

Einfluss der Ruhezeit vor der Schlachtung auf den bakteriologischen Befund im Fleisch geschlachteten Tiere

AVDO H. BEGANOVIĆ und ANTE MILANOVIĆ

Tierärztliche Fakultät der Universität Sarajevo, SFR Jugoslawien

Es wurde der Einfluss der Ruhezeit vor dem Schlachten auf die bakteriologischen Befunde im Fleisch und in den Organen von Kälbern, Rindern und Schweinen untersucht. Die Tiere wurden mit den Lastwagen auf folgende Entfernungen transportiert: Kälber /52-95 kg/ 180-300, Rinder /350-500 kg/ 30-50 und Schweine /84-116 kg/ 150-180 km. Bakteriologische wurden Fleisch und Organe von 60 Kälbern, 40 Rindern und 60 Schweinen untersucht, wobei 50% der Tiere im Zeitraum von 3 Stunden nach dem Ausladen ausgeblutet wurden /Gruppe A/ und die übrigen 50% nach einer Rest von 12-15 Stunden /Gruppe B/.

Im Bezug auf den bakteriologischen Befund bei den Tieren der Gruppe A / $0,4 \times 10^2$ - $8,4 \times 10^3$ /g/, ist die Anzahl der Bakterien bei den Tieren der Gruppe B / $0,1 \times 10^2$ - $4,7 \times 10^2$ /g/ um 12,20 - 98,24% verringert.

Sulfitreduzierende Klostridien wurden im Fleisch und den Organen der Tiere der A-Gruppe bis 60,0% und der B-Gruppe bis 30,0% der untersuchten Proben festgestellt. Der grösste Prozentsatz positiver Befunde findet sich bei den Schweinen und der geringste bei den Kälbern. In den Proben von der Kälber aus der B-Gruppe wurden diese Bakterien nicht festgestellt. E.coli wurden nicht gefunden im Fleisch u. Organen der Kälber der A- und B-Gruppe und der Rinder der B-Gruppe. Bei den Rindern der A-Gruppe wurde E.coli nur in Ln. prescapularis in 5,0% der Proben gefunden. Bei den Schweinen wurden diese Bakterien in beiden Gruppen festgestellt. Der Prozentsatz der positiven Befunde in der A-Gruppe bewegte sich bis zu 40% und der B-Gruppe bis zu 10% /am meisten im Magen und Ln. mesentericus/. Die Ergebnisse der Untersuchungen zeigen, dass eine Ruhepause bis 15 Stunden nicht genügend ist für Tiere welche auf weitere Entfernungen mit Lastwagen transportiert wurden, um die Widerstandskräfte des Organismus wieder herzustellen. Solcher Transport ertragen am schlechtesten die Schweine und am leichtesten die Kälber.

The Effect of Rest Duration in Animals before Slaughter on Bacteriological Findings in Meat and Organs

AVDO H. BEGANOVIĆ and ANTE MILANOVIĆ

Veterinary Faculty University of Sarajevo, SFR Yugoslavia

The effect of duration of rest before slaughter on bacteriological findings in meat and organs of calves and cattle and swine was investigated. The animals were transported by camion at a distance: calves /52-95 kg/ 180-300, cattle /350-500 kg/ 30-50 and swine /84-116 kg/ 150-180 km. Meat and organs of 60 calves, 40 cattle and 60 swine were bacteriologically examined, out of which 50% bled in the course of 3 hours following discharge /group A/ and the other 50% following the rest of 12 to 15 hours /group B /.

As compared with bacteriological finding in animals of group A / $0,4 \times 10^2$ to $8,4 \times 10^3$ /g/ number of bacteria was reduced for 12,20 to 98,24% in animals of group B / $0,1 \times 10^2$ to $4,7 \times 10^2$ /g/.

Sulfite reducing clostridia were found in meat and organs of animals of group A up to 60,0%, group B up to 30,0% of investigated samples. The highest percentage of positive findings was in swine and the lowest in calves. In the samples of meat and organs of calves of group B these bacteria were not found. E. coli were not established in meat and organs of calves of both groups /group A, B / and of cattle of group B. E. coli was found only in cattle of group A in Ln. prescapularis in 5,0% samples. In swine these bacteria were established in both groups. The percentage of positive findings in group A ranged up to 40,0%, whereas in group B up to 10,0% / mostly in bile and Ln. mesentericus /. It can be derived from these findings that rest up to 15 hours was not sufficient for animals transported by camion at longer distances from the point of restitution of defence mechanism of organism. Swine suffered mostly the transportation while the unfattened calves suffered most easily.

