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Evaluation of *Escherichia coli* contamination of consumed eggs around the campus of the agricultural state Polytechnic of Payakumbuh, Indonesia

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ABSTRACT

Escherichia coli (*E. coli*) is a pathogen that is enteropathogenic and/or toxic to human health. In addition, it is also a food safety indicator and an indicator of sanitary conditions for food of animal origin. This study aims to quantify *E. coli* in consumptive eggs in chicken coops around the Agricultural State Polytechnic of Payakumbuh University campus. A total of 30 samples of eggs consumed for food were taken from 5 cooperatives around the campus of the Agricultural State Polytechnic of Payakumbuh. Testing the amount of *E. coli* in eggs using the total bacterial count (TPC) method, the average *E. coli* count was 1.9 x 10^6 cfu/mL. The existence of *E. coli* illustrates the contamination of chicken eggs from laying hens around the campus Agricultural State Polytechnic of Payakumbuh, the need to maintain sanitation and biosecurity measures in keeping laying hens so that they produce eggs that are safe and sound suitable for community consumption.

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1. Introduction

Eggs are a livestock product that is in great demand among the population. The amount of interest is considered reasonable since it has a more affordable price and a rather complex filling. As you know, eggs are one of the perishable products of animal origin.

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The eggs on the market have certainly gone through a fairly lengthy delivery process, starting from the cage to the egg distributor, then going to merchants and finally reaching consumers, of course it took a long time (1). Retail eggs are usually over 7 days. Duration of dispatch and storage of eggs reduces the quality of the eggs and increases the likelihood of microbial contamination (1).

It was argued that bacterial damage to eggs can be caused by two factors, namely internal and external factors. Internal factors are those that originate from the inside, namely, the eggs were infected while they are still in the parent's body, for example, the parent suffers from salmonellosis, therefore the eggs contain the bacteria *Salmonella* sp. Extrinsic factors are factors that come from outside, including bacteria entering the eggs that occur after leaving the parent's body, such as manure, air, tools, and the hands of the parent flock (2). So it is possible the eggs are contaminated with *Escherichia coli* (*E. coli*) bacteria from chicken feces. According to the Indonesian National Standard, the minimum limits for *E. coli* infection, *Salmonella* sp. and Coliforms are 10 cfu/g, , negative, and 10^2 cfu/g, respectively (3). *E. coli* bacteria are enteropathogenic and/or toxic microorganisms harmful to human health. Enteropathogenic bacteria are gram-negative bacteria, pathogenic in nature, that attack the human digestive system (4). Certain strains of *E. coli* bacteria can cause gastroenteritis in humans, where gastroenteritis is a disease of the digestive system such as vomiting and diarrhea caused by infection, which are bacteria that cause digestive disorders such as nausea, vomiting, and diarrhea (5). Therefore, it is very important to know the presence of pathogenic *E. coli* contaminants in chicken eggs consumed in chicken coops around the campus of the Agricultural State Polytechnic of Payakumbuh.

2. Materials and Methods

2.1. Sample collection

Total 30 eggs from each cage, 5 eggs were taken aseptically with plastic containing eggs that had been collected to become sterile. Each sample is labeled and placed in a box and sent to the animal disease and health laboratory at Agricultural State Polytechnic of Payakumbuh for bacteriological analysis.

2.2. Sample processing inoculation

Escherichia coli isolation and identification test were referred to the guideline for laboratory analysis on an examination of microbial contamination in meat, egg, and milk according to SNI 2897:2008 (6). About 2.5 mL of eggs were taken, weighed and placed in a sterile container, 70% saline NaCl was added until the volume to 25 mL. The suspension was transferred to an Erlenmeyer flask, the remaining physiological 70% NaCl solution (for a 1:10 or 10^{-1} dilution) and then homogenized. Then, the solution from the dilution was taken to 1 mL and placed in 9 mL of physiological 70% NaCl, homogeneous again as a decimal dilution of 1: 100 (10^{-2}), and in the same way perform the next decimal dilution (10^{-3}, 10^{-4}).

