www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.03
TPI 2018; 7(4): 773-777

www.thepharmajournal.com
Received: 11-02-2018
Accepted: 16-03-2018

M Naveen Kumar Reddy
Department of Livestock Products and Technology, College of Veterinary Science, P V Narsimha Rao Telangana Veterinary University, Rajendranagar, Hyderabad, Telangana, India

M Shashi Kumar
Department of Livestock Products and Technology, College of Veterinary Science, P V Narsimha Rao Telangana Veterinary University, Rajendranagar, Hyderabad, Telangana, India

GV Bhaskar Reddy
Department of Livestock Products and Technology, College of Veterinary Science, Sri Venkateswara Veterinary University, Tirupati, Andhra Pradesh, India

N Krishnaiah
Department of Veterinary Public Health and Epidemiology, College of Veterinary Science, P V Narsimha Rao Telangana Veterinary University, Rajendranagar, Hyderabad, Telangana, India

N Anitha Reddy
Department of Livestock Products and Technology, College of Veterinary Science, PV Narsimha Rao Telangana Veterinary University, Rajendranagar, Hyderabad, Telangana, India

V Kesava Rao
Department of Livestock Products and Technology, College of Veterinary Science, P V Narsimha Rao Telangana Veterinary University, Rajendranagar, Hyderabad, Telangana, India

Correspondence
N Anitha Reddy
Department of Livestock Products and Technology, College of Veterinary Science, P V Narsimha Rao Telangana Veterinary University, Rajendranagar, Hyderabad, Telangana, India

Quality evaluation of turkey meat sausages incorporated with ground carrot

M Naveen Kumar Reddy, M Shashi Kumar, GV Bhaskar Reddy, N Krishnaiah, N Anitha Reddy and V Kesava Rao

Abstract
A study was undertaken to determine the effect of incorporation of raw carrot paste (RCP) in turkey meat sausages. Raw carrot paste (RCP) was incorporated replacing lean meat in turkey meat sausages at 3 levels i.e., 5, 10 and 15 percent. Control and Raw Carrot Paste (RCP) incorporated turkey meat sausages were prepared and were evaluated for physico-chemical, proximate composition and organoleptic quality. Emulsion stability and cooking yield found decreased; Moisture and crude fiber percentage found increased; crude protein, total ash and crude fat values were found decreased significantly ($P<0.05$) with increase in RCP levels (i.e., 5, 10 and 15 %), when compared to control. Based on the organoleptic evaluation it was recorded that 10% RCP incorporated sausages resulted in better sensory properties when compared to control and other treatments. It can be concluded that raw carrot paste (RCP) could be incorporated up to 10% beneficially and economically.

Keywords: Turkey sausages, carrot incorporation, physico-chemical and sensory evaluation

Introduction
Turkey meat is one of the leanest types of poultry meat because of the low fat and is a good source of protein (Castro Ferreira *et al.*, 2000) [6]. Turkey meat is an excellent source of several important vitamins and nutrients such as iron, niacin, zinc, potassium, and B complex vitamins. Most of the fat in turkey is within the skin and most of the fat within the meat is in the dark meat i.e leg and thigh. Turkey contains more protein per ounce than other meats.
A number of mucoadhesive-based dosage forms, including sustained release tablets, semisolid forms, powders, and micro- and/or nanoparticles for use in the gastro-intestinal tract, nasal tract, cornea, buccal cavity, vagina and rectum have been widely studied [3-6].
Carrot (*Daucus carota*) is one of the most popular vegetable consumed in raw and processed form throughout the world. It is widely used for preparation of salads, pickles, soups and halwas. In recent years, the consumption of carrot and its related products have increased steadily due to recognition of antioxidant and anticancer activities of β-carotene in carrot, which is also a precursor of vitamin A (Kotecha *et al.*, 1998 and Speizer *et al.*, 1999) [10, 15]. Intake of dietary fiber and phytochemicals such as polyphenols, carotenoids, tocopherols and ascorbic acid have been related to the maintenance of health and protection from diseases such as cancer, cardiovascular diseases and many other degenerative disorders (Saura-Calixto, 2011) [13]. Pizzocaro *et al.* (1998) [11] reported that addition of 2% carrot and 10% spinach improved oxidative stability of poultry hamburger. Saleh and Ahmed (1998) [12] conducted studies on ground beef patties formulated with carrot and reported that colour, yield, texture, and vitamin A content of beef patties were improved by the addition of boiled carrot. Therefore, fortification of provitamin A in meat products could be a long term solution for combating vitamin A deficiency in human beings. Angkara (1994) [2] used carrot in fish ball for improving the fish ball quality and reported the product had superior quality and higher sensory scores with 15% carrot addition. Tiwari *et al.* (2005) [16] evaluated processing of chicken meat ball from broiler spent hen with vegetables and reported that blanched vegetables (carrot, cabbage, cauliflower and betel ground) could be successfully incorporated upto 20% in chicken meat balls. The present study was aimed to enhance the nutritive value of turkey meat sausages with incorporation of raw carrot paste by replacing lean meat at levels of 5, 10 and 15%. The physico-chemical and organoleptic quality of turkey meat sausages were evaluated and the optimum level of incorporation of RCP was selected based on the organoleptic evaluation.