B 6:2

L'influence de la durée du repos du bétail avant l'abattage de boucherie sur les prélèvements bactériologiques de la viande et des organes

AVDO H. BEGANOVIĆ et ANTE MILANOVIĆ

Faculté vétérinaire de l'Université de Sarajevo - RSF de Yougoslavie

Les examens ont eu pour l'objet l'influence de la durée du repos avant l'abattage de boucherie sur les prélèvements bactériologiques de la viande et des organes des veaux, boeufs et porcs. Le transport a été effectué en camions à des relations: veaux /52-95 kg/ 180-300, boeufs /350-500 kg/ 30-50 et porcs /84-116 kg/ 150-180 km. L'examen bactériologique a été effectué sur la viande et les organes de 60 veaux, 40 boeufs et 60 porcs, étant entendu que 50% de bétail a saigné en période inférieure à 3 heures après le déchargement /groupe A/, et deuxième 50% après le repos de 12-15 heures /groupe B/.

Le nombre de bactéries du bétail du groupe B $/0,4 \times 10^2 - 8,4 \times 10^3 /g/$ est réduit de 12,20-98,24% par rapport aux prélèvements bactériologiques du bétail du groupe A $/0,1 \times 10^2 - 4,7 \times 10^2 /g/$.

Le sulfure de la clostridie diminute a été constaté dans la viande et les organes du bétail du groupe A- jusqu'à 60,0%, et celui du groupe B jusqu'à 30,0% des échantillons examinés. Le plus grand pourcentage des prélèvements positifs a été découvert chez les porcs, et le plus petit chez les veaux. Dans les échantillons de la viande et des organes des veaux du groupe B ces bactéries n'ont pas été reconnues. E.coli n'est pas reconnue dans la viande et les organes des veaux des groupes A et B et des boeufs du groupe B. Chez les boeufs du groupe A la E. coli n'a été découverte que dans le Ln. prescapularis et ceci dans 5,0% d'échantillons. Chez les porcs, ces bactéries ont été reconnues dans les deux groupes. Le pourcentage des prélèvements positifs du groupe A variait jusqu'à 40,0%, et celui du groupe B jusqu'à 10,0% /la plupart dans le fiel et le Ln. mesentericus /. Les résultats des prélèvements démontrent que le repos inférieur à 15 heures n'est pas suffisant pour le bétail transporté en camions à des relations prolongées tenant compte de la restitution des forces protectrices de l'organisme. Ce sont les porcs qui supportent le plus difficilement le transport, les veaux non engraisés le supportent le plus facilement.

Влияние длительности отдыха животных перед убоем на бактериологический анализ в мясе и органах

АВДО Х. БЕГАНОВИЧ и АНТЭ МИЛАНОВИЧ

Ветеринарный факультет Университета в Сараево, СФР Югославия.

Исследовано влияние длительности отдыха перед убоем на бактериологические анализы в мясе и органах телят, крупного рогатого скота и свиней. Транспортирование животных осуществлялось на грузовой машине на расстояние: телят /52-95 кг/ 180-300 км, крупного рогатого скота /350-500 кг/ 30-50 км и свиней /84-116 кг/ 150-180 км. В бактериологическом отношении исследованы мясо и органы 60 телят, 40 голов крупного рогатого скота и 60 свиней, причем 50% животных убиты в течение 3-х часов после выгрузки /А-группа/, и остальные 50% после отдыха в течение 12-15 часов /Б-группа/.

В сравнении с бактериологическим анализом животных А-группы $/0,4 \times 10^2 - 8,4 \times 10^3 /у животных Б-группы /0,1 \times 10^2 - 4,7 \times 10^2 /г/$ количество бактерий сокращено за 12,20 - 98,24 %.

