

# Standardization, chemical characterization and storage studies on *Metkut*, a pulse based Indian traditional food adjunct

RENU KHEDKAR, PRATIMA SHASTRI AND AMARINDER SINGH BAWA

*Metkut*, a dry chutney powder is an adjunct in the Maharashtrian (a western region of India) cuisine. The formulation and process parameters of *metkut* were standardized with bengal gram (50%), dehulled black gram (24%), rice (12.5%), spice mix (11.5%) and turmeric powder (2%) with the roasting temperature of 150°C. The product was found to be rich in protein (20.42%) and carbohydrates (67.86 %). The net dietary protein calorie per cent (NDPCal %) was 10.06 per cent indicating the product's use as a protein supplement in the diet. The critical moisture content for *metkut* was found to be 12.45 per cent which equilibrated at 70 per cent RH. Storage studies conducted in PE and PET/metallized polyester/polythene pouches at ambient temperature (15-35°C) conditions for 90 days showed that there was significant decline in sensory quality of the product packaged in PE whereas the quality of the product packaged in PET/metallized polyester/polythene pouches was acceptable even after the end of the storage period.

**Key Words :** Food adjunct, Critical moisture content, Storage studies, Sensory quality, Colour analysis

**How to cite this article :** Khedkar, Renu, Shastri, Pratima and Bawa, Amarinder Singh (2016). Standardization, chemical characterization and storage studies on *Metkut*, a pulse based Indian traditional food adjunct. *Food Sci. Res. J.*, 7(1): 105-111.

## INTRODUCTION

Developing world faces a serious problem of protein-calorie malnutrition (FAO, 1985). Plant proteins account for nearly 80 per cent of the proteins in developing world. In Asian countries, the major source of plant proteins is legumes. In Indian diet, they are the only economical source of protein. India leads the list of nations in the production of legumes and is also a leading

producer of cereals (Global and regional trends in production, trade and consumption of food legume crops, 2011). Legumes in combination of cereals can play a great role in the eradication of protein calorie malnutrition. Legumes are classified into pulses and oilseeds. Major pulses are bengal gram, green gram, black gram, red gram and lentils. Pulses may be used as whole, dehusked, or split, or processed into flour. Indian cuisine includes pulses that are fried, roasted, germinated or boiled with spices and herbs for making fermented breads, soups, chutneys, snacks, purees, and sweets (Srinivasan, 2010).

Pulses have been used as a part of staple diet as well as an adjunct in the Indian cuisine. The traditional Indian food adjuncts made from pulses include *wadis* (dried balls), *papad* (flat, thin dried roll), *dry chutney*

### MEMBERS OF RESEARCH FORUM

**Author for correspondence :**

**RENU KHEDKAR**, Amity Institute of Food Technology, AUUP, NOIDA (U.P.) INDIA  
Email : [rdkhedkar@amity.edu](mailto:rdkhedkar@amity.edu)

**Associate Authors' :**

**PRATIMA SHASTRI**, Department of Food Technology, LIT, NAGPUR (M.S.) INDIA  
**AMARINDER SINGH BAWA**, Amity Institute of Food Technology, A.U.U.P., NOIDA (U.P.) INDIA

powders, wet chutneys with herbs, *pakor*s (ground and fried snack), etc. Except for papad, in which the process is mechanized, all other adjuncts are made at a household / cottage level by women. The products are either branded or non-branded and are sold either at nearby grocery shop or through door to door service. The recipe of the products varies from one to another and the packaging is poor. The quality parameters for the products are neither standardized nor documented and monitored by regulatory authorities (Shastri, 2006).

*Metkut*, a dry chutney powder is an adjunct in the Maharashtrian (a western region of India) cuisine. It is made with split bengal gram, black gram, rice, and spices including asafoetida, mustard seeds, etc. All the ingredients are roasted and ground. It has a distinctive aroma, smooth texture and spicy taste. It is relished with hot rice and ghee or as raita (mixture of curd, salt and a pinch of sugar). It is healthy and easy to digest. It is generally given when sick with stomach upset (Metkut, 2013).

