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Journal homepage: <https://tropicalhealthandmedicalresearch.com>***Salmonella* sp Contamination on Chicken Eggs and Duck Eggs at the Antasari Traditional Market, Banjarmasin, Indonesia****Sa'adah, Ratih Dewi Dwiyanti, \*Leka Lutpiatina**Medical Laboratory Technology Poltekkes Kemenkes Banjarmasin  
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**Abstract:** Chicken eggs and duck eggs can be a source of transmission of Salmonellosis. *Salmonella* bacteria can penetrate the eggshell, or the egg's contents can become directly contaminated with *Salmonella* in the reproductive organs before the shell covers the egg. This research aims to analyze *Salmonella* sp in chicken and duck eggs at the Antasari Traditional Market in Banjarmasin, Indonesia. Samples were taken by purposive sampling with the criteria for cracked/broken eggs and intact eggs: 3 chicken eggs and three duck eggs from 6 traders so that the total sample was 24. For the identification of bacteria, microscopic tests and biochemical tests were used on the identification media. The results showed *Salmonella* sp in duck eggs and no *Salmonella* in chicken eggs. In all samples of chicken and duck eggs, 12.50% of *Salmonella* sp, 37.50% of *Klebsiella* sp, 12.50% of *Proteus* sp, and 37.50% of *Pseudomonas* sp were found. Suggestions for consumers are to pay more attention to the hygiene and sanitation of traders before buying eggs, choose clean eggs, store eggs in the refrigerator, and cook eggs until they are cooked.

**Keywords:** Chicken eggs; duck eggs; salmonellosis; traditional market.

**INTRODUCTION**

Nontyphoidal *Salmonella* is estimated to cause approximately 153 million cases of gastroenteritis and 57,000 deaths globally each year<sup>1</sup>. The disease caused by nontyphoidal *Salmonella* enterica is considered the most significant disease burden among enteric diseases<sup>2</sup>.

Several foods have been linked to cases and outbreaks of Salmonellosis<sup>3</sup>. Salmonellosis outbreaks linked to consumption of eggs and egg products accounted for the majority of outbreak-related illnesses in the United States at 2,422 illnesses<sup>4</sup>. Domingues et al.'s research (2012) stated that consumption of undercooked or raw eggs and poultry was found to be a risk factor for sporadic cases of Salmonellosis<sup>5</sup>. Laying chickens are the main reservoir of strains that cause Salmonellosis in humans, causing 42.4% of all cases of human infection and 95.9% of them caused by *Salmonella enteritidis*<sup>6</sup>. *Salmonella enteritidis* has been the leading cause of Salmonellosis in humans<sup>7</sup>, and this Salmonellosis is associated with eggs<sup>8</sup>

Research in Indonesia by Riski L et al. (2023) on chicken eggs sold in traditional markets in Medan Johor District, the results showed that the average total colony of *Salmonella* sp. in Kwala Bekala Market was 1.45 x 10<sup>5</sup>CFU/g in Johor Market it was 5.8

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x 10<sup>4</sup>CFU/g. In Tikung Market it was 3.6 x 10<sup>4</sup> CFU/g<sup>9</sup>. According to Indonesian National Standard Number 7388 of 2009, the maximum microbiological quality requirements for fresh egg food ingredients for *Salmonella* must be negative per 25 g.

There has been research by Riski L et al. (2023) regarding *Salmonella* sp in chicken eggs. However, further research must be done regarding *Salmonella* sp contamination in chicken and duck eggs in other places such as Banjarmasin. So this research aims to analyze *Salmonella* sp in chicken and duck eggs at the Antasari Traditional Market in Banjarmasin, Indonesia.

## MATERIALS AND METHODS

The samples in this study were chicken eggs and duck eggs sold at the Antasari Banjarmasin Traditional Market using a purposive sampling technique with the criteria for cracked/broken eggs and intact eggs, namely three chicken eggs and three duck eggs at six traders so that the total sample was 24. This research was conducted in March 2021.

The tools used in making media are an oven, incubator, hot plate, microscope, analytical balance, knife, blender, petri dish, beaker glass, spoon, stirrer, measuring cup, measuring pipette, erlenmeyer, object glass, colouring rack, spray bottle, spirit lamp, tube, test tube, Durham tube, and dropper pipette.

The materials used in this research were Selenite Broth (Merck), Salmonella Shigella Agar (Merck), MR-VP (Difco), Simmon Citrate (Merck), SIM (Merck), TSIA (Merck) and sugar media (glucose, lactose, mannitol, maltose, sucrose), Gentian Violet 1%, lugol, 96% alcohol, fuchsin, Kovac's reagent, methyl red reagent, 40% KOH reagent, and 5%  $\alpha$  naphthol reagent.

Informed consent was given to research respondents, namely sellers of chicken and duck eggs at the Antasari Banjarmasin traditional market for availability as research respondents. All procedures of this research comply with the ethical standards of the Declaration of Helsinki.

