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Research Paper

Effect of Incorporation of Drumstick Leaf and Jamun Seed Powder on Sensory Quality of Functional Chicken Chips

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ABSTRACT

Natural preservatives can replace the chemical preservatives and their toxic effects contributing health promoting benefits and thereby makes the food functional. This study was undertaken to select the suitable levels of incorporation of drumstick leaf powder (DLP) and Jamun seed powder (JSP) to functional chicken chips (FCC) which was standardized earlier. Different levels (1, 2 and 3%) of drumstick leaf powder (DLP) and (1, 2 and 3%) Jamun seed powders (JSP) were added to the FCC. Functional chicken chips containing 1% DLP and 1% JSP had scores of 6.47 and 6.40 for appearance; 6.47 and 6.37 for flavour; 6.23 and 6.13 for texture; 6.60 and 6.43 for crispiness; 6.53 and 6.27 for acceptance, respectively on 8 point hedonic scale. Sensory scores were significantly ($P<0.05$)higher for 1% DLP and 1% JSP product among treatments and the scores decreased as the level of incorporation of DLP and JSP increased. Hence, 1% DLP and 1% JSP were selected for the development of functional chicken chips (FCC) as a source of natural antioxidant and natural preservative with added health benefit.

Keywords : *Functional chicken chips, Drumstick leaf powder, Jamun seed powder, Sensory quality*

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INTRODUCTION

Growing awareness among consumers about diet and health has increased the interest on natural antioxidants. Use of natural antioxidants can replace the chemical preservatives and their toxic effects and contributes health promoting benefits thereby make the food functional. Natural antioxidants found in the plants and fruits have gained a considerable momentum for their role in preventing the auto-oxidation in fat rich foods (Reddy *et al*. 2005). Diet associated health problems like cardiovascular diseases, obesity, hypertension etc. can be controlled up to a certain level by consumption of functional snack foods instead of unhealthy junk foods as snacks (Aswathi *et al*. 2013).

Drumstick (*Moringa oleifera*) leaves are unique because they are reported to contain high amounts of minerals and lower amounts of harmful compounds. It is reported to be a potent source of natural antioxidants like ascorbic acid, alpha tocopherol and other flavonoids and carotenoids and thus enhancing the shelf life of fat containing foods (Gupta *et al*. 1989; Dillard and German, 2000). The presence of these substances in drumstick leaves reveals its importance as a functional dietary supplement (Makkar and Becker, 1996). Hazra *et al.* (2011) reported a significantly lower thiobarbituric acid value and total plate count in cooked ground buffalo meat treated with drumstick leaves extract (1.5%). The drumstick (*Moringa oleifera*) leaves extract at a level of 100 mg/100g meat was sufficient to protect goat meat patties against oxidative rancidity for periods longer than the most commonly used synthetic antioxidant like BHT without affecting any of sensory attributes of patties (Das *et al.* 2012). Biswas *et al*. (2014) reported that poultry meat wafer incorporated with 0.5% drumstick leaf powder had highest amount of beta carotene, alpha tocopherol and vitamin C at 0.086, 38.4, 5.4 mg/100g, respectively.

Seeds of Jamun (*Eugenia jambolana* Lam or *Syzygium cumini* Linn) showed presence of different constituents like saponins, tannins, phenolic compounds, amino acid, alkaloids, phytosterols, flavanoids and absence for anthraquinone (Murti *et al*. 2012; Modi *et al*. 2010; Kumar *et al*. 2009). Jamun seed possesses wide range of properties such as antimicrobial, antioxidant, cardio protective, anti cancer, anti-diarrheal and hypoglycaemic to mention a few (Stephen, 2012). The seeds are claimed to contain alkaloid, jambosine, and glycoside jambolin as antimellin which halt the diastatic conversion of starch into sugar (Swami *et al*. 2012). Both heat treated and untreated extract of Jamunseeds exhibited significant radical scavenging activity comparable to that of BHT, a synthetic antioxidant and heat treatment does not decrease its antioxidative property (Ahmed *et al*. 2010). Jamun fruit can be

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used as a significant source of natural antioxidant and can be used in food and nutraceutical supplement formulations (Zhang and Lin 2009; Shahnawaz *et al*. 2010).