#### Nutritional importance :

Bengal gram (*Cicer arietinum* L.), also called as Chickpea, Gram or Chana dal in Hindi is a major pulse crop in India. It accounts for nearly 49 per cent of the pulse production in India. India is the largest producer of this crop. It is widely used as a health food supplement protein for the cereal-based diet in India. Bengal gram has higher protein bioavailability as compared to other pulses (Yust *et al.*, 2003 and Sanchez-Vioque *et al.*, 1999). It is shown to impart physiological benefits by reducing the risk of cardiovascular disease (CVD) (Duranti, 2006), coronary heart disease (CHD) (Pittaway *et al.*, 2007), diabetes (Pittaway *et al.*, 2007 and Kendall *et al.*, 2009) cancer (Gaur *et al.*, 2012) and help in weight loss as well as gut health improvement. Legumes are also an important source of antioxidants (Amarowicz and Pegg, 2008). Rice (*Oryza sativa* L.) is one of the oldest cultivated crops and forms a major part of the staple food of population living in the southern and eastern Asia. India is the second largest producer of rice in world, producing 106.65 million tonnes in 2013-14 (Annual report, 2015). Rice is low in fat, high in starchy carbohydrates. It is an excellent source of vitamin E, thiamin, niacin and minerals like potassium.

Asafoetida is a spice and has been used as a folk medicine for centuries. It has been used in the treatment

of diseases like stomach ache, epilepsy, asthma, indigestion, intestinal worms etc. (Takeoka, 2001; Evans, 2002; Zargari, 1996 and Lee *et al.*, 2009). Mustard seed is an annual herb cultivated as oil seed crop or as vegetable. Mustard seeds contribute the pungent taste and are used in traditional remedies as laxative, expectorant, appetizer and antiseptic (Bhattacharya *et al.*, 1999 and Cuhra *et al.*, 2011). Roasting is a simple, commonly used technique used for pre-cooking of ingredients in food grains and oilseeds based mixes, increases the shelf life and acceptability of foods (Gopaldas *et al.*, 1975). It improves the flavour, nutritional value and texture of foods (Siegal and Fawcett, 1976).

In the present study, *metkut* formulation was standardized. Its nutritional characteristics and sensory quality during storage in different packaging materials were also evaluated.

## METHODOLOGY

Major ingredients used in the preparation of *metkut* were pulses like split Bengal gram (*Cicer arietinum*), split, dehulled black gram (*Phaseolus mungo* Roxb.) and rice (*Oryza sativa*) whereas the minor ingredients were spices such as cumin seeds (*Cuminum cyminum*), asafoetida (*Ferula assafoetida*), fenugreek seeds (*Trigonella foenum-graecum*), coriander seeds (*Coriandrum sativum*), black pepper (*Piper nigrum*), red chili powder (*Capsicum annum*), dry ginger powder (*Zingiber officinale* Roscoe), mustard seeds (*Brassica juncea* L.) and turmeric powder (*Curcuma longa*). All ingredients were bought from the local market at Noida, India and were cleaned of any dirt or impurities.

#### Preparation of *metkut* :

A spice mix was prepared by weighing the spices and roasting of cumin seeds, fenugreek seeds, coriander seeds, mustard seeds and black pepper, blending with asafoetida, red chili powder and dry ginger powder in a mixer grinder (Inalsa, India) and sieving it through BS30 mesh. Bengal gram, black gram and rice were also roasted on a slow flame at 150°C till brownish colour and the roasted aroma developed. The roasted pulses and rice were ground into a fine powder in the mixer grinder, mixed with spice mix and turmeric powder and made to pass through a BS 30 (500µ) sieve to yield a uniform size, smooth, free flowing powder. The spice mix recipe

was standardized keeping the levels of major ingredients, bengal gram (50%), black gram (24%) and rice (12.5%) constant. The composition of spice mix and that of turmeric powder was kept constant at 11.5 per cent and 2 per cent, respectively. The spice mix was standardized through various trials conducted using the different levels of mustard seeds (26-40%), asafoetida (10-18%), cumin seeds (15-18%), coriander seeds (10-18%), dry ginger powder (6- 11%), black pepper (0-6%), red chili powder (3- 15%) and fenugreek seeds (0- 2%). Major ingredients in the *metkut* recipe were optimized by using three different combinations of bengal gram, black gram and rice (50:24: 12.5, 24: 50: 12.5 and 50: 12.5: 24), respectively. The formulation of *metkut* was standardized after conducting sensory evaluation on the various trials. Sensory evaluation was conducted by a semi-trained panel consisting of 10 judges using 9- point hedonic scale where 1= dislike extremely and 9= like extremely (Amerine *et al.*, 1965). A curd raita made with 10 per cent *metkut* powder and 1 per cent salt was served to the panelists for conducting sensory quality w.r.t. colour, appearance, flavour, texture, taste and overall acceptance. The panelists were earlier made to acquaint with the product from the market.

