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Effect of Gooseberry Powder on the Shelf Life of Spent Hen Meat Pickle at Room Temperature

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ABSTRACT

Meat is a nutrient dense food. In view of worldwide demand for natural food additives, search for natural preservatives have notably increased for the ready-to-eat products in recent years. Hence, the present study was envisaged to assess the changes in quality of spent hen meat pickle (SHMP) prepared by using gooseberry powder (GBP) as natural preservative along with acetic acid during storage at room temperature. The products *viz*. SHMP containing 1% acetic acid (control), SHMPs with 2% GBP (T-1) and 3% GBP (T-2) along with 0.5% acetic acid were prepared and packed in PET (Polyethylene terephthalate) bottles. The products were stored at room temperature for a period of 60 days after a maturation period of 7 days. The control and treated products were evaluated for physico-chemical, sensory and microbiological quality at 10 days interval on 0, 10, 20, 30, 40, 50 and 60 days of storage. Significant differences ($P<0.05$) in proximate composition (moisture, protein and fat %) and pH between products and between storage days were observed. The protein and fat contents were significantly ($P<0.05$) higher for T-2 product than other products. T-2 product and the control sample showed lower pH values throughout the storage period than T-1 product. T-2 product had significantly ($P<0.05$) lower TBA values than control and T-1 products. There was gradual but significant ($P<0.05$) increase in TBA and tyrosine values in all the products with the advancement of storage period but values were much below the threshold of spoilage. The standard plate count (SPC) values were much below the permissible limit for all the products. All the products had very good sensory scores (>7 in 8 point hedonic scale) for all the sensory attributes throughout the storage period.

Key words: *Meat pickle, Gooseberry powder, Physico-chemical quality, Microbiological quality, Sensory quality*

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INTRODUCTION

Meat is a highly valued food product for human consumption as an excellent source of high quality proteins with well-balanced amino acids, B complex vitamins and certain minerals, especially iron and zinc. Over last few years the demand for poultry meat is increasing because it is an excellent and cheaper protein food of animal origin and considered as low fat and low calorie (Akiba *et al*., 2001). Spent hen meat has poor eating quality because of more toughness and less juiciness which are attributed to high collagen content (Abe *et al*., 1996) with high degrees of cross linkages (Wenham *et al*., 1973; Bailey, 1984) as compared to broiler meat. In spite of containing high quality nutrients, spent hen meat has minimal economic values as fresh meat (Baker *et al*., 1968; Mahapatra *et al*., 1984). Spent hen meat could be profitably utilized by converting into value added meat products by application of suitable and acceptable processing technology to suit the taste of Indian consumers.

Meat pickles are ready-to-eat convenient meat products with good shelf stability at ambient temperature (Das *et al*., 2007; Indumathi *et al*., 2016). Pickling of meat is an alternative method to develop a low cost shelf stable meat product for the market. Pickling also helps in improving desirable characteristics like taste, flavor and texture along with preservative effect. Relatively low water activity (a_w) and low pH are the major barriers that contribute to shelf stability of pickled food (Gadekar *et al*., 2010). Acidification of food to pH below 4.6 is intended to prevent the growth of microorganisms and make the product shelf stable at room temperature (Food Processor Institute, 1998). The growth of *Clostridium botulinum* can be prevented as its spores do not grow below pH 4.6 or at water activity below 0.94 (Solomon and Kautter, 1988). In the process of pickling, various organic acids are used to regulate the pH throughout the storage at room temperature. Acetic acid is one of the most commonly used

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acidulant for preparation of pickles. Now-a-days their usage is being restricted owing to desire for products with natural preservatives. Consumer preferences for natural products have resulted in an increased interest in the use of natural acidulants especially from fruits like gooseberry juice (*Emblica officinalis*), lemon juice *(Citrus limonium*), and green mango (*Mangifera indica*) (Reddy *et al*., 2013).