Material and Methods

Source of turkey meat

Tom turkey birds (Broad Breasted White) of 25-30 weeks of age were procured from the Poultry Research Station (Rajendranagar, Hyderabad) and slaughtered and dressed adopting standard procedure of slaughter at the Department of Livestock Products Technology, C.V.Sc, Rajendranagar. Carcass after postmortem examination was chilled and drained. The birds were subjected to deboning process and the meat, bone and fat were separated. The lean meat was packed in LDPE bags and stored in frozen condition in a deep freezer at -18°C till further use.

Preparation of Raw Carrot Paste

Carrot was washed with tap water for cleaning and removal of extraneous dirt. The cleaned vegetables were peeled manually with peeler, cut into slices and were made into a paste by using a home mixer / grinder.

Non meat ingredients and their preparation

Salt, Sugar, Binder (Wheat Flour), Vegetable oil, Red chili powder (Kashmiri Lal), and ingredients for spice mix were purchased from more super market, Attapur, Hyderabad. Onion and garlic were procured from local vegetable market. The spice were dried in a hot air oven at 50-60ºC/60-75 min. The ingredients were ground separately in a Blender (Model: Panasonic MX-AC 3005) and sieved through a fine mesh. The powders were mixed in suitable proportions to obtain a good spice mix and were stored at room temperature in air tight container for further use. Condiment mix was prepared using onion and garlic in the ratio of 3:1.

Preparation of turkey meat sausages

Frozen turkey meat was thawed in the refrigerator (4±1°C) and minced using meat mincer (Model: Sirman TC 32 Colorado, Italy) using 8mm plate followed by 4mm plate. Sausages were prepared using ingredients as per the recipe presented in Table-1 viz., Control and Carrot incorporated at 5,10,15% levels replacing lean meat. Emulsion was prepared in Bowl Chopper (Model: MADO Garrant MTK 661, Germany) by mixing ingresients in a sequence. Raw carrot paste was added individually (replacing lean meat @3 levels viz., 5%, 10%, 15%) along with minced meat in bowl chopper and chopped for 30 seconds. Then added salt, sugar, phosphate, ice, sequentially and blended for 60 seconds. Oil was added and blended for 30-60 sec for emulsion formation. Dry spice mix, chili powder, wet condiment mix and binder were added sequentially and blended for 30 sec in bowl chopper.

The emulsion was stuffed into synthetic cellulose casings (SCC21) using horizontal sausage stuffer and cooked at 80°C for 20 minutes in moist heat. After cooking the sausages were cooled to room temperature and chilled under refrigeration for few minutes followed by peeling and packing in LDPE pouches (200 Gauge thickness) under aerobic packaging for further analysis. The emulsion prepared was analyzed for quality characteristics viz., pH, emulsion stability, cooking yield.

