J.Meat Sci., 2017, 12 (1) : 52 - 59

Research Paper

Efficacy of Drumstick Leaf and Jamun Seed Powder as Preservative in Chicken Chips

S. Kasthuri, *P.K. Mandal and U.K. Pal

Department of Livestock Products Technology
Rajiv Gandhi Institute of Veterinary Education and Research, Kurumbapet, Pondicherry

ABSTRACT

The effect of incorporating 1% drumstick leaf powder (DLP), 1% *jamun* seed powder (JSP) and 0.5% DLP + 0.5% JSP on physico-chemical, sensory and microbiological quality of chicken chips were evaluated during storage at room temperature for a period of 30 days. All the treatment products showed significantly (P<0.05) lower pH values throughout the storage period than control. No significant (P>0.05) differences were observed in TBA and tyrosine values among the products throughout the storage study. Results on sensory evaluation revealed no significant (P>0.05) difference in appearance, flavour, texture, crispiness and acceptability scores between the products and between the storage days. All the products had very good sensory score (above 7 in 8 point hedonic scale) throughout the storage study for all the sensory attributes. Storage had no significant effects on standard plate count (SPC) up to 20 days of storage and on yeast and mould count (YMC) up to 30 days of storage. The functional chicken chips with DLP (1%), JSP (1%) and DLP (0.5%) + JSP (0.5%) could be stored at room temperature for 30 days without any appreciable deterioration in qualities.

Keywords : *Chicken chips, Drumstick leaf powder, Jamun seed powder, Quality attributes*

Received : 10.12.2016 Accepted: 12.05.2017

INTRODUCTION

The golden proverb "Food is the best medicine" is now receiving renewed interest because of increasing incidence of life style diseases. Today the leading causes of death in the world are cardiovascular disease, diabetes and cancer (Wolfe . 2003; Kaul 2012) and around 32% deaths due to these diseases could be avoided by dietary manipulations (Wolfe *et* . 2003). There is increased awareness among consumers about the fact that foods are associated directly to their health. At the same time preference for delicious, tasty, ready-to-eat (RTE) food products is also increasing because of changing life styles and the busy schedules of working peoples, change in eating habits of children and its convenience and easy acceptability. So, there is need for development of ready-to-eat functional meat products.

Chips, a well known snack food are one of the unique and universal fast food. Its beneficial properties are enhanced when prepared with meat having high nutritional quality (Devalakshmi *et al*. 2010). Improvement in sensory quality of chips by adding meat was reported by many workers (Sharma and Nanda 2002; Singh *et al*. 2002). Diet associated health problems like cardiovascular diseases, obesity, hypertension etc can be controlled up to a certain level by development and consumption of functional snack foods instead of unhealthy junk foods (Aswathi *et al*. 2013).

Flax seed contains 32% carbohydrates, 19.3% protein and 35% of its mass is oil, of which 55% is alpha linolenic acid (ALA) which is considered to be good for health (Ramcharitar *et al*. 2005; Prasad 2009; Rubilar *et al*. 2010). Besides containing carbohydrate, oats is a rich source of protein and fibre and contains a number of important minerals, lipids, vitamin E and beta glucans which is well known as a prebiotic having anticancer activity (Peterson *et al*. 2002). Drumstick leaves (*Moringa oleifera*) is reported to be a potent source of natural antioxidants like ascorbic acid, alpha tocopherol and other flavonoids and carotenoids and thus enhancing the shelf life of fat containing foods (Gupta *et al*. 1989; Dillard and German, 2000). Jamun seed possess wide range of properties such as antimicrobial, antioxidant, cardio protective, anti cancer, anti-diarrheal and hypoglycemic to mention a few (Stephen 2012).

Diabetic and heart patients are generally advised to avoid oily foods and junk foods, but they may be served as healthy snack which would improve their health and satisfy their hunger at any time. It's very difficult to consume drumstick leaf powder and *jamun* seed powder regularly due to their unusual taste. The reports on meat chips with functional ingredients and natural additives are very scanty. Therefore, this study was planned to prepare chicken chips incorporated with functional ingredients (flax seed and oats) and natural anti-

*Corresponding author E-mail address: mandalpkm@gmail.com

oxidants (DLP and JSP) to find their effects on the storage stability of the products at room temperature.

