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Development and quality evaluation of instant soup mix incorporated with spent hen meat shred

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Abstract
Spent hen meat shreds was incorporated in the preparation of an instant soup mix which was evaluated for physico-chemical, proximate composition and sensory parameters for a period of 90 days. Four treatment combinations with 0%, 20%, 25% and 30% spent hen meat shred were prepared as treatment A, B, C and D respectively. The bulk density and solubility increased with increase in meat shreds content. The water activity exhibited a significantly inclined trend as storage period advanced. The pH and TBARS values of the treatments increased significantly with increasing percentage of meat shreds. The moisture content increased significantly with storage period of 0 to 90 days in all the treatments. Significantly decreasing trend of moisture and carbohydrate content and significantly increasing trend of crude protein, crude fat, total ash and calorific value of the treatments were observed with increasing level of incorporation of chicken shreds. The sensory attributes showed significant decreasing trend during storage period irrespective of the treatments. Total Plate Count, Yeast & Mould, *E. coli* and *Staphylococcus spp.* indicates absence of microbial load during the whole storage period. The study indicated that the spent hen meat shred to the extent of 25% could successfully be incorporated in the formulation of instant soup mix to improve its nutritional and sensory qualities. It was also found that the instant soup mix was suitable to be aerobically stored in LDPE pouches at ambient temperature for a period of 90 days without any deterioration in its quality and acceptability.

Keywords: *Bhujia*, spent hen meat shred, Fracturability, storage stability, sensory attributes

Introduction
Soup is probably one of man's oldest foods, since it must have developed about the time when boiling was found to be a way of cooking food. It is a very fast form of cookery. Soups can be of poultry, meat or sea food, or of vegetables or combination of all in hot/boiling water until the flavour is extracted, forming a broth. However different in styles, but technically all the soup preparation involves the processes of boiling for flavour extraction and heat induced composition interaction. The word "soup" is originated from the teutonic word, *suppa*, which describes a medieval dish consisting of a thick stew poured on slices of bread, called sop, used to soak up the liquid. Soup is the one of the traditional food which can be classified as an appetizer, warm food during cold and sick. In this modern era homemade soup is replaced by commercially prepared instant soup such as canned, dehydrated, and frozen soups as soup preparation is a time consuming process. Instant soup can become an alternative food for breakfast because of its high energy and nutrient content, ease of preparation and minimum serving time [1]. Chicken soup is a soup made from chicken, simmered with various other ingredients. The classic chicken soup consists of a clear broth, often with pieces of chicken. Chicken soup, for instance, is regarded as the most ubiquitous medicinal soup in the world. The reputation of its healing power is well illustrated by its nick-name of "Jewish penecillin" "bohbymycetin" and "bobamycin" [2, 3]. Further, soup would stimulate the appetite and flow of digestive juices in stomach and normally they are consumed before meal. Studies on the effect of chicken soup on the inflammatory response indicate that some components of the chicken soup inhibit neutrophil migration, which may be linked to an anti-inflammatory effect and could hypothetically lead to temporary ease from symptoms of illness[4]. Chicken soup is prepared using old hens too tough and stringy to be roasted or cooked for a short time. Spent hens have always been a problem to the meat industry because of tough texture but they can be effectively used in processing of different value added processed products namely patties, sausages, loaf items, chicken soups etc. Studies have been conducted to develop chicken soup

from different sources of meat like chicken whey soup [5], chicken soup and instant soup mix [6]. However very little work have been carried out on the development of healthier chicken soup which are low in salt, fat, cholesterol, nitrites and calories in general and also contain some bioactive components like carotenoids, unsaturated fatty acids, sterols, and fibers.

As a dry product, instant soup mix can be stored for a longer period. Soups based on corn, mixed vegetables, palak, mushroom and chicken etc. are common in India and abroad. Apart from good storage stability of these products, the products with nutritional/therapeutic properties will be well received all over the world because of the increasing health consciousness amongst the population. Thus, in this context the current study aims at development of a dehydrated instant soup mix with hen spent meat shreds and to evaluate its physiochemical, microbiological and sensory characteristics during storage.

