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PREVALENCE OF SALMONELLA IN MEAT PRODUCTS

By

Younes, A.H., Mohamed, Kh.F, Samir, A. and Hasouba, M.*

Department of Microbiology, Faculty of Veterinary Medicine, Cairo University, Egypt

*Animal Health Research Institute (AHRI)

ABSTRACT

To study the incidence of *Salmonella* spp. in meat products such as raw meat, minced meat, sausage and hawawshi, a total of 160 meat products samples were collected from shops and supermarkets; 40 samples of each product. It was observed that 17.5% (7/40) of raw meat; 10% (4/40) of minced meat; 10% (4/40) of sausage; and 15% (6/40) of hawawshi were positive for *Salmonella*. Positive samples of *Salmonella* were identified by serology typing (*Salmonella* Newport*, Salmonella* typhimurium and *Salmonella* senftenberg).

Key words:

Salmonella · Meat Products · Raw meat · Minced meat · Sausage · Hawawshi

INTRODUCTION

Salmonella is a gram negative rod, mostly non-lactose fermenter, facultative anaerobic, on-spore forming, mesophilic heterotrophs, produce acid and gas from glucose, belonging to the family *Enterobacteriaceae*, are classified and identified into serotypes according to the Kauffmann-White scheme 7 that currently contains more than 2000 serotypes [1]. *Salmonellosis* is still one of the major global causes of gastroenteritis in humans and animals [2]. *Salmonella* is one of the most commonly reported causes of food-borne disease in the European Union and show the highest disease burden on the population scale among bacterial food-borne pathogens [3]. *Salmonella* spp. is isolated with 84% from examined meat products and 51% of children were reported to be infected with the same serotypes isolated from meat samples, suggesting this pathogen is widespread in food and humans [4]. An outbreak of multidrug-resistant *Salmonella* Newport infections affected 42 case patients in USA in 2007, a case-control study implicated ground beef from one chain store [5]. *Salmonella* contamination in animals entering the slaughterhouse can be attributed to several sources such as lairages, holding pens, transport, animals' viscera (i.e., caecum content and lymph nodes), slaughter line points and processing facilities, there is a strong link between the isolates recovered from carcasses and previous sources [6]. Faecal contamination of carcasses in the slaughterhouse is generally considered to be the source of *Salmonella* contamination [7].

Contamination of minced meat with *Salmonella* is still considered a major problem in food hygiene [8, 9]. Food borne *Salmonella* infection is an important cause of morbidity and mortality worldwide. *Salmonella* spp.can be investigated in raw and cooked meat as well as meat products using culture methods employing Rappaport Vassiliadis agar, *Salmonella*-Shigella agar and brilliant sulphite agar, serology and PCR method for direct detection from samples [10]. In this study we investigate the prevalence of *Salmonella* in some meat products sold in shops and supermarkets.

MATERIAL AND METHODS

Collection of Samples: 160 meat products samples were collected from retailers and markets. 40 samples were collected from each product; raw meat, minced meat, sausage and hawawshi. Samples were collected in sterile polyethylene bags, put in ice tank under low temperature and transported to the laboratory for bacteriological examination.

Preparation of Samples: 25 g meat was taken from each meat product sample in sterile stomacher bag, mixed with 225 ml buffered peptone water (BPW) (Oxoid Limited, Hampshire, England) and homogenized by using Stomacher® 400 Circulator (Seward Ltd., UK).

Isolation and Identification: The techniques adopted were carried out according to ISO-6579: 2002 standard [11]. the samples mixtures incubated at 37 ± 2 °C for 18± 0.2 hours, 0.1 ml mixture was transferred to 10 ml Rappaport-Vassiliadis (RV) medium, vortexed and incubated for 24 ± 2 h at 41.5±0.5 °C, and 1 ml of the mixture were added to 10 ml of Tetrathionate broth, vortexed and incubated for 24± 2 h at 35± 2 ºC. Three microliter loopful (10 µl) of each incubated tube was streaked on both Xylose Lysine Desoxycholate (XLD) agar and Brilliant Green Agar (BGA) and incubated for 24 ± 2 h at 35±2 °C. Typical colonies of *Salmonella* on XLD were pink colonies with or without black centers. Many cultures of *Salmonella* may produce colonies with large, glossy black centers or may appear as almost completely black colonies, while on BGA were cause the colour of the medium to be red/pink (phenolred is the indicator). The colonies are grey-reddish/pink and slightly convex. *Salmonella* isolates were confirmed by biochemical tests as Triple Sugar Iron (TSI) agar, Lysine decarboxylase (LIA), Urease, Indole, Methyl red, Voges-Proskauer and Simmons citrate utilization [12- 17]. Isolates proved biochemically to be *Salmonella* microorganisms were subjected to serological identification.

