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Effect of different level *Aloe vera* gel and mint extract incorporation in the development of chicken meat cutlets

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Abstract
People are more aware about benefits as well as importance of herbal products in their routine life. The present study was predicted to develop chicken meat cutlets with the incorporation of *Aloe vera* gel 3%(AG_1), 5%(AG_2) & 7%(AG_3) and Mint extract 0.6%(ME_1), 0.8%(ME_2)& 1%(ME_3) by replacing lean meat in the basic formulation. The developed cutlets were evaluated for various parameters. The physico-chemical study of cutlets revealed that there was a higher value of emulsion stability and cooking yield for *Aloe vera* gel treated groups than control and Mint extract groups. A non-significant (P>0.05) difference and decline trend in rusk pick up percentage was observed for all treatments during storage. The proximate analysis of cutlets revealed that moisture content of cutlets incorporated with *Aloe vera* gel was higher than Mint extract treated groups. A non-significant (P>0.05) and decline trend in protein and fat were observed in mint extract than control. A significant (P<0.05) difference as well as decline leaning in protein and fat was observed in *Aloe vera* gel groups. The chicken cutlet could be incorporated with 3% of *Aloe vera* gel and 0.8% Mint extract for optimum results. The *Aloe vera* gel can be utilized as an organic and natural preservative for preparation of chicken cutlets.

Keywords: Cutlets, *Aloe vera* gel, mint extract, physico-chemical, proximate analysis

Introduction
Chicken cutlet is the most common meat snacks food that satisfying short term hunger and provide high biological value energy and essential nutrients. Poultry meat consumption is continuously uplifting in both developed as well as developing nations because of its high nutrients density, low fat and with more desirable unsaturated fatty acid content than other meats. Poultry meat has significant content of vitamins from group B such as thiamine, riboflavin, niacin and vitamin B_6, although vitamin B_{12} content is less than in other meats (Barroeta, 2007) [5].

Aloe vera used in food industry attracts attention for production of many different type of functional food products such as drink, beverage, ice cream and edible coatings (Moore and MacAnalley, 1995) [15]. The *Aloe vera* plant and its' derivative products have played a role in medicine and health-care dating as far back as the 4th century B.C. when ancient Greek doctors obtained *Aloe vera* from the island of Socotra in Indian Ocean (Manvitha and Bidya 2014) [14]. *Aloe vera* (*Aloe barbadensis miller*) has numerous monosaccharide's and polysaccharide's, vitamin B_1, B_2, B_6 and C, niacinamide and choline, enzymes (acid and alkaline phosphatase, amylase, lactate dehydrogenase, lipase) and organic compounds (aloin, barbaloin and emodin). Additional minerals found in *Aloe vera* include copper, iron, potassium, phosphorus and sodium (Barcroft and Myskja, 2003) [4].

According to Arslan *et al.*, (2010) [2] mint flavour is most common type of flavoring agent coming after vanilla and citrus flavors. The extract of mint can be utilized to enhance nutritive value of product, as mint is well known for its nutritional qualities. The principal component in *Mentha piperita* is usually neomenthol and isomenthol. Other monoterpenes include menthone, menthyl acetate, mentofurran, cineol and limonene. Mint Leaves are good source of β-carotene (1620 µg / 100 g), calcium (200 mg / 100 g), Iron (15.6 mg / 100 g) and vitamin C (27mg /100 g). The mint leaves also contain riboflavin (80 µg / 100 g) and thiamin (50 µg / 100 g) (Bose, 1985).

Material and Methods

The broiler meat was purchased from local market of Vallabhnagar, Udaipur. Meat was manually deboned and packed in low density polyethylene (LDPE) and stored at -18±1 °C overnight then used for product formulation after thawing at 4±1 °C. Spice mix powder was prepared using proportion of each ingredient as mentioned by Kumari (2016): black paper (*Piper nigrum*) 16.6%, cumin (*Cuminum cyminum*) 31.6%, coriander (*Coriandrum sativum*) 33.3%, cinnamon (*Cinnamomum zeylanicum*) 10% and red paper 8.3%. Mint leaves were ground in an electrical grinder and the collected pulpy content was filtered through muslin cloth to get pure extract. Filtered mint extract was stored at 4 °C until use. Fresh *Aloe vera* leaves were washed, traditional hand filleting method was adopted to harvest the parenchymatous gel inside. Gel was collected and preserved for future use in refrigeration (4±1 ^{0}C) until further use.

