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THE SUBSTITUTION OF RABBIT MEAT FOR PORK IN THE FORMULATION OF SALCHICHON SAUSAGES IN MEXICO

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# INTRODUCTION

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The use of rabbits as a source of meat and skins is steadily increasing in many parts of the world (Oween, 1982), including Mexico (Owen and Arzate Valdez 1980). At present very little use is made of rabbit meat for the production of processed products such as sausages. In Mexico the annual per capita meat consumption is very low at 8.54kg (de la Puente, 1984), and there is a growing demand such as rabbits, would help to increase the quantity and variety of meat products available. Such as rabbits, would help to increase the quantity and variety of meat products available.

The few studies which have been carried out on the use of rabbit meat in this way have produced encouraging the studies which have been carried out on the use of rabbit meat in this way have produced the studies which have been carried out on the use of rabbit meat in this way have produced encouraging the studies which have been carried out on the use of rabbit meat in this way have produced encouraging the studies which have been carried out on the use of rabbit meat in this way have produced encouraging the studies which have been carried out on the use of rabbits meat in this way have produced encouraging the studies which have been carried out on the use of rabbits meat in this way have produced encouraging the studies which have been carried out on the use of rabbits meat in this way have produced encouraging the studies which have been carried out on the use of rabbits meat in this way have produced encourage encour encouraging results (Lee and Cheong, 1981, Haga et al, 1981).

 $B_{aker}$  et al (1972) showed that the organoleptic quality of frankfurters made with rabbit meat was  $l_{evel}$  et al (1972) showed that the organoleptic quality of frankfurters made with rabbit meat was that the organoleptic quality with or superior to those made with beef. Furthermore, Whiting and Jenkins (1981), indicated that the functional properties of rabbit meat, such as water holding capacity, were at the functional properties of rabbit meat, such as water holding capacity, were at that the functional processing properties of rabbit meat, such as water holding capacity, were at for pig meet to those of beef when used for frankfurter production. The substitution of rabbit meat in the  $r_{\text{Op}}^{\text{equal to those of beef when used for frankfurter production. The substitution that in the product meat in English pork sausages showed that consumers could only detect rabbit meat in the product of 75% but not at 50% (MacDougall and Jolley, 1983). The present students of 75% but not at 50% (MacDougall and Jolley, 1983).$ Production for the formation of the set of t  $S_{\rm al}$  chichon Chicken Sausage, without altering the organoleptic quality. Salchichon Sausage is a  $S_{\rm al}$  chichon Chicken Sausage, without altering the organoleptic quality. Salchichon Sausage is a  $S_{\rm al}$  chicken Sausage, without altering the organoleptic quality. <sup>Cooked</sup> emulsion product, similar to Bologna, which is very popular in urban areas of Mexico.

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### MATERIALS AND METHODS

Thirty New Zealand White Rabbits from the University of Chihuahua Rabbit Unit, of liveweights ranging between 1.5 and 4.5kg were slaughtered. Their chilled carcases were dissected to provide 25g of fresh meat. Lean pork was obtained from a local meat plant in Chilbertur meat. Lean pork was obtained from a local meat plant in Chihuahua.

Salchichon Sausages were made according to a standard industrial formula using commercially prepared curing salt and spice mixtures. Rabbit meat was substituted for simula using commercially at 20, curing salt and spice mixtures. Rabbit meat was substituted for pig meat in the formulations at 20, 40, 60, 80 and 100%, using 100% rig meat sources on the termination of the variant termination of the second sec 40, 60, 80 and 100%, using 100% rig meat sausages as the control (Table 1). The meat from the various rabbit carcases was minced and thoroughly rived as the control (Table 1). The meat from the variant rabbit carcases was minced and thoroughly mixed prior to inclusion. The rabbit meat, pig meat and pork fat were all chilled and minced through a 1/8" plate. These and other ingredients were passed through a bowl chopper, stuffed into synthetic collagen casings at 7cm diameter, and cocked at 72 until the core temperatures reached 65°C. The sausages were finally stored at 30°C. Three repliprocessing runs were carried out Three replicate processing runs were carried out

Proximate analysis was carried out according to AOCS (1980), salt determination by the method of Relation and Mutter (1970) Belcher and Nutton (1970), and water holding capacity after Wismer Pedersen (1959). Cooking yield was measured by weight difference. pH with a Construct after Wismer Pedersen (1959). was measured by weight difference, pH with a Corning meter using 10gm samples in de-ionised water, and shear values on a core samples using a Marca Detter and a shear values on a sample samples using a marcar and shear values on ½" core samples using a Warner Bratzler Shear apparatus. All analyses were car ried out in triplicate. Non visual organoleptic quality was estimated using a trained taste panel of '16-20 persons employing a triangular companison test. The resolution of using a trained taste panel of The panel were blindfolded for this test to avoid the influence of colour variation. An analysis of variance was carried out on the chemical and physical parameters analysed and treatment differences estimated with Derived out on the chemical tast? 16-20 persons employing a triangular comparison test. physical parameters analysed and treatment differences estimated with Duncans test. Triangular taste

Sausages containing rabbit meat were only identified by the taste panel at levels of 80% and higher. (Table 4.)