Table 1: Formulations of turkey meat sausages with incorporation of different levels of raw carrot paste (RCP) Raw carrot paste was incorporated into turkey meat sausages by replacing lean meat at 5%, 10%, 15% levels to determine the optimum level of lean replacement in turkey meat sausages

Ingredients	Control	Treatments		
	C	T1	T2	T3
Meat %	85	80	75	70
Fat %	15	15	15	15
Raw carrot paste`%	-	5	10	15
Non meat ingredients				
Salt %	2			
Sugar %	1			
Polyphosphate(STPP)%	0.3			
Ice flakes %	10			
Dry Spice mix %	1.5			
Kashmiri chili powder %	0.25			
Wet condiment mix* %	4			
Binder (wheat flour) %	3			

*onion and garlic paste (3:1)

Physico-chemical and sensory parameters

The pH of the emulsion and product was determined by following the method of Trout *et al.* (1992). Five grams of sample was blended with 45 ml of distilled water for one minute using a mortar and pestle. The pH of the suspension is recorded by dipping combined glass electrode of a digital pH meter (Model:Hanna HI 2211) after calibration with three standard buffers pH 4.0, 7.0 and 14.0. Emulsion stability was carried out by adopting method of Townsend *et al.* (1968) [17] with some modifications. About 25 g of raw emulsion was placed in low density polyethylene (LDPE) bags. Bags with weighed samples were sealed and placed in a water bath and cooked at 80°C for 20 minutes. The bags were removed from water bath, cut open and the cook out fluid drained off and the cooked samples were weighed. Emulsion stability was calculated as percent by dividing final weight with initial emulsion weight. The cooked sausages were cooled to room temperature for 30 min and were reweighed to calculate the cooking yield. Cooking Yield was calculated as Percentage by obtaining ratio between weight of the sausages after cooking and raw sausage as per the method suggested by Murphy *et al.* (1975).

Proximate Composition including Moisture, crude protein, crude fat, total ash and crude fiber were measured according to the methods recommended by A. O. A. C. (1995).

Turkey sausages were evaluated organoleptically for appearance, flavour, texture, juiciness and overall acceptability using 9-point hedonic scale (where, 9 is excellent and 1 is extremely poor) as per the procedure described by Keeton, (1983) [9]. Semi trained panelists comprising of faculty and students were used as panel for evaluation of product. The panelists were explained about the

nature of experiment without revealing the identity of the treatment and were asked to record their preference. Turkey meat sausages were shallow fried in a pan to desirable temperature to serve hot. Sensory evaluation was conducted between 3 to 4 PM in the evening. Warm water and bland biscuits were used as neutralizers during evaluation between samples.

Statistical Analysis

Statistical analysis was carried out using SPSS version 20.0 of windows, SPSS Chicago (US). The data on all parameters were analyzed using analysis of variance (ANOVA) and Duncan's new multiple range test (Snedecor and Cochran, 1994).

Results and Discussion

Physico-chemical properties

Physico-chemical properties of RCP incorporated turkey meat sausages are presented in table-2.

The pH of emulsion of control and various treatments ranged from 6.07 to 5.85. There was a significant decrease ($P<0.05$) in the pH of the emulsion as the incorporation level of RCP increased from 5 to 15 % replacing lean. The pH of cooked sausages of control and treated group ranged from 6.34 to 6.16. In the present study there was a significant difference ($P<0.05$) in the pH of control and treatments. There was a significant decrease ($P<0.05$) in the pH of the sausages as the incorporation level of RCP increased from 5 to 15 %. Decrease in pH in treatments might be due to the lower pH of raw carrot paste. Similarly, a decrease in pH was also reported by Bhosale *et al.* (2011) [4] in chicken nuggets incorporated with ground carrot and mashed sweet potato and the decrease in pH was attributed to the fact that pH of vegetables added in the products were slightly acidic.