Diabetic and heart patients are generally advised to avoid oily foods and junk foods, but they may be served healthy snack which will improve their health and satisfy their hunger at any time. It's very difficult to consume Jamun seed powder regularly due to its bitter taste.The reports on meat chips with functional ingredients and natural additives are very scanty. So this study was undertaken to prepare functional chicken chips by incorporating a suitable level of drumstick leaves powder and Jamun seed powder in the standardized recipe of functional chicken chips as a source of natural anti-oxidants and to study its sensory quality.

MATERIALS AND METHODS

Preparation of drumstick leaf powder (DLP): Fresh drumstick leaves were collected from the RIVER campus, Puducherry, washed thoroughly, dried under shade for 8 hours followed by drying in hot air oven at 50^0C for 2 hours. Then the dried leaves were ground mechanically using home mixer grinder and sieved through a fine mesh. The powdered leaves were stored in glass bottles and kept in refrigerator for further use.

Preparation of Jamun seed powder (JSP): Fresh Jamun fruits were collected from the trees near the LPT Department, RIVER, the seeds were separated and washed in potable water and air dried. Then the seeds were ground in home mixer and kept in hot air oven at the temperature of 60^0C overnight for proper drying. The dried powder was ground once more in home mixer grinder and sieved through a fine mesh. The Jamun seed powder were packed in food grade plastic container and kept in refrigerator for further use.

Incorporation of DLP and JSP in chicken chips: Drumstick leaf powder (DLP) at the level of 1, 2, 3 % and Jamun seed powder (JSP) at the level of 1, 2, 3 % were incorporated in thestandardized recipe (table 1) of functional chicken chipsduring the preparation of the batter in the bowl chopper (Kasthuri *et al*. 2017). Product prepared without the incorporation of DLP and JSP was used as control. Then the products were subjected to sensory evaluation. Based on the results of sensory evaluation the best level of inclusion of DLP and JSP was selected for the preparation of functional chicken chips with added health benefit and as a source of natural antioxidant.

Table 1: Standardized recipe of functional chicken chips

Ingredients	Meat
Per cent (%)	70.00
Chicken fat	5.00
Whole egg liquid	5.00
Green condiments	2.50
Rice flour	2.00
Dry spice	2.00
Salt	1.70
Sugar	1.00
Sodium bicarbonate	0.50
Alkaline phosphate	0.30
Flaxseed powder (FSP)	4.00
Oats powder (OP)	6.00
Total	100.00
Chilled water	10.00

Mincing deboned meat and fat
⇩
Placing minced meat in bowl chopper
⇩
Addition of salt, sugar, phosphate, sodium bicarbonate, chilled water
⇩
Addition of whole egg liquid, chicken fat, flaxseed powder and mixing
⇩
Addition of condiments, rice flour, oats powder, dry spices and mixing
⇩
Filling batter in stainless steel mould
⇩
Partial cooking (80^0C for 30 min)
⇩
Cooling, opening and slicing (3mm)
⇩
Processing in microwave to get chicken chips
⇩
Packaging and storage

Fig 1: Standardized procedure for preparation of functional chicken chips

Sensory evaluation: A semi-trained panel consisting of ten faculty and post-graduate students of RIVER were selected for sensory evaluation of the products. The panellists were explained about the nature of experiment without disclosing the identity of the samples. They were requested to record their preference on 8 point hedonic scale (8=extremely desirable, 1=extremely undesirable) (Keeton, 1983) for appearance, flavour, texture, crispiness and acceptability.

Statistical analysis: Each experiment was replicated thrice. The data were analyzed using SPSS version 16.0 MSI (SPSS, Chicago, U.S.). One way analysis of variance (ANOVA) was used for sensory attributes of chicken chips. The level of significant effects was tested using the least significant difference (LSD) test (Snedecor and Cochran, 1967).