MATERIALS AND METHODS

Preparation of chips: The functional chicken chips were prepared as described by Kasthuri *et al*. (2016). The product prepared without the addition of DLP and JSP was treated as control, which contained flaxseed powder (4%) and oats powder (6%). The selected level of drumstick leaf power (DLP 1%) (T1), Jamun seed powder (JSP 1%) (T2) and their combination (0.5% DLP + 0.5% JSP) (T3) were added in the functional chicken chips (FCC) recipe. These functional chicken chips were packed in air tight PET containers and stored at room temperature for a period of 30 days. The samples were drawn on 1st, 10th, 20thand 30th day of storage to assess the physico-chemical, sensory and microbiological qualities.

Physico-chemical quality attributes: The cooking yield (%) of chicken chips was calculated by adopting the procedure laid down by Murphy *et al*. (1975). The moisture, protein, fat, total ash and crude fibre contents of chicken chips were determined in accordance with AOAC (1995). The pH was determined following the procedure laid down by AOAC (1995) using combined glass electrode of the pH meter. The extraction method outlined by Witte *et al*. (1970) was followed for the determination of TBA reacting substances. Tyrosine value of chicken chips was estimated adopting the procedure of Strange *et al*. (1977).

Sensory evaluation: A 10 member semi-trained panel recorded their preference on 8 point hedonic scale (8=extremely desirable, 1=extremely undesirable) (Keeton 1983) for the attributes viz. appearance, flavour, texture, crispiness and acceptability. Plain water was provided to each panellist to rinse their mouth in between the samples.

Microbiological analyses: The microbial quality of the chicken chips was evaluated by estimating the standard plate count (SPC), yeast and mould counts (YMC) as per the standard procedure of APHA (1984).

Statistical analysis: Each experiment was replicated thrice and each parameter was analyzed in duplicate. The data were analyzed using SPSS version 16.0 MSI (SPSS, Chicago, USA). One way analysis of variance (ANOVA) was used for cooking yield and for data related to storage study were analysed using 2-way ANOVA. The level of significance was tested using the least significant difference (LSD) test (Snedecor and Cochran 1967).

RESULTS AND DISCUSSION

Cooking yield: Cooking yield (%) of FCC recorded in the present study ranged from 35.92 to 36.45% (Table1). No significant differences were observed between the treatments and control. However, FCC with 0.5% DLP+0.5% JSP (T3) exhibited numerically lower cooking yield. Similarly, Najeeb *et al*. (2014) reported that incorporation of DLP at 1% level had no significant effect on cooking yield of restructured chicken slices. Chand *et al*. (2013) recorded the cooking yield of 24.59 - 26.72% in ready-to-fry chicken meat chips. Cytyarasan (2011) reported no significant difference in cooking yield (58.95 – 73.87%) of murukku with different levels of chicken skin powder.

Proximate composition: No significant differences were observed for moisture, protein, crude fat, crude fibre and total ash content of chips samples between the storage days (Table1). However, there were significant ($P<0.05$) differences in the proximate composition of the samples from different treatments which could be due to the use of different additives with different composition. The moisture content of the FCC with natural additives varied between 2.29-2.60% and 2.58-2.78% on the 1st and 30th day of storage, respectively. Protein content was significantly ($P<0.05$) higher for T1 (1% DLP) (42.82-42.97) FCC and there was no significant difference in protein contents of T1 (1% DLP) and T3 (0.5% DLP+0.5% JSP) (41.89-42.04%) products. There was no significant difference in protein content between the control (41.07-41.13%) and T2 (1% JSP) (41.33-41.47%). The crude fat content was significantly higher ($P<0.05$) for T2 (25.17-25.25%) product followed by T3 (24.14-24.44%), T1 (23.26-23.40%) incorporated products and control (23.19-23.28%) samples. There was no significant difference between control and T1 containing product. Crude fibre content of the samples ranged between 1.54-1.84% and 1.51-1.82% on the 1st and 30th day of storage, respectively. Crude fibre content of chips without any natural additives was 0.43% which increased in FCC containing natural additives. Ash content was numerically higher in T3 followed by T1 incorporated products.

Biswas *et al*., (2014) recorded protein (41.33 - 41.96 %), fat (18.44-20.16%), crude fibre (0.95-1.34%) and ash content (3.47-3.82%) in poultry meat wafers incorporated with 2% apple peel paste, 2.5% banana peel paste, 2% aloe vera gel and 0.5% DLP. Aswathi *et al*. (2013) observed moisture (6.52-7.22%), protein (50.82-60.51%) fat (22.59-26.52%), fibre (1.37-5.39%) and ash content of 8.31-11.65% in functional poultry meat sticks with oat flour and corn flour. Soni *et al*. (2013) reported the moisture (8.63%), protein (49.50%) fat (14.50%) and ash content of 5.33% in dehydrated meat rings. Singh *et al*. (2014b) reported that crude fibre content was 0.42% in chicken meat patties without linseed flour and it was 1.9% in chicken meat patties with 4% linseed flour which was significantly (P<0.05) higher compared to control.