Fresh onion, ginger, garlic were minced in a mixer grinder and condiment mix (paste) was prepared by blending mixing onion, ginger and garlic paste in the 2:1:1 ratio respectively. Fresh potatos were purchased and washed with tap water, boiled and manually shredded after separation of their outer covering. They were stored in clean, dry and sterilized polyethylene terephthalate (PET) moisture free jar for subsequent use. Whole egg liquid was made by using fresh egg procured from the poultry farm of College of Veterinary and Animal Science, Navania, Vallabhnagar, Udaipur**.**

Bread was dried in an oven at 70±2 °C for 2 hours and grinded in domestic grinder and stored in moisture free clean, dry and sterilized PET (polyethylene terephthalet) jar till further use.

Abbreviation used for control and treatments are as following: Control (C), 0.6% mint extract (ME_1), 0.8% mint extract (ME_2),), 1% mint extract (ME_3), *Aloe vera* gel 3% (AG_1), *Aloe vera* gel 5% (AG_2) and *Aloe vera* gel 7% (AG_3). All the required chemicals and media used in the study were of analytical grade and purchased from standard firms (Hi-media, India, SRL, India and Molychem, India).

Methodology

Deboned meat was deboned after thawing cut into small pieces in meat mincer. Salt was added in minced meat and chopped in bowl chopper (SANCO, Model: SFP54) with ingredients to get proper emulsion. Chicken cutlets were prepared from emulsion according to the method of Singh *et al.,* (2015) [16-17] with slight modification. During experiment the treatment groups were replaced as *Aloe vera* Gel at 3%, 5% and 7% and mint extract at 0.6%, 0.8%, 1% levels.

The chicken meat emulsion was moulded (oval shaped) in equal size and cooked in hot air oven at 175 °C for 20 minute with intermittent turning after 10 minutes. Then down the temperature of cutlets at room temperate and rolled over the bread crumbs. Than shallow frying at 140-150 °C till it became golden brown, cooled upto room temperature, packed in LDPE bags and stored in refrigerator (4 ± 1 ^{0}C).

The cooking yield of product was calculated as: Cooking yield (%) =Weight of cooked cutlet / Weight of uncooked cutlets x 100.

Rusk pick up of chicken cutlets was determined by as per the procedure of Hsia *et al*., (1992) [11]. Shrinkage of the cooked cutlet was determined as per procedure described by El-Magoli *et al.,* (1996) [8] with slight modification. Moisture, fat, protein and ash content of chicken cutlets were estimated as per the method of AOAC (1995) [1].

The pH of chicken cutlets was measured using digital pH meter as suggested by Trout *et al.,* (1992) [21]. Emulsion stability of product was determined as per the procedure of Baliga and Madaiah (1970) [3].

Statistical analysis of data obtained was done according to ANOVA describe method by Snedecor and Cochran (1989) [18].

Results and Discussion

The emulsion stability did not differ significantly (P>0.05), but slight decrease in emulsion stability was noticed with incorporation of different levels of mint extract. This might be attributed due to increase in moisture content with addition of mint extract in chicken cutlet. Similar observations were made by Dushyanthan *et al.,* (2008) [7], who observed that higher emulsion stability in cutlet with low moisture content which had same meaning that if moisture in product increases at the same time emulsion stability decreased.

All the three treatments of *Aloe vera* gel cutlet (AG_1, AG_2 and AG_3) were having the higher value of emulsion stability than mint extract (ME_1, ME_2 and ME_3) groups. Where all treatments of *Aloe vera* gel observed higher emulsion stability compare to control. The emulsion stability of chicken cutlet incorporated with different level of *Aloe vera* differed significantly (P<0.05) with increasing trend, this might be due to gel-forming properties of *Aloe vera* (Hamman, 2008; Coviello *et al*., 2007) [8].

A significant (P<0.05) increasing trend was observed in cooking yield with escalating *Aloe vera* incorporation. This might be due to gel forming properties of *Aloe vera* attributed to monosaccharide polymers.

Rusk pick up percentage was found non-significantly (P>0.05) different in all treatments as well as control. Singh *et al*., (2015) [16-17] also observed that non-significant changes found in rusk pick up of chevon cutlet with incorporated oats.

The shrinkage value of chicken cutlets incorporated with mint extract did not differ significantly (P>0.05), but slightly increase in shrinkage was noticed with increasing level of mint extract. *Aloe vera* treated cutlets were seen to be decreasing significantly (P<0.05) with increasing levels of *Aloe vera*. This could be attributed to the high water holding & moisture retention of *Aloe vera* during cooking (Soltanizadeh and Ghiasi-Esfahani, 2015) [19]. The present findings are in agreement with Soltanizadeh and Ghiasi-Esfahani (2015) [19].

