HURDLE TECHNOLOGY APPLIED TO THE PRODUCTION OF CANNED POULTRY LIVER PATÉ

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SUMMARY

Processing conditions to reach a minimum heat treatment for canned poultry liver paté (83x42mm format) were optimized. Poultry liver, pork back fat, milk, egg, wheat flour and cognac with or without additions of various combinations of the humectants sodium lactate (1 to 3%), propylene glycol (0.5 to 3%), glycerol (0.5 to 3%) and glucono-delta-lactone (0.2 to 0.5%) were used to formulate the patés, that were prepared and tested whithin one week. Products were evaluated for proximate composition, sensory quality and microbiological characteristics.

Preliminary trials revealed that the preserving effect of humectants tested was best maintained by control of the water activity of the product through regulation of added water or the use of glucono-delta-lactone.

Preference tests results showed that the paté processed with sodium lactate (SL), propylene glycol (PG), glycerol (G) and glucono-delta-lactone (GDL) at levels of 2%, 0.8%, 0.8% and 0.3% were the most prefered among the treatments investigated. Water activity (Aw) and pH values of the selected product varied from 0.91 to 0.92 and 6.17 to 6.20 respectively and Fo - value of 0.73 were enough to inhibity the *Clostridium sporogenes* PA 3679 inoculated at level of 10^2 spores per gram.

On the basis of the results obtained, it can be concluded that the hurdles investigated (Fo, Aw, pH and Eh) leads to quality improvement of canned poultry liver paté.

INTRODUCTION

Production technology of canned liver paté, differentation of raw material and additives (HASSLER and JACQUET 1987, SUDAKOV el al. 1990), influence of formulation and processing conditions (VINAGRE et al. 1985, SALUSWKOVA 1987), quality requirements and assessment (CERVERA et al. 1988, CASTRERA et al. 1991) are some aspects mainly investigated. However at present, much attention has been given to the potential of using combination of methods to produce a microbiologically stable product while minimizing the adverse effects associated with standard processing procedures like severe heat treatment, dehydration and acidification.

In relation to the above considerations, this study was performed to optimize mild processing conditions which would provide better sensory and stability characteristics to canned poultry liver paté, formulated with humectant and acidulant. Process parameters evaluated were heat treatment (Fo), Aw, pH and Eh.

MATERIALS AND METHODS

Canned poultry liver patés were prepared with chicken liver, pork back fat, milk, egg with or without additions of various combinations of the humectants SL (1 to 3%), PG (0.5 to 3%), G (0.5 to 3%) and GDL (0.2 to 0.5%) as acidulant. Other ingredients such as salt (1.3%), wheat flours (4.3%), cognac (3%), nutmeg (0.02%), clove (0.4%), nitrite (0.02%) and erythorbate (0.05%) were added in all treatments.

The products were formulated to contain 51-52% moisture, 26-28% fat and 15-16% protein. The ingredients were chopped in a vertical cutter without vacuum for 2 minutes at a low blade speed of 1800 rpm (2 blades, 26cm diameter) and at high blade speed of 3500 rpm until a constant temperature of 10°C. Twenty (83x42mm) cans (190g/can) per treatment were filled with each batter. Fifteen cans per treatment were inoculated with *C.sporogenes* PA 3679 spores (100/g)while 5 cans per treatment were left uninoculated and served as controls for gas productions, Aw and pH determinations. Cans were vacuum sealed and thermally processed in a static retort at a temperature of 116°C to reach Fo values of 0.5, 1.0, 1.5 and 2.5. Fo values were calculated using the methods described by STUMBO (1973).

Preliminary trials were conducted to determine which moisture/protein (M/P) ratios would be effective to formulate the product containing humectants and acidulant,as far as microorganism spoilage is concerned.

Inoculated (15 cans/treatment) and uninoculated (5 cans/treatment) cans were stored at 35°C and monitored daily for gas production (swelling). Unswollen cans were opened and Total Anaerobe Counts (TAC) made on Liver Veal Agar. TAC plates were incubated in jars under anaerobic conditions at 35°C for 2 days (SPECK 1984).