Table 1: Effect of incorporation of DLP, JSP and their combination on the cooking yield and proximate composition of FCC during room temperature storage (Mean ± SE)

Parameters (%)	Treatments			
	C	T_1	T_2	T_3
Cooking yield	36.36±0.39	36.45±0.24	36.33±0.27	35.92±0.32
Moisture				
Day-1	2.29±0.03	2.43±0.05	2.60±0.115	2.55±0.197
Day-30	2.58±0.10	2.66±0.04	2.78±0.100	2.72±0.087
Protein				
Day-1	41.07±0.41^a	42.82±0.31^b	41.33±0.32^a	41.89±0.32^{ab}
Day-30	41.13±0.27^a	42.97±0.21^b	41.47±0.26^a	42.04±0.14^{ab}
Crude fat				
Day-1	23.28±0.26^a	23.40±0.18^a	25.25±0.15^c	24.44±0.39^b
Day-30	23.19±0.05^a	23.26±0.22^a	25.17±0.29^c	24.14±0.15^b
Total ash				
Day-1	7.76±0.05	7.89±0.01	7.83±0.06	8.15±0.04
Day-30	7.74±0.03	7.81±0.05	7.80±0.02	8.05±0.08
Crude fibre				
Day-1	1.54±0.02^a	1.84±0.05^b	1.84±0.06^b	1.84±0.05^b
Day-30	1.51±0.06^a	1.81±0.02^b	1.81±0.07^b	1.82±0.05^b
Crude fibre content of chips without any additives was 0.43%				

C – FCC without DLP and JSP; T_1 – FCC with 1% DLP; T_2 - FCC with 1% JSP; T_3 – FCC with 0.5% DLP+0.5%JSP

Means with different superscripts (lower case letters) in a row differ significantly (P<0.05)

pH: Significant (P<0.05) differences in pH values were observed between the products and between the storage days (Table-2). The pH of the products decreased significantly (P<0.05) in the following order: Control (6.68-6.75) followed by T1 (6.58-6.63), T2 (6.48-6.56) and T3 (6.46-6.53) incorporated products on 1st day to 30th day of storage. Storage days also had significant (P<0.05) effect on pH of the products. Control and treated products had significantly lower (P<0.05) pH on 10th day compared to 30th day of storage. But no significant differences were found between 1st and 10th day between 1st and 20th day and between 20th and 30th day of storage. Similar to the present findings, Kumar *et al*. (2013) recorded a pH value of 6.57-6.91 in chicken sticks with various levels of meat and gram flour. Similar trend of increase in the pH values as storage days advanced was also reported by Devalakshmi *et al*. (2010), Singh *et al*. (2011).

Thiobarbituric acid value: There was no significant difference in TBA value among the products on all the days of storage (Table 2). TBA value was higher for all treatment products on 1st day and it showed decreasing trend till 20th day of storage followed by significant (P<0.05) increase on 30th day of storage at room temperature. However, for control sample TBA value significantly increased from 1st to 10th day of storage followed by significant (P<0.05) decrease on 20th day which again increased (P<0.05) on 30th day of storage. TBA value showed significantly (P<0.05) lower value on 20th day for all the products. No significant (P<0.05) differences were found on 10th and 30th day of storage for all the products. The highest TBA value on first day might be due to the mincing, mixing, cooking and drying steps involved in the preparation process, which resulted in extensive destruction of cellular structure, allowing the mixing of various meat constituents and prooxidants. No significant differences in TBA values among treatments and control product were noticed and values were much below the threshold level of oxidative spoilage of the products. Therefore, it may be postulated that antioxidants present in oats (avenanthramides) and in FSP (lignans-polyphenolic) compounds exerted good antioxidant activity.

Biswas *et al.* (2014) recorded the TBA value of (0.24-1.24 mg malonaldehyde/Kg) in poultry meat wafers and found that TBA value showed increasing trend throughout the storage period of 60 days at ambient temperature and 0.5% DLP incorporated poultry meat wafer had significantly ($P<0.05$) lower TBA value than all the products. The TBARS value of dehydrated chicken meat rings increased significantly ($P<0.05$) on 15th day of storage as compared to initial value and thereafter it remained comparable up to 30th day of storage and then a non-significant ($P>0.05$) decrease in TBARS value was observed on 45th day of storage (Mishra *et al*. 2015). Cytyarasan (2011) reported that TBA value of murukku incorporated with 10% raw chicken skin and 7.5% chicken skin powder increased significantly ($P<0.01$) during the storage at room temperature.

