



# Isolation of *Candida* spp. from Broiler Chickens' Crop at a Slaughterhouse in Banda Aceh, Indonesia

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## ABSTRACT

*Candida* spp. are opportunistic yeasts commonly found in the gastrointestinal tract of poultry. The present study aimed to determine the distribution and compare the colony counts of presumptively identified *Candida* spp. recovered from the crop of broiler chickens at a poultry slaughterhouse in Banda Aceh, Indonesia. Ten crop samples collected from individual broiler chickens were enriched in peptone water and subsequently cultured on CHROM agar™ *Candida*. Presumptive identification of *Candida* spp. was based on characteristic colony color and morphology. The results revealed marked differences in colony counts among the three presumptively identified *Candida* species. *Candida albicans* (*C. albicans*) exhibited the highest mean colony count ( $9.10 \pm 0.88$  colonies/plate), followed by *C. krusei* ( $6.60 \pm 0.97$  colonies/plate) and *C. tropicalis* ( $6.10 \pm 0.99$  colonies/plate). Pairwise comparisons revealed that *C. albicans* had significantly higher colony counts than both *C. krusei* and *C. tropicalis*, whereas no significant difference was observed between *C. krusei* and *C. tropicalis*. The present findings indicated that *C. albicans* was the predominant presumptively identified *Candida* species in broiler chicken crops and highlight the need to further investigate their occurrence, epidemiology, and potential public health implications in poultry production and processing systems.

**Keywords:** Broiler chicken, *Candida albicans*, *Candida krusei*, *Candida tropicalis*, Crop

## INTRODUCTION

Broiler chickens (*Gallus gallus domesticus*) represent an important source of animal protein in Indonesia and are commonly raised under traditional or semi-intensive management systems (Dewi et al., 2022). Traditional and semi-intensive production systems increase exposure to environmental microorganisms, including opportunistic fungi that may colonize the gastrointestinal tract of poultry (Domán et al., 2023; Haroun et al., 2026). Although *Candida* spp. are generally commensal microorganisms that constitute part of the normal mycobiota, they can act as opportunistic pathogens under certain conditions, such as physiological stress, immunosuppression, or microbial dysbiosis, potentially resulting in candidiasis (Talapko et al., 2021).

The crop is an important compartment of the upper gastrointestinal tract in chickens and has been documented as a site from which *Candida* spp. can be recovered (Wyatt and Hamilton, 1975; Haroun et al., 2026). Previous studies in broiler chickens demonstrated that *Candida* spp. could be recovered from crop contents, with *C. albicans* representing the predominant species among the isolates examined (Wyatt and Hamilton, 1975).

A previous study in Banda Aceh has also documented *Candida* spp. in chicken crop samples (Erina et al., 2019). Erina et al. (2019) reported the isolation of *Candida* spp. from crop samples collected from chickens at the Peunayong poultry slaughterhouse in Banda Aceh, providing context for the present study's focus on broiler chicken crops at this site.

Despite these previous observations, quantitative information on the distribution of individual *Candida* species in broiler chicken crops at the slaughterhouse level remains limited. In particular, information regarding differences in colony counts among presumptively identified *Candida* species recovered from broiler chicken crop samples in Banda Aceh is scarce, limiting understanding of their occurrence and relevance at this stage. Therefore, the present study aimed to characterize the distribution and compare the colony counts of presumptively identified *Candida* spp. recovered from the crops of broiler chickens at a poultry slaughterhouse in Banda Aceh, Indonesia.

## MATERIALS AND METHODS

### Study location and timing

The present study was conducted at the Microbiology Laboratory, Faculty of Veterinary Medicine, Syiah Kuala University, Banda Aceh, Indonesia. Sample collection was carried out at a poultry slaughterhouse located in Peunayong Market, Banda Aceh, Indonesia. The study was conducted from December 2018 to January 2019.

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### Equipment and materials

The equipment used in this study included Petri dishes (OneMed, Indonesia), test tubes (OneMed, Indonesia), sterile containers, test tube racks, inoculating loops, Bunsen burners, forceps, bent glass rods, plastic pipettes, and a micropipette. The materials consisted of ten crop samples obtained from broiler chickens (*Gallus gallus domesticus*), aquabidest, peptone water (Sigma-Aldrich, Germany), gentamicin (Sigma-Aldrich, USA), and CHROM agar Candida (CAC; Himedia Laboratories, India).

### Sample collection

Ten crop samples from ten broiler chickens during slaughter were collected to examine individual chickens. Each crop sample represented one individual chicken. The crops were rinsed once with running water in sterile containers and subsequently rinsed with aquabidest before being transported to the Microbiology Laboratory, Faculty of Veterinary Medicine, Syiah Kuala University, Indonesia, at 37°C. Sample processing followed previously described methods (Thompson, 1969; Hastiono, 1987), with additional reference to a recent study on the isolation of *Candida* spp. from chicken crops in Banda Aceh (Erina et al., 2019).