Determination of pH, moisture, protein, fat and ash were carried out on the products according to AOAC

methods (1984). Aw measurements were performed using the NOVASINA (model EEJA/3 BAG coupled in a conditioned chamber model 4-TEBO).

Ranking test were used to run the sensory analyse. 31 untrained panelists were instructed to rank the samples according to their preference. All sensory data were statistically analysed by procedure described by CAMPOS (1976).

RESULTS AND DISCUSSION

The initial work aimed to determine the influence of M/P ratios (Figure 1a), SL, P, PG levels (0.5, 1.0, 2.0 and 3.0%) and GDL levels (Figure 1b) on lowering Aw and pH as well as the sensory quality and microbiological stability (Figure 2) of the canned poultry liver paté.

Comparisons made within the same M/P ratios (3.5/1) with paté formulated without humectants and acidulant showed that the lowering of Aw values by SL and PG were 1.5% and 1.3% respectively while G was 0.90%. Increasing levels of GDL produced a good reduction of pH values (10.5%) of the patés formulated with 1.2% PG and 3.5/1 M/P ratio.

The effect of altering the quantites of humectant, acidulant and water on sensory quality of the products were carried out by 5 trainned panelists. The upper limit of SL, G, PG and GDL considered acceptable by the panel was 2%, 1.2%, 1.2% and 0.3% respectively whereas the M/P ratio of 3.5/1 was judged to be the lower limit as far as juiciness and texture were concerned.

As shown in Figure 2, in accordance with earlier findings (MADDEN 1984), lowering the Aw of patés to 0.942 and 0.944 (treatments E and G respectively) assured the microbiological stability of the products.

The use of PG gave a product judged by the panelists to be slightly bitter. Addition of different levels of G and milk (M) minimize this effect as well as reduce the Aw to the ranges of 0.939 to 0.918 (Figure 1c) and 0.935 to 0.907 (Figure 1d).

Five trainned panelists selected 8 treatments previously and a ranking test was set in two differents sessions by using 31 untrainned panelists. The statistics results shown in Tables 1 and 2 have significant differences among the treatment evaluated. On the basis of best preference ranked and levels of humectant and milk added patés containned 2% SL, 0.8% PG, 5.5% M, 0.3% GDL, 3.5/1 M/P ratio (product 1) and 2% SL, 0.8% PG, 0.8% G, 4.9% M, 0.3% GDL, 3.5/1 M/P (product 2) met the desired requiriments for sensory acceptance and manufacturing feasibility.

From the results shown in Table 3 it appeared evident that the differences in composition selected treatments were small and the presence of additional humectant (G) in product 2 caused the lowering of Aw.

Figure 3 illustrates clearly the marked reduction of anaerobic microbial counts as the heat treatment is increased. The results suggest that Fo value of 0.73 produces microbiological stability to the products investigated.

CONCLUSIONS

The results in this sduty indicate that a mild heat treatment (Fo) combined with other hurdles (Aw, pH and Eh) produce a microbiologically stable product.

Sensory quality alterations of patés processed with the humectants investigated are small and the inclusion of glycerol contributes to a favorable paté taste.

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Table 1. Ranking scores* of liver paté formulated with 2% SL; 0.3% GDL; 3.5/1 M/P ratio by varying PG and M respectively: (I) 0.8; 4.3% (II) 1.2; 4.3% (III) 1.2; 4.9% (IV) 0.8; 5.5%.

Ranking	Paté formulations			
	I	II	III	IV
First place	2	11	5	13
Second place	20	12	12	18
Third place	15	24	45	9
Fourth Place	56	24	20	24
Total Ranking	93^{a}	71^{ab}	82^{ab}	64^{b}

(*) Scores with unlike superscripts are significantly different: $P < 0.5$.

