

## THE DYNAMICS OF ANTIMICROBIAL RESISTANCE OF *SALMONELLA TYPHIMURIUM* ISOLATES.

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### ABSTRACT

*Salmonella typhimurium* is the most common pathogen isolated in foodstuffs toxin infections. The development of antibiotic resistance in *S. typhimurium* over the last twenty years is caused by an extensive application of some antibiotics. The study of antimicrobial resistance of *S. typhimurium* isolates helps the physicians in using the indispensable antibiotic and replacing the resistant antibiotics with new ones. The aim of this study was to determine the prevalence of antimicrobial resistance of *S. typhimurium* isolates of persons with foodstuff's toxin infections in Elbasan region during the years 1985-2004, to which are made the antibiograms and the antimicrobial resistance. This study includes 2931 *S. typhimurium* strains in this period of time. All the strains were tested using disk diffusion method (with antibiotics: AM, TE, C, SXT, NA and CIP). *S. typhimurium* strains have been more resistant to Ampicilin (98.29 %), Tetracycline (93.48 %), Bactrim (64.14 %). The reason of passivity of such antibiotics against *S. typhimurium* is their use, in most cases, without doing the antibiograms in each case and physicians have used very often the above antibiotics, bringing about the intensification of bacteria's resistance towards them.

**Key words:** antibiotics, antibiograms, pathogen, *S. typhimurium*, toxin infections.

### INTRODUCTION

The genus *Salmonella* contains over 2400 serotypes and *Salmonella typhimurium* is one of the most important pathogens in the family Enterobacteriaceae. *S. typhimurium* is a common cause of food poisoning (salmonellosis) in humans, spread through contaminated food. Strains of *S. typhimurium* cause gastrointestinal illnesses characterized by diarrhea, cramps and fever. [1,2]. Antibiotic resistance of *Salmonella* has increased rapidly during the last decade,

creating a serious threat to the treatment of infectious diseases. [1,3]. The study of antimicrobial resistance of *S. typhimurium* strains introduces a great theoretical and practical importance. It helps Public Health authorities revealing the real infection source and it also helps the physicians in using the indispensable antibiotics and replacing the resistant antibiotics with new ones. Considering what is being said above, such study was undertaken to demonstrate the antimicrobial resistance of *S. typhimurium* strains isolated in individuals diagnosed with of food borne infections in Elbasan City (Albania) during the years 1985-2004.

### MATERIALS & METHODS

The *S. typhimurium* strains isolated in petri dishes with D.C.A nutrition are identified based on their cultural and biochemical characteristics in the Enterotube II. For a complete identification of *S. typhimurium* strains, beside the above biochemical tests, the serologic method of agglutination on glass with antistrains diagnostics serums was used. National Microbiology Laboratory of Elbasan City's registers have been used as the primary source of reference and we have worked in this institution during the years 1999-2004. All *S. typhimurium* strains isolated in Elbasan's district during this period of time were tested using the disc-diffusion method or the Kirby-Bauer method. Antibiograms and the antimicrobial resistance tests were performed on these isolated strains using antibiotics: Ampicilin (AM), Tetracycline (TE), Chloramphenicol (C), Bactrim (SXT), Nalidixin (NA) and Ciprofloxacin (CIP). [1,2,4]. Some of the antibiotic discs were surrounded by a clear halo. That is where the bacterial growth has been inhibited by the antimicrobial agent. The more sensitive the microorganism, the larger the halo was. So the size of each halo was measured and compared with susceptibility standard of each drug. [1,3].

## RESULTS

Antimicrobial resistance of *S. typhimurium* strains is a serious problem for Public Health authorities all over the world and particularly in developing countries (Albania is one of them), for the control of salmonellosis. Our study

included 2931 strains of *S. typhimurium* isolated from individuals diagnosed with food borne infections during the years 1985-2004. Antimicrobial resistance of 2931 *S. typhimurium* strains isolated in the years 1985-2004, is demonstrated in the table below.

**Table 1.** Antimicrobial resistance of *S. typhimurium* strains isolated in Elbasan City during the years 1985 – 2004. (In absolute numbers and in percentage).