RESULTS AND DISCUSSION

Effect of DLP on the sensory quality of functional chicken chips: The scores for appearance of the chicken chips incorporated with different levels of DLP were moderately desirable with the numerical score ranging between 5.57 to 6.47 (Table 2). Control sample had significantly ($P<0.05$) higher score than all the treatments. However, the appearance scores for the product with 1% DLP was significantly ($P<0.05$) higher when compared with 2% and 3% DLP treated products. There was no significant difference between 2% and 3% DLP incorporated product. This decrease in appearance score were probably due to the greenish colour of the DLP treated products at higher level of inclusion which were comparatively less preferred by the panelists. Najeeb *et al*. (2015) reported that appearance score was lower for the restructured chicken slices incorporated with 1% DLP when compared with BHT (200 ppm) treated samples. Biswas *et al*. (2014) reported that appearance score of poultry meat wafer was not affected by the incorporation of 0.5% DLP and no significant difference could be found between the control and 0.5% DLP containing product.

Table 2: Effect of incorporation of drumstick leaf powder (DLP) on the sensory

Parameters	Control	1% DLP	2% DLP	3% DLP
Appearance	7.17 ± 0.17^{c}	6.47 ± 0.16^{b}	5.97 ± 0.17^{a}	5.57 ± 0.15^{a}
Flavour	6.97 ± 0.16^{c}	6.47 ± 0.17^{b}	5.80 ± 0.15^{a}	5.40 ± 0.18^{a}
Texture	6.93 ± 0.14^{c}	6.23 ± 0.16^{b}	6.03 ± 0.15^{b}	5.60 ± 0.15^{a}
Crispiness	7.23 ± 0.16^{c}	6.60 ± 0.18^{b}	6.23 ± 0.21^{ab}	5.83 ± 0.21^{a}
Acceptability	7.20 ± 0.15^{d}	6.53 ± 0.13^{c}	6.00 ± 0.13^{b}	5.60 ± 0.13^{a}

Means with different superscripts in the same row-wise differ significantly ($P<0.05$)

The flavour scores of the FCC incorporated with different levels of DLP varied between slightly desirable to moderately desirable with the numerical score ranging between 5.40 to 6.47 for treated products and 6.97 for control product (Table 2). The flavour score for the product with 1% DLP was significantly ($P<0.05$) lower than control but significantly higher ($P<0.05$) when compared with 2% and 3% DLP containing products. There was no significant difference between 2% and 3% DLP incorporated products. This decrease in flavour scores was probably due to the undesirable flavour of DLP at higher level of inclusion which partially masked the meat flavour. Similarly, Najeeb *et al*. (2015) reported that restructured chicken slices with 1% DLP showed lowest flavour scores compared to other additives. However, Biswas *et al*. (2014) reported that flavour score of poultry meat wafer was not affected by incorporation of 0.5% DLP which might be due to lower level of DLP.

The texture (5.60 to 6.23) and crispiness (5.83 to 6.60) scores of the FCC incorporated with different levels of DLP were moderately desirable (Table 2) and followed the similar trends. The texture and crispiness scores were significantly ($P<0.05$) lower for 3% DLP containing product when compared to control and 1% and 2% DLP incorporated products. There was significant difference between control and treatment productsbut no significant difference between 1% and 2% DLP incorporated products was found. Texture of the product became harder as the level of DLP increased. Incorporation of DLP at increasing levels might have reduced the puffiness and expansion of the products. At the highest level of incorporation of DLP (3%), the product shrunk imparting the tough texture and a bit hard crispiness to the product. Biswas *et al*. (2014) reported that texture and crispiness scores of poultry meat wafer were not affected by the incorporation of 0.5% DLP and found no significant difference between the control and 0.5% DLP containing product.

The acceptability (5.60 to 6.53) scores of the FCC incorporated with different levels of DLP were moderately desirable (Table 2).There was significant (P<0.05) difference between control and all treatment products. The acceptability score was significantly (P<0.05) higher for 1% DLP incorporated FCC among the treatments, with gradual but significant (P<0.05) decrease in scores with increase in the levels of DLP incorporation.As the level of DLP increased the scores for all the sensory attributes decreased significantly (P<0.05) which might be the reason for the decrease in acceptability scores as the level of DLP increased. Similarly, Najeeb *et al*. (2015) reported that restructured chicken slices with drumstick leaf powder at 1% level had lower overall acceptability scores. Biswas *et al*. (2014) reported that acceptability score of poultry meat wafer was not affected due to incorporation of 0.5% DLP and no significant difference could be noted between the control and 0.5% DLP containing product.Sensory evaluation of FCC containing 1, 2, 3% drumstick leaf powder (DLP) showed that products containing 1% DLP were highly acceptable.