Emulsion stability decreased significantly ($P<0.05$) with increase in levels of carrot pulp. This might be due to the interaction of water molecules of carrot with meat proteins thereby reducing the emulsion stability. The possible reason for decrease in emulsion stability could also be attributed to linear decrease in pH. These findings were in agreement with those of Devatkal *et al.* (2004) [7] who reported a decrease in emulsion stability of buffalo liver loaf extended with carrot paste. Similar to the findings of this study Shinde (2006) [14] also reported that increase in level of incorporation of carrot paste could decrease the emulsion stability in pork patties.

Gradual decline in cooking yield was noticed upto 15% carrot incorporated turkey meat sausages as compared to control. This results are in agreement with the observations of Saleh and Ahmed (1998) [12] and Shinde (2006) [14], who recorded a decrease in cooking yield was due to the addition of mashed carrot in ground beef patties and pork patties.

Proximate Composition

Proximate composition of turkey sausages is presented in table 3.

Moisture

Moisture percent of the treated products increased with the increase in the levels of carrot pulp and significant effect ($P<0.05$) was observed at all levels of incorporation. This could be due to comparatively higher moisture content in the carrot pulp. Turkey meat sausages prepared with incorporation of 15% carrot showed significantly ($P<0.05$) higher moisture content than control. Similar findings were reported by Devatkal *et al.* (2004) [7], where in increase in moisture content of buffalo liver vegetables loaf incorporated with carrot paste was observed. Bhosale *et al.* (2011) [4] reported that with increase in the level of incorporation of carrot and mashed sweet potato, moisture content was increased. Kaur *et al.* (2015) [8] also reported that with increase in the level of incorporation of carrot moisture content increased.

Protein

Gradual decline in protein content in turkey meat sausages was observed as the incorporation level of carrot increased, but it was insignificant up to 10% level and significant at 15% level. Almost similar findings were reported by Bhosale *et al.* (2011) [4] who reported that protein content of carrot incorporated chicken nuggets did not vary significantly from control even upto 15% level of incorporation, while control had highest protein values. Kaur *et al.* (2015) [8] also reported that with increase in the level of incorporation of carrot protein content decreased.

Fat

Addition of carrot in turkey meat sausages had significant ($P<0.05$) effect on the fat content. Gradual decline in fat content was observed as the incorporation of carrot level increased. Similar findings were reported by Kaur *et al.* (2015) [8] in carrot incorporated chicken nuggets. Brauer (1994) [5] also reported that fat and moisture content are very closely related in meat products and if fat content is low, the moisture content is likely to be high.

Ash

Ash percent showed a non-significant decline ($P>0.05$) (2.22 to 2.11) in carrot incorporated turkey meat sausages. Similar findings were reported by Kaur *et al.* (2015) [8] who recorded non-significant decrease in ash content in chicken nuggets incorporated with carrot.

Crude Fibre

Increasing level of carrot pulp increase the fiber contents significantly ($P<0.05$) in the turkey sausages. Bhosale *et al.* (2011) [4] reported that with increase in the level of incorporation of carrot and mashed sweet potato, crude fibre content increased. Verma *et al.* (2010) [18] also observed that there was significant increase in dietary fiber content in chicken nuggets by sodium chloride replacement and apple pulp inclusion.

Sensory quality

The sensory scores (presented in table 4) for all the quality attributes of turkey meat sausages differed significantly ($P<0.05$) due to incorporation of different levels of carrot. From the observations of this study it is evident that incorporation of carrot enhances the colour and appearance score in turkey sausages, which might be due to addition of carrot as it contains colour pigments, carotenoids which impart colour to the product which is in accordance with the findings of Bhosale *et al.* (2011) [4]. According to Alamanou *et al.* (1996) [1], aroma and flavour are the most important attributes that influence sensory properties of comminuted meat products. Addition of carrot upto 10% did not change flavour intensity, while 15% had significantly lowered ($P<0.05$) flavour scores which might be attributed to raw carrot flavour. Present findings are in agreement with