Materials and Methods

Raw materials

Spent hens of commercial layer birds were obtained from Regional Poultry Breeding Farm, Kyrdemkulai, Ri Bhoi District, Meghalaya, India. Following ante-mortem examination, spent hens were slaughtered, dressed and deboned manually following proper hygienic conditions in the laboratory of AICRP on PHET, Department of LPT, C.V.Sc., AAU, Khanapara, Assam, India. Post-mortem examination of the spent hens was also performed to detect any kind of abnormalities. All visible fat, fascia and connective tissue were separated and trimmed off and the meat was minced through 6 mm sieve in a meat mincer and packed in low density polyethylene (150µm thickness) bags and then kept at -18±2 °C till further use. Refined salt (Tata Chemicals Ltd., Mumbai), corn flour, potato starch powder and MSG were procured from local market of Guwahati. Dried chopped green chili, black pepper powder, onion powder, garlic powder and dried chopped vegetable (bean, pea and carrot) were prepared in the laboratory. Dried spent hen meat shred was prepared by following the procedure as given in figure 1.

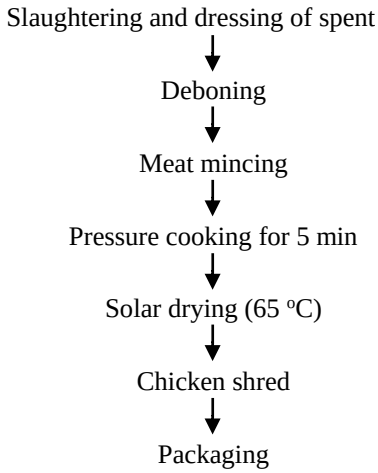

Fig 1: Flow chart for preparation of spent hen meat shred

In this experiment, formulations for instant chicken soup mix were standardized using different levels of spent hen meat shred, starches, salt and other ingredients as indicated in Table 1. Soup were prepared from instant chicken soup mixes of four formulations namely Treatment-A, B, C and D (Table 1), which fulfilled sensory attributes of consumers.

Preparation of instant chicken soup mix

Mixing of corn flour, potato starch, spent hen meat shred, salt, black pepper, onion powder, garlic powder, dried green chili, dried vegetable (pea: bean: carrot= 1:1:1) and monosodium glutamate was manually done to obtain the instant chicken soup mix (Table 1). Instant chicken soup mix was then packaged in low density polyethylene (150µm thickness) bags and stored at ambient temperature.

Reconstitution of instant chicken soup mix

The instant chicken soup mix was reconstituted in cold potable water (instant soup mix: water = 1:16), stirred and brought to boil to get ready-to-drink soup.

Table 1: Formulation of instant soup mix (in percentage)

S. N.	Ingredients	Treatment-A	Treatment-B	Treatment-C	Treatment-D
1	Corn flour	15	15	15	15
2	Potato starch powder	40	20	15	10
3	Spent hen shreds	0	20	25	30
4	Dried chopped vegetable	12	12	12	12
5	Salt	20	20	20	20
6	Black pepper powder	3	3	3	3
7	Onion powder	5	5	5	5
8	Garlic powder	3	3	3	3
9	Dried chopped green chilli	1.5	1.5	1.5	1.5
10	MSG	0.5	0.5	0.5	0.5
Total		100	100	100	100

Physico-chemical parameters

Bulk density

The bulk density of instant chicken soup mix was determined by measuring the weight of the mix and the corresponding volume. Approximately 5 gm of sample was placed in a 10 ml graduated measuring cylinder. The bulk density was calculated by dividing the mass of the mix by the volume occupied in the cylinder [7].