Gooseberry is the richest source of antioxidants like vitamin C, emblicanin A and B, punigluconin, pedunculagin, superoxide dismutase, catalase, gluthathione peroxidase (Bhattacharya *et al.*, 2000) and tannin, trigalloyl, polyphenol, flavonoids, ellagic acid and phyllembic acid (Anilakumar *et al*., 2004). Gooseberry juice has been reported to contain 0.35% ascorbic acid, 0.33% tannins, 0.13% gallic acid, 0.58% total organic acid and 0.002% iron (Padma *et al*., 2014). Gallic acid and tannic acids are the phenolic acids present in gooseberry which contribute to the antioxidant activity, in addition to ascorbic acid. Vitamin C present in the gooseberry fruit does not get oxidized easily during high heat processing due to protection from tannins (Scartezzini *et al*., 2006). Gooseberry fruit possesses strong free radical scavenging activity of 89% (Naveen *et al*., 2011). Gooseberry is reported to possess high antibacterial activity against *E. coli, Klebsiella pneumoniae, Pseudomonas aerugenosa* and *Salmonella paratyphi* (Saeed and Thariq, 2007).

Lipid oxidation and growth of undesirable microorganisms in food products are the major causes of off flavor, rancidity, deterioration and spoilage rendering such products unacceptable for human consumption. Meat is a rich medium for the growth of microorganisms due to its high water activity and high levels of nutrients and hence, it is a highly perishable food. Synthetic anti-oxidants which are used in food industry have been found to exhibit various adverse health effects in consumers. Therefore, there is an increasing interest in use of natural antioxidants in meat products. Hence, the present study was conducted to evaluate the effect of gooseberry powder on the shelf stability of spent hen meat pickle at room temperature.

MATERIALS AND METHODS

Preparation of spent hen meat pickle with gooseberry powder: Spent hen meat pickles were prepared as per the standardized recipe and procedure (Kumerasan *et* al., 2019) containing 1% acetic acid for control, 0.5% acetic acid+2% gooseberry powder for 2% GBP product (T-1) and 0.5% acetic acid +3% gooseberry powder for 3% GBP product (T-2). Then the meat pickles (control and treatments) were packed in Polyethylene terephthalate (PET) bottles and stored at room temperature. Changes in the physico-chemical, microbiological and organoleptic quality of the pickles were studied at 10 days interval up to 60 days (*i.e.*, on 0, 10, 20, 30, 40, 50 and 60th day) of storage.

Physico-chemical analyses and chemical composition: The cooking yield (%) of spent hen meat pickle was calculated following Murphy *et al.* (1975). The pH of spent hen meat pickles was determined by following the procedure of AOAC (1995) using combined glass electrode of the pH meter. The distillation method described by Tarladgis *et al.* (1960) was followed for the determination of TBA value of spent hen meat pickles. Tyrosine value of spent hen meat pickles was estimated adopting the procedure of Strange *et al.* (1977). Chemical composition including moisture, crude protein and fat contents of the spent hen meat pickles were determined as per AOAC (1995). Samples for determination of moisture and protein contents were taken after complete draining followed by wiping of gravy from the pickled meat pieces using tissue paper. Fat (%) was determined using moisture free samples.

Microbiological quality: Microbiological parameters such as standard plate count (SPC) and yeast and mould counts (YMC) of spent hen meat pickles were determined by following the procedures recommended by APHA (1984).

Sensory Evaluation: A semi-trained panel recorded their preference on 8 point hedonic scale (8=extremely desirable, 1=extremely undesirable) (Keeton, 1983) for the sensory attributes of the spent hen meat pickle *viz.* appearance, flavor, texture, saltiness, sourness and overall palatability.

Statistical Analysis: Each experiment was replicated thrice and each parameter was analyzed in duplicate. The data recorded were analyzed using SPSS version 17.0 (SPSS, Chicago, III, and U.S.A). One-way analysis of variance (ANOVA) was used for cooking yield and for all the other parameters two-way analysis of variance was applied. The significant effects were tested by comparing mean values using the least significant difference (LSD) test at 1 and 5% level (Snedecor and Cochran, 1994).

RESULTS AND DISCUSSION

Effect of gooseberry powder (GBP) on the cooking yield (%) of spent hen meat pickle: Cooking yield (%) of spent hen meat pickles ranged from 64.46±0.20 to 65.32±0.10% (Table 1). No significant differences were observed among the treatments and control. However, T-2 pickle exhibited slightly lower cooking yield compared to control and T-1 pickles. Jayanthi *et al.* (2008) reported an average cooking yield of 58.4% for spent hen meat pickle which was little lower than the cooking yield (%) recorded in the present study. Kanagaraju and Subramanian (2012) also recorded *cooking yield of* 58.4% in spent duck meat pickle.