The whole proximate analysis is presented in Table 2. Chicken cutlets treated with *Aloe vera* gel recorded higher moisture content than mint extract group and control. A significant difference (P<0.05) and inclined trend in moisture content was observed in *Aloe vera* gel treated chicken cutlets. This might be due to higher moisture present in *Aloe vera* pulp (Eshun and He, 2004) [9]. Das *et al.,* (2013) [6, 22] also reported an increase in moisture of a chicken nugget incorporated with the fermented bamboo shoot.

The non-significant (P>0.05) difference was found in protein content of mint extract treated chicken cutlets. The protein content of *Aloe vera* gel treated chicken cutlets decreased significantly (P<0.05) with lean meat replacement. The present findings are in agreement with Verma *et al*., (2013) [22] who also reported a decrease in the protein content of sheep meat nuggets and low fat, low sodium chicken nuggets with the incorporation of guava powder and bottle gourd, respectively.

Fat content of C group was highest (14.435±0.002) and AG_3 was lowest (13.684±0.201). In mint extract treated cutlets

(ME_1, ME_2 and ME_3) a non-significant and decline trend was observed. A significant (P<0.05) decreasing trend was observed in *Aloe vera* gel treated cutlets (AG_1, AG_2 and AG_3). The probable reason for the decreasing trend in fat percent might be due to the lower fat content of *Aloe vera* pup (Eshun and He, 2004) [9].

The results indicated that there was non-significant difference in ash content of mint extract treated cutlets as well as in control. A significant (P<0.05) decreasing trend was observed with increasing incorporation levels of *Aloe vera*. However, the difference was non-significant (P>0.05) between AG_2 and AG_3. AG_1 was significantly (P<0.05) lower as compared to control.

The pH mean values of all mint extract treated cutlets were found higher than control group during the whole storage period as Table 3. The pH of *Aloe vera* treated cutlet were lower than control as well as mint extract group. The similar observation was made by Soltanizadeh and Ghiasi-Esfahani (2015) [19], who reported that *Aloe vera* has an acidic pH that reduces the pH of meat products. During storage, there was a significant (P<0.05) increase in pH of a chicken cutlet. The increase in pH during storage might due to degradation of lactic acid and liberation of protein metabolites by bacterial enzymes (Jay, 1996) [12]. Similar finding was reported by Sudheer *et al*., (2010) [20] in the restructured chicken block.

Conclusion

On the basis of physico-chemical properties and proximate analysis, result indicates that cutlet from broiler meat could be successfully incorporated with 3 percent of *Aloe vera* gel and 0.8% mint extract for optimum results.

Table 1: Effect of incorporation of mint extract and *Aloe vera* gel on chicken cutlets (Mean ± SE)

Parameters/ Treatments	C	ME_1	ME_2	ME_3	AG_1	AG_2	AG_3
Emulsion Stability (%)	$92.412^{c} \pm 0.010$	$92.384^{c} \pm 0.010$	$92.344^{c} \pm 0.007$	$92.266^{c} \pm 0.045$	$93.748^{b} \pm 0.134$	$94.092^{a} \pm 0.067$	$94.242^{a} \pm 0.078$
Cooking Yield (%)	$86.518^{d} \pm 0.211$	$86.496^{d} \pm 0.211$	$86.348^{d} \pm 0.184$	$86.27^{d} \pm 0.162$	$87.486^{c} \pm 0.165$	$88.514^{b} \pm 0.151$	$89.458^{a} \pm 0.185$
Shrinkage (%)	$0.958^{a} \pm 0.006$	$0.962^{a} \pm 0.006$	$0.964^{a} \pm 0.007$	$0.972^{a} \pm 0.007$	$0.822^{b} \pm 0.004$	$0.746^{c} \pm 0.002$	$0.674^{d} \pm 0.002$
Rusk pick up (%)	$6.193^{a} \pm 0.060$	$6.144^{a} \pm 0.020$	$6.146^{a} \pm 0.020$	$6.148^{a} \pm 0.020$	$6.123^{a} \pm 0.001$	$6.125^{a} \pm 0.001$	$6.126^{a} \pm 0.001$

[n=6, Mean in column bearing a common superscripts (small letters) do not differ significantly (P>0.05). C= control, ME_1= 0.6% mint extract, ME_2= 0.8% mint extract, ME_3= 1% mint extract, AG_1=3% *Aloe vera* gel, AG_2= 5% *Aloe vera* gel and AG_3=7% *Aloe vera* gel]