#### Proximate analysis :

The standardized samples of *metkut* were analyzed in triplicate for proximate composition. Moisture, crude fat, total protein, crude fibre and ash contents were estimated using standard methods (Ranganna, 2001). Carbohydrates were estimated by the difference method. Calcium was estimated by gravimetry while iron by spectroscopy using a Systronics model 2202UV-visible double beam spectrophotometer. Energy values were calculated by the standard method of summing up the values obtained and multiplying the quantity of carbohydrate and protein per 100g by 4 kcal and that of fat per 100g by 9 kcal, respectively. The protein value of *metkut* expressed as net dietary protein calorie per cent (NDPCal %) was determined (Platt *et al.*, 1961).

#### Sorption studies :

Moisture sorption studies were conducted on the standardized samples of *metkut* by keeping 5 g each of the sample in separate desiccator maintained at relative humidities of 10 per cent RH, 20 per cent RH, 30 per cent RH, 40 per cent RH, 50 per cent RH, 60 per cent

RH, 70 per cent RH, 80 per cent RH and 90 per cent RH, using varying normality sulphuric acid solutions (Landrock and Proctor, 1951) at 25°C. Sample weights were noted at regular intervals till there was no further loss or gain in weight. Adverse changes like lump formation, discoloration and mold growth were also noted from time to time. Critical and equilibrium moisture contents were determined from the sorption isotherm.

#### Storage studies :

*Metkut* samples (25g each) were packaged in PE (50µ) and PET/metallized polyester/polythene (10µ/10µ/37.5µ) laminate pouches (MPE) (10 cm x 10 cm). The packaged samples were kept under ambient temperature (15-35°C) conditions for a period of 90 days. The samples were drawn at an interval of 15 days and evaluated for the sensory quality in comparison with a freshly prepared sample.

#### Statistical analysis :

The data were expressed as mean ± S.D. Statistical analysis was carried out with SPSS version 21.0 using one-way ANOVA followed by Tukey's post hoc test for significance ( $P \leq 0.05$ ).

### OBSERVATIONS AND ASSESSMENT

The composition of the selected spice mix is given in Table 1. Other samples of spice mix were discarded due to low sensory scores. The sensory scores for the selection of major ingredients are given in Table 2. In the selection of composition of major ingredients, out of the three combinations, sample A scored over sample B and C in the sensory evaluation. The hedonic scores of sample A were significantly ( $P \leq 0.05$ ) different from those of the samples B and C for colour, appearance, flavour, taste and overall acceptance. There was no significant ( $P \geq 0.05$ ) difference in texture between the three samples.

**Table 1 : Composition of spice mix**

Sr. No.	Name of spice	Composition (%)
1.	Mustard seeds	39.5
2.	Cumin seeds	17.1
3.	Asafoetida	17.1
4.	Coriander seeds	11.8
5.	Dry ginger powder	6.6
6.	Black pepper	3.3
7.	Red chili powder	3.3
8.	Fenugreek seeds	1.3

**Table 2 : Sensory scores for selection of major ingredients in metkut (n=10)**

Parameters	Scores		
	Sample A	Sample B	Sample C
Colour	8.5 ± 0.71	7.5 ± 0.85	7.7 ± 0.95
Appearance	8.7±0.48	7.7 ± 0.95	7.8 ± 0.92
Flavour	8.8 ±0.42	7.5 ± 0.71	7.7 ± 0.82
Texture	8.5 ± 0.71	8.3 ± 0.67	8.1 ± 0.74
Taste	8.7 ± 0.67	7.5 ± 0.71	7.7 ± 0.82
Overall acceptance	8.6 ± 0.70	7.8 ± 0.79	7.6 ± 0.70
Remarks	Free flowing, bright yellow in colour, good aroma	Free flowing and smooth texture, pale yellow in colour, less aroma	Free flowing, pale yellow in colour, less aroma