Table 1: Effect of gooseberry powder (GBP) on the cooking yield of spent hen meat pickle

Sample	Cooking yield (%)
Control	65.32±0.10
T-1 (2% GBP)	64.75±0.15
T-2 (3% GBP)	64.46±0.20

***Effect of gooseberry powder on the pH of spent hen meat pickle at room temperature storage*:** Significant (P<0.05) differences in pH values were observed between the products and between the storage days (Table 2). The initial pH of T-1 sample was significantly (P<0.05) higher than the control and T-2 samples and this trend continued throughout the storage period. In control samples pH showed very minimal variation and remained almost unchanged during storage. In T-1 products pH decreased significantly (P<0.05) to 4.41±0.08 on 20th day of storage from an initial pH of 4.45± 0.01 and thereafter the pH remained stable throughout the storage period. In T-2 samples pH did not show any significant variation throughout the storage period. Das *et al.* (2013) reported that pH of spent hen chicken pickle ranging from 4.72 ± 0.12 to 4.77 ± 0.15. The pH of all the products in the present study was little below the reported range but well below the pH of 5.00 which is considered to be critical for storage stability of meat pickle (Dziezak, 1986). Singh *et al.* (2011) reported that gooseberry juice added spent quail meat pickle had lower pH (4.70) compared to lemon juice and green mango juice added quail meat pickles.

***Effect of gooseberry powder on the Thiobarbituric acid value (TBA) of spent hen meat pickle at room temperature storage*:** There were significant (P<0.05) differences in TBA values between products as well as the storage days (Table 2). The TBA values (mg malonaldehyde/ kg) of the products increased significantly (P<0.05) in the following order: control (0.559±0.01 to 0.707±0.01) followed by T-1 (0.340±0.01 to 0.411±0.01) and T-2 (0.3±0.01 to 0.385±0.01). Control had significantly higher (P<0.05) TBA value than T-1 and T-1 had significantly higher (P<0.05) TBA values than T-2 throughout the storage period. There was slow but significant (P<0.05) linear increase in TBA values for all the products with the increase in storage period. TBA values in chicken gizzard pickles stored at room temperature increased from 0.3 mg malonaldehyde/kg at 0 day to 2 mg/kg on 45th day (Sachdev *et al.*, 1994). Shukla and Srivastava (1999a) reported a significant (P<0.01) increase in TBA values of chicken pickle from 0.373 mg malonaldehyde/kg product on 0 day to 1.036 mg/kg of malonaldehyde on 90th day of ambient storage. Similar to the findings of the present study various authors have reported gradual but significant (P<0.05) increase in the TBA values during storage of pickles prepared from mature chicken and chicken gizzard (Puttarajappa *et al.*, 1996; Grover *et al.*, 2004; Jayanthi *et al.*, 2008 and Nayak *et al.*, 2009). Das *et al.* (2013) recorded increase in TBA values (mg malonaldehyde/ kg) from 0.341± 0.11 to 0.411± 0.33 from 0 day to 90 days of storage and reported significant differences (P<0.01) amongst the storage periods. In the present study, the lower TBA value in T-1 and T-2 samples might be due to antioxidant properties of GBP as gooseberry is reported to be rich in antioxidants which can withstand thermal processing (Karpagavalli *et al.*, 2014).

***Effect of gooseberry powder on the Tyrosine value (TV) of spent hen meat pickle at room temperature storage*:** The product type and storage days had significant effects (P<0.05) on the tyrosine value. Control samples had significantly (P<0.05) higher TV (mg/100g product) of 17.64 ± 0.02 than T-1 (16.53 ± 0.03) at initial stage. But T-2 had significantly (P<0.05) lower TV (16.09 ± 0.01) than control and T-1 samples on 0 day and this trend continued for entire storage period (Table 2). All the samples showed slow but significant (P<0.05) increase in TV during the storage but T-2 had the lowest value compared to control and T-1. All the values were much below the threshold of spoilage for the entire period of storage. Banikumar (2012) reported that duck pickle had tyrosine value ranging from 0.411 to 0.706 (mg/ 100g) at room temperature for 28 days of storage. It is evident that in the present study GBP had exerted some preservative effects which helped in reducing the TV in treated products significantly compared to control sample and this effect continued throughout the storage period.