Effect of JSP on the sensory quality of functional chicken chips: The scores for appearance (5.90 to 6.40) of the FCC incorporated with different levels of JSP were moderately desirable compared to score (7.23) for the control sample (Table 3). The appearance scores for the product with 1% JSP was significantly higher when compared with 2%, 3% JSP incorporated products among the treatments. This decrease in appearance score were probably due to the brownish colour of the JSP treated products at higher level of inclusion which were comparatively less preferred by the panellists. Report on use of JSP in meat based foods or snacks could not be found in literature available with us. Therefore, the results are compared with the reports on use of JSP in other food systems.Priyanka and Mishra (2015) reported thatthe appearance score of JSP fortified biscuits was not affected up to 2.5% level but the scores were reduced as the level of incorporation of JSP increased further.

Table 3: Effect of incorporation of jamun seed powder (JSP) on the sensory quality of FCC.

Parameters	Control	1% DLP	2% DLP	3% DLP
Appearance	7.23 ± 0.10^{c}	6.40 ± 0.11^{b}	6.07 ± 0.14^{a}	5.90 ± 0.11^{a}
Flavour	6.97 ± 0.13^{c}	6.37 ± 0.14^{b}	6.17 ± 0.16^{b}	5.70 ± 0.15^{a}
Texture	6.97 ± 0.14^{b}	6.13 ± 0.15^{a}	5.93 ± 0.15^{a}	5.87 ± 0.18^{a}
Crispiness	7.27 ± 0.14^{c}	6.43 ± 0.18^{b}	6.20 ± 0.17^{ab}	5.83 ± 0.22^{a}
Acceptability	7.33 ± 0.13^{c}	6.27 ± 0.14^{b}	6.00 ± 0.14^{ab}	5.60 ± 0.17^{a}

Meanswith different superscripts in the same row differ significantly (P<0.05)

The flavour (5.70 to 6.37) scores of the FCC incorporated with different levels of JSP were moderately desirable (Table 3). The flavour scores for the product was significantly (P<0.05) higher for control when compared with treatment products. But there was no significant difference between 1% and 2% JSP treated products.Flavour scores of FCC containing different levels of JSP revealed that there was significant (P<0.05) decrease in scores with increase in levels of JSP. This decrease in flavour scores were probably due to the bitter taste of JSP at higher level of inclusion which might have masked the meat flavour. Hence, the flavour of FCC containing JSP had lower preference for the consumers in comparison to control resulting in lower scores.

Texture (5.87 to 6.13) and crispiness (5.83 to 6.43) (Table 3) scores of FCC containing different levels of JSP showed significant (P<0.05) decrease in scores. Texture became harder as the level of JSP increased because there was no puffiness and expansion of the product, rather it shrunk which imparted the tough texture to the product. The same might be the reasons for reduced crispiness. Priyanka and Mishra (2015) reported that the texture scores of JSP fortified biscuits decreased at higher level of Jamun seed powder incorporation.

The acceptability (5.60 to 6.27) scores of the FCC incorporated with different levels of JSP were moderately desirable (Table 3). Significant (P<0.05) difference was recorded between control and all the treatment products. The acceptability score was significantly higher for 1% JSP incorporated FCC among treatment groups. As the level of JSP increased the scores for all the sensory attributes decreased significantly (P<0.05) which might be the reason for the decreased acceptability scores as the levels of JSP increased. Priyanka and Mishra (2015) reported that the overall acceptability scores of JSP fortified biscuits reduced at higher level of incorporation.

CONCLUSION

Sensory scores were significantly higher ($P<0.05$) for 1% DLP and 1% JSP added product among treatments and the scores decreased as the level of incorporation of DLP and JSP increased. Hence, 1% DLP and 1% JSP is recommended for incorporation into functional chicken chips (FCC) as a source of natural antioxidant and natural preservative with added health benefit.