Сульфит редуцирующие клостридии обнаружены в мясе и органах животных А-группы в количестве 60%, а Б-группы 30% анализируемых образцов. Самый большой процент положительных анализов у свиней, а меньший у телят. В пробах мяса и органов телят из Б-группы эти бактерии не обнаружены. E.coli не обнаружена в мясе и органах телят А и Б - групп и крупных рогатых животных из А-группы. E.coli обнаружена только в Ln. prescapularis 5% образцов. У свиней эти бактерии обнаружены в обеих группах. Процент положительных анализов в А-группе находился в границах 40,0%, а в Б-группе до 10,0% /больше всего в желчи и Ln. mesentericus /. Результаты испытаний показывают, что отдых в течение 15 часов недостаточен для животных, транспортируемых грузовой машиной на большем расстоянии в отношении реституирования защитных способностей организма. Транспортирование грузовой машиной тяжелее всего переносят свиньи и легче всего это переносят неоткормленные телята.

The Effect of Rest Duration in Animals before Slaughter on Bacteriological Findings in Meat and Organs

AVDO H. BEGANOVIĆ and ANTE MILANOVIĆ

Veterinary Faculty University of Sarajevo, SFR Yugoslavia

Introduction

Physical and physiological condition of animals besides the other, immediately before slaughter reflects, on bacteriological findings in meat and organs. For this reason regime of resting and nutrition of animals in deposits of slaughterhouses should be especially considered. Duration of resting is conditioned by transport relations and circumstances in which the animals were transported and with signs of physical fatigue and disorders in physiological and neurohumoral function of organism, respectively, influenced by physical and psychological stress factors /3,4,13,16/. It is possible that one day rest after hard transport is sufficient length to reconstitute glycogen in muscles, as well as defence mechanism to subdue microbes which, due to decreased resistance during transport, burst from intestine content into blood and lymph.

Various species of bacteria, including salmonella /5,6,7,8,9,11,12,15,17/ were established in meat and organs of clinically healthy animals bled under circumstances of routine slaughter. Thus, it was noted, for example, /15,17/ that salmonella were found in lymph nodes in swine at normal slaughter in 1-2% cases, whereas *Cl. perfringens* in 1,5-42,7% samples of swine, cattle, calves, sheep and lambs /2,9,11,1 etc./. Bacteria were established in the highest number of cases in mesenteric lymph nodes /8,11/. Hence they are considered active reservoirs of microorganisms on the way from intestine content to organs and meat. The same species of bacteria were found in more organs of the same animal, and in one and the same organ more species of bacteria were found indicating to endogenic infections /5,6,7,9,11/.

The results of investigations on the effect of rest duration in animals before slaughter on bacteriological findings in meat and organs are reported in this paper as a contribution to the understanding of the problem.

Materials and Methods

Sixty calves, 40 cattle and 60 swine were involved in examination. The animals were transported by camion to the slaughterhouse at the distances as follows: calves /weight 52-95 kg/, 180-300 km; cattle /weight 350-500 kg/ 30-50 km; and swine /weight 84-116 kg/ 150-180 km. Out of the total number of animals according to the sorts 50% bled in the period of 3 hours after discharge /Group A/ and 50% /Group B/ after rest from 12-15 hours. During rest the animals were not fed in deposit of the slaughterhouse and water refused as late as 2 hours before slaughter. After stunning /cattle with Sherman's pistol, swine with electric shock and calves with butchering tool/ the animals were bled in hanging position and carcasses prepared in an usual technological procedure /13,16/.

The samples of meat and organs /muscles of forearm and knee, liver, spleen, gall-bladder, lymph nodes/ were taken immediately after finished processing, natural sized and packaged separately in sterile polyvinyl sacs and containers with dry ice to laboratory. From the time of taking the samples until bacteriological analysis passed no more than 60 minutes. The samples were examined by the method of qualitative bacteriological analysis and counting method of bacteria/gram /10,14/. Media for multiplying /selenite and tetrathionate broth/ were used for isolation of *Salmonella* and from selective and differential stiff media /Brilliant green, Wilson Blair and *Salmonella-Schigella* agar/. For counting aerobic mesophilic bacteria was used tryptone glucose yeast extract agar, for sulphite reducing clostridia sulphite tryptone yeast extract iron citrate and for *Escherichia coli* Violet Red Bile Agar and Endo Agar /at 37 and 44,5°C/. Inoculation and incubation of media, morphological, cultural and biochemical identification and interpretation of results were carried out in a usual way.

Results and Discussions

Results of bacteriological analyses are shown in the tables 1-3 and graph 1-a, b and c.