Table2: Effect of gooseberry powder on the pH, TBA value and Tyrosine value of spent hen meat pickle during storage at room temperature (Mean ± SE)

Parameter		Storage days						
	Sample	**0**	**10**	**20**	**30**	**40**	**50**	**60**
pH	Control	4.33 ± 0.01^{aA}	4.38 ± 0.003^{bB}	4.35 ± 0.02^{abA}	4.35 ± 0.003^{aA}	4.36 ± 0.04^{abA}	4.37 ± 0.06^{abA}	4.33 ± 00.01^{aA}
	T-1 (2% GBP)	4.45 ± 0.01^{bB}	4.47 ± 0.01^{bC}	4.41 ± 0.08^{aB}	4.39 ± 0.005^{aB}	4.40 ± 0.003^{aB}	4.41 ± 0.001^{aB}	4.41 ± 0.005^{aB}
	T-2 (3%GBP)	4.34 ± 0.01^{bA}	4.35 ± 0.002^{bA}	4.33 ± 0.01^{bcA}	4.34 ± 0.005^{bA}	4.35 ± 0.004^{bA}	4.35 ± 0.005^{bA}	4.32 ± 0.002^{cA}
TBA Value (mg malonaldehyde/ kg product)	Control	0.559 ± 0.01^{aC}	0.592 ± 0.01^{bC}	0.603 ± 0.01^{cC}	0.617 ± 0.01^{dC}	0.635 ± 0.01^{eC}	0.661 ± 0.01^{fC}	0.707 ± 0.01^{gC}
	T-1 (2% GBP)	0.340 ± 0.01^{aB}	0.358 ± 0.01^{bB}	0.389 ± 0.01^{cB}	0.396 ± 0.01^{dB}	0.398 ± 0.01^{dB}	0.402 ± 0.01^{eB}	0.411 ± 0.01^{fB}
	T-2 (3% GBP)	0.300 ± 0.01^{aA}	0.314 ± 0.01^{bA}	0.325 ± 0.01^{cA}	0.342 ± 0.01^{dA}	0.356 ± 0.01^{eA}	0.372 ± 0.01^{fA}	0.385 ± 0.01^{gA}
Tyrosine Value (mg/100g product)	Control	17.64 ± 0.02^{aC}	21.08 ± 0.03^{bC}	25.30 ± 0.02^{cC}	32.40 ± 0.02^{dC}	35.20 ± 0.02^{eC}	40.14 ± 0.02^{fC}	46.39 ± 0.05^{gC}
	T-1 (2% GBP)	16.53 ± 0.03^{aB}	19.19 ± 0.02^{bB}	23.89 ± 0.04^{cB}	31.85 ± 0.06^{dB}	32.14 ± 0.01^{dB}	37.45 ± 0.12^{eB}	42.44 ± 0.07^{fB}
	T-2 (3% GBP)	16.09 ± 0.01^{aA}	18.79 ± 0.02^{bA}	20.21 ± 0.03^{cA}	28.10 ± 0.02^{dA}	28.14 ± 0.03^{dA}	33.36 ± 0.02^{eA}	38.29 ± 0.03^{fA}

Means with different superscripts in a row (lower case letters) and in a column (upper case letters) differed significantly ($P<0.05$)

Effect of gooseberry powder on the proximate composition of spent hen meat pickle during storage at room temperature: The moisture content of control, T-1 and T-2 samples varied between 48.96±0.20 to 45.42±0.02%, 47.90±0.22% to 44.77±0.22%, 45.01±0.07 to 42.84±0.03%, respectively during storage. Both product type and storage periods had significant ($P<0.05$) effects on the moisture content of spent hen meat pickles (Table 3). Control samples had significantly higher ($P<0.05$) moisture (%) than T-1 and T-2 samples and differences in the moisture content between T-1 and T-2 samples were also significant ($P<0.01$) and this trend continued for entire storage period. The decrease in moisture (%) in GBP added products might be due to addition of GBP in the products which had high dry matter content. Sharma *et al.* (1986) prepared chicken gizzard pickles using indigenous recipes and recorded 40.53 per cent moisture in the product. As observed in the present study, Puttarajappa *et al.* (1996) also reported gradual decrease in moisture contents of shelf stable chicken pickle over a period of 6 months at ambient temperature. Maiti *et al.* (2009) reported that control gizzard pickle had 54.25% moisture and the moisture (%) of organ pickles were in the range of intermediate moisture meat products having about 46 to 55% moisture which are almost in the range found in the present study. Singh *et al.* (2011) reported that gooseberry juice added quail meat pickle had moisture content of 63.27 to 64.93 % which were higher than results obtained in the present study.