Table 2. Ranking scores* of liver paté formulated with 2% SL; 0.3% GDL; 3.5/1 M/P ratio by varying PG, G and M respectively: (A) 0.5; 0.5; 4.9% (B) 0.8; 0.8; 4.9% (C) 1.2; 1.2; 4.9% (D) 0.5; 0.5; 5.5%.

Ranking	Paté formulations			
	A	B	C	D
First place	3	12	13	3
Second place	20	20	12	10
Third place	36	18	18	21
Fourth place	24	12	24	64
Total Ranking	83^{ab}	62^{b}	67^{b}	98^{a}

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

Table 3. Proximate analysis of liver paté formulated with 2% SL; 0.3% GDL and addition of (1) 0.8% PG; 5.5% M (2) 0.8% PG; 0.8% G; 4.9% M.

Product	%						
	Moisture	Protein	Fat	Ash	pH	Na Cl	Aw
1	51.24	15.34	28.43	3.20	6.17	1.93	0.920
2	51.89	15.21	28.21	3.15	6.20	1.81	0.910

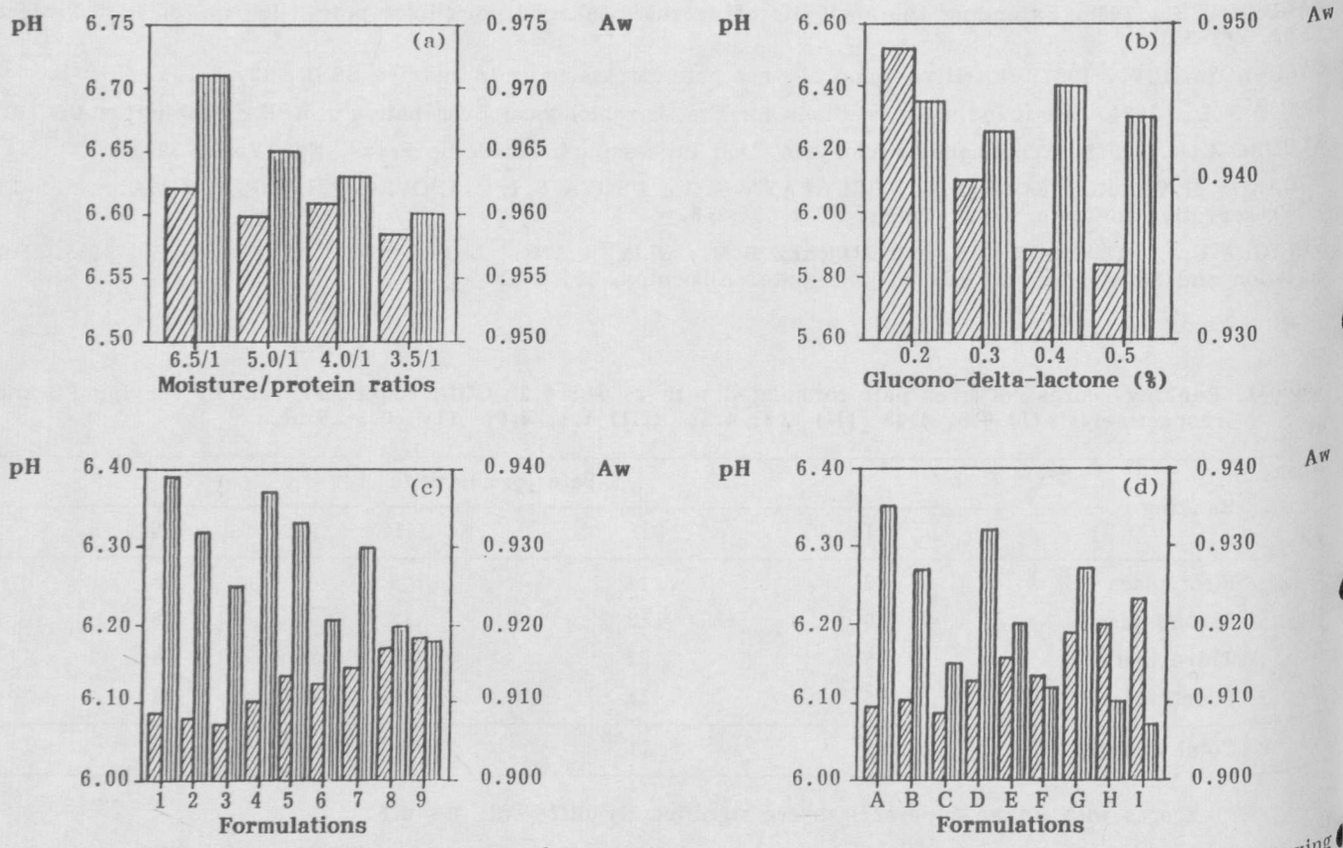