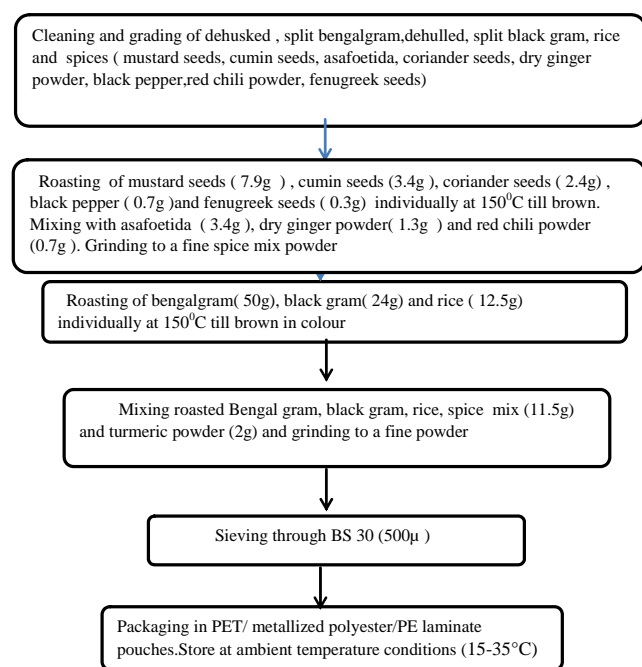
Values are mean ±S.D.

Sample A: Bengal gram (50%)+ Black gram (24%) + rice (12.5%) + Spice mix (11.5%)+ turmeric powder (2%)

Sample B: Bengal gram (24%) + Black gram (50%) + rice (12.5%) + Spice mix (11.5%) + turmeric powder (2%)

Sample C: Bengal gram (50%) + Black gram (12.5%) + rice (24%) + Spice mix (11.5%) + turmeric powder (2%)

Sample A with Bengal gram ( 50%), Black gram (24%), rice (12.5%), spice mix (11.5%) and turmeric powder (2%) had the characteristic colour, smooth texture and strong spicy flavour. The standardized process flowsheet for the manufacturing of *metkut* has been presented in Fig.1.



**Fig. 1 : Flow sheet for preparation of standardized metkut**

**Proximate composition :**

The proximate composition for *metkut* has been given in Table 3. The product had a low moisture content of 4.12 per cent. It can be seen that the product is rich in protein (20.24%) and carbohydrates (67.86%). The crude

fat content was found to be 5.26 per cent, crude fibre 0.13 per cent, total ash 2.52 per cent and energy value 399.74 kcal. The mineral content in *metkut* was calcium 10.6mg/100g and iron 8.35mg/100g. The protein value of *metkut* expressed as Net dietary protein calorie per cent (NDPCal %) was found to be 10.06 per cent, where chemical score (CS) was 49.67 with tryptophan as the limiting protein.

**Table 3 : Proximate and mineral composition of metkut (per 100g)**

Sr. No.	Parameter (g)	Metkut
1.	Moisture	4.12 ± 0.21
2.	Protein (%N x 6.25)	20.24 ± 0.98
3.	Crude fat	5.26 ± 0.23
4.	Crude fibre	0.13 ± 0.04
5.	Total Ash	2.52 ± 1.25
6.	Carbohydrates( by difference)	67.86 ± 0.61
7.	Energy value,kcal	399.74 ± 4.07
8.	Calcium, mg/100g	10.60 ± 1.48
9.	Iron, mg/100g	8.35 ± 1.18
10.	NDPCal %	10.06

Values are average of triplicate analyses ±S.D. and are expressed on sample basis

**Moisture sorption isotherm:**

Moisture sorption isotherm for *Metkut* is presented in Fig.2. Initial moisture content of metkut was 4.12 per cent which equilibrated at 42 per cent RH. The critical moisture content for *metkut* was found to be 12.45 per cent which equilibrated at 70 per cent RH. The product gained moisture quickly above 75 per cent RH, indicating the product to be non- hygroscopic in nature.

