MICROBIOLOGICAL STABILITY OF VACUUM-PACKED POULTRY LIVER PATÉ

N.F.A. SILVEIRA, E.T.F. SILVEIRA, M.K. BARBIERI, I. SHIROSE, V.C.A. JUNQUEIRA and M. T. E. L. GALVÃO
Meat Technology Centre - ITAL, Caixa Postal 139, Campinas, SP, Brazil

SUMMARY

The present research was undertaken to determine the effect of 2% sodium lactate (SL) 1.2% prolylene glycol (PG) and 1.2% glycerol (G) on the microbiological stability of vacuum-packed poultry liver paté stored at 7°C during 5 weeks. The physical and sensorial characteristics were also evaluated during storage time.

Microbiological results showed the effectiveness of PG and G in retarding growth of lactic acid bacteria and psychotropic aerobic and anaerobic bacterias. The inhibitory effect of lactate was more pronounced for lactic acid bacteria, keeping its number at same initial level of 10^2 CFU/g. Results suggest that the humectants evaluated had a inhibitory effect on the growth of the tested bacterias by lowering the water activity (Aw) from 0.96 to 0.94.

Objective measurements of color for the treatment studied revealed that the lightness increased significantly with the storage time while redness decreased and yellowness did not change markedly. The sensory evaluation results indicate that storage time did not affect significantly the taste and overall acceptability for all treatments, but off-flavor developed significantly for the products containing the humectants tested after 28 days of storage.

INTRODUCTION

Vaccum-packed poultry liver paté is a pasteurized product (72°C/10 minutes), packed after processing, and consequently can be easily spoiled by microorganism resulting in economic losses and risks to the consumers.

Spoilage of vaccum-packed meat product is specially done by lactic acid bacterias, which lead the product to undesirable souring, to the development of off odours and slime and gas formation in the packs (SCHILLINGER and LUCKE, 1988, DEBEVERE, 1989).

DEGNAN et al. (1992) reported that alternate control measures should be proposed to avoid the microbial hazard in meat products such as the use of liquid smoke or humectants like sodium lactate.

The addition of humectants to vacuum-packed meat products can contribute greatly to the microbiologial stability of the product avoiding microbial proliferation through reducing water activity (DEBEVERE, 1989). Salt is normally used to achieve this purpose but as high levels are advisable to prevent the growth of pathogenics organisms the food taste can be unacceptable (SHIN, 1991).

CHIRIFE et al. (1979) reported that glycerol has been sucessfully used in increasing the microbiological stability of meat products.

In the present investigation, the effect of three different humectants 2% SL, 1.2% PG, and 1.2% G, on the microbiological stability of vaccum-packed pasteurized poultry liver paté, stored at 7°C were studied.

MATERIALS AND METHODS

Vaccum-packed poultry liver patés were prepared with chicken livers, pork, back fat, milk, egg, with addition of 2% sodium lactate (60% active principle); 1.2% propylene glycol (analytical grade); 1.2% glycerol (analytical grade) and without humectant (control).

Common ingredients in all treatments were salt (1.3%), wheat flour (4.3%), cognac (3%), nutmeg (0.02%), clove (0.4%), nitrite (0.02%) and erythorbate (.0.5%).

The products were formulated to contain 60 to 61% moisture, 22 to 23% fat and 13 to 14% protein. They were prepared in a vertical cutter, filled in baking mould heated to a core temperature of 75°C. After cooling to 2°C they were sliced in blocks of 250g, vacuum-packed and stored at 7°C for five weeks under light conditions to simulate display chills in supermaket.

Proximate composition of the products were carried according to the procedure given in AOAC methods (1984). The Aw measurements were performed in a NOVASINA (model EEJA/3 BAG coupled in conditioned chamber model 4-TEBO).

Color was assessed instrumentally using Minolta Chromameter CR 200b to measure L (lightness), a (redness), b (yellowness) of treatments investigated.

At weekly intervals, 25g were taken for microbiological analysis.

Samples of each treatment were homogenized in 225ml of sterile 0.1% peptone water in a stomacher blender LAB 400 and a dilution series was made. The number of CFU/g (Colonies Forming Units per gramm) of aerobic and anaerobic psychrotrophic bacteria was determined in Plate Count Agar (DIFCO). Aerobic plates were inubated at 22°C for 5 days and anaerobics plates were incubated in anaerobic jar at 22°C for 5 days for 5 days as described by DEBEVERE (1989). The number of CFU of lactic acid bacteria was determined in Rogosa S.L. Agar (DIFCO), pour plate technique with cover and incubated at 28°C for 48 hours. The tests were done in duplicate an after incubation period, the log of average CFU were recorded.

Sensory evaluation of the products was performed weekly, in two sessions. Flavour, odour and overall quality were evaluated by nine pre-trainned panelists using a seven point intensity scale where zero and six indicates free and intense (off-odours, off-flavours) respectivelly. Samples were presented to the judgers, monodically at room temperature following the same presentation order. Sensory values were statistically evaluated by analysis of variance and Tukey test at level of 5%.