Cooking yields, water holding capacity, and shear value did not vary significantly between the treatments (Table 3). pH values although not showing an overall significantly between the treatmently ments (Table 3). pH values although not showing an overall significant trend were significantly higher at 80 and 100% levels of rabbit meat inclusion (P = <0.01).

With regard to chemical analysis moisture content was found to be significantly lower in the  $\frac{80 \text{ and}}{100\%}$  rabbit meat inclusion levels (P = <0.01) Protein cat and analysis regulation of the significantly lower in the significant significant set of the significant s 100% rabbit meat inclusion levels (P = <0.01). Protein, ash and salt contents did not vary significantly (Table 2).

high levels, without significantly affecting organoleptic properties. In the present study the on meat sausages were only identified at the 80% or higher levels of inclusion. The estimates study the on fight pork sausages by MacDevert English pork sausages by MacDougall and Jolley (1983), sausages containing rabbit meat were identified at sausages were considered about meat were identified at sausages were considered about meat were identified at sausages were considered about meat were interpret at a sausages were considered at the sausages as a sausage were considered about meat were interpret at a sausage were considered at the sausage at a sausage at a sausage were considered at the sausage at a only when the level exceeded 75%. The rabbit meat sausages were considered by the taste panelists as Deing acceptable at all levels of inclusion. The triangular taste panel analysis did not take of account the colour differences between the various treatments, the sausages with tither levels of mathematical sausages are analysis as a sausage of the sausages with tither levels of the sausages of the sausage of the sausages are analysis as a sausage of the sausages are the sausage of the sausag rabbit meat being noticably lighter. The sausages containing higher levels of rabbit meat had a reciprocally higher moisture content due to the relatively of rabbit meat had a reciprocally higher moisture content due to the relatively of rabbit meat reciprocally higher moisture content due to the relatively of rabbit meat reciprocally higher moisture content due to the relatively of rabbit meat reciprocally higher moisture content due to the relatively of rabbit meat reciprocally higher moisture content due to the relatively of rabbit meat reciprocally higher moisture content due to the relatively of rabbit meat reciprocally higher moisture content due to the relatively of rabbit meat reciprocally higher moisture content due to the relatively of rabbit meat reciprocally higher moisture content due to the relatively of rabbit meat reciprocally higher moisture content due to the relatively of rabbit meat reciprocally higher moisture content due to the relatively of rabbit meat reciprocally higher moisture content due to the relatively of rabbit meat reciprocally higher moisture content due to the relatively of rabbit meat reciprocally higher moisture content due to the relatively of rabbit meat reciprocally higher moisture content due to the relatively of rabbit meat reciprocally higher moisture content due to the relatively of rabbit meat reciprocally higher moisture content due to the relatively of rabbit meat reciprocally higher moisture content due to the relatively of rabbit meat reciprocally higher moisture content due to the relatively of rabbit meat reciprocally higher moisture content due to the relatively of rabbit meat reciprocally higher moisture content due to the relatively of rabbit meat reciprocally higher meat reciprocally hig fat content and a reciprocally lighter. The sausages containing higher levels of rabbit meat had a frat bit meat (Lipinsiky et al 1973). In the present study the continue to the relatively leaner character of capacity bit meat (Lipinsiky et al 1973). In the present study the cooking yields and water holding capacity were not significantly altered by substitution of rabbit meat. This water holding capacity in were not significantly altered by substitution of rabbit meat. This is in agreement with results the data of the substituted rabbit meat. The inclusion of rabbit meat at higher levels did not however increase the pH of the sausages, as in the study by MacDougall and Jolley (1983). There is clearly score for the of the sausages, the emulsion study by MacDougall and Jolley (1983). There is clearly scope for the production of cooked emulsion the organo type sausage, such as Salchichon, substituting pig meat for rabbit meat, without reducing the organor the physical processing characteristics.

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Frinciples and TORRY, J.H. (1960) WeGraw-Hill D. Procedures of Statistics with Special Reference to Biological Sciences McGraw-Hill Book Co. Inc., New York. 72-220, 308-427.