**Storage studies :**

It was observed that a quantity of 2g *metkut* added

Parameters/storage period (days)	PET/Met.poly/PE (n=10)													
	0	15	30	45	60	75	90	0	15	30	45	60	75	90
Colour	8.7±0.48 <sup>a</sup>	8.6±0.7 <sup>a</sup>	8.5±0.85 <sup>a</sup>	8.2±0.79 <sup>a</sup>	7.8±0.42 <sup>a</sup>	7.2±0.79 <sup>b</sup>	5.6±0.84 <sup>c</sup>	8.7±0.48 <sup>a</sup>	8.7±0.48 <sup>a</sup>	8.6±0.52 <sup>a</sup>	8.5±0.53 <sup>a</sup>	8.3±0.67 <sup>a</sup>	8.2±0.63 <sup>a</sup>	8.1±0.57 <sup>a</sup>
Appearance	8.9±0.32 <sup>a</sup>	8.8±0.42 <sup>a</sup>	8.5±0.53 <sup>a</sup>	8.3±0.66 <sup>a</sup>	7.9±0.74 <sup>a</sup>	7.4±0.84 <sup>b</sup>	6.8±0.79 <sup>b</sup>	8.9±0.32 <sup>a</sup>	8.9±0.32 <sup>a</sup>	8.8±0.42 <sup>a</sup>	8.7±0.48 <sup>a</sup>	8.7±0.48 <sup>a</sup>	8.7±0.48 <sup>a</sup>	8.5±0.53 <sup>a</sup>
Flavour	8.9±0.32 <sup>a</sup>	8.7±0.48 <sup>a</sup>	8.6±0.52 <sup>a</sup>	7.8±0.63 <sup>b</sup>	7.2±0.63 <sup>b</sup>	6.6±0.52 <sup>b</sup>	5.3±0.48 <sup>b</sup>	8.9±0.32 <sup>a</sup>	8.9±0.32 <sup>a</sup>	8.6±0.52 <sup>a</sup>	8.5±0.53 <sup>a</sup>	8.4±0.52 <sup>a</sup>	8.3±0.48 <sup>a</sup>	8.3±0.48 <sup>a</sup>
Texture	8.9±0.32 <sup>a</sup>	8.7±0.48 <sup>a</sup>	8.5±0.71 <sup>a</sup>	8.1±0.74 <sup>a</sup>	7.7±0.66 <sup>a</sup>	7.3±0.66 <sup>a</sup>	6.8±0.92 <sup>b</sup>	8.8±0.42 <sup>a</sup>	8.8±0.42 <sup>a</sup>	8.6±0.52 <sup>a</sup>	8.5±0.53 <sup>a</sup>	8.5±0.53 <sup>a</sup>	8.4±0.52 <sup>a</sup>	8.2±0.42 <sup>a</sup>
Taste	8.9±0.32 <sup>a</sup>	8.7±0.48 <sup>a</sup>	8.6±0.70 <sup>a</sup>	8.3±0.66 <sup>a</sup>	7.6±0.84 <sup>b</sup>	7±0.67 <sup>b</sup>	5.9±0.74 <sup>c</sup>	8.8±0.42 <sup>a</sup>	8.7±0.48 <sup>a</sup>	8.5±0.53 <sup>a</sup>	8.4±0.52 <sup>a</sup>	8.4±0.52 <sup>a</sup>	8.3±0.48 <sup>a</sup>	8.3±0.48 <sup>a</sup>
Overall acceptance	8.9±0.32 <sup>a</sup>	8.8±0.42 <sup>a</sup>	8.5±0.53 <sup>a</sup>	8.3±0.66 <sup>a</sup>	7.8±0.79 <sup>a</sup>	7.1±0.57 <sup>b</sup>	5.8±0.63 <sup>c</sup>	8.9±0.32 <sup>a</sup>	8.8±0.42 <sup>a</sup>	8.7±0.48 <sup>a</sup>	8.5±0.53 <sup>a</sup>	8.4±0.52 <sup>a</sup>	8.4±0.52 <sup>a</sup>	8.4±0.52 <sup>a</sup>
Remarks	Good colour, strong flavour, smooth texture	Good colour, strong flavour, smooth texture	Good colour, good flavour, smooth texture	Good colour, slight less flavour, smooth texture	Good colour, slight loss of flavour, smooth texture	Colour slightly darkened, loss of flavour, smooth texture	Colour darkened, high flavour loss, lumpy texture	Very good colour, flavour, texture	Very good colour, flavour, texture	Very good colour, flavour, texture	Very good colour, flavour, texture	Very good colour, flavour, texture	Very good colour, flavour, texture	Very good colour, flavour, texture

Similar superscripts indicate non-significant difference at  $P > 0.05$ ; Values are mean  $\pm$  S.D.