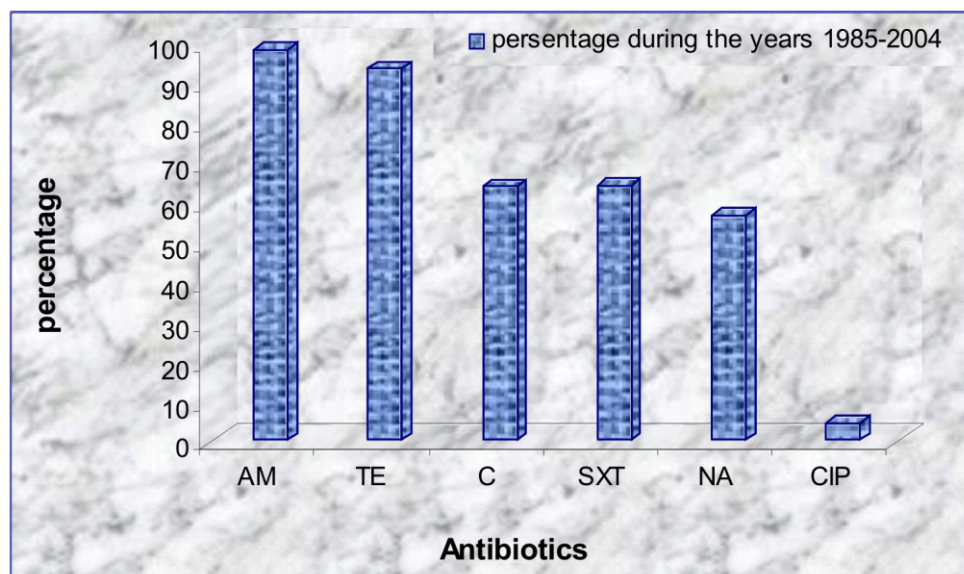
Years	Nr. Strains	ANTIBIOTICS					
		AM	TE	C	SXT	NA	CIP
1985	461	99.78	75.05	96.75	72.89	98.91	-
1986	411	98.05	83.21	92.45	82.23	95.13	-
1987	590	99.32	60.33	62.88	57.62	96.27	-
1988	668	99.25	34.13	29.79	53.89	94.91	-
1989	347	97.98	29.39	46.39	46.39	81.55	-
1990	114	99.12	92.10	45.61	61.40	47.36	-
1991	113	89.38	94.69	64.60	77.87	52.21	-
1992	71	95.77	91.54	87.32	90.14	73.23	-
1993	70	98.57	97.14	95.71	88.57	91.42	-
1994	15	86.66	73.33	80.00	80.00	73.33	-
1995	12	91.66	75.00	83.33	83.33	66.66	0.00
1996	11	81.81	54.54	63.63	63.63	45.45	9.09
1997	8	100.0	87.50	62.50	75.00	75.00	0.00
1998	27	92.59	74.07	66.66	59.25	62.96	7.41
1999	4	100.0	75.00	25.00	75.00	50.00	0.00
2000	4	75.00	75.00	50.00	75.00	50.00	0.00
2001	0	0.00	0.00	0.00	0.00	0.00	0.00
2002	4	100.0	50.00	50.00	75.00	75.00	0.00
2003	1	100.0	100.0	0.00	100.0	100.0	0.00
2004	0	0.00	0.00	0.00	0.00	0.00	0.00
<b>1985-2004</b>	<b>2931</b>	<b>98.29</b>	<b>93.48</b>	<b>63.73</b>	<b>64.14</b>	<b>56.53</b>	<b>4.23</b>

Note: The mark minus (-) means that the antibiotic is not use

In the table above is seen that all strains of *S. typhimurium* during the years 1985-2004 have been more resistant to Ampicilin (98.29%), Tetracycline (93.48%), Bactrim (64.14%), Chloramphenicol (63.73 %), Nalidixin (56.53 %), and less resistant to Ciprofloxacin (0.10 %) as represented in Fig.1

Also is noticed that the antimicrobial resistance of the isolated strains during this period was increased toward: Ampicilin, Bactrim, Ciprofloxacin, but decreased toward Tetracycline, Chloramphenicol, Nalidixin.