Devatkal *et al.* (2004) [7] who also reported a significant decrease in flavour scores of liver-vegetable buffalo loaf extended with carrot paste. Texture of the carrot treated sausages increased significantly (P<0.05) as compared to control. It might be due to property of added fibre which has unique characteristics in building texture, due to their ability to bind water and form gels. Similar findings were recorded by Kaur *et al.* (2015) [8] for chicken nuggets. Saleh and Ahmed (1998) [12] reported significantly higher scores for texture of cooked beef patties added with boiled carrot. The sensory scores for juiciness revealed that an increase in levels of incorporation of carrot increased the juiciness significantly (P<0.05). These findings are in agreement with those of Kaur *et al.* (2015) [8] for chicken nuggets with incorporation of carrot. Among the treatments 10% carrot incorporated turkey meat sausages recorded significantly (P<0.05) higher scores for overall acceptability. Based on the results of sensory attributes, 10% carrot incorporated turkey meat sausages was found to be optimum.

Table 2: Effect of incorporation of different levels of raw carrot paste on physico-chemical properties of Turkey meat emulsion and sausages

Parameters	Control	Treatment		
		5 % RCP	10 % RCP	15 % RCP
Emulsion pH	6.07±0.02^{a}	5.99±0.03^{b}	5.93±0.02^{bc}	5.85±0.02^{c}
Product pH	6.34±0.05^{a}	6.27±0.06^{b}	6.21±0.05^{c}	6.16±0.09^{d}
Emulsion stability (%)	96.22±0.24^{a}	95.58±0.23^{a}	93.42±0.20^{b}	92.80±0.26^{b}
Cooking yield (%)	95.42±0.20^{a}	94.76±0.56^{ab}	93.90±0.39^{b}	92.92±0.38^{c}

Values are Mean ± SE (n=6).
Means with different superscripts in the same row differed significantly (P<0.05).

Table 3: Effect of incorporation of different levels of raw carrot paste on proximate composition of Turkey meat sausages.

Parameters	Control	Treatment		
		5 % RCP	10 % RCP	15 % RCP
Moisture (%)	61.64±0.23^{c}	62.44±0.15^{b}	63.20±0.10^{ab}	63.96±0.15^{a}
Crude Protein (%)	18.82±0.17^{a}	18.12±0.33^{a}	17.34±0.12^{ab}	16.47±0.22^{b}
Ether Extract (%)	15.63±0.15^{a}	15.22±0.13^{a}	14.65±0.15^{b}	14.08±0.09^{c}
Total Ash (%)	2.22±0.05	2.19±0.01	2.16±0.02	2.11±0.06
Crude Fibre (%)	1.42±0.03^{d}	1.76±0.04^{c}	2.24±0.03^{b}	2.50±0.04^{a}

Values are Mean ± SE (n=6).
Means with different superscripts in the same row differed significantly (P<0.05).

Table 4. Effect of incorporation of different levels of raw carrot paste on organoleptic qualities of Turkey meat sausages.

Parameters	Control	Treatment		
		5 % RCP	10 % RCP	15 % RCP
Appearance	7.30±0.01^{c}	7.38±0.02^{b}	7.44±0.03^{ab}	7.48±0.03^{a}
Flavour	7.42±0.04^{a}	7.31±0.02^{ab}	7.27±0.04^{b}	6.83±0.05^{c}
Texture	7.05±0.07^{b}	7.29±0.03^{a}	7.32±0.02^{a}	7.36±0.03^{a}
Juiciness	6.92±0.05^{c}	7.06±0.07^{b}	7.11±0.06^{ab}	7.15±0.07^{a}
Overall acceptability	7.23±0.03^{b}	7.26±0.02^{b}	7.37±0.04^{a}	7.13±0.02^{c}

Values are Mean ± SE (n=6).
Means with different superscripts in the same row differed significantly (P<0.05).

Summary and Conclusion

The demand for ready to eat processed meat products in India is constantly increasing due to change in lifestyle. Consumption of turkey meat is gaining popularity among people because of its low fat and high content of polyunsaturated fatty acids.

The utilization of various vegetables replacing lean in meat products minimizes the cost of value added products. Vegetables are used as lean replacers and extenders at levels, where they may not affect the physico-chemical and organoleptic quality. In other hand they improve the nutritive value in terms of fiber enrichment, vitamin fortification etc.