Each homogenized dilution solution was taken up to 1 mL, and then placed in a sterile petri dish, previously labeled in accordance with the degree of dilution. Then, 10-15 mL of Eosin methylene blue agar (EMBA) (temperature 44-46°C) was added to each plate that already contained the sample solution. To mix the EMBA solution and medium uniformly, the plates were rotated to form a figure eight. It was left to solidify. After the EMBA was solidified, another 3-4 mL was added,, so that the temperature of the liquid EMBA was 45-48°C (overlay) on the surface of the agar, which was pre-solidified to allow it to solidify again. After that, the layers were solidified again, the plates were inverted and incubated at 37°C for 18-24 h.

3. Results

The results showed that 18 samples were positive containing *E. coli* (60%) in consumed chicken eggs obtained from the campus of the Agricultural State Polytechnic of Payakumbuh, an average of 1.9 x 10^6 cfu/mL. The results showed that the amount of *E. coli* found in the consumed chicken eggs was higher than the SNI value of 7388-2009 (3).

Table 1. Results isolation of *E. coli* based on samples of eggs.

Sample location	*Escherichia coli* count (n=30) (cfu/mL)
Padang Rajo	<x10^3
Taratak	<x10^3
Purwajaya	2,9x10^6
PPNP	8x10^6
Tigo Alua	8x10^5
Average	1.9x10^6

4. Discussion

Out of the total 30 samples of consumption chicken eggs collected in cages around the campus Agricultural State Polytechnic of Payakumbuh and tested in this study, 18 samples (60%) were contaminated with *E. coli*. The presence of this bacterial contamination indicates that the consumer eggs have been contaminated with pathogenic agents. *Escherichia coli* can infect consumer eggs through infected broodstock, fecal contamination, packaging and transport systems, which can lead to cracked or broken eggshells, long storage times and environmental pollution (7–9).

Infection of eggs with *Escherichia coli* can be caused by two factors, namely internal and external factors. Internal factors include the condition of the parents, while external factors depend on the age of the eggs, storage area, hygiene, cage sanitation and the hygiene of the cage staff (10). In addition, egg storage also affects the presence of *E. coli*, because the interaction between temperature and storage time has a very significant effect (8).

Different cage conditions also affect the contamination of consumer eggs in laying hens on the campus Agricultural State Polytechnic of Payakumbuh. Sources of egg contamination can occur through the chickens themselves (sick), cloaca, cage mats, egg containers (boxes, egg trays), feces, dust, soil (environment), storage areas, as well as from the breeders themselves (11,12). In addition, contamination can also occur through cracked eggshell or open pores so that microbes can penetrate the layers of the eggshell and cuticle, and contamination can also occur when the egg is cracked (12,13). The presence of *Escherichia coli* was also not detected from laying hens isolated from feces, water and the environment around the cage (14,15).

The presence of *Escherichia coli* was very high in several laying hens that exceeded the Indonesian Standards Agency (3). contamination threshold of 10 cfu/g. The quality requirements for poultry products did not contain pathogenic microorganisms such as *Salmonella* sp, *Staphylococcus aureus*, *Escherichia coli, Campylobacter* sp and Coliform.

The government, in an effort to protect and improve the health of the population and ensure the inner peace of the community, has developed a policy for the provision of safe, healthy, untouche and halal food of animal origin (ASUH) (16,17). In addition, *Escherichia coli* is also reported to be present in chicken meat, chicken sausage and chicken satay (18–20).

It is hoped that people who have laying hen farms will go through the licensing process to obtain a veterinary control number, which is a certificate that serves as valid written proof that the animal husbandry business has met the hygiene and sanitation requirements as a basis to be able to guarantee the safety of food of animal origin, where every animal food business unit must apply for an NKV (21,22). In addition, people who buy and consume chicken eggs must see the condition of the chicken eggs being purchased and pay attention to proper and correct processing methods so as to ensure the safety of eggs consumed.

5. Conclusion

Chicken eggs that came from chicken coops around the Payakumbuh State Agricultural Polytechnic campus, were found to be contaminated with *E. coli*. Farmers are expected to support sanitation and biosecurity measures for laying hens to produce eggs that are safe and fit for human consumption.

Conflict of interest

The authors declare to have no conflict of interest.

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