**Fig. 1.** Antimicrobial resistance of *S. typhimurium* strains isolated in Elbasan City during the years 1985 - 2004. (In percentage).



#### DISCUSSION:

According to the ratings given above during 1985-2004 we notice that up to 1991 we have a considerable number of strains *S. typhimurium* and later they are reduced and consequently the reduction of antibiograms. This is explainable because:

- Before 1990-es, period that interests our study, obligatory tests were done by public health in day cares, kindergartens, schools, canteens etc.

- After social changes of the 1990-es, tests were not obligatory any more so we have a less cases of salmonellosis.

- The improvement of hygienic-sanitary conditions is also another factor of such a reduction.

- The private laboratories and National Microbiology one haven't an understanding language between them.

For all these reasons we don't have an exact number of cases with salmonellosis and consequently of antibiograms during these years encountered in the district of Elbasan.

*S. typhimurium* strains have shown higher resistance toward Ampicilin, Tetracycline, and Bactrim. This can be due to a lot of reasons like:

- resistance gained due to frequent use of these antibiotics without prescription,
- without consulting the physician,
- without performing the antibiograms in each case and have used very often the above antibiotics,
- due to not properly respecting the timeframe of the antibiotic treatment.

The antimicrobial resistance trend of *S. typhimurium* strains isolated in Elbasan City during 1985-2004 is comparable with the trends of other *S. typhimurium* strains studied from different foreign and domestic researchers which are represented in Table 2

**Table 2.** Antimicrobial resistance of *S. typhimurium* strains isolated in Albania and in other countries. (In percentage)

Author	Country	Year	ANTIMICROBIAL RESISTANCE					
			AM	TE	C	SXT	NA	CIP
Hysko M.	Tirana (AL)	1990	84.1	62.7	85.7	55.8	15.3	-
Hizmo F.	Tirana (AL)	1995	86.2	69.2	86.0	62.0	26.6	-
Puto K.	Gjirokast. (AL)	1995	-	74.6	81.0	15.7	-	-
Abazi E.	Fier (AL)	2001	18.55	83.84	97.93	95.53	-	-
Kryemadhi A.	Durres (AL)	2001	75.63	73.71	62.15	53.20	14.79	-
Hila N.	Elbasan (AL)	2004	98.29	93.48	63.73	64.14	56.53	4.23
Velonakis E. N.	Greece	2000	37.7	62.3	31.1	14.8	-	0.0
Mehr M.A.	Turkey	1999	90.0	-	72.0	52.0	-	0.0
Staycheva M.	Bulgaria	2000	-	-	79.0	-	-	-
Florescu S.	Romania	2000	100.0	-	-	100.0	33.3	-
Prats G.	Spain	1998	85.0	89.0	69.0	22.0	-	0.0
Hakanen A.	Finland	1997	26.0	33.0	23.0	6.5	1.3	-
Wasfy M. O.	Egypt	1999	-	-	79.3	-	-	-
Baudin B. A.	Canada	2001	35.0	35.0	35.0	-	-	-
P. A. H	Columbia	2000	88.0	-	4.0	88.0	-	9.0

## CONCLUSIONS

Analyzing what has been mentioned above, we can conclude that *S. typhimurium* strains have shown higher resistance toward Ampicilin, Tetracycline, and Bactrim. This can be due to a lot of reasons like: resistance gained due to frequent use of these antibiotics without prescription, without consulting the physician or without performing the antibiograms, or due to not properly respecting the timeframe of the antibiotic treatment.

Knowing the resistance of *S. typhimurium* strains toward different antimicrobial agents helps the physicians and health authorities offer a better and more effective treatment to individuals diagnosed with salmonellosis and even in case when they have not done the antibiograms. Furthermore, knowing the resistance trend against one or more specific antibiotics helps in coming up with new antibiotics or effective combinations as part of an effective treatment.

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