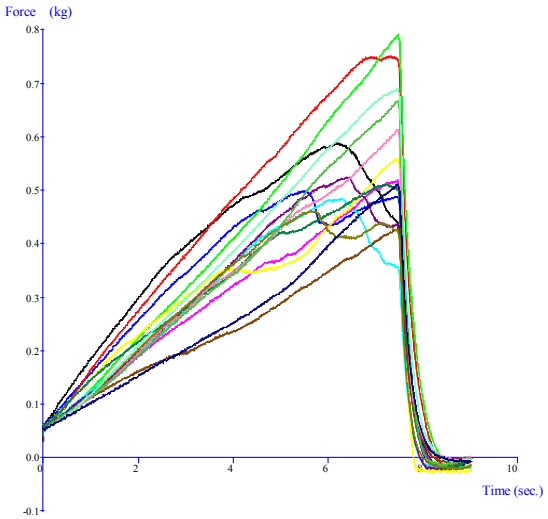
It is observed from the (table 4 and graph-9) the maximum sponginess was observed by dhokla prepared by JG 218 and the least sponginess was observed by the dhokla of JG 63 variety (table 4 and graph-10). Non-significant differences were observed for the treatment with regards to force used for cutting

strength of dhokla. It was observed that the resistance to cutting offered by dhokla was maximum for JG 218 (table 4 and graph-5) however, the least resistance to cutting strength was exhibited by the dhokla of Local chickpea (table 4 and graph-3).

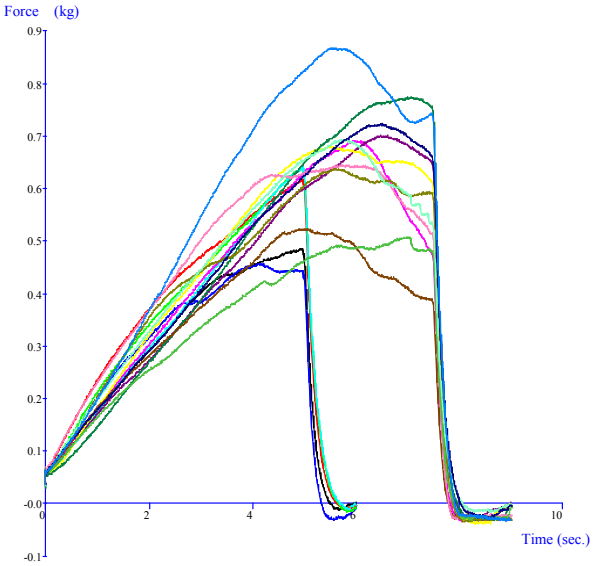
Fig 1: Different probes used for texture analysis of Dhokla product

Fig.1 Setup for sponginess test

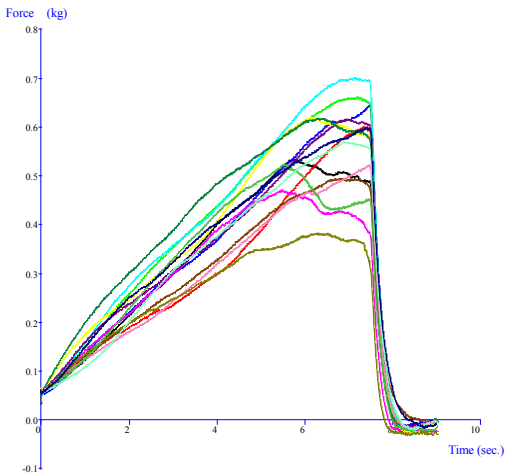
Fig.2 Setup for cutting test



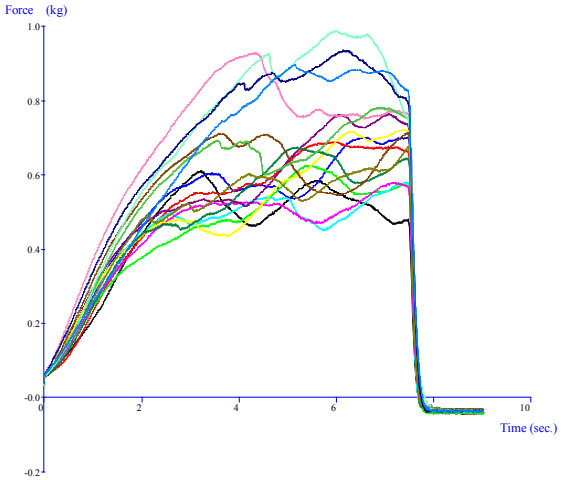
GRAPH.3:DHOKLA CUTTING STRENGTH (LOCAL CHICKPEA)