Solubility

Solubility of instant chicken soup mix was determined by the standard procedure [8] with slight modifications [9]. One gram of mix was dispersed in 100 ml distilled water by blending at high speed (13,000 rpm) for 5 minutes using a blender. The dispersed mix was then centrifuged at 3000 rpm for 5 minutes. A 25 ml aliquot of the supernatant was carefully pipetted and transferred to a pre-weighed aluminium dish and then oven dried at 105 ^{0}C for 5 hours. Drying was continued for 2 hours and weight of the sample was taken in every hour.

The solubility of the mix (%) was determined by taking the weight difference. The weight differences were used for determination of the water solubility of the product (%).

Water activity

The instant chicken soup mix was placed in the sample container up to 1/2 to 3/4th level and kept inside the sample chamber and water activity was recorded by a water activity meter of Aqua Lab (Dew point water activity meter 4TE).

pH

The pH was measured as per the procedure of AOAC [10]. Ten grams of instant chicken soup mix was homogenized with 50 ml of distilled water in a laboratory blender (POLYTRON, PT 300) for 1 min and the pH was recorded [11] by using a digital pH meter (Make: Metrohm, Switzerland; Model: 780).

Thiobarbituric Acid Reactive Substance (TBARS) value

The TBARS value was determined as per the method of Witte *et al*. [12].

Proximate composition

Moisture, crude fat, protein and ash percentage of instant chicken soup mix of the control and the treated groups were estimated as per the standard procedure laid down by the AOAC [13].

Calorific value

The energy content was determined by multiplying the percent values of crude protein, crude fat and total crude carbohydrate by the factor of 4, 9 and 4 respectively and summing up these values [14].

Microbiological examinations

Total plate count, Staphylococcus count, E coli count and yeast and mold count in the samples were determined [15].

Total plate count

Enumeration of total viable plate count of the samples was done in standard plate count agar medium, pH 7.0±0.1 by following pour plate technique [15]. Plates were incubated at 37 °C for up to 72 hrs for enumeration of total viable aerobic count. Counting was done by using a bacteriological colony counter and all those plates yielding >25 and <250 bacterial colonies were taken into account.

Yeast and mould counts

Yeasts and moulds counts of the instant chicken soup mix were made at similar time intervals as that of the total viable plate count by inoculating the appropriate dilution of the sample on Rose Bengal Agar Base, pH 7.2±0.1 and on incubating at 25 °C up to 72 hrs [15]. Counting was done by using a bacteriological colony counter.

Escherichia coli

Enumeration of E. coli counts of the samples was done in EMB Agar (Eosin Methylene Blue Agar) by following pour plate technique [15]. Counting was done by using a bacteriological colony counter and all those plates yielding >25 and <250 bacterial colonies were taken into account.

Total Staphylococcus count

Enumeration of staphylococcus counts of the samples was done in Mannitol Salt Agar (MSA) medium, pH 7.4 ± 0.2 by following pour plate technique [15]. Counting was done by using a bacteriological colony counter and all those plates yielding >25 and <250 bacterial colonies were taken into account.

Sensory evaluation

Instant chicken soup mix was served at ambient temperature to the semi-trained panelists of 7- member panel. All the samples were evaluated for appearance, colour, flavour, consistency, taste and overall acceptability by using a 7 point hedonic scale score card [16].

Results and Discussion

The physico-chemical properties of the instant soup mix are presented in Table 2. The bulk density of the soup mix increased with increase in the percentage of meat shreds in the soup mix. The solubility of the soup mix also increased with increase in the percentage of meat shreds. The water activity (a_w) decreased significantly with increased incorporation of meat shreds in the soup mixes. In all the treatments, the water activity exhibited a significantly inclined trend as storage period advanced.

The pH of the treatments increased significantly with increased incorporation of meat shreds in the instant soup mix and decrease in the percentage of potato starch powder which could be attributed to high pH (5.7) of spent hen meat shreds as compared to 4.8 pH of potato starch powder. Slight increase of 0.3 to 0.4 units in pH could be observed in the treatments in later stages of storage.