The mean value of aerobic mesophilic bacteria in meat and organs of animals /Group A/ amounted from $0,4 \times 10^2$ - $8,4 \times 10^3$ /g. These bacteria were found in bile of cattle and in *Ln. mesentericus* of cattle and swine in number higher than 10^3 /g. The mean value of aerobic mesophilic bacteria in the animals /Group B/ amounted from $0,1 \times 10^2$ - $4,7 \times 10^2$ /g. These bacteria were found only in bile and *Ln. mesentericus* of cattle

B 6:4

Table 1.- Number of bacteria/g in liver and bile of calves, cattle and swine bled after resting from 1 to 3 /Group A/ and from 12 to 15 hours /Group B/ Transport by camion at the distance: calves 180-300 km; cattle 30-50 km; swine 150-180 km

species, groups and number of bacteria/g		calves				cattle				swine			
		g r o u p s											
		A		B		A		B		A		B	
		1	2	1	2	1	2	1	2	1	2	1	2
		n u m b e r o f a n i m a l s											
		30	30	30	30	20	20	20	20	30	30	30	30
aerobic mesophilic bacteria	<10 ²	4	4	6	4	8	6	13	10	3	6	6	17
	10 - 10 ²	14	18	14	18	11	12	7	9	18	21	22	9
	≥10 ²	12	8	10	8	1	2	-	1	9	3	2	4
	mean value	178	371	46	50	130	3700	20	410	92	120	31	53
sulphite reducing clostridia	<10	24	22	30	30	16	19	19	19	15	27	25	27
	≥10	6	8	-	-	4	1	1	1	15	3	5	3
	% pos.	20,0	26,7	0,0	0,0	20,0	5,0	5,0	5,0	50,0	10,0	16,7	10,0
E.coli	<10	30	30	30	30	20	20	20	20	27	18	28	27
	≥10	-	-	-	-	-	-	-	-	3	12	2	3
	% pos.	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	10,0	40,0	6,7	10,0

1 = liver

2 = bile

Table 2.- Number of bacteria/g in lymph nodes of calves, cattle and swine bled after resting from 1 to 3 /Group A/ and from 12-15 hours /Group B/ Transport by camion at the distance: calves 180-300 km; cattle 30-50 km; swine 150-180 km

species, groups and number of bacteria/g		calves				cattle				swine			
		g r o u p s											
		A		B		A		B		A		B	
		1	2	1	2	1	2	1	2	1	2	1	2
		n u m b e r o f a n i m a l s											
		30	30	30	30	20	20	20	20	30	30	30	30
aerobic mesophilic bacteria	<10 ²	2	6	6	8	12	12	13	16	3	-	7	8
	10 - 10 ²	12	16	20	12	6	7	6	4	18	14	19	18
	≥10 ²	16	8	4	10	2	1	1	-	9	6	4	4
	mean value	380	68	45	27	8.400	220	470	30	5.100	120	90	58
sulphite reducing clostridia	<10	28	30	30	30	15	19	18	20	18	18	25	28
	≥10	2	-	-	-	5	1	2	-	12	12	5	2
	% pos.	6,7	0,0	0,0	0,0	25,0	5,0	10,0	0,0	40,0	40,0	16,7	6,7
E.coli	<10	30	30	30	30	20	19	20	20	18	27	27	29
	≥10	-	-	-	-	-	1	-	-	12	3	3	1
	% pos.	0,0	0,0	0,0	0,0	0,0	5,0	0,0	0,0	40,0	10,0	10,0	3,3