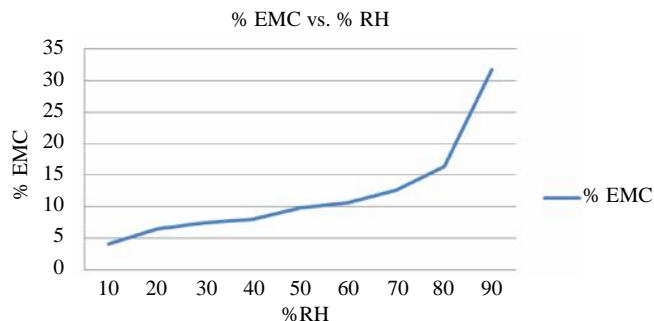


Fig. 2 : Moisture sorption isotherm for *Metkut* using sulphuric acid solutions of various RH

to 20g curd and 0.2g salt was optimum for sensory evaluation. The sensory scores of *metkut* packed in PE and PET/Met.poly/PE for the storage at ambient temperature conditions are presented in Table 4. The overall acceptance scores for product packed in PE ranged from 8.9 (excellent) to 5.8 (not like not dislike) whereas the score for product packed in PET/Met.poly/PE ranged from 8.9 (excellent) to 8.4 (very good). The products packed in PE showed significant changes in the sensory scores of all parameters at the end of 90 days whereas the product packed in PET/Met. Poly/PE did not show any significant difference in the sensory scores during the storage period. Rao *et al.* (2004) evaluated the metallized polyester packaging for curry leaf chutney powder and Satyanarayana *et al.* (2013) studied the metallized polyester /PE packaging for flaxseed chutney powder and found the packaging suitable for storage up to 6 months.

### Conclusion :

The recipe of *Metkut* was standardized using roasted Bengal gram (50%), black gram (24%), rice (12.5%), spice mix (11.5%) and turmeric powder (2%). The product when packaged in PET/Met. Poly/PE laminated pouches retained overall acceptance for 90 days. *Metkut* is rich in protein, carbohydrates with considerable amounts of minerals and vitamins and is used as a functional food adjunct. Protein digestibility of the product is also improved by the addition of spices like asafoetida and mustard seeds which help in the digestion. Many a times, traditional foods, in spite of demand, lose ground due to poor packaging and appearance. Product and process standardization along with suitable packaging can ensure quality assurance and attract global consumers. It can revive the traditional food sector,

generate employment for the local people and keep the product technology for coming generations.

