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Optimization of orange peel and *Moringa oleifera* leaves extract incorporation in chicken sausages

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Abstract
The present study aimed to optimize the incorporation of orange peel and *Moringa oleifera* leaves extracts in chicken sausage formulation based on the sensory quality. The aqueous and ethanolic extracts of orange peel and *Moringa oleifera* leaves were prepared and incorporated at 1, 2, 3 and 4 ml level in sausage formulation. The aqueous extract of orange peel and *Moringa oleifera* leaves significantly affected the flavor, texture, juiciness, tenderness and overall acceptability but no significant effect was observed on colour values of chicken sausages. The ethanolic extracts of both, orange peel and *Moringa oleifera* leaves significantly affected all the sensory attributes and combination of both also had significant effect on all the sensory attributes. The 4 ml level of aqueous and ethanolic extracts of orange peel, *Moringa oleifera* leaves and combination of both had shown significantly lower sensory overall acceptability values of the sausages. With the objective to incorporate higher level of extracts in sausage formulation with very good sensory quality, the 3ml level of aqueous and ethanolic extracts of orange peel and *Moringa oleifera* leaves separately and in combination were optimized for incorporation in chicken sausage formulation. It was concluded that 3 ml extracts of orange peel and *Moringa oleifera* leaves can be used for development of chicken sausages with very good sensory quality.

Keywords: Orange peel extract, *Moringa oleifera* leaves extract, chicken sausages, sensory quality

Introduction
Poultry meat is the fastest growing component of global meat demand and India is experiencing a rapid growth in poultry sector. Chicken meat has become a very popular food commodity due to its high biological value animal proteins, essential amino acids and fatty acids, vitamins and other nutrients (Biesalski, 2005; Mulla *et al.*, 2017) [1, 8]. Chicken sausage is a minced meat product which has seen a dramatic increase in consumption throughout the world. Since, meat is one of the most perishable food items consumed worldwide therefore very prone to deterioration. Quality deterioration in meat and minced meat products occurs due to oxidation of lipids and proliferation of spoilage microbes. Lipid oxidation in meat products results in development of off flavours and a decrease in its sensory and nutritional quality.
Synthetic antioxidants like butylated hydroxytoluene (BHT) and butylated hydroxyanisole (BHA) have successfully been used to prevent lipid oxidation in meat. Reports on health claims of these synthetic chemicals (Panicker *et al.*, 2014) [11] particularly their carcinogenic (Whysner *et al.*, 1994) [16] and toxic (Moure *et al*., 2001) [7] effects have necessitated research on effective alternatives particularly from natural sources.
Moringa oleifera is reputedly known as horseradish tree or drumstick tree. It is a native of Indian sub-continent and is cultivated worldwide owing to its numerous utilities (Omotesho *et al*., 2013; Razis, 2014) [9, 12]. Every part of this tree is edible and has been consumed by humans since ancient times. It has both nutritional and medicinal value including some useful vitamins, minerals and amino acids etc. (Sanchez-Machado *et al*., 2010) [13]. The antioxidant activity of various extracts of *M. oleifera* leaf has been reported (Sreelatha and Padma, 2009) [14].
Mandarin orange (*Citrus reticulata*) is most common among citrus fruits grown and it occupies nearly 40% of the total area under citrus cultivation in India.Orange fruits processing generates large amount of waste consisting of peels and seeds. It also contains a high concentration of phenolic compounds having health related properties and represents a rich source of natural flavonoids and limonoids (Hayat *et al.*, 2010) [4]. Sawalha *et al.* (2009) [15] reported that roughly 30% of the fruit mass in oranges is represented by the peel and the highest concentration of flavonoids in citrus fruits occurs in peel. Hence, the present study was envisaged to develop chicken sausages incorporated with orange peel and *Moringa oleifera* leaves extract with good sensory quality.

Materials and methods

Broiler chicken

Healthy birds of 6 weeks of age were procured from the Livestock farm, College of Veterinary Sciences, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar. Birds were slaughtered in the slaughter house of Department of Livestock Products Technology as per scientific standard procedure. The dressed chicken were washed thoroughly, packaged and stored at -18±1ºC till further use. The frozen chunks were drawn as per requirement and thawed overnight in a refrigerator (4±2°C) and were used for further study.

