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ACHROMYCIN IN THE PRESERVATION OF
PASTEURISED MEATS

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Even since 1944 Tarr et al. /14/ reported that antibiotics can be successfully applied for the extension of keeping time of fresh meat and especially fish. Ever since up to date the literature collected a great number of works signifying attempts of antibiotics application for the purpose of preservation of food.

Goldberg, Deatherage and Weiser /7/ have ascertained that out of 6 tested broad spectrum antibiotics only chloramphenicol, aureomycin and terramycin extended storage life of ground beef. Lepoweczy et al. /9/ achieved similar observation.

Džinleski /6/ has examined influence of aureomycin, terramycin and penicillin as well as combination of aureomycin-terramycin, aureomycin-penicillin and terramycin-penicillin on storage life of ground beef. Also in this work aureomycin and combination of aureomycin and terramycin showed the best results. Džinleski observed that simultaneous influence of these antibiotics and other factors /e.g. chilling/ gives particularly favorable results. Džinleski's observations about the influence of antibiotics regarding the stability of meat's colour is also interesting.

Besides these works the literature also contains, among the others, the following: Weiser et al. /16/, Reese et al. /11/, Sacchi et al. /12/, Dowing et al. /4/, Weiser et al. /17/, Weiser et al. /18/, Ziegler and Stadelman /19/, Tarr et al. /13/, Krücken /8/, Dubrova and Lazarov /5/ etc.

Curran and Evans /3/ reported that addition of antibiotics to canned hams may stop the germination of spores. Krücken /8/ considers that this question has not been solved, because anaerobes and spores generally have the different reaction towards the antibiotics.

- 2 -

Campbell and O'Brien /2/ say that so far the attempts of use of antibiotics for extension of storage life of the canned meat remained without results.

Baumgartner and Hersom /1/ state: "The only reasonable view of the present position is that canned foods cannot safely be preserved by the use of an antibiotic coupled with mild heat treatment. There is ample evidence that certain antibiotics reduce the heat resistance of sporeforming organisms likely to be found in canned foods, but much further work, including investigation of possible physiological effects of antibiotics is required before these substances can safely be applied in the canning process."

Ordal and Brown /10/ established that the addition of oxytetracycline to the curing brine of low sodium chloride content /4 per cent/ markedly extended the storage life of such hams.

Synergetic effect of achromycin and pasteurisation on keeping quality of canned hams, shoulders, tenderloins and frankfurters. - Examinations performed in the Institute of Meat Technology of FRRY/by the group Savić, Trumić, Zlata, Birovljev, Mihajlović, Karan: Djurdjić/ confirmed Džinleski's results, and on the basis of series of experiments it has been determined that among the all antibiotics the best outlooks for practical use in preservation of meat, and especially of pasteurised meats has achromycin. Trumić et al./15/ in his work "Increase of keeping quality of frankfurter sausages in brine by means of added achromycin" suggest that on the basis of acquired experience, the firm conditions, by which one antibiotic must satisfy in order to be used as preservative for food, can be stipulated at the present time. First of all, this antibiotic must not be toxic, should be easily dissolved in water, should be sufficiently thermostable, should have broad spectrum of action on putrefactive and patogene microorganisms, must not affect organoleptic properties of food and should not be of the too high cost price. Mainly achromycin corresponds to all of these conditions.

-3-

In the above mentioned paper Trumić et al. used achromycin hydrochloride /Tetracycline HCl Crystalline - Lederle Lob. Div. Am. Cyanamid Comp./ in the first place because of its greater thermostability compared with aureomycin /boiling temperature destroys it in 15 minutes/.

Achromycin which as it is well known, belongs to the group of broad spectrum antibiotics, has all the qualities of aureomycin and besides, is more effective on certain patogene bacteria /E.coli, Shigella, Proteus/. Achromycin is of better dilution than aureomycin. The only difference between achromycin and aureomycin is that in its formula achromycin contains one chlor-atom less.