Table 2: Effect of incorporation of mint extract and *Aloe vera* gel on proximate analysis of chicken cutlets. (Mean ± SE)

Parameters/ Treatments	C	ME1	ME2	ME3	AG1	AG2	AG3
Moisture %	$57.168^{d} \pm 0.183$	$57.21^{d} \pm 0.188$	$57.242^{d} \pm 0.183$	$57.272^{d} \pm 0.188$	$57.674^{c} \pm 0.136$	$58.112^{b} \pm 0.212$	$58.758^{a} \pm 0.126$
Protein %	$18.534^{a} \pm 0.002$	$18.526^{a} \pm 0.001$	$18.518^{a} \pm 0.003$	$18.513^{a} \pm 0.001$	$18.050^{b} \pm 0.003$	$18.008^{b} \pm 0.005$	$17.672^{c} \pm 0.198$
Fat %	$14.43^{a} \pm 0.002$	$14.42^{a} \pm 0.001$	$14.420^{a} \pm 0.002$	$14.415^{a} \pm 0.002$	$14.062^{b} \pm 0.012$	$14.020^{b} \pm 0.013$	$13.684^{c} \pm 0.201$
Ash%	$2.362^{a} \pm 0.001$	$2.354^{a} \pm 0.001$	$2.352^{a} \pm 0.000$	$2.349^{a} \pm 0.001$	$2.104^{b} \pm 0.009$	$1.982^{c} \pm 0.004$	$1.940^{c} \pm 0.040$

[n=6, Mean in column bearing a common superscripts (small letters) do not differ significantly (P>0.05). C= control, ME_1= 0.6% mint extract, ME_2= 0.8% mint extract, ME_3= 1% mint extract, AG_1=3% *Aloe vera* gel, AG_2= 5% *Aloe vera* gel and AG_3=7% *Aloe vera* gel]

Table 3: Effect of incorporation of mint extract and *Aloe vera* gel on pH of chicken cutlets. (Mean ± SE)

Days/Treatments	0^{th}	5^{th}	10^{th}	15^{th}	20^{th}
C	$^{C}6.143^{c} \pm 0.000$	$^{C}6.148^{c} \pm 0.002$	$^{C}6.157^{c} \pm 0.005$	$^{B}6.308^{b} \pm 0.012$	$^{A}6.372^{d} \pm 0.003$
ME_1	$^{C}6.208^{b} \pm 0.000$	$^{C}6.215^{b} \pm 0.002$	$^{C}6.232^{b} \pm 0.002$	$^{B}6.350^{a} \pm 0.018$	$^{A}6.411^{c} \pm 0.001$
ME_2	$^{C}6.229^{ab} \pm 0.000$	$^{C}6.230^{b} \pm 0.000$	$^{C}6.231^{b} \pm 0.000$	$^{B}6.368^{a} \pm 0.000$	$^{A}6.421^{b} \pm 0.001$
ME_3	$^{C}6.248^{a} \pm 0.000$	$^{C}6.255^{a} \pm 0.002$	$^{C}6.266^{a} \pm 0.002$	$^{B}6.385^{a} \pm 0.016$	$^{A}6.441^{a} \pm 0.001$
AG_1	$^{C}5.851^{d} \pm 0.002$	$^{C}5.855^{d} \pm 0.002$	$^{C}5.862^{d} \pm 0.001$	$^{B}6.025^{c} \pm 0.008$	$^{A}6.040^{e} \pm 0.000$
AG_2	$^{C}5.731^{e} \pm 0.021$	$^{C}5.735^{e} \pm 0.021$	$^{C}5.761^{e} \pm 0.000$	$^{B}5.955^{d} \pm 0.023$	$^{A}6.022^{f} \pm 0.002$
AG_3	$^{C}5.591^{f} \pm 0.000$	$^{C}5.604^{f} \pm 0.000$	$^{C}5.621^{f} \pm 0.000$	$^{B}5.826^{e} \pm 0.025$	$^{A}5.865^{g} \pm 0.008$

[n=6, Mean in column bearing a common superscripts (small letters) do not differ significantly (P>0.05). C= control, ME_1= 0.6% mint extract, ME_2= 0.8% mint extract, ME_3= 1% mint extract, AG_1=3% *Aloe vera* gel, AG_2= 5% *Aloe vera* gel and AG_3=7% *Aloe vera* gel]

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