Preparation of orange peel and *Moringa oleifera* leaves extract

Orange peels were collected from local market juice shops of Hisar and *Moringa oleifera* leaves from tree located in university campus. Peels and leaves were washed and dried separately in the tray air drier at temperatures of 50±5°C for 24-48 hours. After drying, both the samples were ground to fine powder. The powder was sieved and used to prepare aqueous and ethanolic extracts. Aqueous and ethanolic (by using 70% ethanol) extracts of orange peel and *Moringa oleifera* leaves were prepared by using 10 g sample in 100 ml of solvent with the incubation time of 6 hours with frequent shaking. Both the mixture of aqueous and ethonolic were filtered through muslin cloth and then filtered through Whatman No. 42 filter paper separately to obtain the respective plant extract. Fresh extract was used during product development and test procedures.

Preparation of chicken sausages

The frozen deboned chicken meat was minced in an electrical meat mincer (3mm plate). Sausages were prepared by making meat emulsion using minced meat, common salt (2%), sodium nitrite (0.02%), spicemix (2%),condiments paste (3%), vegetable oil (15%), semolina (5%) and ice flakes/chilled water (10%). All ingredients were properly mixed in the electric meat mixer for sufficient time to make a fine emulsion. Treatments consisted of different levels of different extracts (orange aqueous, orange ethanolic, *Moringa oleifera* aqueous, *Moringa oleifera*, combination of aqueous extracts and combination of ethanolic extracts) i.e. 1, 2, 3and 4 ml of extracts along with other ingredients. Emulsion thus formed was filled in cellulose casings by hand operated sausage filling machine and linked. The sausages were steam cooked for 35 min. The cooked sausages were taken out, cooled in chilled water for 5 min and casings were peeled off. They were packaged in low density polyethylene bags and stored at refrigerated temperature (4±2ºC) for further analysis. The final selection was based on sensory evaluation using 8-point descriptive scale (Keeton, 1983) [6], where 8= excellent and 1= very poor with the help of 4 semi trained panellists.

Results and Discussion

Sensory quality of chicken sausages incorporated with aqueous extracts

The levels of orange peel and *Moringa oleifera* leaves extracts were optimized on the basis of sensory evaluation. The sensory scores of aqueous extracts of orange peel and *Moringa oleifera* leaves incorporated sausages showed no significant difference in the colour scores of control and extract treated chicken sausages (Table 1). Other sensory attributes did not show any significant variation upto 3 ml of incorporation. The flavour, texture, juiciness, tenderness and overall acceptability (OAA) scores were comparable in case of control, OPAE 1, OPAE 2 and OPAE 3 treated sausages. These observations were consistent with the study of Das *et al*. (2012) [2] who reported that addition of MOL extract had no effect on the sensory attributes. The scores were significantly lower in case of OPAE 4 treated chicken sausages incorporated with 4 ml of orange peel aqueous extract. Similar trend was observed in case of MLAE treated sausages. A study by Jayawardana *et al.* (2015) [5] revealed that increase in MOL percentages above 0.50% resulted in a significant negative effect on sensory attributes like colour, flavour and OAA scores. OPAE 3 was optimized as the sensory scores of treatment OPAE 3 was above 7.0 meaning very good acceptability and comparable with control.

Sensory quality of chicken sausages incorporated with ethanolic extracts

Sensory analysis illustrated that incorporation of ethanolic extracts upto 3 ml resulted in comparable sensory scores (Table 2). Further increase in extract amount resulted in a significant decline in colour scores and treatments OPEE 4 and MLEE 4 had significantly lower colour scores in comparison to control. The decrease in the colour scores may be attributed to the darker colour of the ethanolic extracts of orange and moringa. These findings are similar to the report of Evivie *et al*. (2015) [3] who reported that the colour scores decreased significantly with increase in level of incorporation of moringa leaf powder in soy meat balls.

Sharp and significant decline in flavour scores of treatments MLEE 4 and OPEE 4 was also noticed. Use of ethanolic extracts resulted in a decrease in meaty flavour leading to significant decrease in flavour scores in these treatments. However the scores were above 7.0 upto 3 ml (Treatment OPEE-3) of incorporation. Further increase in OPEE level resulted in a significant and drastic decrease in flavour with treatment OPEE 4 having flavour scores of 4.0 meaning slightly undesirable. Texture, juiciness, tenderness and OAA scores of these treatments also showed significant decline. Otunola *et al*. (2013) [9] reported that cookies without moringa leaves waste were superior in taste and texture as compared to those incorporated with 5% and 10% moringa leaves waste. OPEE 3 was optimized due to better sensory scores.