1 = Ln. mesentericus

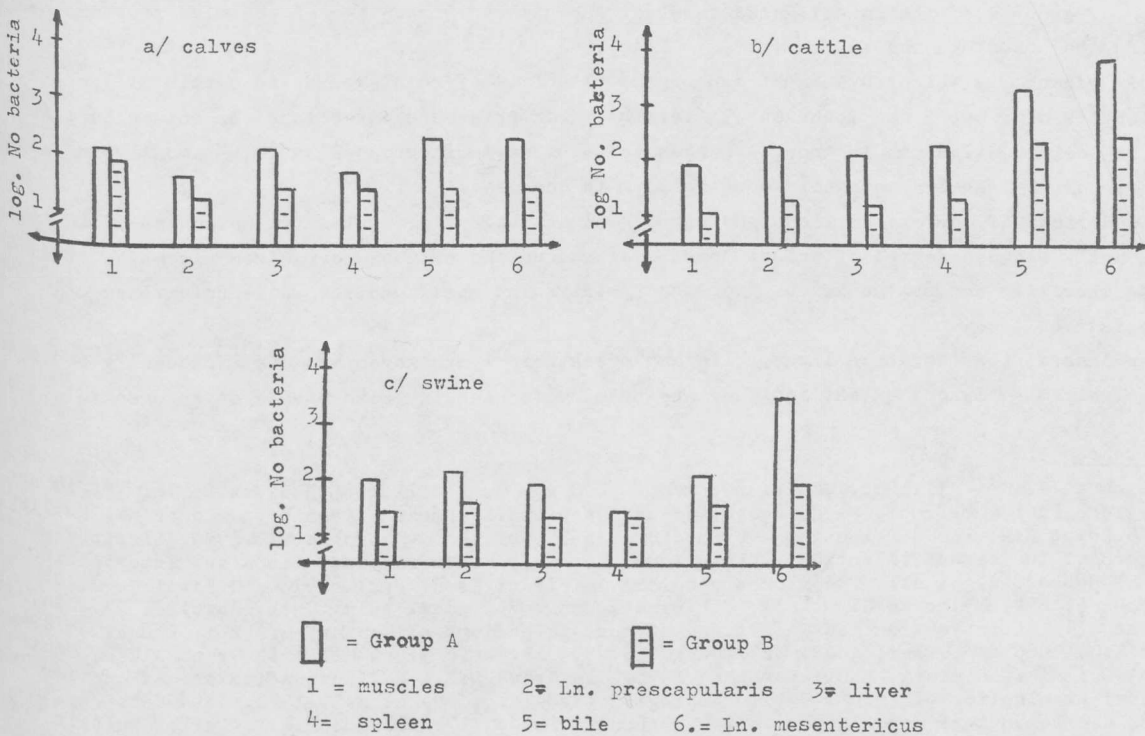
2 = Ln. prescapularis

Table 3.- Number of bacteria/g in muscle tissue of forearm and spleen of calves, cattle and swine bled after resting from 1 to 3 /Group A/ and from 12-15 hours /Groups B/ Transport by camion at the distance: calves 180-300 km; cattle 30-50 km; swine 150-180 km

Species, groups and number of bacteria/g		calves				cattle				swine			
		A		B		A		B		A		B	
		1	2	1	2	1	2	1	2	1	2	1	2
		n u m b e r o f a n i m a l s											
		30	30	30	30	20	20	20	20	30	30	30	30
aerobic mesophilic bacteria	<10 ²	6	4	14	6	12	12	13	14	6	6	9	11
	10 - 10 ²	12	18	12	20	7	6	7	5	18	18	18	14
	≥10 ²	12	8	4	4	1	2	-	1	6	6	3	5
	mean value	180	72	96	43	90	320	12	36	100	41	48	38
sulphite reducing clostridia	<10	28	30	30	30	20	15	20	19	12	12	21	24
	≥10	2	-	-	-	-	5	-	1	18	18	9	6
	% pos.	6,7	0,0	0,0	0,0	0,0	25,0	0,0	5,0	60,0	60,0	30,0	20,0
E. coli	<10	30	30	30	30	20	20	20	20	27	27	29	29
	≥10	-	-	-	-	-	-	-	-	3	3	1	1
	% pos.	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	10,0	10,0	3,3	3,3

1 = muscles
2 = spleen

Graph 1.- Aerobic mesophilic bacteria in meat and organs of calves, cattle and swine bled after resting from 1 to 3 /Group A/ and from 12-15 hours /Group B/



B 6:6

in number higher than 10^2 /g. As compared to bacteriological finding in animals of group A number of bacteria in animals of group B was reduced for 12,20-98,24%. The highest percentage of reduction was established in Ln. mesentericus 88,16-98,24% and the lowest in bile 12,20-88,75%. Reduction in muscle tissue amounted 46,67-86,67%.

Sulphite reducing clostridia were established in meat and organs of animals /Group A/ to 60,0% and to 30,0% of examined samples /Group B/. The highest percentage of positive findings was in swine while the lowest in calves. These bacteria were not found in meat and organs of calves of group B.