Tyrosine value: Tyrosine value increased significantly ($P<0.05$) up to 30th day of storage in all the products (Table 2) but no significant differences in tyrosine value were observed between 10th and 20th day and 20th and 30th day of storage. There was no significant difference between the treatment groups and control products throughout the storage study and the values remained far below permissible limit for all the products. The treatment groups had a higher value on day1. This may be due to the phenolic groups present in the DLP and JSP. Therefore, the differential value with respect to each treatment with that of control was reduced from all the values in all subsequent days of storage. Cytyarasan (2011) reported that tyrosine value of murukku with 10% raw skin and 7.5% skin powder and control increased significantly ($P<0.05$) during storage up to 20th day at room temperature. Karthikeyan (2010) also reported significant ($P<0.05$) increase in tyrosine value during storage of buffalo meat extruded product at room temperature.

Table 2: Effect of incorporation of DLP, JSP and their combination on the physico-chemical qualities of FCC during room temperature storage (Mean ± SE)

Products	**Storage days**			
	1	**10**	**20**	**30**
		pH		
	6.73 ± 0.01^{dAB}	6.68 ± 0.02^{dA}	6.74 ± 0.02^{dB}	6.75 ± 0.01^{dB}
	6.62 ± 0.01^{cAB}	6.58 ± 0.01^{cA}	6.62 ± 0.02^{cB}	6.63 ± 0.01^{cB}
2	6.55 ± 0.02^{bAB}	6.48 ± 0.10^{bA}	6.56 ± 0.02^{bB}	6.56 ± 0.01^{bB}
T_3	6.51 ± 0.01^{aAB}	6.46 ± 0.01^{aA}	6.53 ± 0.01^{aB}	6.53 ± 0.01^{aB}
		TBA value		
C	0.26 ± 0.03^{B}	0.31 ± 0.03^{C}	0.15 ± 0.02^{A}	0.27 ± 0.02^{C}
T_1	0.29 ± 0.01^{C}	0.27 ± 0.01^{B}	0.13 ± 0.01^{A}	0.27 ± 0.01^{B}
T_2	0.34 ± 0.02^{C}	0.28 ± 0.01^{B}	0.14 ± 0.01^{A}	0.28 ± 0.01^{B}
T_3	0.32 ± 0.02^{C}	0.25 ± 0.05^{B}	0.14 ± 0.01^{A}	0.23 ± 0.01^{B}
		Tyrosine value		
C	4.44 ± 0.35^{A}	6.47 ± 0.59^{B}	6.56 ± 0.51^{BC}	6.58 ± 0.14^{C}
T_1	4.44 ± 0.51^{A}	6.44 ± 0.36^{B}	6.39 ± 0.66^{BC}	6.81 ± 0.16^{C}
T_2	4.43 ± 0.29^{A}	5.22 ± 0.76^{B}	6.66 ± 0.36^{BC}	7.36 ± 0.14^{C}
T_3	4.43 ± 0.31^{A}	6.76 ± 0.28^{B}	6.63 ± 0.23^{BC}	7.63 ± 0.42^{C}

C – FCC without DLP and JSP; T_1 – FCC with 1% DLP; T_2 - FCC with 1% JSP; T_3 – FCC with 0.5% DLP+0.5%JSP

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

Sensory evaluation: The appearance scores (Table 3) for control and various treatment groups ranged between 7.23-7.80from day 1 to 30 days of storage indicating all the products had very good appearance scores throughout the storage period and these scores were comparatively higher than those reported by other authors for similar products. There was significant (P<0.05) difference between 1st day and 30th day of storage for 1% DLP and 0.5% DLP+0.5% JSP incorporated products. Singh *et al*. (2014a) reported that appearance score of chicken meat caruncles with tapioca starch ranged between 6.89-7.11, whereas, Biswas *et al*. (2014) reported appearance score of poultry meat wafer with 0.5% DLP between 6.08-6.70 and observed that scores decreased significantly (P<0.05) with increase in storage days at ambient temperature. Chand *et al*. (2013) recorded appearance score of 6.74-7.02 for dried ready-to-fry chicken meat chips with different levels of *sabudana* flour, arrow-root flour and corn flour.