The TBARS values increased significantly with increased incorporation of meat shreds in the instant soup mix which might be due to high fat percentage in meat shreds. However, in the present study TBARS values were much lower than threshold value of 1mg/ kg [17]. It was also observed that TBARS values increased significantly with storage period of 0 to 90 days in all treatments. Similar findings of gradual increase in TBARS value during storage period was also recorded in shelf stable buffalo meat chunks [18]; chicken chips [19]; freeze dried beef [20]; dehydrated chicken *pulav* [21]; dehydrated chicken *kebab* mix [22]; hurdle treated sausages[23] and dehydrated spent hen meat mince [24]. Increase in TBARS values on storage might be attributed to available oxygen in LDPE package [25] that led to lipid oxidation. Singh *et al*. [26], reported gradual increase of TBARS values in beef and chicken snacks stored at ambient temperature.

The proximate composition of the instant chicken soup mix is shown in Table 3.The proximate analysis gives the idea about the nature and amount of the nutrients present in the sample. The moisture percentage decreased significantly with increase in the level of chicken shreds and decreased incorporation of potato starch powder in the treatment groups which might be due to hygroscopic nature of the potato starch powder that absorbed moisture during mixing of the soup ingredients. However, the moisture content increased significantly (P<0.05) with storage period of 0 to 90 days in all the treatments. The gradual increase in moisture content might be due to moisture absorption by the product from the environment that gradually permeated through packaging materials and also from the respiration of the growing microorganisms [27]. Similar increase in moisture content of dehydrated chicken *kebab* mix packaged in metalized polyester pouches was reported during ambient temperature storage [22]. Significantly increasing trend of crude protein, crude fat and total ash content of the treatments could be

observed with increased level of incorporation of chicken shreds in the instant soup mix. The increase in the crude protein and crude fat content of the treatments from A to D might be due to the partial replacement of potato starch powder (0.47% Crude Protein and 0.1% Crude fat) in treatments B, C & D with spent hen meat shreds (70% Crude Protein and 10% Crude fat). The increase in the total ash content of the instant soup mix might be due to low content of mineral matter in potato starch as compared to spent hen meat. The carbohydrate content of the treated instant soup mixes showed a significantly (P<0.05) decreasing trend with increase level of incorporation of meat shreds which might be due to the fact that meat contains less carbohydrate (5.5%) than the potato starch powder (86%). The calorific value of the products showed a significant (P<0.05) increasing trend with increase level of incorporation of spent hen meat shreds in the instant soup mixes which might be due to increase crude fat content in the samples from Treatment A to D respectively.