REFERENCES

Ahmed F, Huded S, Malik FA (2010) In vitro study on the radical scavenging and anti- lipidperoxidative effects of *Eugenia jambolana* aqueous extracts. J Pharm Res 3: 198-200

Aswathi PB, Biswas AK, Beura CK, Yadav AS (2013) Physico-chemical and sensory characteristics of functional poultry meat sticks. Indian J Poult Sci 48: 228-233

Biswas AK, Beura CK, Yadav AS, Pandey NK, Mendiratta SK, Kataria JM (2015) Influence of novel bioactive compounds from selected fruit by-products and plant materials on the quality and storability of microwave-assisted cooked poultry meat wafer during ambient temperature storage. LWT–Food SciTechnol 62: 727-733

Das AK, Rajkumar V, Verma AK, Swarup D (2012) *Moringa oleferia* leaves extract: A natural antioxidant for retarding lipid peroxidation in cooked goat meat patties. Int J Food SciTechnol 47:585-591

Dillard CJ, German JB (2000) Phytochemicals, nutraceuticals and human health: A review. J Sci Food Agric 80: 1744-1756

Gupta K, Barat GK, Wagle DS, Chawla HKL (1989) Nutrient content and antinutritional factors in conventional and non-conventional leafy vegetables. Food Chem 3**:**105-116

Hazra S, Biswas S, Bhattacharyya D, Das SK Khan A (2011) Quality of cooked ground buffalo meat treated with the crude extracts of *Moringa oleifera* (Lam.) leaves. J Food Sci Technol 49:240-245

Kasthuri S, Mandal PK, Pal UK (2017) Efficacy of Drumstick leaf and Jamun seed powder as preservative in chicken chips. J Meat Sci 12:52-59

Keeton JT (1983) Effect of fat, NaCl and phosphate levels on the sensory properties of pork patties. J Food Sci 48:878-881

Kumar A, Ilavarasan R, Jayachandran T, Decaraman M, Aravindhan P, Padmanabhan N, Krishnan MRV (2009) Phytochemicals investigation on a tropical plant, *Syzygium cumini*fromkattuppalayam, Erode District, Tamil Nadu, South India. Pakistan J Nutr 8:83-85

Makkar HPS, Becker K (1996) Nutritional value and antinutritional components of whole and ethanol extracted *Moringaoleifera* leaves. Anim Feed Sci Technol 63: 211–228

Modi DC, Patel JK, Shah BN, Nayak BS (2010) Pharmacognostic studies of the seed of *Syzygiumcumini* Linn. Pharm Sci Monitor 1:20-26

Murti K, Paliwal D, Madan S, Kundu R, Kaushi M (2012) Exploration of preliminary phytochemical studies of seed of *Syzygiumcumini*. Am J Pharmacol Toxicol7:12-14

NajeebAP, Mandal PK, Pal UK(2015) Efficacy of leaves (drumstick, mint and curry leaves) powder as natural preservatives in restructured chicken block. J Food Sci Technol 52:3129-3133

Priyanka A, Mishra AA (2015) Development and quality evaluation of jamun powder fortified biscuits using natural sweetners. Int J Sci, Engineering and Technol 3:796-801

Reddy V, Urooj A, Kumar A (2005) Evaluation of antioxidant activity of some plant extracts and their application in biscuit. Food Chem 90:317-321

Shahnawaz M, Sheikh SA, Bhangar MI, Ahmed E (2010) Total phenolic compounds and antioxidant activity of jamun fruit (*Eugenia jambolana*) products. Pakistan J Food Sci 20:1-4

Snedecor GW and Cochran WG (1967) Statistical methods. 6thedn. Oxford and IBH publishing Co. New Delhi.

Stephen A (2012) Syzygiumcumini (L.) Skeels: A multipurpose tree, its phytotherapic and pharmacological uses. J PhytotherapyPharmacol 1:22-32

Swami SB, Thakur NSJ, Patil MM, Haldankar PM (2012) Jamun (Syzygium cumini (L.)): A review of its food and medicinal uses. Food Nutr Sci3: 1100-1117

Zhang LL, Lin YM (2009) Antioxidant tannins from *Syzygiumcumini* fruit. Afr J Biotechnol 8:2301-2309