The protein content of spent hen meat pickles ranged from 24.76±0.05 to 25.41±0.13% for control, 25.18±0.18 to 26.16±0.01

% for T-1 and 26.30±0.15 to 27.23±0.22% for T-2 samples and there were significant differences ($P<0.05$) between control and treatments (Table 3). The protein content of all the products increased from 20 days onwards and then remained almost stable up to 60 days of storage. This increase might be due to reduction in the moisture per cent during storage. Protein content of the samples in present study was very close to the values (25.75 to 25.99%) reported by Wani and Majeed (2014) for meat pickle prepared from chicken gizzard. However, Das *et al.* (2013) recorded lower protein content of 17.28±0.56% in pickle obtained from culled hen meat.

The fat content of the spent hen meat pickles was significantly higher for T-2 (17.10±0.08 to 17.79±0.04%) followed by T-1 (16.85±0.01 to 17.37±0.04) and control (16.08±0.09 to 16.54±0.01%) during storage period (Table 3). Significant differences ($p<0.05$) were recorded between control and treated products. Siddhu *et al.* (1995) reported that meat pickle prepared from mature chicken contained 14.75 per cent fat. In another study, fat content of 15.77% in spent quail meat pickle containing gooseberry juice was reported by Singh *et al.* (2011).

Table 3: Effect of gooseberry powder on the proximate composition of spent hen meat pickle during storage at room temperature (Mean ± SE)

Parameter	Sample	Storage days 0	10	20	30	40	50	60
Moisture (%)	Control	48.41 ± 0.12^{bC}	48.96 ± 0.2^{bC}	48.97 ± 0.15^{bC}	48.57 ± 0.19^{bC}	47.62 ± 0.11^{bC}	45.87 ± 0.03^{aC}	45.42 ± 0.02^{aC}
	T-1 (2% GBP)	47.79 ± 0.16^{bB}	47.90 ± 0.22^{bB}	47.44 ± 0.14^{bB}	47.17 ± 0.03^{bB}	45.33 ± 0.05^{aB}	44.76 ± 0.02^{aB}	44.77 ± 0.22^{aB}
	T-2 (3%GBP)	44.64 ± 0.15^{bA}	45.01 ± 0.07^{bA}	44.87 ± 0.26^{bA}	44.81 ± 0.13^{bA}	43.21 ± 0.02^{aA}	43.24 ± 0.35^{aA}	42.84 ± 0.03^{aA}
Protein (%)	Control	24.76 ± 0.05^{aA}	24.81 ± 0.06^{aA}	25.23 ± 0.09^{bA}	25.20 ± 0.02^{bA}	25.25 ± 0.02^{bA}	25.29 ± 0.04^{bA}	25.41 ± 0.13^{bA}
	T-1 (2% GBP)	25.56 ± 0.01^{aB}	25.18 ± 0.18^{aA}	25.97 ± 0.16^{bB}	26.06 ± 0.06^{bB}	26.10 ± 0.02^{bB}	26.13 ± 0.02^{bB}	26.16 ± 0.01^{bB}
	T-2 (3% GBP)	26.54 ± 0.04^{aC}	26.30 ± 0.15^{aB}	27.23 ± 0.22^{bC}	26.71 ± 0.03^{abC}	26.63 ± 0.04^{abC}	26.70 ± 0.05^{abC}	26.47 ± 0.02^{aC}
Fat (%)	Control	16.08 ± 0.09^{aA}	16.15 ± 0.05^{aA}	16.39 ± 0.02^{bA}	16.46 ± 0.09^{bA}	16.48 ± 0.04^{bA}	16.50 ± 0.03^{bA}	16.54 ± 0.01^{bA}
	T-1 (2% GBP)	17.05 ± 0.04^{B}	16.85 ± 0.01^{B}	17.37 ± 0.04^{B}	17.12 ± 0.03^{B}	17.08 ± 0.01^{B}	17.11 ± 0.01^{B}	17.14 ± 0.04^{B}
	T-2 (3% GBP)	17.41 ± 0.08^{C}	17.10 ± 0.08^{C}	17.79 ± 0.04^{C}	17.65 ± 0.05^{C}	17.31 ± 0.08^{C}	17.24 ± 0.07^{C}	17.14 ± 0.04^{C}