RESULTS AND DISCUSSION

The microbiological results clearly show that all tested humectants had effect on the lactic acid bacteria growth, keeping the initial counts near to 10^2 CFU/g along the storage time (Figure 3).

Concerning to total anaerobic and aerobic psychrotropic bacterias counts, effective microbial control by PG and G was seen (Figures 1 and 2), while for lactic acid bacteria SL showed equal effectiveness (Figure 3).

DEBEVERE (1989) stated that the deterioration in meat products such as vacuum-packed paté is due to the growth of psychrotrophic bacterias specially lactic acid bacterias, and changes in the products quality appear when the total number of lactic acid bacterias reaches the level of 10^6 CFU/g (critical level for the product).

Concerning to the stability of paté containing SL, PG and G, the maximal microbial growth observed was 10^5 UFC/g after 5 weeks of storage, while the control reached 10^6 UFC/g one week before (Figures 1 to 3).

The reduction in Aw to 0.94 moved the paté from "highly perishable" (Aw > 0.95 and pH > 5.2 category to "perishable" (Aw > 0.95 or pH > 5.2) (RODEL et al. 1975). Although the minimal Aw value to make the product safety against *Clostridium botulinum* is 0.93 (TROLLER, 1973), other hurdles (curing ingredients and low storage temperature) produce effective control of this organism in the products investigated (ROBERTS et al. 1973).

From Table 1 it can be seen that for patés containing humectants, the pH values remained unchanged along the storage, whereas the control showed a slight increasing after 4 weeks of storage. This fact can be associated with the increasing of psychrotrophic mixed flora growth in the same period of storage.

The storage time influenced significantly the colour of all treatments studied (Table 2). The product appearance became paler as evidentiates the significant increasing of lightness (L) and reduction of redness (b). It is expected that storage under light conditions contributes to improve the loss of initial colour of the product.

The sensory evaluation data are shown in Tables 3, 4 and 5. The results indicate that storage time did not affect significantly the taste and overall acceptability for all treatments, but off odour developed significantly in the product containing humectants evaluated after 28 days of storage.

CONCLUSIONS

In the general way, the humectants tested were effective to control lactic acid bacteria growth. For the mixed psychrotrohic flora, the patés containing 1.2% PG and 1.2% G showed more effectivesses.

Storage conditions affected adversely the sensory characteristic of the products containing humectants since off-odours were detected after 28 days of storage. However, the shelf life of patés formulated with 1.2% PG and 1.2% G could be longer than 5 weeks since the product is stable microbiologically. The organoleptic alteration verified could be due to a chemical change and a further investigation on this subject would be of considerable interest.

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Table 1. The evolution of pH in poultry liver paté along the storage time. Control (1), 2% sodium lactate (2), 1.2% propylene glycol (3), 1.2% glycerol (4).

Treatments	Storage time (weeks)					
	0	1	2	3	4	5
1	6.55	6.54	6.54	6.52	6.60	6.60
2	6.54	6.55	6.57	6.57	6.55	6.56
3	6.54	6.54	6.53	6.55	6.54	6.54
4	6.53	6.52	6.53	6.55	6.54	6.55

Table 2. Appearance (1) of vacuum-packed poultry liver paté stored at 7°C for 5 weeks.

Weeks	Control			2% sodium lactate			1.2% p. glycol			1.2% glycerol		
	L	a	b	L	a	b	L	a	b	L	a	b
1	60.4^{ab}	11.1^{a}	17.5^{a}	$60.4^{a,b}$	11.1^{a}	17.7^{a}	57.8^{b}	10.9^{a}	16.4^{a}	58.6^{a}	11.5^{a}	17.7^{a}
2	60.0^{a}	10.7^{a}	16.9^{b}	60.1^{a}	10.9^{a}	17.0^{b}	60.6^{a}	$10.6^{a,b}$	19.9^{a}	$54.4^{a,b}$	10.9^{b}	17.2^{b}
3	59.6^{a}	10.7^{a}	18.0^{a}	$61.2^{b,c}$	10.2^{b}	17.7^{a}	60.3^{a}	10.7^{a}	18.0^{b}	$60.1^{b,c}$	10.6^{b}	17.6^{a}
4	$60.4^{a,b}$	10.7^{a}	17.6^{a}	61.5^{c}	10.1^{b}	17.1^{b}	61.9^{a}	$10.0^{b,c}$	17.4^{ab}	60.7^{c}	10.6^{b}	$17.4^{a,b}$
5	61.2^{b}	9.4^{b}	17.6^{a}	$61.6^{b,c}$	10.3^{b}	17.5^{a}	61.8^{a}	9.7^{c}	$17.2^{a,b}$	61.4^{d}	9.8^{c}	$17.4^{a,b}$

Mean values not followed by the same letter within a columm are significantly different ($P < 0.05$).