Table 2: Physico-chemical properties of instant soup mix (Mean±SE)*

Parameter	Day	Treatment-A	Treatment-B	Treatment-C	Treatment-D
Bulk Density	0	0.49±0.03	0.54±0.03	0.55±0.04	0.57±0.05
Solubility	0	29.98±2.08	30.46±3.99	30.89±4.23	30.95±4.15
Water activity	0	$0.47±0.01^{A}$	$0.45±0.01^{AB}$	$0.44±0.01^{B}$	$0.43±0.01^{B}$
	15	$0.47±0.01^{A}$	$0.46±0.01^{AB}$	$0.44±0.01^{BC}$	$0.43±0.01^{C}$
	30	$0.48±0.01^{A}$	$0.46±0.01^{AB}$	$0.44±0.01^{BC}$	$0.43±0.01^{C}$
	45	$0.48±0.01^{A}$	$0.46±0.01^{AB}$	$0.45±0.01^{BC}$	$0.43±0.01^{C}$
	60	$0.48±0.01^{A}$	$0.46±0.01^{AB}$	$0.45±0.01^{B}$	$0.44±0.01^{B}$
	75	$0.49±0.01^{A}$	$0.46±0.01^{B}$	$0.45±0.01^{B}$	$0.44±0.01^{B}$
	90	$0.49±0.01^{A}$	$0.47±0.01^{AB}$	$0.45±0.01^{BC}$	$0.44±0.01^{C}$
pH	0	$5.83±0.02^{C}$	$6.21±0.03^{B}$	$6.28±0.01^{B}$	$6.40±0.05^{A}$
	15	$5.85±0.02^{C}$	$6.22±0.02^{B}$	$6.29±0.01^{B}$	$6.41±0.05^{A}$
	30	$5.85±0.02^{C}$	$6.23±0.02^{B}$	$6.29±0.01^{B}$	$6.42±0.05^{A}$
	45	$5.86±0.02^{C}$	$6.23±0.02^{B}$	$6.30±0.02^{B}$	$6.42±0.05^{A}$
	60	$5.86±0.02^{C}$	$6.25±0.03^{B}$	$6.30±0.02^{B}$	$6.43±0.05^{A}$
	75	$5.87±0.02^{C}$	$6.25±0.03^{B}$	$6.32±0.01^{B}$	$6.43±0.05^{A}$
	90	$5.88±0.02^{C}$	$6.26±0.03^{B}$	$6.32±0.01^{B}$	$6.44±0.05^{A}$
TBARS	0	$_{e}0.37±0.01^{B}$	$_{d}0.39±0.01^{A}$	$_{d}0.39±0.01^{A}$	$_{d}0.40±0.00^{A}$
	15	$_{de}0.38±0.01^{C}$	$_{d}0.39±0.01^{BC}$	$_{cd}0.40±0.01^{AB}$	$_{cd}0.41±0.01^{A}$
	30	$_{de}0.38±0.01^{B}$	$_{cd}0.40±0.01^{A}$	$_{bc}0.41±0.01^{A}$	$_{cd}0.41±0.01^{A}$
	45	$_{cd}0.39±0.01^{C}$	$_{cd}0.40±0.01^{BC}$	$_{bc}0.41±0.01^{AB}$	$_{bc}0.42±0.01^{A}$
	60	$_{bc}0.40±0.01^{B}$	$_{bc}0.41±0.01^{B}$	$_{bc}0.41±0.01^{B}$	$_{ab}0.43±0.01^{A}$
	75	$_{ab}0.41±0.01^{B}$	$_{ab}0.42±0.01^{AB}$	$_{ab}0.42±0.01^{AB}$	$_{ab}0.43±0.01^{A}$
	90	$_{a}0.42±0.01^{B}$	$_{a}0.43±0.01^{AB}$	$_{a}0.43±0.01^{AB}$	$_{a}0.44±0.01^{A}$

Table 3: Proximate composition of instant soup mix (Mean±SE)*

Parameter	Day	Treatment-A	Treatment-B	Treatment-C	Treatment-D
Moisture (%)	0	$7.89±0.22^{A}$	$6.67±0.18^{B}$	$5.99±0.11^{C}$	$5.46±0.10^{D}$
	15	$7.92±0.22^{A}$	$6.69±0.17^{B}$	$6.01±0.11^{C}$	$5.48±0.09^{D}$
	30	$7.95±0.22^{A}$	$6.73±0.17^{B}$	$6.04±0.11^{C}$	$5.51±0.09^{D}$
	45	$7.98±0.22^{A}$	$6.76±0.17^{B}$	$6.05±0.10^{C}$	$5.53±0.09^{D}$
	60	$8.00±0.22^{A}$	$6.78±0.17^{B}$	$6.08±0.11^{C}$	$5.56±0.09^{D}$
	75	$8.02±0.22^{A}$	$6.83±0.17^{B}$	$6.13±0.11^{C}$	$5.61±0.08^{D}$
	90	$8.04±0.21^{A}$	$6.87±0.18^{B}$	$6.18±0.11^{C}$	$5.66±0.09^{D}$
Crude protein (%)	0	$8.88±0.34^{D}$	$25.93±0.28^{C}$	$35.05±0.17^{B}$	$43.23±0.35^{A}$
Crude fat (%)	0	$0.82±0.16^{C}$	$2.46±0.16^{B}$	$2.68±0.15^{B}$	$3.56±0.19^{A}$
Total ash (%)	0	$15.61±0.80^{D}$	$19.03±0.28^{C}$	$20.73±0.26^{B}$	$21.61±0.18^{A}$
Carbohydrate (%)	0	$66.80±0.30^{A}$	$45.92±0.29^{B}$	$35.55±0.47^{C}$	$26.15±0.57^{D}$
Calorific value (Kcal)	0	310.11±1.85	309.51±0.20	306.52±1.13	309.53±0.79