Means with different superscripts in a row (lower case letters) and in a column (upper case letters) differed significantly ($P<0.05$)

Effect of gooseberry powder on the Microbiological quality of spent hen meat pickle during storage at room temperature: The SPC (log cfu/g) for control, T-1 and T-2 samples ranged between 2.62±0.01 to 3.53±0.01, 2.72±0.01 to 3.43±0.01 and 2.54±0.01 to 3.36±0.01, respectively, from 0 day to 60 days of storage (table 4). Addition of 3% GBP in pickle resulted in significant ($P<0.05$) reduction in SPC (log cfu/g) on 0 day and this trend continued throughout the storage period. There was a slow but progressive significant ($P<0.05$) increase in SPC in all samples with the advancement of the storage period. Similar to the findings of the present study, Grover *et al.* (2004); Nayak *et al.* (2009) and Das *et al.* (2013) also recorded slow but linear significant ($P<0.05$) increase in SPC in gizzard pickle (2.47 to 3.88 (log cfu/g)), matured chicken pickle (3.42 to 3.98) and spent hen meat pickle (2.41±0.93 to 3.12±0.49 (log cfu/g)), respectively.

Yeast and mould counts were not detected in all the test products and control samples throughout the storage period. Similarly, Puttarajaappa *et al.* (1996) also recorded yeast and mould counts to the tune of 0 – 10 cfu/g during storage of shelf stable chicken pickle at room temperature for six months. Kumar and Bachhil (1993) reported that pork pickle was free from yeast and mould up to 120 days of storage. However, in other experiment yeast and mould counts were reported to have remained below 10 cfu/g in goat meat pickle throughout the storage period of 60 days (Pal and Agnihotri, 1994).

Table 4: Effect of gooseberry powder on the SPC of spent hen meat pickle during storage at room temperature (Mean ± SE)

Sample	Storage days						
	0	10	20	30	40	50	60
Control	2.62 ± 0.01^{aB}	2.86 ± 0.01^{bB}	3.04 ± 0.01^{cB}	3.15 ± 0.01^{dB}	3.29 ± 0.01^{eB}	3.42 ± 0.01^{fB}	3.53 ± 0.01^{gC}
T-1 (2% GBP)	2.72 ± 0.01^{aC}	2.91 ± 0.01^{bB}	3.08 ± 0.01^{cC}	3.17 ± 0.01^{dC}	3.32 ± 0.01^{eB}	3.39 ± 0.01^{fB}	3.43 ± 0.01^{gB}
T-2 (3%GBP)	2.54 ± 0.01^{aA}	2.75 ± 0.01^{aA}	2.96 ± 0.01^{cA}	3.06 ± 0.01^{dA}	3.23 ± 0.01^{eA}	3.24 ± 0.01^{fA}	3.36 ± 0.01^{gA}

Means with different superscripts in a row (lower case letters) and in a column (upper case letters) differed significantly ($P<0.05$)

Effect of gooseberry powder on the sensory attributes of spent hen meat pickle during storage at room temperature: The sensory evaluation scores of the products during storage of 60 days at room temperature (table 5) ranged from 7.40±0.62 to 7.80±0.45 for appearance, 7.40±0.62 to 7.80±0.40 for flavour, 7.30±0.52 to 7.70±0.46 for texture, 7.27±0.64 to 7.80±0.48 for saltiness, 7.33±0.75 to 7.77±0.43 for sourness and 7.37±0.55 to 7.80±0.40 for overall acceptability indicating that all the products had very high sensory scores throughout the storage period. Texture, saltiness, overall acceptability scores for T-1 samples were slightly higher than other two products but no significant differences were observed between the products and between the storage days for all the sensory attributes. Similarly, Jayanthi *et al.* (2008) and Das *et al.* (2013) observed a non-significant effect of storage on colour/appearance, flavour, texture, saltiness, sourness and overall acceptability scores of pickle prepared from spent hen meat over a period of 60 days. Singh *et al.* (2011) reported that gooseberry juice added quail meat pickle had texture, saltiness and sourness scores of 7.19, 7.07 and 6.98, respectively on 8-point hedonic scale which were lower than the scores recorded in the present study.