Thermostability of achromycin in curing brines of different concentrations of salt and pH values. - The experiments conducted by Mihajlović and Zlatar /unpublished data/ and Trumić et al./15/ showed that achromycin dissolved/10, 20 and 100 gama in 1 ml/ in distilled water or curing brines of various concentrations and pH values presented the following results:

1. Thermostability of achromycin in distilled water and in curing brines of various concentrations of salt and pH values

/Mihajlović-Zlatar/

	pH V a l u e								
	5,5			6,2			7,3		
	10	20	100	10	20	100	10	20	1000
Achromycin 1 gama/1 ml									
Aq.dest.	+	+	+	+	+	+	+	+	+
3% NaCl	+	+	+	+	+	+	±	±	+
10% NaCl	+	+	+	+	+	+	±	±	+
15% NaCl	+	+	+	-	-	±	-	-	+

+ not destroyed at 120°/ 70'

± not destroyed at 110°/ 70' but destroyed at 120°/ 70'

- destroyed at lower temperature of 110°/ 70' or 120°/40'

- 4 -

However, experiments of thermostability of achromycin incorporated in meat showed a greater sensibility to the heat in this medium. This decrease of thermostability of antibiotic was different for various meat compounds, but generally speaking the activity of achromycin was completely lost already within 3 days after the pasteurisation, regarding the majority of meat products. After this period of time biological proof of antibiotic is not possible.

The role of achromycin in synergizing of the thermal death time of spores of heat-resistant spoilage bacteria. - Examinations about effect of achromycin on heat resistance of sporeforming and other bacteria are still in course at this Institute. Although these experiments upon their termination will be published it can be said even now that achromycin reduces thermal death time of bacteria, but not having the equal effect on all media. Of course this sensibility is influenced by the factors as: quantity of proteins, concentration of salt and antibiotic and also to some extent of pH value.

Experiments in processing plants. - Having in consideration the above basic data, several series of experiments have been conducted in processing plants by addition of achromycin to the pasteurised cans /frankfurters, hams, shoulders, tenderloins/. Trumić, Zlatar and Birovljev have already published one part of their results achieved with the canned frankfurters. Table 2 presents excerpt of one table given by the authors in their work. Hence it is evident that longer heating /even at the lower temperature/ is less effective than shorter heating at higher temperatures.

Afterwards Karan-Djurdjić and Birovljev, and later Trumić and Tadić, also, /unpublished data/ performed 4 more series of experiments under different circumstances using achromycin in dosage of 5 mgr/kg for filling material or brine. In these experiments several hundreds of canned frankfurters were treated under various conditions of processing. All treated cans had satisfactory keeping time and resisted a several-week thermostatic control. All inoculated control

cans and one part of inoculated cans showed under the same conditions bombage or were spoiled otherwise.

2. Thermostability of achromycin

2. Excerpt of one table given by Trumić et al. in the paper: "Increase of keeping quality of frankfurter sausages in brine by means of added achromycin"

Achromycin mgr/kg filling mat. -brine	Pasteuri- sation	pH of brine after pasteuri- sation	Number of cans in expe- riment	Bombage	
				Cans with achro- mycin	Control cans
2	80°C/100'	6,3	20	10	10
2,5	90°C/60'	6,2	14	2	7
5	95°C/50'	6,2	14	-	7
10	95°C/45'	6,2	14	-	7

Simultaneously with examinations of canned frankfurters the tests of extension of keeping time of canned hams by adding of achromycin were performed. Different ways of application of antibiotics were examined; but so far the injecting of antibiotics together with curing brines into arteria along with dipping of ham in the solution of antibiotics directly prior to canning, or the latter treatment only, showed the favorable results.

It is interesting to notice that the examinations performed up to date of over 250 canned hams and shoulders did not show any of unfavorable influence of antibiotics /e.g.colour or otherwise/. All hams treated by the achromycin stand a 10-day thermostatic control irrespective whether inoculated artificially by the mixed cultures of heat-resistant bacteria or left to the casual infection. Control hams show regularly spoilage in a considerable percentage.

Analogical experiments were carried out by the same group of authors on the canned shoulders and tenderloins. Also this time products showed a great keeping time, in dif-

ference of the control ones, the keeping time of which depended on the processing conditions or on both species and amount of the inoculated microorganisms. Prior to canning shoulders and tenderloins were dipped in solutions of achromycin.

Bacteriological examinations of all cans treated by achromycin have not been accomplished yet. The determination of thermal death time of strains surviving the pasteurisation in the presence of antibiotics involves particularly sufficient time. It can be said that the total number of bacteria in cans treated by achromycin was normally very small; with slight exceptions it was possible to ascertain only the presence of the inoculated microorganisms. Cans treated by antibiotics not artificially inoculated were mainly sterile. It was especially the case with frankfurters which showed 100% sterility /on the contrary with control ones showing the considerable percentage of spoilage/.

