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Short communication

A review on nutritional composition of product, storability of developed products, and effect of storage on fat acidity/free fatty acid of products from chickpea and other leaves

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Abstract
Chickpea is an important pulse crop with a diverse array of potential nutritional and health benefits. Chickpea can be utilized to develop nutritious value added products and hence products can also be used as nutritious food for low income group in developing countries and for patients suffering with life style diseases. Chickpea (*Cicer arietinum* L.), also called garbanzo bean or Bengal gram, is an Old World pulse and one of the seven Neolithic founder crops in the Fertile Crescent of the Near East. Scientist reported that the changes in moisture, peroxide value (PV) and Free Fatty Acid (FFA) for *mathi* prepared in *vanaspati* and refined cottonseed oil. There was no significant change in the moisture content during storage for five months. Another scientist reported, during their study on addition of natural resins obtained from amla, drum stick leaves and raisins, that addition of plant extracts from the three plant foods gave an excellent antioxidant effect on the biscuit compared with the effect of butylated hydroxyl anisole (BHA). Extracts from drumstick leaves and amla were more effective in controlling lipid oxidation during storage.

Keywords: *Cicer arietinum* L, nutritious**,** leaves, plant extracts

Introduction

Nutritional composition of products from chickpea and other leaves

Chickpea is a good source of carbohydrates and proteins, which together constitute about 80% of the total dry seed mass. The starch content of chickpea cultivars have been reported to vary from 41% to 50%. The kabuli type contains more soluble sugars**.** Chickpea can be utilized to develop nutritious value added products and hence products can also be used as nutritious food for low income group in developing countries and for patients suffering with life style diseases. Chickpea (*Cicer arietinum* L.), also called garbanzo bean or Bengal gram, is an Old World pulse and one of the seven Neolithic founder crops in the Fertile Crescent of the Near East.

Vijayalakshmi and Devdas (1994) [14] carried out a study on enhancing the nutritive value of convenience foods by incorporating green leafy vegetables. It was concluded from the study that addition of coriander and curry leaves in *vadai* mix and *bhaji* mix increased the nutritive value of convenience -carotene, calcium and iron. The protein content before adding greens were 16 g in *vadai* mix and 16 g in *bhaji* mix which increased to 12 g and 12.9 mg (*vadai* mix) and 12 g, 8.9 mg in *bhaji* mix. They also reported that the β - carotene content before adding greens were 0.0 µg, in *vadai* mix and 0 µg in mix which increased to 2171 µg, (*vadai* mix) and 2170 µg in *bhaji* mix. The iron contents before adding greens were 13 mg in *vadai* mix and 7 mg in mix which increased to 12.9 mg (*vadai* mix) 8.9 mg in *bhaji* mix. The calcium content before adding greens were 42 mg in *vadai* mix and 50 mg in mix which increased to 181 mg (*vadai* mix) and 187 mg in *bhaj i*mix.

Kaveri *et al.* (2004) [8] incorporated fresh (15.0 and 20.0%) and dehydrated (5.0 to 10.0%) shepu (*Peucedanum graveolens*) and kilkeerae (*Amaranthus tricolor*) in wheat based papads. The fired papads were subjected to sensory analysis by a panel of 100 members. The study results inferred the suitability of *papads* incorporated with green in terms of and nutritional quality.

Negi and Roy (2001) [10] studied the retention of quality characteristics of dehydrated leaves (*viz.*, savoy beets and fenugreek) during storage. The leaves were dehydrated in low temperature drier and stored for nine months under ambient conditions after packaging in a single or double layers of HDPE (200) gauge and result showed that the double packed and cold stored samples of fenugreek retained only 57.0 per cent of initial β-carotene under similar conditions. Similarly, the higher retention of ascorbic acid and chlorophyll was observed in double packed cold stored samples.

Nalwade *et al.* (2002) [9] found that the moisture content varied from 80.86 g in chickpea leaves curry to 90.75 g/100 g in spinach curry. Ankita and Prasad (2013) [1] found in spinach that the increase in dehydration temperature from 50 to 80 ^{0}C led to the dehydrated powders having lesser moisture content, which was reduced from 4.86 to 1.71 per cent in case of untreated leaves and 5.89 to 2.92 per cent in case of blanched spinach leaf samples.