Figure 1. pH (▨) and Aw (▥) of liver paté formulations. (a) varying moisture/protein ratios, (b) varying GDL (%), (c) varying propylene glycol and milk respectively; (1) 0.5; 4.3% (2) 0.8; 4.3% (3) 1.2; 4.3% (4) 0.5; 4.9% (5) 0.8; 4.9% (6) 1.2; 4.9% (7) 0.5; 5.5% (8) 0.8; 5.5% (9) 1.2; 5.5% (d) varying propylene glycol, glycerol and milk respectively: (A) 0.5; 0.5; 4.3% (B) 0.8; 0.8; 4.3% (C) 1.2; 1.2; 4.3% (D) 0.5; 0.5; 4.9% (E) 0.8; 0.8; 4.9% (F) 1.2; 1.2; 4.9% (G) 0.5; 0.5; 5.5% (H) 0.8; 0.8; 5.5% (I) 1.2; 1.2; 5.5%.

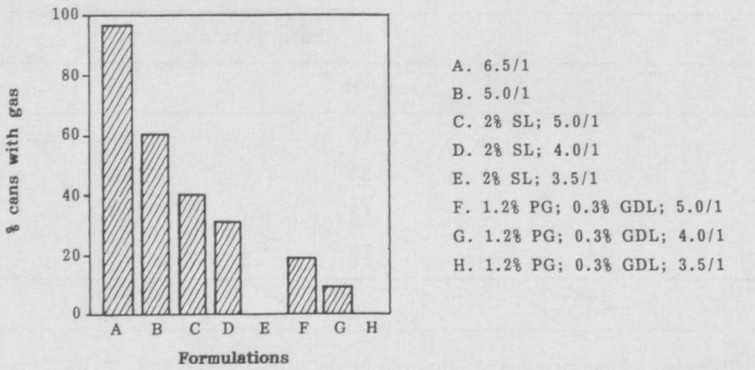

Figure 2. Effects of 2% sodium lactate (SL), 1.2% propylene glycol (PG), 0.3% glucono-delta-lactone (GDL) and 4 moisture/protein ratios M/P of canned liver paté (10 cans/treatment) processed to Fo=2.5 showing gas when stored inoculated at 35°C during 10 days.

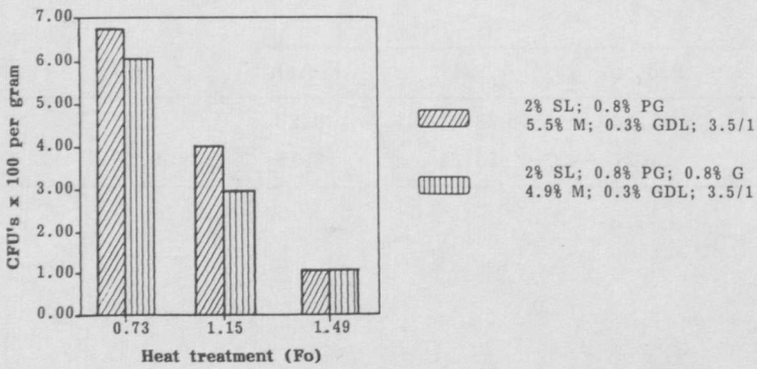

Figure 3. Effect of heat treatment (Fo) on the anareobic count formation colonies (CFU's) of canned liver paté formulations.