RESULTS

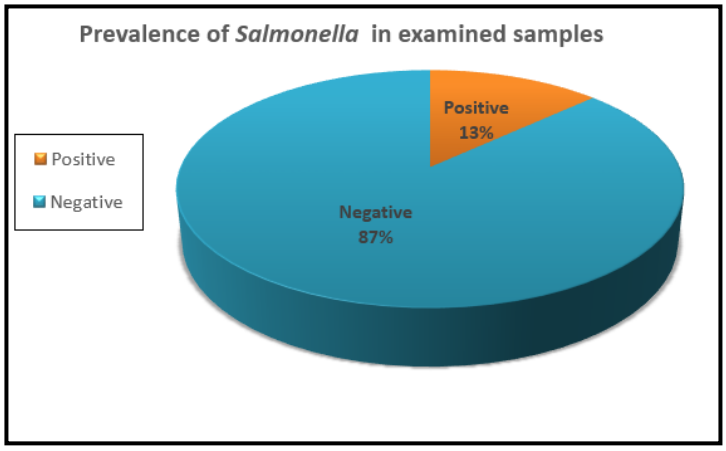

Fig. (1): Prevalence of *Salmonella in* examined samples

Fig. (1): Shows the overall prevalence of *Salmonella* spp. was 13.125% in the examined meat products.; raw meat and hawawshi showed the highest contamination rates (17.5 and 15%) respectively; minced meat and sausage exhibited lower contamination rates (10%) both.

Table (1): *Salmonella* Prevalence in each product separately.

Product	No. of examined samples	Results			
		No. of positive	% of positive	No. of Negative	% of Negative
Raw meat	40	7	17.5%	33	82.5%
Minced meat	40	4	10%	36	90%
Sausage	40	4	10%	36	90%
Hawashi	40	6	15%	34	85%

Table (2): Results of serological examination and serotyping

Serology / Strains	O antigen	H anigen	
		Phase I	Phase II
Salmonella **newport**	6,8,20	E, h	1,2
Salmonella **typhimurium**	1,4,(5),12	i	1,2
Salmonella **senftenberg**	1,3,19	g, (s), t	-

DISCUSSION

The over-all prevalence of *Salmonella* spp. in all meat products was 13.125% which agreed with some other studies such as **Sjölund-Karlsson *et al***. 15.7% [18], **Alemu *et al.*** 15% [19] and **Ukut *et al***. 11.1% [20]; higher than other results such as, **Mboto *et al***. 10 % [21], **Zhao *et al.*** 3% [22], **Kegode *et al***. 2.9% [23] and **Datta *et al.*** 0 % [24]; and less than other studies such as **Kusumaningrum *et al.*** 16.7% [17], **Little *et al* .** 28% [14], **Essa *et al.*** 23.3% [15], **Torlak *et al***. 23% [16] and **Moffatt *et al.*** 31% [25]. The highest percentage of *Salmonella* spp. was found in raw meat (17.5%), which agree with **Lammerding *et al.*** [26] and disagree with **Vanderlinde *et al.*** [27] (0.22 % in beef carcass meat and 0.38 % in frozen meat produced in Australia). Then in Hawawshi *Salmonella* spp. found in 15 % of samples that was less than results 40 % found by **Hassanin *et al***. [28] and 30% recorded by El-Shenawy [29], but higher than **Alhaddad *et al***. [30] 0 % and Al-Mutairi [31] 4 %. Also, 10% positive *Salmonella* isolates in sausage that agrees with **Cabedo *et al,*** [32] (11%), Al-Mutairi [31] (8 %) and **Mattick, *et al*** [33] (10%), and was less than some finding of 40% by El-Shenawy [29]. Also 10% positive Salmonella isolates in Minced meat was lower than some findings of 20 % by **Hassanin *et al***. [34] and 80% by **Karaboz *et al.*** [35].Higher incidence of *salmonella* spp. was found in raw meat and hawawshi these results could be attributed to the physical conditions of raw meat and hawawshi; and the pre-cooked status without any heat that keep them more liable to microbial contamination [36]. Raw materials used for manufacturing of meat products should be carefully selected and tested for freedom of *Salmonella*. Lower incidence of *Salmonella* spp. in minced meat and sausage could be due to heat treatment during manufacture and presence of chemical preservatives [37]. Cutting boards, surfaces used for preparation of meat and equipments like meat grinders, mincers, blinders are considered an important source for meat contamination by *Salmonella* [38], while other studies mentioned that trucks, lairages, slaughter line, quartering, knives and surface of table are main sources of *Salmonella* contamination of meat and meat products [39]; contaminated water used to clean equipment and cutting/slicing machines leading to cross- contamination especially if used with raw foods, handlers not practicing proper sanitation and faulty monitoring devices [40]. Survival of *Salmonella* in ready-to-eat products has the potential to cause illness. Of the four most frequently isolated serovars found in this study, *S.* Typhimurium is the only serovar that is often being reported to be among the most

frequently isolated elsewhere as compared to other serovars. In the US, 43% of all *Salmonella* isolates from human sources are only from three types of strains; *S.enteritidis, S.* newport and *S.* typhimurium, and of which the latter contributes to 11% of all *Salmonella* outbreaks. In a different study in meat and meat products, *S.* typhimurium was among the top five most frequently isolated in Algeria [41].

CONCLUSION

Raw meat and meat products like minced meat, sausage and hawawshi are considered important sources of pathogenic *Salmonella* spp. which causing severe gastroenteritis in human, especially products manufactured of raw and minced meat and not subjected for heat treatment. Good cooking of meat products before eating can tremendously decrease the incidence of *Salmonella*.

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