The mean sensory scores of the instant soup mixes for all the treatments during storage for 3 months are given in Table 4. In general, sensory attributes i.e., appearance, colour, flavour, consistency, taste and overall acceptability showed significant decreasing trend during storage period irrespective of the treatments. The mean value of all sensory parameter was significantly highest in Treatment C which might be due to incorporation of spent hen meat shreds in appropriate level. Treatment C showed a significantly higher value (P<0.05) than other treatments (Treatment A, B & D) in respect to all the sensory attributes. No significant difference in consistency of the treated instant chicken mixes could be observed during the entire storage period. Significantly higher (P<0.05) overall acceptability for Treatment C could be due to better appearance, colour, flavour, consistency, taste and slower rate of lipid oxidation than the other treatment groups.

Table 4: Sensory evaluation of soup prepared by instant soup mix (Mean±SE)*

Parameter	Day	Treatment-A	Treatment-B	Treatment-C	Treatment-D
Appearance	0	$_{a}5.86\pm0.14^{C}$	$_{a}6.20\pm0.10^{B}$	$_{a}6.49\pm0.07^{A}$	$_{a}5.77\pm0.18^{C}$
	15	$_{ab}5.81\pm0.11^{C}$	$_{ab}6.14\pm0.10^{B}$	$_{ab}6.43\pm0.06^{A}$	$_{ab}5.71\pm0.16^{C}$
	30	$_{ab}5.76\pm0.08^{C}$	$_{ab}6.09\pm0.09^{B}$	$_{ab}6.37\pm0.04^{A}$	$_{ab}5.66\pm0.15^{C}$
	45	$_{ab}5.70\pm0.07^{C}$	$_{abc}6.03\pm0.10^{B}$	$_{abc}6.31\pm0.05^{A}$	$_{ab}5.60\pm0.13^{C}$
	60	$_{ab}5.63\pm0.07^{C}$	$_{abc}5.94\pm0.09^{B}$	$_{abc}6.23\pm0.04^{A}$	$_{ab}5.53\pm0.13^{C}$
	75	$_{ab}5.59\pm0.07^{C}$	$_{bc}5.87\pm0.10^{B}$	$_{bc}6.16\pm0.06^{A}$	$_{b}5.49\pm0.10^{C}$
	90	$_{b}5.54\pm0.06^{BC}$	$_{c}5.81\pm0.10^{B}$	$_{c}6.09\pm0.07^{A}$	$_{b}5.44\pm0.08^{C}$
Colour	0	$_{a}5.94\pm0.15^{BC}$	$_{a}6.14\pm0.10^{AB}$	$_{a}6.31\pm0.05^{A}$	$_{a}5.80\pm0.10^{C}$
	15	$_{a}5.90\pm0.13^{BC}$	$_{ab}6.09\pm0.12^{AB}$	$_{ab}6.26\pm0.07^{A}$	$_{ab}5.76\pm0.08^{C}$
	30	$_{ab}5.84\pm0.11^{BC}$	$_{abc}6.03\pm0.12^{AB}$	$_{ab}6.21\pm0.08^{A}$	$_{ab}5.71\pm0.07^{C}$
	45	$_{ab}5.79\pm0.11^{BC}$	$_{abc}5.97\pm0.14^{AB}$	$_{ab}6.17\pm0.10^{A}$	$_{ab}5.66\pm0.08^{C}$
	60	$_{ab}5.70\pm0.10^{BC}$	$_{abc}5.90\pm0.13^{AB}$	$_{ab}6.09\pm0.09^{A}$	$_{ab}5.59\pm0.08^{C}$
	75	$_{ab}5.66\pm0.11^{B}$	$_{bc}5.83\pm0.14^{AB}$	$_{ab}6.04\pm0.10^{A}$	$_{ab}5.54\pm0.08^{B}$
	90	$_{b}5.59\pm0.10^{B}$	$_{c}5.76\pm0.13^{AB}$	$_{b}5.97\pm0.12^{A}$	$_{b}5.50\pm0.07^{B}$