CONCLUSION

Based on the findings of present study it may be concluded that spent hen meat pickle containing gooseberry powder (2% and 3%) along with 0.5% acetic acid and 1% acetic acid alone (control) can be stored at room temperature for 60 days without any deterioration in qualities. Use of gooseberry powder as natural preservative in spent hen meat pickle has not only imparted shelf stability to the product but also helped in reducing the level of acetic acid in meat pickles thereby promising additional health promoting effect in the human body system.

Table 5: Effect of gooseberry powder on the pH, TBA value and Tyrosine value of spent hen meat pickle during storage at room temperature (Mean ± SE)

Parameter	Sample	Storage days 0	10	20	30	40	50	60
Appearance	Control	7.47±0.68	7.40±0.62	7.43±0.62	7.63±0.55	7.63±0.49	7.63±0.49	7.63±0.49
	T-1 (2% GBP)	7.53±0.57	7.40±0.67	7.47±0.73	7.60±0.62	7.73±0.45	7.73±0.45	7.73±0.45
	T-2 (3%GBP)	7.47±0.68	7.53±0.50	7.63±0.55	7.57±0.67	7.80±0.45	7.80±0.45	7.76±0.46
Flavour	Control	7.63±0.61	7.43±0.67	7.40±0.62	7.57±0.67	7.80±0.40	7.60±0.62	7.60±0.62
	T-1 (2% GBP)	7.57±0.56	7.47±0.62	7.43±0.67	7.60±0.49	7.80±0.40	7.77±0.43	7.77±0.43
	T-2 (3% GBP)	7.50±0.62	7.43±0.62	7.40±0.77	7.57±0.62	7.73±0.45	7.67±0.47	7.67±0.47
Texture	Control	7.43±0.77	7.33±0.71	7.43±0.62	7.37±0.61	7.30±0.52	7.40±0.62	7.43±0.62
	T-1 (2% GBP)	7.50±0.57	7.57±0.77	7.47±0.73	7.66±0.63	7.67±0.54	7.67±0.47	7.70±0.46
	T-2 (3% GBP)	7.47±0.50	7.43±0.67	7.33±0.80	7.60±0.62	7.60±0.47	7.60±0.50	7.60±0.50
Saltiness	Control	7.43±0.67	7.27±0.64	7.53±0.57	7.50±0.57	7.63±0.49	7.73±0.45	7.77±0.43
	T-1 (2% GBP)	7.63±0.57	7.57±0.62	7.67±0.61	7.60±0.49	7.77±0.43	7.73±0.45	7.80±0.48
	T-2 (3% GBP)	7.60±0.49	7.50±0.57	7.63±0.75	7.63±0.49	7.43±0.67	7.60±0.49	7.37±0.61
Sourness	Control	7.43±0.67	7.50±0.57	7.40±0.62	7.67±0.54	7.70±0.46	7.70±0.46	7.70±0.46
	T-1 (2% GBP)	7.63±0.57	7.60±0.57	7.37±0.76	7.63±0.49	7.73±0.45	7.73±0.45	7.77±0.43
	T-2 (3% GBP)	7.60±0.49	7.57±0.58	7.33±0.75	7.60±0.49	7.47±0.62	7.30±0.65	7.50±0.57
Over all acceptability	Control	7.60±0.62	7.37±0.55	7.50±0.57	7.52±0.34	7.63±0.49	7.63±0.49	7.63±0.49
	T-1 (2% GBP)	7.67±0.62	7.57±0.56	7.50±0.63	7.60±0.56	7.70±0.53	7.70±0.53	7.80±0.40
	T-2 (3% GBP)	7.57±0.68	7.43±0.77	7.53±0.57	7.60±0.49	7.60±0.49	7.60±0.57	7.70±0.57

CONFLICT OF INTEREST STATEMENT: Authors declare no conflict of interest in preparing this manuscript.

ETHICS STATEMENT: Chicken samples were purchased from retail markets and experiments did not involve live birds handling or slaughter.

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