The flavour scores for chips were control (7.63-7.77), T1 (7.50-7.57), T2 (7.47- 7.60), T3 (7.40-7.67) from day 1 to 30 days of storage. Crispiness (Table 4) scores for all the products ranged from 7.37 to 7.77. Numerically highest crispiness score was recorded for control (7.50-7.77) samples followed by T2 (7.47-7.70), T1 (7.40-7.63) and T3 (7.37-7.63) treated products. Acceptability scores (Table 4) were numerically higher for control samples (7.60-7.83) followed by 1% JSP (7.63-7.73), 1% DLP (7.47-7.73), 0.5% DLP+0.5% JSP (7.53-7.63) containing products. Scores ranged from 7.47-7.83 indicating very good acceptability for all the products throughout the storage period. Kumar *et al*. (2013) reported flavour score of 6.00-7.22 for chicken sticks with different levels of meat and gram flour. Cytyarasan (2011) observed no significant effect of storage on the flavour, texture, crispiness and acceptability scores of murukku with 10% raw chicken skin and 7.5% chicken skin powder during storage of 30 days at room temperature. Singh *et al*. (2011) observed that there was no significant difference in flavour, texture, crispiness and acceptability score of vacuum packaged chicken snacks up to 30th day of storage. However, Biswas *et al*. (2014) reported that flavour, texture, crispiness and acceptability scores of poultry meat wafer with different natural ingredients decreased (P<0.05) with increase of storage days. Chand *et al*. (2013) recorded flavour (6.68-7.17), texture (6.68-7.17) and overall acceptability (6.62-7.25) scores for dried ready-to-fry chicken meat chips which were comparatively lower than scores recorded in the present study.

Table 3: Effect of incorporation of DLP, JSP and their combination on the sensory qualities of FCC during room temperature storage (Mean ± SE)

Products	Storage days			
	1	10	20	30
		Appearance		
	7.73±0.08^{cA}	7.73±0.08^{bA}	7.80±0.09^{bA}	7.70±0.12^{aA}
	7.23±0.12^{aA}	7.47±0.10^{aAB}	7.40±0.11^{aAB}	7.70±0.09^{aB}
T_2	7.67±0.09^{bcA}	7.67±0.09^{abA}	7.57±0.12^{abA}	7.73±0.09^{aA}
T_3	7.43±0.11^{abA}	7.60±0.09^{abAB}	7.63±0.10^{abAB}	7.73±0.09^{aB}
		Flavour		
C	7.63±0.09	7.77±0.10	7.67±0.11	7.70±0.09
T_1	7.50±0.13	7.57±0.11	7.50±0.13	7.50±0.12
T_2	7.53±0.12	7.60±0.11	7.57±0.13	7.47±0.12
T_3	7.47±0.13	7.67±0.12	7.50±0.12	7.40±0.11
		Texture		
C	7.87±0.06	7.70±0.09	7.57±0.13	7.60±0.11
T_1	7.60±0.09	7.70±0.09	7.57±0.12	7.60±0.09
T_2	7.37±0.11	7.63±0.10	7.57±0.12	7.60±0.10
T_3	7.53±0.09	7.60±0.10	7.47±0.10	7.50±0.12
		Crispiness		
C	7.77±0.09	7.73±0.08	7.50±0.13	7.73±0.08
T_1	7.63±0.09	7.57±0.13	7.40±0.11	7.50±0.10
T_2	7.50±0.10	7.53±0.10	7.70±0.11	7.47±0.12
T_3	7.63±0.10	7.57±0.11	7.40±0.12	7.37±0.11

		Acceptability		
C	7.83±0.07	7.73±0.09	7.60±0.12	7.83±0.07
T_1	7.63±0.08	7.73±0.08	7.47±0.14	7.57±0.10
T_2	7.60±0.09	7.73±0.08	7.63±0.11	7.67±0.09
T_3	7.63±0.10	7.63±0.10	7.53±0.10	7.57±0.10

C – FCC without DLP and JSP; T_1 – FCC with 1% DLP; T_2 - FCC with 1% JSP; T_3 – FCC with 0.5% DLP+0.5%JSP

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

Standard plate count (SPC): During storage the SPC for control, T1, T2, T3 treatment groups ranged between 1.60 – 1.86, 1.22 – 1.57, 1.40 – 1.69 and 1.27 – 1.60 (log cfu/g), respectively and these values are much below the permissible level. The SPC of the products varied significantly (P<0.05) between the products and between days of storage. All the treatment products had significantly (P<0.05) lower counts when compared to control. SPC in all the products was significantly (P<0.05) higher on 30th day of storage but no significant difference was found from 1st to 20th day of storage for control and T1 and T2 products.