Sensory quality of chicken sausages incorporated with combination of extracts

Incorporation of extract of both the plants in combination revealed similar results as those noticed when individual plant extracts were incorporated (Table 3). Treatments OMAE1, OMAE 2 and OMAE 3 having combination of orange peel and *Moringa oleifera* leaf aqueous extracts up to 3 ml had sensory scores similar to control. Significant decline in sensory scores in comparison to control was noticed in treatment OMAE 4. Sensory panelists observed marked ethanolic smell and bitterness as the concentration of extract in combination increased beyond 3ml resulting in poor flavour scores in OMEE 4.Treatment OMEE 4 had 4.83 as OAA score which was significantly lower and thus rejected. Treatment having 1.5ml orange and 1.5 ml *Moringa oleifera* aqueous extracts (OMAE 1) was optimized to maintain uniformity in amount of extract of both the plant sources, although the treatments OMAE 2 and OMAE 3 also had comparable sensory scores.

It can be concluded that 3 ml of aqueous and ethanolic extracts of orange peel and *Moringa oleifera* leaves alone and in combination (1.5 ml each) can be incorporated to develop chicken sausages with very good acceptability scores.

Table 1: Sensory quality of chicken sausages incorporated with aqueous extracts of orange peel and *Moringa oleifera* leaves (Mean±SD, n=12)

Treatments	Colour	Flavour	Textures	Juiciness	Tenderness	OAA
Orange peel aqueous extracts						
Control	7.75±0.45	7.83^{b}±0.44	7.83^{b}±0.44	7.79^{b}±0.50	7.83^{b}±0.78	7.83^{b}±0.33
OPAE 1	7.83±0.33	7.75^{b}±0.62	7.75^{b}±0.78	7.75^{b}±0.45	7.83^{b}±0.39	7.78^{b}±0.52
OPAE 2	7.67±0.65	7.50^{b}±0.67	7.75^{b}±0.52	7.67^{b}±0.44	7.67^{b}±0.52	7.67^{b}±0.52
OPAE 3	7.67±0.44	7.33^{b}±0.65	7.50^{ab}±0.41	7.33^{ab}±0.49	7.54^{b}±0.78	7.50^{b}±0.55
OPAE 4	7.50±0.52	6.67^{a}±0.49	7.04^{a}±0.62	7.00^{a}±0.60	6.83^{a}±0.41	6.92^{a}±0.41
Moringa leaves aqueous extracts						
Control	7.75±0.45	7.83^{b}±0.44	7.83^{b}±0.44	7.79^{b}±0.50	7.83^{b}±0.78	7.83^{b}±0.33
MLAE 1	7.67±0.52	7.50^{b}±0.41	7.54^{b}±0.52	7.67^{b}±0.52	7.75^{b}±0.89	7.63^{b}±0.55
MLAE 2	7.63±0.55	7.42^{b}±0.67	7.33^{b}±0.41	7.54^{b}±0.50	7.65^{b}±0.52	7.50^{b}±0.41
MLAE 3	7.58±0.47	7.38^{b}±0.64	7.25^{b}±0.72	7.50^{b}±0.41	7.58^{b}±0.47	7.33^{b}±0.52
MLAE 4	7.50±0.52	5.33^{a}±0.52	6.50^{a}±0.84	6.67^{a}±0.52	6.83^{a}±0.41	6.17^{a}±0.78

Means with different superscripts in a column for a particular extract differ significantly (P≤0.05)

OPAE 1-1 ml of orange peel aqueous extract, OPAE 2-2 ml of orange peel aqueous extract, OPAE 3-3 ml of orange peel aqueous extract, OPAE 4-4 ml of orange peel aqueous extract, MLAE 1-1 ml of moringa leaves aqueous extract, MLAE 2-2 ml of moringa leaves aqueous extract, MLAE 3-3 ml of moringa leaves aqueous extract, MLAE 4-4 ml of moringa leaves aqueous extract.

Table 2: Sensory quality of chicken sausages incorporated with ethanolic extracts of orange peel and *Moringa oleifera* leaves (Mean±SD, n=12)