Egg samples were taken to the laboratory and examined using an ice box. The eggs were removed from the shell aseptically and homogenized using a blender, then 25 ml was taken using a measuring pipette aseptically and planted in Selenite Broth media, incubated for 24 hours at 37°C. The growth results in Selenite Broth were planted on Salmonella Shigella agar by streaking the loop in a zigzag manner over the surface of the media, then incubated for 24 hours at 37°C.

The suspected colony of *Salmonella* sp was taken from the Salmonella Shigella agar medium, then made into a Gram stain and planted in sugar media (Glucose, Lactose, Mannitol, Maltose, Saccharose), AP (Peptone Water), VP (Voges Proskauer), MR (Methyl Red), SIM and Simmon Citrate<sup>9</sup>.

## RESULTS AND DISCUSSION

Based on the findings of *Salmonella* sp in chicken and duck eggs sold at the Antasari Banjarmasin traditional market, the results were obtained in Table 1.

Based on Figure 1, 12.50% *Salmonella* sp bacteria were found in 3 samples and 37.50% *Klebsiella* sp, 12.50% *Proteus* sp, and 37.50% *Pseudomonas* sp in 21 other samples.

Table 1. Results of *Salmonella* sp Examination on Chicken Eggs and Duck Eggs at the Antasari Banjarmasin Traditional Market

Egg type	Number of Egg Samples	Bacterial Identification Results		
		Types of Bacteria	Number of Samples	Percentage
Whole Chicken Egg	6	<i>Pseudomonas sp</i>	4	16,67%
		<i>Proteus sp</i>	1	4,16%
		<i>Klebsiella sp</i>	1	4,16%
Broken/Cracked Chicken Eggs	6	<i>Pseudomonas sp</i>	2	8,34%
		<i>Proteus sp</i>	2	8,34%
		<i>Klebsiella sp</i>	2	8,34%
Whole Duck Egg	6	<i>Salmonella sp</i>	2	8,34%
		<i>Pseudomonas sp</i>	3	12,50%
		<i>Klebsiella sp</i>	1	4,16%
Broken/Cracked Duck Eggs	6	<i>Salmonella sp</i>	1	4,16%
		<i>Klebsiella sp</i>	5	20,83%
Total	24		24	100%

Based on the data in Table 1, *Salmonella* sp was found in 3 samples and other bacteria, namely *Pseudomonas* sp, *Proteus* sp, and *Klebsiella* sp, in 21 samples. The percentage of *Salmonella* sp identification results can be seen in Figure 1.

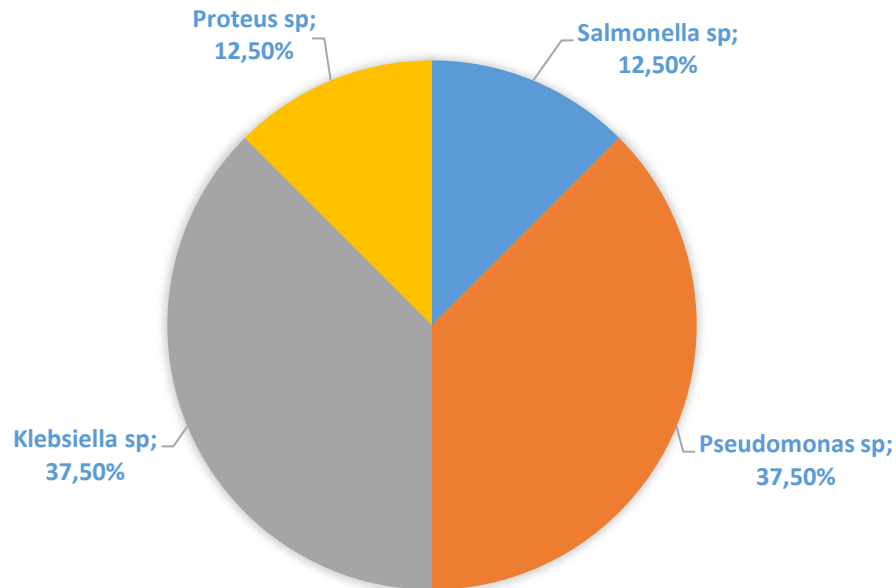


Figure 1. Graph of Percentage of Research Results

Based on observations of 6 egg traders, five traders (83.3%) use tables when selling, and one trader (16.7%) does not use a table when selling. The condition of eggs sold as clean (washed first) was not found, and all traders (100%) sold eggs in dirty conditions. The results of observations were that the placement of intact (not broken/not cracked) eggs was separate from broken/cracked eggs in 1 trader (16.7%) and five traders (83.3%) who mixed the placement of the eggs. Observation results showed that one trader (16.7%) had sufficient lighting when selling, and five traders (83.3%) did not have enough lighting when selling. Observation results showed that one trader (16.7%) had a closed trash can, and five traders (83.3%) did not have a closed trash can. The results of observations were that five traders (83.3%) stored eggs in clean and odourless containers and one trader (16.7%) in containers that were unclean and odourless.