Soni *et al.* (2013) and Mishra *et al*. (2015) reported increasing trend in SPC (log cfu/g) of the dehydrated meat rings with advancement of storage days at ambient temperature. Cytyarasan *et al*. (2011) observed SPC count of murukku incorporated with 10% raw chicken skin and 7.5% chicken skin powder ranged from 2 to 3.13 log cfu/g and the counts increased significantly (P<0.05) during the storage up to 30 days at room temperature. Similarly, standard plate counts of both control (2 to 12 cfu/g) and cookies with 10% chicken meat mince (3 to 20 cfu/g) exhibited gradual increase during 90 days storage period (Berwal *et al*. 2013).

Table 4: Effect of incorporation of DLP, JSP and their combination on the standard plate count and Yeast and mould count of FCC during room temperature storage (Mean ± SE)

Products	Storage days			
	1	10	20	30
		Standard plate count (log cfu/g)		
	$1.60±0.03^{cA}$	$1.62±0.04^{cA}$	$1.70±0.03^{bA}$	$1.86±0.03^{cB}$
	$1.20±0.06^{aA}$	$1.22±0.08^{aA}$	$1.30±0.07^{aA}$	$1.57±0.04^{aB}$
T_2	$1.40±0.05^{bA}$	$1.40±0.05^{bA}$	$1.45±0.09^{aA}$	$1.69±0.06^{bB}$
T_3	$1.27±0.06^{abA}$	$1.38±0.04^{abAB}$	$1.43±0.05^{aB}$	$1.60±0.03^{abC}$
		Yeast and mould count (log cfu/g)		
C	$1.44±0.07^{bA}$	$1.50±0.05^{cA}$	$1.57±0.04^{cA}$	$1.57±0.09^{bA}$
T_1	$0.66±0.52^{aA}$	$0.60±0.27^{aA}$	$0.88±0.18^{aA}$	$1.01±0.22^{aA}$
T_2	$1.06±0.22^{abA}$	$1.27±0.06^{bcA}$	$1.35±0.04^{bcA}$	$1.40±0.09^{bA}$
T_3	$0.81±0.26^{aA}$	$0.87±0.28^{abA}$	$1.20±0.06^{bA}$	$1.30±0.0^{abA}$

C – FCC without DLP and JSP; T_1 – FCC with 1% DLP; T_2 - FCC with 1% JSP; T_3 – FCC with 0.5% DLP+0.5%JSP

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

Yeast and mould count (YMC): The YMC (Table 4) for control, T1, T2, T3 treatment groups from day 1 to 30 days of storage ranged between 1.44 – 1.57; 0.66 – 1.01; 1.06 – 1.40 and 0.81 – 1.30 (log cfu/g), respectively. No significant difference was found in YMC between the days of storage at room temperature, but significant difference (P<0.05) was recorded between the products. The YMC was significantly (P<0.05) lower for FCC with T1 when compared with T3 and T2 added products and control on all the days of storage. There was no significant (P>0.05) difference in YMC between T1 and T3 product in all the days of storage except on 20th day of storage. The YMC for all the products were far below the permissible limit for all the products.

Anna Anandh *et al*. (2005) observed that the yeast and mould count of aerobically packaged buffalo tripe snacks food increased significantly (P<0.05) on storage but all these counts were below 2.5 log cfu/g at ambient temperature storage. Cytyarasan (2011) reported that yeast and mould counts increased significantly (P<0.01) from 0 day to 30th day of storage at room temperature in control and raw chicken skin incorporated murukku. Singh *et al*. (2011) could not detect YMC (cfu/g) in chicken snacks till 18th day, after that an increasing trend in YMC was noticed during the rest of the storage period. Soni *et al*. (2013) reported that YMC were not detected on 0 day of ambient storage of dehydrated meat rings but YMC increased significantly (P<0.05) on 15th day of storage and thereafter remained stable up to 30th day of storage and then further increased significantly (P<0.05) on 45th day of storage.

CONCLUSION

Functional chicken chips containing oats and flax seed powder with drumstick leaf powder (1%), Jamun seed powder (1%) and drumstick leaf powder (0.5%)+ Jamun seed powder (0.5%) could be stored at room temperature for 30 days without any appreciable deterioration in qualities.

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