Treatments	Colour	Flavour	Textures	Juiciness	Tenderness	OAA
Orange peel ethanolic extracts						
Control	7.75^{b}±0.45	7.83^{b}±0.44	7.83^{b}±0.44	7.79^{b}±0.50	7.83^{b}±0.78	7.83^{b}±0.33
OPEE 1	7.58^{ab}±0.49	7.79^{b}±1.33	7.50^{b}±0.84	7.63^{b}±0.41	7.67^{b}±0.52	7.63^{b}±0.52
OPEE 2	7.33^{ab}±0.49	7.73^{b}±0.41	7.25^{b}±0.62	7.29^{b}±0.75	7.58^{b}±0.41	7.54^{b}±0.41
OPEE 3	7.27^{ab}±0.52	7.33^{b}±0.41	7.25^{b}±0.45	7.25^{b}±0.62	7.37^{b}±0.50	7.33^{b}±0.41
OPEE 4	7.08^{a}±0.82	4.00^{a}±0.89	6.50^{a}±0.55	6.04^{a}±0.62	6.33^{a}±0.52	5.43^{a}±0.75
Moringa leaves ethanolic extracts						
Control	7.75^{b}±0.45	7.83^{b}±0.44	7.83^{b}±0.44	7.79^{b}±0.50	7.83^{b}±0.78	7.83^{b}±0.33
MLEE 1	7.67^{b}±0.52	7.54^{b}±0.89	7.50^{b}±0.52	7.33^{b}±0.52	7.58^{b}±0.89	7.50^{b}±0.52
MLEE 2	7.67^{b}±0.49	7.42^{b}±0.50	7.42^{b}±0.41	7.29^{b}±0.75	7.50^{b}±0.71	7.42^{b}±0.41
MLEE 3	7.50^{b}±0.55	7.29^{b}±0.78	7.33^{b}±0.41	7.21^{b}±0.41	7.38^{b}±0.48	7.38^{b}±0.48
MLEE 4	6.76^{a}±0.41	3.50^{a}±0.55	5.50^{a}±0.52	5.50^{a}±0.48	6.33^{a}±0.49	5.08^{a}±0.90

Means with different superscripts in a column for a particular extract differ significantly (P≤0.05)

OPEE 1-1 ml of orange peel ethanolic extract, OPEE 2-2 ml of orange peel ethanolic extract, OPEE 3-3 ml of orange peel ethanolic extract, OPEE 4-4 ml of orange peel ethanolic extract, MLEE 1-1 ml of moringa ethanolic extract, MLEE 2-2 ml of moringa ethanolic extract, MLEE 3-3 ml of moringa ethanolic extract, MLEE 4-4 ml of moringa ethanolic extract.

Table 3: Sensory quality of chicken sausages incorporated with combination of extracts of orange peel and *Moringa oleifera* leaves (Mean±SD, n=12)

Treatments	Colour	Flavour	Texture	Juiciness	Tenderness	OAA
Combination of aqueous extracts						
Control	7.75^{b}±0.45	7.83^{b}±0.44	7.83^{b}±0.44	7.79^{b}±0.50	7.83^{b}±0.78	7.83^{b}±0.33
OMAE 1	7.54^{b}±0.52	7.75^{b}±0.40	7.67^{b}±0.41	7.67^{ab}±0.41	7.73^{b}±0.41	7.67^{b}±0.41
OMAE 2	7.46^{ab}±0.41	7.67^{b}±0.41	7.54^{b}±0.52	7.63^{ab}±0.55	7.63^{b}±0.52	7.54^{b}±0.63
OMAE 3	7.42^{ab}±0.63	7.58^{b}±0.70	7.50^{b}±0.55	7.50^{ab}±0.55	7.58^{ab}±0.41	7.46^{b}±0.41
OMAE 4	7.04^{a}±0.52	6.17^{a}±0.72	6.67^{a}±0.41	7.21^{a}±0.41	7.25^{a}±0.62	6.29^{a}±0.75
Combination of ethanolic extracts						
Control	7.75±0.45	7.83^{b}±0.44	7.83^{b}±0.44	7.79^{b}±0.50	7.83^{b}±0.78	7.83^{b}±0.33
OMEE 1	7.63^{b}±0.52	7.75^{b}±0.41	7.71^{b}±0.52	7.17^{b}±0.41	7.67^{b}±0.41	7.63^{b}±0.79
OMEE 2	7.46^{b}±0.65	7.70^{b}±0.63	7.63^{ab}±0.64	7.50^{b}±0.55	7.54^{b}±0.52	7.58^{b}±0.41
OMEE 3	7.34^{b}±0.08	7.54^{b}±0.50	7.58^{b}±0.47	7.50^{b}±0.55	7.46^{b}±0.45	7.50^{b}±0.63
OMEE 4	6.67^{a}±0.52	2.33^{a}±0.52	6.50^{a}±0.55	6.83^{a}±0.63	6.08^{a}±0.67	4.83^{a}±0.75

Means with different superscripts in a column for a particular extract differ significantly (P≤0.05)