### LITERATURE CITED

- Amarowicz, R. and Pegg, R.B. (2008).** Legumes as a source of natural antioxidants, *Eur. J. Lipid Sci. Tech.*, **110** (10) : 865-878
- Amerine, M.A., Pangborn, R.M. and Roessler, E.B.(1965).** *Principles of Sensory Evaluation of Food*, Academic Press, New York.
- Bhattacharya, S., Vasudhaand, N. and Murthy, K.S.K. (1999).** Rheology of mustard paste: a controlled stress measurement. *J. Food Eng.*, **41**: 187-191
- Cuhra, P., Gabrovska, D., Rysova, J., Hanak, P. and Stumr, F. (2011).** ELISA Kit for mustard protein determination: Interlaboratory study. *J. AOAC Internat.*, **94**(2): 605-610
- Duranti, M. (2006),** Grain legume proteins and nutraceutical properties, *Fitoterapia*, **77** : 67-82
- Evans, W.C. (2002).** Volatile oils and resins, Trease and Evans Pharmacognosy, fifteenth edition, W.B. Saunders, London, 286
- FAO (1985). The state of Food and Agriculture, Rome, 103
- Gaur, P.M., Jukanti, A.K., Gauda, C.L.L. and Chibbar, R.N. (2012).** Nutritional quality and health benefits of chickpea (*Cicer arietinum* L.) : A review, *Brit. J. Nutr.*, **108** : S1, S11-S26
- Gopaldas, Srinivas T.N., Varadrajana, I., Shingwekar, A.G., Seth R., Mathur, R.S. and Bhargava, V. (1975).** Project Poshak, vol.1, CARE-India, New Delhi 157-180
- Kendall, C.W.C., Sievenpiper, J.L., Esafahani, A., Wong, J.M.W., Carleton, A.J., Jiang, H.Y., Bazinet, R.P., Vidgen, E. and Jenkins, D.J.A. (2009).** Effect of non-oil-seed pulses on glycaemic control: a systematic review and meta-analysis of randomized controlled experimental trial in people with and without diabetes. *Diabetologia*, **52** : 1479-1495.
- Landrock, A.H. and Proctor, B.E. (1951).** Measuring humidity equilibria. *Mod. Packag.*, **24** (6) : 123
- Lee, C.L., Chiang, L.C., Cheng, L.H., Liaw, C.C., Abd El-Razek, M.H., Chang, F.R. and Wu, Y.C. (2009).** Influenza (H<sub>1</sub>N<sub>1</sub>) antiviral and cytotoxic agents from *Ferula assafoetida*. *J. Nat. Prod.*, **72** : 1568-1572.
- Pittaway, J.K., Ahuja, K.D.K., Robertson, I.K. and Ball, M.J. (2007).** Effects of a controlled diet supplemented with chickpeas on serum lipids, glucose tolerance, satiety and bowel function. *J. Am. Coll. Nutr.*, **26** (4) : 334-340.
- Platt, B.S., Miller, D.S. and Painne, P.R. (1961).** In: Recent Advances In Clinical Nutrition, Edited by Brock JF, London: J& A Churchill Ltd., 351
- Ranganna, S. (2001).** *Handbook of analysis and quality control for fruit and vegetable products*, 2<sup>nd</sup> Ed., Tata-McGraw Hill
- Rao, D.G., Jyothirmayi, T. and Balaswamy, K. (2004).** Studies on preparation of curryleaf (*Murraya koenigii* L.) chutney powder. *Food Service Res. Int.* , **14** : 175-187.
- Sanchez-Vioque, R., Clemente, A., Vioque, J., Bautistab, J. and Millána, F. (1999).** Protein isolates from chickpea (*Cicer arietinum* L.): Chemical composition, functional properties and chemical characterization. *Food Chem.*, **64** : 237-243.
- Satyanarayana, A., Balaswamy, K., Mala, K.S., Rao, G.N. and Rao, P.P.(2013).** Preparation and storage stability of flaxseed chutney powder, a functional food adjunct. *J. Food Sci. & Tech.*, **50**(1): 129-134.
- Shastri, P.N. (2006).** Changing face of traditional food adjuncts. *Indian Food Industry*, **25**(6) : 73-77.
- Siegal, A. and Fawcett, B. (1976).** Food legumes and processing and utilization (with special emphasis on application in developing countries), Agriculture, food and nutrition science division, 1<sup>st</sup> edition, International development research centre, Ottawa, Canada, 16-24
- Srinivasan, K. (2010).** *Functional foods of the east* edited by Shi J., Tang Ho C. and Shahidi F, CRC Press, Boca Raton, 55
- Takeoka, G. (2001).** Volatile constituents of asafetida. In Takeoka, GR; Guntert, M; Engel, KH( edn.). Aroma active compounds in foods. American Chemical Society, Washington , DC, 33-44
- Yust, M.M., Pedroche, J. and Giron-Calle, J. (2003).** Production of ace inhibitory peptides by digestion of chickpea leguminwith alcalase. *J. Food Chem.*, **81** : 363-369
- Zargari, A. (1996).** Medicinal plants, sixth edition, Tehran University, Tehran

### WEBLIOGRAPHY

- Annual report, DoAC, GoI.(2015). Available online at <http://agricoop.nic.in/Annualreport2014-15/EnglishAR2732015.pdf> (accessed on 18<sup>th</sup> Sept., 2015)
- Global and regional trends in production, trade and consumption of food legume crops, 2011. Available online

at <http://impact.cgiar.org/sites/default/files/images/Legumetrends.pdf> (accessed on 2<sup>nd</sup> Jan., 2016)

Metkut(Maharashtrian magic powder) .(2013). Available online at <http://purvasfoodfunda.blogspot.in/2013/02/mekut-maharastrian-magic-powder.html> (accessed on 15<sup>th</sup> June,

2015)

Rice: Nutritional profile and GI implications. Available online at [www.riceassociation.org.uk/.../Nutritional%20Benefits%20of%20Rice.pdf](http://www.riceassociation.org.uk/.../Nutritional%20Benefits%20of%20Rice.pdf)(accessed on 28<sup>th</sup> Nov., 2015)

**Received :** 24.02.2016; **Revised:** 07.03.2016; **Accepted :** 22.03.2016