Flavour	0	$_{a}5.49\pm0.06^{C}$	$_{a}5.99\pm0.08^{B}$	$_{a}6.34\pm0.06^{A}$	$_{a}5.89\pm0.16^{B}$
	15	$_{a}5.43\pm0.05^{C}$	$_{ab}5.93\pm0.07^{B}$	$_{a}6.29\pm0.08^{A}$	$_{ab}5.83\pm0.17^{B}$
	30	$_{a}5.40\pm0.04^{C}$	$_{ab}5.87\pm0.07^{B}$	$_{a}6.24\pm0.08^{A}$	$_{ab}5.76\pm0.18^{B}$
	45	$_{a}5.39\pm0.04^{C}$	$_{ab}5.83\pm0.07^{B}$	$_{a}6.23\pm0.09^{A}$	$_{ab}5.71\pm0.18^{B}$
	60	$_{a}5.31\pm0.04^{C}$	$_{ab}5.76\pm0.07^{B}$	$_{a}6.16\pm0.09^{A}$	$_{ab}5.66\pm0.17^{B}$
	75	$_{a}5.27\pm0.04^{C}$	$_{ab}5.71\pm0.07^{B}$	$_{a}6.13\pm0.09^{A}$	$_{ab}5.61\pm0.18^{B}$
	90	$_{a}5.21\pm0.05^{C}$	$_{b}5.66\pm0.06^{B}$	$_{a}6.09\pm0.10^{A}$	$_{b}5.56\pm0.18^{B}$
Consistency	0	5.84 ± 0.10^{B}	6.24 ± 0.14^{A}	6.50 ± 0.13^{A}	5.80 ± 0.12^{B}
	15	5.79 ± 0.11^{B}	6.19 ± 0.16^{A}	6.43 ± 0.15^{A}	5.73 ± 0.13^{B}
	30	5.73 ± 0.11^{B}	6.14 ± 0.17^{A}	6.39 ± 0.16^{A}	5.71 ± 0.13^{B}
	45	5.71 ± 0.11^{B}	6.11 ± 0.17^{A}	6.34 ± 0.17^{A}	5.69 ± 0.12^{B}
	60	5.66 ± 0.10^{BC}	6.03 ± 0.16^{AB}	6.27 ± 0.15^{A}	5.60 ± 0.12^{C}
	75	5.63 ± 0.11^{BC}	6.00 ± 0.17^{AB}	6.24 ± 0.16^{A}	5.57 ± 0.13^{C}
	90	5.59 ± 0.13^{BC}	5.91 ± 0.18^{AB}	6.19 ± 0.15^{A}	5.51 ± 0.13^{C}
Taste	0	$_{a}5.46\pm0.08^{C}$	$_{a}5.96\pm0.04^{B}$	$_{a}6.54\pm0.05^{A}$	$_{a}6.02\pm0.09^{B}$
	15	$_{ab}5.41\pm0.11^{C}$	$_{a}5.90\pm0.03^{B}$	$_{a}6.51\pm0.05^{A}$	$_{ab}5.95\pm0.07^{B}$
	30	$_{ab}5.39\pm0.10^{C}$	$_{ab}5.86\pm0.02^{B}$	$_{ab}6.46\pm0.06^{A}$	$_{abc}5.88\pm0.05^{B}$
	45	$_{ab}5.37\pm0.09^{C}$	$_{abc}5.79\pm0.04^{B}$	$_{ab}6.41\pm0.07^{A}$	$_{bcd}5.82\pm0.06^{B}$
	60	$_{ab}5.30\pm0.09^{C}$	$_{bc}5.71\pm00.04^{B}$	$_{bc}6.31\pm0.07^{A}$	$_{cd}5.75\pm0.06^{B}$
	75	$_{ab}5.29\pm0.09^{C}$	$_{bc}5.69\pm0.04^{B}$	$_{bc}6.29\pm0.07^{A}$	$_{cd}5.74\pm0.06^{B}$
	90	$_{b}5.24\pm0.08^{C}$	$_{c}5.64\pm0.05^{B}$	$_{c}6.21\pm0.07^{A}$	$_{d}5.68\pm0.07^{B}$
Overall palatability	0	$_{a}5.76\pm0.06^{D}$	$_{a}6.21\pm0.04^{B}$	$_{a}6.55\pm0.02^{A}$	$_{a}5.93\pm0.07^{C}$
	15	$_{ab}5.70\pm0.07^{D}$	$_{ab}6.15\pm0.03^{B}$	$_{a}6.51\pm0.03^{A}$	$_{ab}5.86\pm0.05^{C}$
	30	$_{abc}5.66\pm0.06^{C}$	$_{ab}6.08\pm0.04^{B}$	$_{ab}6.45\pm0.04^{A}$	$_{abc}5.80\pm0.03^{C}$
	45	$_{abc}5.66\pm0.06^{C}$	$_{bc}6.01\pm0.06^{B}$	$_{abc}6.41\pm0.05^{A}$	$_{bcd}5.74\pm0.04^{C}$
	60	$_{bcd}5.59\pm0.06^{C}$	$_{cd}5.91\pm0.06^{B}$	$_{bcd}6.31\pm0.05^{A}$	$_{cde}5.66\pm0.04^{C}$
	75	$_{cd}5.54\pm0.07^{C}$	$_{cd}5.86\pm0.08^{B}$	$_{cd}6.26\pm0.07^{A}$	$_{de}5.60\pm0.06^{C}$
	90	$_{d}5.50\pm0.09^{C}$	$_{d}5.80\pm0.10^{B}$	$_{d}6.17\pm0.08^{A}$	$_{e}5.56\pm0.06^{C}$