E.coli was not established in meat and organs of calves from both groups and cattle of group B. E.coli was found only in Ln.prescapularis in cattle of group A in 5,0% samples. These bacteria were established in swine in both groups. The percentage of positive findings in group A ranged to 40,0%, while in group B to 10,0% /the highest in bile and Ln.mesentericus/.

Salmonella were not established neither in one sample of meat and organs of cattle, calves and swine.

Sulphite reducing clostridia and E.coli were found by the other authors too in meat and organs of calves, cattle and swine at normal slaughter /1,2,5,6,7,8,9,11,12 etc./. Some of the authors established that in a higher or lower percentage of the examined samples what was conditioned by the way and circumstances of transport and treatment of animals in the deposit of slaughterhouse. Results of investigations in conditions of our experiments suggest that resting the animals before slaughter in the course of 12 to 15 hours considerably reduces the degree of endogenic infection of meat and organs but an absolute sterility cannot be obtained. With respect to bacteriological findings and transport relations swine suffer most difficult the transport by camion and most slowly recover from transport stresses while unfattened calves are most resistive. The highest percentage of positive bacteriological findings in both groups of animals was established in bile and Ln.mesentericus what was reported in literature /8,11 etc./. These findings are logical consequence of the course of endogenic infection. Bacteria maintained for a long time in bile by reason that such a substrate affords available conditions for development.

Conclusion

Number of aerobic mesophilic bacteria in meat and organs of calves, cattle and swine rested 12-15 hours before slaughter following the transport by camion at the distance 30-300 km /Group B/ was reduced for 12,20-98,24% as compared to the animals from the same transport which rested up to 3 hours /Group A/.

Sulphite reducing clostridia were established in meat and organs of animals of Group A to 60,0% and to 30,0% of group B of the investigated samples. The highest percentage of positive findings was in swine and the lowest in calves.

E.coli was not established in meat and organs of calves of both groups and cattle of group B, while in 5,0% cases of group A was found in cattle. These bacteria were established in both groups in swine. Number of positive findings in group A ranged to 40,0% while in group B to 10,0% /mostly in bile and Ln.mesentericus/. Salmonella were not found neither in one case.

In conditions of our examinations resting of animals before slaughter in the course of 12 to 15 hours significantly reduced degree of infection of meat and organs with bacteria from digestive tract but an absolute sterility was not achieved. From that point swine mostly suffer while unfattened calves are most resistive.

Regardless of rest duration liver, bile and mesenteric lymph nodes are most frequently contaminated in relatively the highest extent and they are primary focuses in pathogenesis of endogen infection.

References

1. Canada J.C. et all. 1965. J.Bact. 89, 1623.
2. Cygan Z. et all. 1969. Med.Vet. 25, 70.
3. FAO and WHO: Meat Hygiene. Publ. Rome 1957.
4. H. Beganović A.: Mikrobiologija mesa i mesnih preradjevina. Publ. Sarajevo 1975.
5. Hobbs C.B.: Food Poisoning and Food Hygiene. Publ. 1968.
6. Hobbs C.B. 1969. Clostridium perfringens and Bacillus cereus infections. /in Riemann H., Ed.: Foodborne infections and intoxications. Publ. 1969/.
7. Hobbs C.B. et all. The Microbiological Safety of Food. Publ. 1973.
8. Karolija S. et all. 1971. Tehn. mesa 9, 274.
9. Moram N. et all: 7th Panam. Cong. Vet. med. Anim. Husb. Bogota 1973.
10. Mossel D.A.A. et all: La prevention les infections et toxi-infections alimentaires. Publ. Bruxelles 1962.
11. Narayan K.G. 1966. Acta Vet. Acad. Sci. Hung. 16, 65.
12. Perić M. et all: 5th Symp. WAVFH, Opatija 1969.
13. Prost E.: Higijena mesa. Publ. Warszawa 1975.
14. Speck L.M., Ed.: Compendium of methods for the Microbiological Examination of Foods. Publ. Washington 1976.
15. Šuvakov M.D. 1972. Acta Vet. 22, 321.
16. Thornton H.: Textbook of Meat Inspection. Publ. London 1968.
17. Williams F.E. et all: Abattoir Practices and Their Effect on the Incidence of Salmonellae in Meat. 1973. /in Hobbs C.B. et all: The Microbiological Safety of Foods. Publ. 1973/.