OMAE 1-1.5 ml of orange peel aqueous extract +1.5 ml of moringa leaves aqueous extract, OMAE 2-2 ml of orange peel aqueous extract +1 ml of moringa leaves aqueous extract, OMAE 3-1 ml of orange peel aqueous extract +2 ml of moringa leaves aqueous extract, OMAE 4-2 ml of orange peel aqueous extract +2 ml of moringa leaves aqueous extract, OMEE 1-1.5 ml of orange peel ethanolic extract +1.5 ml of moringa leaves ethanolic extract, OMEE 1-2 ml of orange peel ethanolic extract +1 ml of moringa leaves ethanolic extract, OMEE 3-1 ml of orange peel ethanolic extract +2 ml of moringa leaves ethanolic extract, OMEE 4-2 ml of orange peel ethanolic extract +2 ml of moringa leaves ethanolic extract.

References

1. Biesalki HK. Meat as a component of healthy

diet-are there any risks or benefits if meat is avoided in the diet? Meat science. 2005; 70:509-524.
2. Das AK, Rajkumar V, Verma AK, Swarup D. *Moringa oleifera* leaves extract: a natural antioxidant for retarding lipid peroxidation in cooked goat meat patties. International Journal of Food Science and Technology. 2012; 47:585-591.
3. Evivie SE, Ebabhamiegbebho PA, Imaren JO, Lgene JO. Evaluating the Organoleptic Properties of Soy Meatballs (BEEF) with varying Levels of *Moringa oleifera* Leaves Powder. Journal of Applied Sciences and Environmental Management. 2015; 19(4): 649-656.
4. Hayat X, Zhang H, Chen S, Xia CJ, Zhong F. Liberation and separation of phenolic compounds from citrus mandarin peels by microwave heating and its effect on antioxidant activity. Separation and Purification Technology. 2010; 73:371-376.
5. Jayawardana BC, Liyanage R, Lalantha N, Iddamalgoda S, Weththasinghe P. Antioxidant and antimicrobial activity of drumstick (*Moringa oleifera*) leaves in herbal chicken sausages. Food Science and Technology. 2015; 64:1204-1208.
6. Keeton JT. Effect of fat, NaCl and phosphate levels on the chemical and sensory properties of pork patties. Journal of Food Science. 1983; 48:878-81.
7. Moure A, Cruz JM, Franco D, Dominguez JM, Sineiro J, Nunez MJ *et al*. Natural antioxidants from residual sources. Food Chemistry. 2001; 72:145-171.
8. Mulla M, Ahmed J, Al-Attar H, Castro-Aguirre E, Arfat YA, Auras R. Antimicrobial efficacy of clove essential oil infused into chemically modified LLDPE film for chicken meat packaging. Food control. 2017; 73:663-671.
9. Omotesho KF, Sola-Ojo FE, Fayeye TR, Babatunde RO, Otunola GA, Aliyu TH. The potential of *Moringa* tree for poverty alleviation and rural development: Review of evidences on usage and efficacy. International Journal of Development and Sustainability. 2013; 2:799-813.
10. Otunola GA, Arise AK, Sola-Ojo FE, Nmom IO, Toye AA. The effects of addition of Moringa leaf waste fibre on proximate and sensory characteristics of cookies. Agrosearch. 2013; 13(1):69-75.
11. Panicker VP, George S, Krishna D. Toxicity study of butylated hydroxyl toluene (bht) in rats. World Journal of Pharmacy and Pharmaceutical Sciences. 2014; 3(8):758-763.
12. Razis AFA, Ibrahim MD, Kntayya SB. Health benefits of *Moringa oleifera*. Asian Pacific Journal of Cancer Prevention. 2014; 15:8571-8576.
13. Sanchez-Machado DI, Nunez-Gastelum JO, Reyes-Moreno C, Ramirez-Wong B, Lopez-Cervantes J. Nutritional quality of edible parts of *Moringa oleifera*. Food Analytical Methods. 2010; 3:175-180.
14. Sreelatha S, Padma PR. Antioxidant activity and total phenolic content of *Moringa oleifera* leaves in two stages of maturity. Plant Foods and Human Nutrition. 2009; 64(4):303-311.
15. Sawalha SMS, Roman AD, Carretero AS, Gutierrez AF. Quantification of main phenolic compounds in sweet and bitter orange peel using CE–MS/MS. Food Chemistry. 2009; 116:567-574.
16. Whysner J, Wang CX, Zang E, Iatropoulos MJ, Williams GM. Doseresponse of promotion of butylated hydroxyanisole in chemically initiatedtumors of the rat for stomach. Food and Chemical Toxicology. 1994; 32:215-222.