Sigmond *et al.* (2010) [12] reported that the nutrient composition of dried broccoli leaf powder to be 2.84 per cent moisture 22.43 per cent crude protein and 12.6 g of dietary fibre.

Ankita and Prasad (2013) [1] found that reduction of moisture content to a lower level makes the product shelf stable over an extended period of time. Also, it endow with several benefits of substantial weight reduction and reduction in volume, minimizing the packaging cost with storage and transportation costs (Doymaz, 2004, 2007) [4, 5]. Preservation in lean seasons at remunerative prices could provide additional benefits of round the year availability of this important leafy vegetable.

Karmakar *et al.* (2013) [7] found that the iron content of the leafy vegetables varies from 11.78 to 78.24 mg /100 g of dry vegetable powder sample. It is found to be highest (78.24 mg /100 g) in slender carpet weed leaves and lowest (11.78 mg /100 g) in goose foot leaves.

Nutritional analysis shows that protein and iron content of dried vegetables *mathri* i.e. 7.44 g and 5.37 mg was higher as compared to fresh vegetables *matrhi.*

Singh and Grover (2014) [13] reported that the total iron content of dehydrated chickpea leaves under investigation was found to be 111.83 mg / 100 g. The total, soluble and ionizable iron cooked of all accepted value added in products. *Chappatti* had higher content of total iron (14.797 g/787 mg) supplemented with dehydrated chickpea green leaves than *Poori* (1287 mg / 100 g) and *Paratha* during cooling during cooking. Soluble iron was also estimated to be the highest in *chapatti* (5.98 mg /100 g) using dehydrated chickpea leaves. The ionizable iron content of the value added products were higher than their control, which may be attributed by the fact that basic constituents of recipes was replaced by leaves powder having higher iron content than the basic constituents of recipe.

Dahiya (2004) [3] developed *wadi*, papad and noodles incorporated with spinach and fenugreek at 5 per cent level. All the supplemented products were found to be organolpetically acceptable to the human palate during the whole storage period which was up to five months.

The acceptability of *Paratha* was found to be decreased when the per cent level of dehydrated green leaves were increased. A significant difference in the score for sensory attributes i.e. colour; appearance, flavor, texture, taste and overall were observed in treatment as compared to control (Singh and Grover, 2014) [13].

Storability of developed products

Kalra *et al.* (1998) [6] reported that the changes in moisture, peroxide value (PV) and Free Fatty Acid (FFA) for *mathi* prepared in *vanaspati* and refined cottonseed oil. There was no significant change in the moisture content during storage for five months. It varied from 0.90 to 4.71 per cent among the samples of both types the rate of peroxidation was the highest in *mathi* prepared in refined cottonseed oil. After 5 months of storage, the peroxide value rose to as high as 227.2 meq O_2/kg of oil from its initial value of 19.25 meq O_2/kg of oil.

Effect of storage on fat acidity/free fatty acid of products

On the other hand, Kalra *et al.* (1998) [6] reported that the peroxide value of *mathi* prepared in *vanastapti* showed only a slight change from 5.73 to 6.07 meq O_2/kg of oil during 5 month storage. The free fatty acid content of *mathi* prepared in *vanaspati* had not shown any significant change during storage. However, free fatty acid of the product in refined cottonseed oil increased from 0.12 to 0.28 per cent (as oleic acid). The increase in FFA in *mathi* may be mainly from the degradation products of hydroperoxide (Thakur and Arya, 1990). Deteriorative changes in fried products during storage and exposure to atmosphere are loss of flavor, development of rancidity and softening of texture (Bhat *et al.* 1982) [2].

Reddy *et al.,* (2005) [11] reported, during their study on addition of natural resins obtained from amla, drum stick leaves and raisins, that addition of plant extracts from the three plant foods gave an excellent antioxidant effect on the biscuit compared with the effect of butylated hydroxyl anisole (BHA), as the per cent increase in acid values after 6 weeks were lower than that of the control and BHA treated samples. Extracts from drumstick leaves and amla were more effective in controlling lipid oxidation during storage.

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