1. Minolta Chroma Meter CR 200b.

Table 3. Mean panel scores for off odour (Tukey test 5%) of vacuum-packed poultry liver paté.

Storage time (days)	Treatments			
	Control	Sodium lactate 2%	Propylene glycol 1.2%	Glycerol 1.2%
7	1.0^{a}	1.0^{a}	1.0^{a}	1.0^{a}
14	1.0^{a}	1.0^{a}	1.0^{a}	1.0^{a}
21	1.0^{a}	1.1^{a}	1.1^{a}	1.1^{ab}
28	1.1^{a}	1.4^{b}	1.3^{b}	1.2^{b}

Scores with unlike superscripts are significantly different: $P < 0.05$.

Table 4. Mean panel scores for off flavor (Tukey test 5%)

Storage time (days)	Treatments			
	Control	Sodium lactate 2%	Propylene glycol 1.2%	Glycerol 1.2%
7	1.0^{a}	1.2^{a}	1.0^{a}	1.0^{a}
14	1.1^{a}	1.1^{a}	1.1^{a}	1.1^{a}
21	1.1^{a}	1.3^{a}	1.2^{a}	1.2^{a}
28	1.1^{a}	1.4^{a}	1.2^{a}	1.2^{a}

Scores with unlike superscripts are significantly different: $P < 0.05$.

Table 5. Mean panel scores for overall acceptability (Tukey test 5%) of vacuum-packed poultry liver paté.

Storage time (days)	Treatments			
	Control	Sodium lactate 2%	Propylene glycol 1.2%	Glycerol 1.2%
7	3.9^{a}	3.8^{a}	3.8^{a}	3.9^{a}
14	3.9^{a}	3.9^{a}	3.8^{a}	3.9^{a}
21	3.8^{a}	3.8^{a}	3.8^{a}	3.8^{a}
28	3.8^{a}	3.7^{a}	3.8^{a}	3.8^{a}

Scores with unlinke superscripts are significantly different: $P < 0.05$.

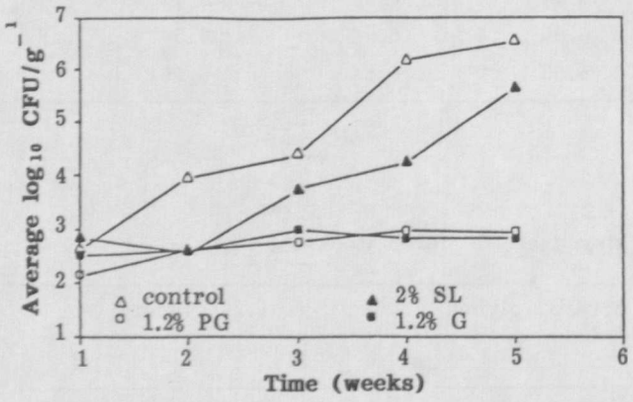

Figure 1. Total aerobic psychrotrophic bacterias counts in pasteurized vacuum-packed liver paté.

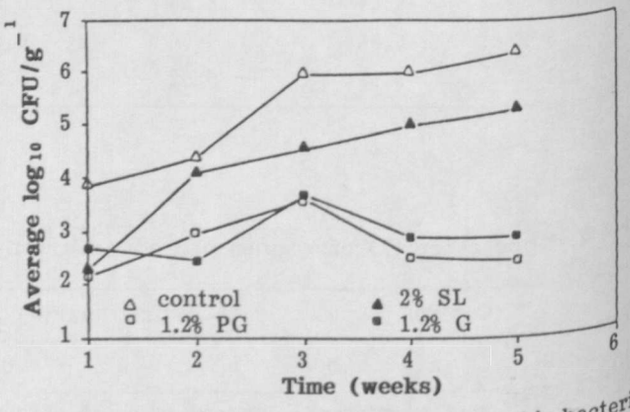

Figure 2. Total aenaerobic psychrotrophic bacterias counts in pasteurized vacuum-packed poultry liver paté.

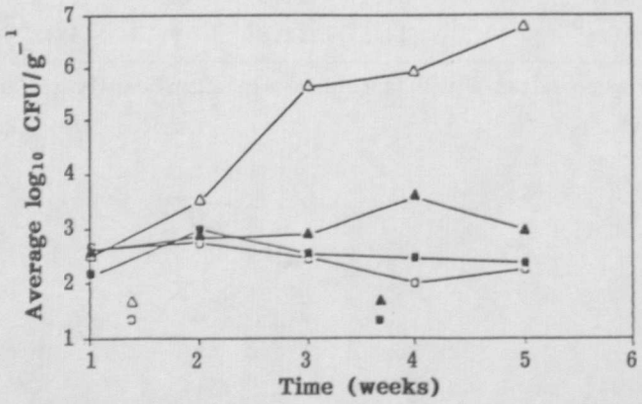

Figure 3. Total lactic acid bacteria counts in pasteurized vacuum-packed poultry liver paté.