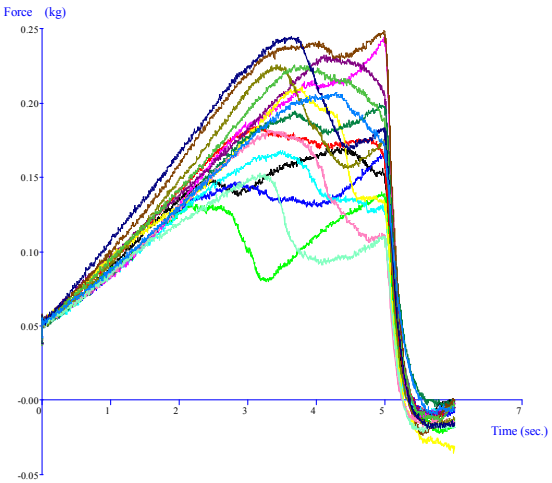
GRAPH 4:**DHOKLA CUTTING STRENGTH (JG 16)**



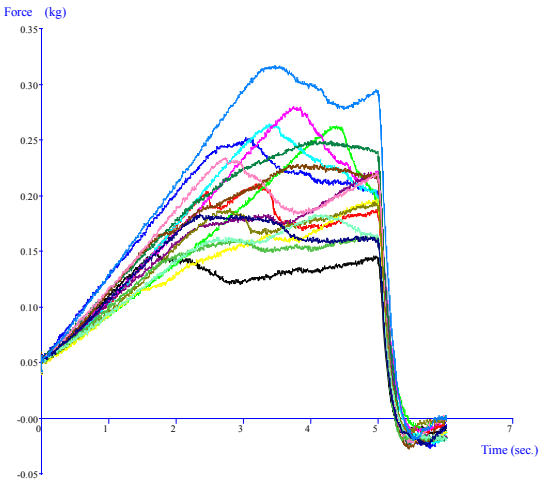
GRAPH 5: DHOKLA CUTTING STRENGTH (JG 218)



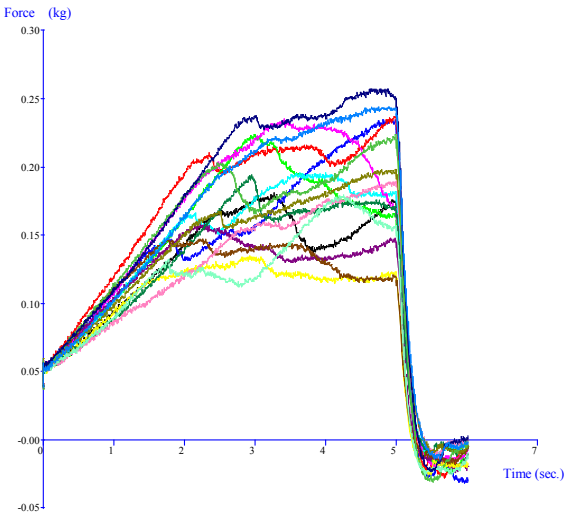
GRAPH 6::DHOKLA CUTTING STRENGTH (JG 63)



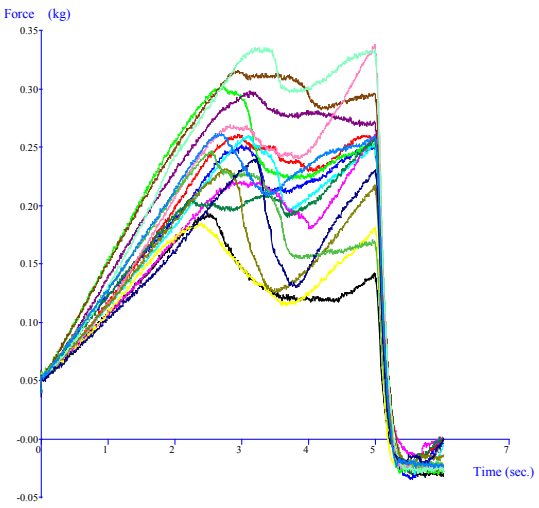
GRAPH 7: DHOKLA SPONGINESS (LOCAL CHICKPEA)



GRAPH 8:DHOKLA SPONGINESS (JG 16)



GRAPH 9: DHOKLA SPONGINESS (JG 218)



GRAPH 10:DHOKLA SPONGINESS (JG 63)

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