

Chorizo gallego: a microbiological investigation as well as other quality parameters

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Background:

Chorizo is a very popular cold-smoked fermented sausage in Spain. The export of Chorizo to Germany is increasing, where it is offered mainly in speciality shops of the retailer business.

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Objectives:

This is a study on the hygiene qualities of the Galician chorizo, in particular the typical microbiological investigations as well as sensoric characteristics, physical and chemical parameters.

120 samples from four different producers (A, B, C, D) were analysed. Two of these are Galician producers and the samples were sent to Germany in vacuum-packs. The other two come from retailers located in Germany and specialized in Spanish products, with the merchandize coming from Galicia. From each producer, three batches with ten chorizos each were analysed. It was known that the samples of producer A were formulated with additives and that producer B was using no additives whatsoever. None of the producers used starter cultures.

Methods:

The pH-values and temperatures were measured with a Portamess 651-2 (Knick, Berlin) at two or more locations of each sample. Then the mean values were calculated.

The chemical analysis (dry matter, contents of water, ash, crude protein, hydroxy proline, total fat, nitrite and nitrate) of one Chorizo from each producer was carried out in order to the "Amtliche Sammlung von Untersuchungsverfahren nach § 35 Lebensmittel- und Bedarfsgegenst ndegesetz (LMBG)".

The microbiological investigation was carried out in order to the "Amtliche Sammlung von Untersuchungsverfahren nach § 35 Lebensmittel- und Bedarfsgegenst ndegesetz (LMBG)". The mediums and incubating conditions are shown in Table 1.

Results and discussions:

At the sensory investigation paprika and garlic is tastable and smellable primary.

The pH-values were minimal 4.6, maximal 5.3 and on average 5.0.

The temperatures measured to the point in time of the investigation of the tests lay between 10°C and 25°C.

The chemical analysis of one Chorizo of each organization showed the following results in reference to the valuable components: The BEFFE-contents lay between 17.7 and 23.3%, the content of connective tissue between 2.1 and 3.4% and the fat contents extended from 31.0 to 46.7%.

At the microbiological investigation the results were ascertained as following:

The total number of aerobic germs on PFHG- and Blood-agar plates were minimal log 6.7 and log 6.6, respectively, maximal log 9.0 and log 9.2, respectively and on average log 8.4 and log 8.5 CfU / g, respectively. By differentiation of the germs of the Blood-agar-plates the lactobacillaceae as dominant flora were found in the chorizos of all producers, followed by isolates of the genus *Bacillus*. Distinctly smaller quantities of irregular non-spore forming rods and members of the family *Micrococcaceae* including DNase-negative staphylococci were found in the chorizos. *Enterobacteriaceae* were detected only in the Chorizos of two producers. Only single isolates of the genera *Aerococcus*, *Streptococcus*, *Pediococcus*, *Alcaligenes*, *Moraxella*, *Pseudomonas*, *Acinetobacter*, *Chromobacter* and *Flavobacterium* were found.

The examination of the Chorizos using selective media showed the following results:

Lactobacilli were minimal log 5.2, maximal log 9.0 and on average 8.4 CfU / g as expected the dominant flora. In contrast to the number of the lactobacilli the number of the *Micrococcaceae* varies with minimal log 0.5, maximal log 3.6 and on average log 2.7 CfU / g distinctly between the chorizos of the different producers.

The germ counts of the *Enterobacteriaceae* were maximal log 5.0 CfU / g. *E. coli* with germ counts of maximal log 3.6 CfU / g were isolated solely in 8 Chorizos from two producers. None of these 20 *E. coli* isolates showed pathogenic factors. *Salmonella* could not be detected.

Enterococci were found with germ counts of maximal log 4.9 CfU / g.

Yeasts and moulds were detected only sporadically at a maximum of log 4.0 and log 4.1 CfU / g in chorizos of two producers.



Taxonomic differentiation of the isolates:

Lactobacilli

Most of the 299 *Lactobacillus* isolates were assigned to either the facultatively homofermentative *Streptobacterium* group or to the obligately heterofermentative *Betabacterium* group. As result of the further differentiation the homofermentative isolates following species were detected: *L. plantarum* (23.8%), *L. sake* (21.4%), *L. curvatus* (14.8%), *L. alimentarius* (11.4%), *L. casei tolerans* (11.4%), *L. bavaricus* (7.1%) and *L. farciminis* (7.1%). In individual cases *L. casei* spp. *casei*, *L. pseudoplantarum* and *L. coryniformis* were found. As result of the differentiation the heterofermentative isolates following species were found: *L. hilgardii* (45.1%), *L. brevis* (27.5%), *L. fermentum* (11.8%), *L. buchneri* (7.8%), *L. viridescens* (5.9%) and *L. divergens* (2.0%).

Micrococcaceae

Most of the 194 differentiated isolates were assigned to the genus *Staphylococcus*. Only a small number of isolates was identified as *Micrococcus*. The genus *Planococcus* was not isolated. Within the genus *Staphylococcus* the following species were found: *S. simulans* (35.3%), *S. saprophyticus* (27.1%), *S. warneri* (10.6%), *S. xylosus* (8.2%), *S. aureus* (5.9%), *S. cohnii* (4.7%), *S. epidermidis* (4.7%), *S. capitis* (1.2%) and *S. sciuri* (1.2%). Within the *Micrococci* two different isolates were differentiated: *M. varians* (83.3%) and *M. kristinae* (8.3%). Two isolates could not be speciated.

Conclusions:

Vakuum-packing extends the maximal storage time of the Chorizo and changes the microflora. At a comparison the galician Chorizo with similar fermented sausages of the German market like the Pepperoni, and in comparison of the results with set up limits of the Swiss decree (Eidg. V. 1987) as well as with the recommendations of the CeNAN 1976, the hygienic status is to judge as „well“ to „satisfactory“.

The differences between the factories with regard to the number the *Enterobacteriaceae*, *Enterococci*, *Yeasts* and *Moulds* can be associated with different conditions at packing, transport and storage of the samples. The Chorizos of the factories A and B were quite quickly vacuum-packed after the manufacture, while the conditions of transport and storage of the Chorizos of the retail traders C and D are not known.

The chorizos investigated in this study were slightly below the legally alleged values of protein.

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Table 1: Mediums and incubating conditions

Medium	Producer	Germs	Incubating	
			time [d]	temperature [° C]
PFHG	self made	aerob mesophil germs	3	30
Blood	Oxoid No. FSR 1055	aerob mesophil germs	2	30
MRS	Oxoid No. CM 359/ CM 361	Lactobacillus	2	30
KRANEP	Merck No. 5395	Micrococcaceae	2	37
VRBG	Oxoid No. CM 485	Enterobacteriaceae	2	37
CAA	Oxoid No. CM 591	Enterococcus	2	42
YGC	Merck No. 16000	Yeasts and Moulds	4 - 5	20
ECD	Merck No. 104038	E. coli	1 - 2	37