Experimental Treatment	1*	2	3	. 4	5	6	
% Rabbit Meat	Value 0	20	40	60	or tion 08	100	
% Pig Meat	100	80	60	40 🥀	20	0	

TABLE 1: Formulation of Salchichon Sausages Using Different Levels of Rabbit Meat

N.B.: Lean meat formed 65% of the total sausage formulation, which also included 14% pork fat and 14% water added as ice.

14% pork fat and 14% water added as ice. \* Control

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Level of Substitution with Rabbit Meat (%)	Moisture (%)	Fat (%)	Protein (%)	Ash (%)	Salt (%
0 (Control)	59.16	21.14	14.58	3.66	2.13
	± 0.82	± 0.54	± 1,63	± 0.65	± 0.52
20	59.28	± 21.26	14.83	3.28	1.92
	± 0.42	± 1.68	± 0.93	± 0.15	± 0.03
40	± 0.77	± 21.25 ± 1.93	± 14.83	3.43 ± 0.14	1.93 ± 0.17
60	60.54	20.55	15.34	3.76	2.12
	± 1.12	± 1.45	± 1.49	± 0.42	± 0.11
80	61.73	16.15	15.78	3.52	2.09
	± 0.29	± 0.06	± 0.56	± 0.11	± 0.23
100 of eals	62.53	16.42	16.27	3.75	1.96
	± 0.81	± 0.81	± 1.07	± 0.11	± 0.16.
Values Values	6.53**	9.47**	0.87ns	0.09ns	3.71ns

TABLE 2: Proximate Analysis and Salt Content of Salchichon Sausages Formulated with Rabbit Meat. Mean Values with Standard Deviations (m = 9)

## (Table 4.) \*\* : P = <0.01; ns: not significant

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Level of Substitution of Rabbit Meat (%)	Cooking Vield	Nater Jolding Capacity	pH Value	Shear Value
( )0 /		(70)	manage magnetic loose	(kg)
0 (Control)	91.12 ± 2.12	20.41 ± 4.56	6.47 ± 0.15	0.35 ± 0.00
20	92.23 ± 1.82	22.62 ± 0.57	6.42 ± 0.25	0.23 ± 0.03
40	89.81 ± 1.99	22.24 ± 3.19	6.26 ± 0.02	0.40 ± 0.07
60	89.41 ± 2.68	18.42 ± 4.44	6.39 ± 0.28	0.36 ± 0.07
80	± 89.33	15.74 ± 2.54	6.74 ± 0.02	0.41 ± 0.10
ido	* 0.95	14.92 ± 2.46	6.73 ± 0.01	0.40 ± 0.13
' Values	0.10ns	2.26ns	3.85ns	-

TABLE 3: Physical Measurements Carried Out on Salchichon Sausages Formulated with Rabbit Meat. Mean Values with Standard Deviations (n \* )

ns: not significant

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TABLE 4: Triangular Taste Panel Test Applied to Salchichon Sausages Formulated with Rabbit Meat Against Control Sausages Formulated with Pig Meat Formulated with Pig Meat

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Sausage Comparison	Detection of Odd Sample in Triangular Test (Correct/Total)	Significance	भाग अधीय समाधा का समिता मिनित सिंह अनुमाह प्राथमा का मेलन के सुनी H del Levs देत मिन्द्र हम से सुनीवृत्ता का प्र यहने मिन्द्र के सुनीवृत्ता का प्र
100 % Pig 20 % Rabbit	8/20	and throughout the peri ns	efter 2 weeks. So of the experiment Material
100 % Pig 40 % Rabbit 100 % Pig 60 % Rabbit	3/16 10/16	stasimus dorain and runn inhtered and an Atter 10 days' storag nd exposed to anther air 20 min in air an	Striploin (M. long coventionally slat bays (M.R. Grace) from each joint an blast-frozen for 8
100 % Pig 80 % Rabbit 100 % Pig 100 % Rabbit	17/20 00000000000000000000000000000000000	steaks were then vacuum g 75u Surlyn film with a s were then frozen comple **	The crust-frozen i Farnborough) using 25°C All sample display,

The skin packed steats were displayed in a domestic deep-freeze cabinet00.00>n= 9t:\*\*\*<sup>0</sup>C with an illusination level of 1000 lux' (Matural, Atlas) to simulate retailing clou0t>o=9 :\*\*

Tolour was measured with a Hunter D25D? Colour Difference Meter. No sample was removed from the display case for longer than the minutes, and care was taken to avoid losting of the surface during measurement. The colour arce used was Hunter L. \* 5. Sat removed . S. is a measure of colour intensity or colourfulmas, and is calculated: appropriate for reporting the results of this study.