The microbiological quality of treatment groups (Treatment A, B, C & D) in respect to total plate count, yeast & mould, *E. coli* and *Staphylococcus spp.* (Table 5) indicated absence of microbial load during the whole storage period which might be due to the low moisture content as well as low water activity in the products during storage that hindered the microbial growth.

Table 5: Effect of ambient storage on the microbiology of aerobically packaged instant soup mix (Mean±S.E.)*

Parameters	Days	Treatment-A	Treatment-B	Treatment-C	Treatment-D
Total Plate Count (cfu/g)	0 day	ND	ND	ND	ND
	15 days				
	30 days				
	45 days				
	60 days				
	90 days				
Yeast & Mould count (cfu/g)	0 day	ND	ND	ND	ND
	15 days				
	30 days				
	45 days				
	60 days				
	90 days				
E. coli count (cfu/g)	0 day	ND	ND	ND	ND
	15 days				
	30 days				

	45 days				
	60 days				
	90 days				
Staphylococcus spp. count (cfu/g)	0 day	ND	ND	ND	ND
	15 days				
	30 days				
	45 days				
	60 days				
	90 days				

ND: Not Detected

Conclusion

From the present study it can be concluded that spent hen meat can effectively be used for the production of instant soup mixes to the extent of 25% in shred forms with an improved physico-chemical, nutritional and overall acceptability scores. The instant soup mixes was suitable to be aerobically stored in LDPE pouches (150µm) at ambient temperature for a period of 90 days without any deterioration in its quality and acceptability.

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