The present study revealed that the raw carrot paste can be successfully used as a lean replacer in turkey sausages at 10 % level without effecting its sensory quality.

Reference

1. Alamanou S, Bloukas JG, Panevas ED, Doxastakis G. Influence of protein isolate from lupin seed on processing and quality characteristics of frankfurters. Meat Science 1996; 42(1): 79-83.
2. Angkara P. Improving of fish ball quality. Lampang Agricultural Research and Training Center (Thailand). Processing of 11th Ragmangla Institute of Technology Seminar. (Thialand). 1994; 148: 1-8.
3. Association of Official Analytical Chemists (AOAC) Official methods of analysis 16th Ed. Virginia, USA: Association of Official Analytical Chemist, 1995.
4. Bhosale SS, Biswas AK, Sahoo J, Chatli MK, Sharma DK, Devatkal SK. Effect of carrot and sweet potato on the storability of chicken nuggets during refrigeration storage. Journal of Meat Science. 2011; 7(1):17-22.
5. Brauer MC. Fat reduced frankfurter-type sausage. A technology for preventing too firm and rubbery a bite. Fleischwirtschaft. 1994; 73:64-65.
6. Castro Ferreira MM, Morgano MA, Nascimento de Queiroza SC, Mantovani DMB. Relationships of the minerals and fatty acid contents in processed turkey meat products. Journal of Food Chemistry. 2000; 69:259-265.
7. Devatkal S, Mendiratta SK, Kondaiah N. Quality Characteristics of loaves from buffalo meat, liver and vegetables. Meat science. 2004; 67(3):377-383.

8. Kaur M, Kumar A, Kumar S, Hakeem HR, Gupta S. Effect of carrot on quality characteristics of chicken nuggets. Indian Veterinary Journal. 2015; 92(4):44-47.
9. Keeton. Effects of fat and NaCl or phosphate levels on the chemical and sensory properties of pork patties. Journal of Food Science. 1983; 48:878-881
10. Kotecha PM, Desai BB, Madhavi DL. Carrot In: Salunkhe, DK, Kadam SS. Handbook of Vegetable Science and technology-production, composition, storage, processing. New York Macel Dekker. 1998; 119-135.
11. Pizzocaro F, Senesi E, Veronese P, Gasparolo A. Mechanically deboned "Poultry meat hamburgers". 2nd protective and antioxidant activity of carrot and spinach tissue during frozen storage. Industric Alimentaries. 1998; 37:710-720.
12. Saleh NT, Ahmed ZS. Impact of natural source rich in provitamin on cooking characteristics, colour, texture and sensory attributes of beef patties. Meat Science. 1998; 50:285-293.
13. Saura-Calixto F. Dietary fiber as a carrier of dietary antioxidants: An essential physiological function. Journal of Agricultural and Food Chemistry. 2011; 59: 43-49
14. Shinde AT. Studies on pork paties extended with onion, carrot, radish and sweet potato. Ph. D. thesis, IVRI, Izatnagar, 2006.
15. Speizer FE, Colditz GA, Hunter DJ, Rosner B, Hennekens C. Prospective study of smoking, antioxidant intake and lung cancer in middle aged women. Cancer cause control. 1999; 109(5):475-82.
16. Tiwari AK, Kondaih N, Anjaneyulu ASR. Processing chicken spent hen with vegetables. 23rd Annual conference and national Symposium on poultry production in changed global scenario of world: Challenges, opportunities. Hyderabad. Abstract no.297, 2005.
17. Townsend WE, Witnauer LP, Rillof JA, Swift CE. Comminuted meat emulsion: Different thermal analysis for fat transition. Food Technology. 1968; 22:319-323.
18. Verma AK, Sharma BD, Banerjee R. Effect of sodium chloride replacement and apple pulp inclusion on the physico-chemical, textural and sensory properties of low fat chicken nuggets. Food Science Technology. 2010; 43(4):715-719.