According to the regulations existing in Yugoslavia the use of all antibiotics for the preservation of food is forbidden. It is considered as necessary to carry on the experiments on large scale in order to establish possible harmful influence of antibiotics or decomposition thereof on public health. However, it should be emphasised that the above named authors have been consuming for a longer time these products in considerable quantities and that so far no harmful consequences could be noticed.

Conclusion

1. Achromycin in certain concentrations is a synergistic agent in reducing thermal death time of bacteria in pasteurised hams, shoulders, tenderloins and frankfurters. The addition of achromycin to the pasteurised meats extends their keeping time to the level of commercially sterile canned meats.

2. Achromycin implied in cans before pasteurisation can be proved by the method of antibiogram within first 2-3 days.

3. Volunteers who consumed the pasteurised meats treated by achromycin do not show, so far, any physiological disturbances.

B i b l i o g r a p h y

1. Baumgartner I.G., Hersom A.C.: Canned food, 4th edition, London, 1956.
2. Campbell L.L., O'Brien R.T.: Antibiotics in Food Preservation, Food Technol. Vol. 9, No. 9, 1955.
3. Curran E.R., Evans F.R.: Penicillin as a Sporicidal Agent, Proc. Soc. Exper. Biol. 58, 262 /1945/.
4. Dowing H.E., Mahan J.R., et al.: Antibiotic Preservation of Meats IV, Antibiotic Symposium, Washington D.C. November 1955.
5. Dubrova G., Lazarov E.: Use of Antibiotics in the Meat Industry /in Russian/, Miasnaia Indus., SSSR 27 /2/, 46 /1956/.
6. Džinleski B.: The Extention of Ground Beef Storage Life by Use of Antibiotics /in Serbian/, Acta Veterinaria Vol. VII, Fasc. 3, 1957.
7. Goldberg H.S., Weiser H.H., Deatherage F.E.: Studies on Meat: IV. Use of Antibiotics in Preservation of Fresh Beef, Food Technol. Vol. 7, No 4, 1953.
8. Krücken J.: Zur Frage der Verwendung von Antibiotica für Konservierung von Lebensmitteln besonders von Fleisch, L. Hyg. No. 1, 1957.
9. Lepoweczy M.: cit. by Weiser et al., Appl. Microbiol. 2, 88 /Mar. 1954/.
10. Ordal L.J., Brown W.L.: The Effect of Oxytetracycline on the Keeping Quality of Cured Hams, Antibiotics Ann. 1956-1957. Medical Encyclopedia, Inc. New York, N.Y.
11. Reese H., et al.: Antibiotics in Poultry. Meat Preservation: A Comparision of the Tetracycline, Food Technol. Vol. 11, No. 8, 1957.
12. Sacchi E.M., et al.: Antibiotic Preservation of Meats II, Antibiotics Ann., 731 /1955-56/.
13. Tarr H.L.A., Boyd J.W., Bisset H.M.: Experimental Preservation of Fish and Beef with Antibiotics, J. Agr. Food Chem. 2, 372 /1954/.
14. Tarr H.L.A.: cit. by Miller H.: The Maintenance of Freshness of Poultry, Red Meats and Fish with Achromize-chlor-tetracycline. American Cyanamid Company.
15. Trumić Ž., Zlatar Ljiljana, Birovljev T.: Increase of Keeping Quality of Frankfurter Sausages in Brine by Means of Added Achromycin, Acta Veterinaria, Vol. VIII, Fasc. 1, 1958.

- 8 -

16. Weiser H.H., et al.: The Use of Antibiotics in Meat Processing.
~~Appl. Microbiol.~~, 2, 88 /Mar. 1954/.
17. Weiser H.H., et al.: Observations on Fresh Meat Processed by
the Infusion of Antibiotics, Food Tech-
nol., Vol.7, No.12, 1953.
18. Weiser H.H., et al.: The Use of Antibiotics in Meat Processing,
A.C.S., Abstr. of Paper 124th Meet.
p.30A /1953/.
19. Ziegler F., Stadelman W.J.: The Effect of Aureomycin Treat-
ment on the Shelf Life of Fresh Poultry
Meat, Food Technol., Vol.7, No.12, 1953.
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