*Salmonella* sp is a pathogenic bacteria that can cause food poisoning. This research was conducted to determine whether or not *Salmonella* sp was present in chicken eggs and duck eggs sold at the Antasari Banjarmasin traditional market. Based on the results of laboratory examinations, it was found that 12.5% of duck eggs were contaminated with *Salmonella* sp bacteria. In contrast, none of the chicken eggs were contaminated with *Salmonella* sp bacteria. In chicken and duck eggs, other bacteria were found, namely *Klebsiella* sp, as much as 37.5%; *Proteus* sp, 12.5%; and *Pseudomonas* sp, 37.5%. The presence of pathogenic bacteria *Salmonella* sp in food, in this case, the egg samples do not comply with Indonesian National Standard 7388:2009 concerning the maximum limit of microbial contamination in fresh eggs; for *Salmonella* sp, it must be negative or must not contain *Salmonella* sp.

Based on observations, it was found that 100% of eggs sold needed to be cleaned first. There are two possible routes for *Salmonella* contamination of eggs. First, horizontally, the bacteria penetrate the eggshell; secondly, through vertical (transovarian) transmission, the egg's contents are directly contaminated with *Salmonella* in the reproductive organs before the egg is covered by shell components<sup>11,12</sup>.

The results of this research are in line with the results of research conducted by Loisa et al. (2016), namely that 52 samples of duck meat originating from duck farms in Bogor Regency were tested for the presence of *Salmonella* sp. with the results of three samples suspected to be positive for *Salmonella* sp. (5.8%)<sup>13</sup>.

Positive results for *Salmonella* sp were also obtained in samples of duck eggs that were not intact (broken); eggs that were sold cracked or broken were more easily contaminated with microorganisms around the eggs. The quality of the egg will be better if the eggshell is intact and not cracked. The condition of the eggshell with a rough, cracked and dirty surface will affect the quality of the egg because the eggshell has pores that allow air and dirt to enter the egg. Apart from that, it could also be due to the poor sanitation conditions of the sellers and the market environment that the current condition of the Antasari Banjarmasin traditional market is still simple and does not meet standards. This is proven by the results of observations, which found that the egg storage area was unclean and smelly and did not have a rubbish dump. Which are closed and whole (not broken/not cracked) eggs mixed with eggs that are not whole (broken/cracked).

According to Cha et al. (2013), the prevalence of *Salmonella* was 65.2% in duck farms in Pekin, South Korea, with the identification of *Salmonella* enterica serotypes consisting of *S. Typhimurium*, *S. Enteritidis*, and *S. London*<sup>14</sup>. According to Bouzidi et al. (2012), *Salmonella* contamination occurred in laying hen farms, namely *S. Enteritidis* in Annaba and Eltarf, Algeria<sup>15</sup>. The primary habitat of *S. enteritidis* is in the digestive tract of warm-blooded animals<sup>16</sup>. *S. enteritidis* passes through the transovarian contamination route more likely than eggshell penetration<sup>11</sup>.

In the other 21 samples, there were other bacteria, namely *Klebsiella* sp as much as 37.5%, *Proteus* sp as much as 12.5%, and *Pseudomonas* sp as much as 37.5%. According to Morais et al. (2010), generally, the bacteria that contaminate eggs are the Enterobacteriaceae group, such as *Shigella* sp, *Enterobacter* sp, *Klebsiella* sp, *Escherichia coli*, *Proteus* sp, and *Salmonella* sp<sup>17</sup>.

Many other factors may contribute to outbreaks of salmonellosis associated with eggs and egg products<sup>18,19</sup>. Salmonellosis is transmitted through eggs from various dishes such as dressings, pasta, meat/fish pies, custards, and desserts because the food is not heated thoroughly<sup>20</sup>. *Salmonella* levels in whole eggs are usually less than 10 CFU/egg<sup>21</sup>, but eggs containing more than 105 CFU/g have also been found<sup>21</sup>. Egg whites more often test positive for *Salmonella* than egg yolks<sup>21</sup>. When stored at room temperature, *Salmonella* in egg yolks can produce high numbers of *Salmonella* in a relatively short time<sup>22</sup>. Lowering the temperature to 8°C or lower inhibits the growth of *Salmonella* in egg yolk<sup>23</sup>. Most previous studies have been conducted at constant temperatures, but there is strong evidence that temperature fluctuations (25 to 35 °C) will increase *Salmonella* levels in eggs<sup>24</sup>. Storing eggs in the refrigerator from the time of collection and proper cooking will significantly reduce the risk of salmonellosis<sup>25</sup>. A limitation of the research is the small number of samples used, besides manually identifying bacteria using agar media for biochemical tests and checking the test results with references.

## CONCLUSION

Eggs at the Antasari Banjarmasin traditional market were contaminated with *Salmonella* sp as many as 3 (12.5%) of the duck egg samples. Suggestions for consumers are to pay more attention to the hygiene and sanitation of traders before buying eggs, choose clean eggs, store eggs in the refrigerator, and cook eggs until they are cooked.

## CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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