### Sample preparation and enrichment

Upon arrival at the laboratory, the crop samples were handled aseptically and rinsed three times with aquabidest containing gentamicin (0.1 mL/100 mL) to reduce contamination. The crop samples were aseptically cut into approximately 3-5 mm sections and transferred into sterile containers containing peptone water at a sample-to-medium ratio of 1:9 to enrich *Candida* spp. Each sample was enriched in peptone water at 37°C for 24 hours.

### Cultivation on CHROM agar Candida

Following enrichment, 0.2 mL of each enriched sample was inoculated onto a CHROM agar Candida plate using a micropipette and incubated at 37°C for 48 hours to allow colony development. Each enriched crop sample was inoculated onto a single CHROM agar Candida plate, with one plate representing one individual crop sample. No technical replicates or duplicate plating were performed, and no serial dilution was conducted before inoculation.

### Presumptive identification of *Candida* spp.

Following incubation, *Candida* colonies were presumptively identified based on their colony color and morphology on CHROM agar Candida. Colonies exhibiting characteristic color patterns were recorded according to the presumptive identification criteria for *C. albicans*, *C. krusei*, and *C. tropicalis* to distinguish the species. Colony counts for each presumptively identified species were recorded as colonies per plate.

### Colony counting

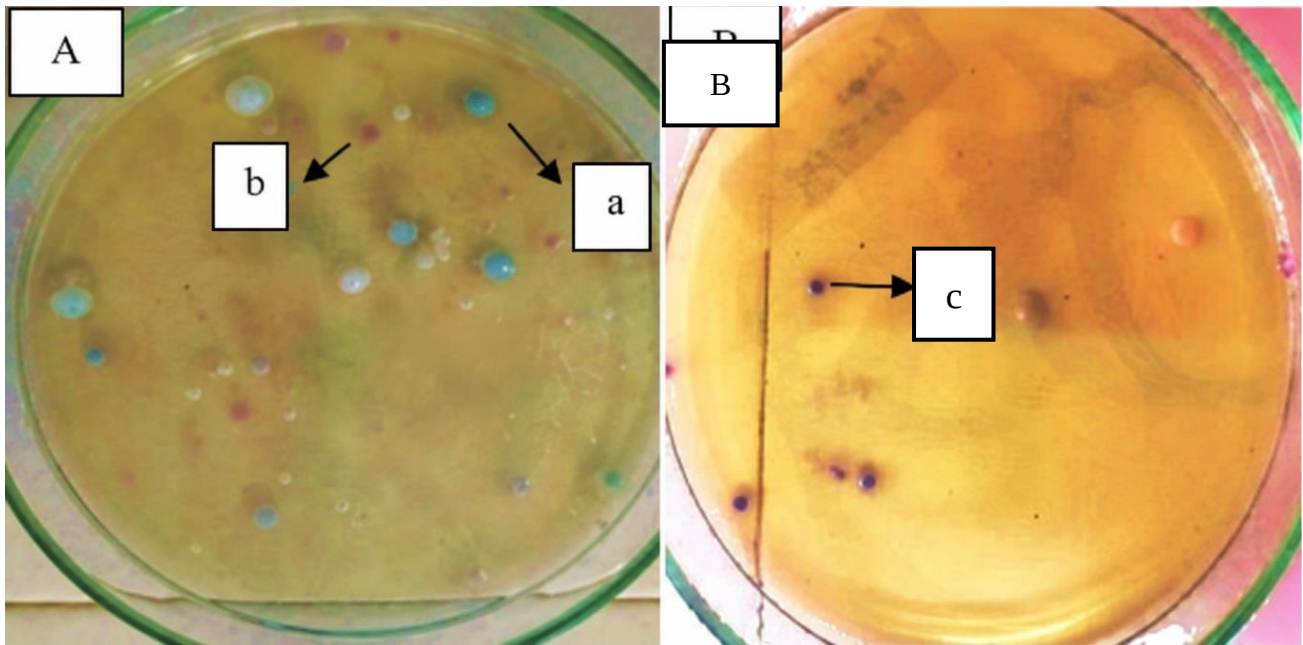
After incubation, colonies with the characteristic color and morphology of each presumptively identified species were counted manually to quantify growth on each plate. Because no dilution was performed, colony counts were expressed directly as colonies per plate.

### Statistical analysis

Colony counts were summarized as the mean  $\pm$  standard deviation (SD) and range. Differences among the three presumptively identified *Candida* species were analyzed using the Friedman test. When a significant overall difference was detected, pairwise comparisons were performed using the Wilcoxon signed-rank test with Bonferroni adjustment. All statistical analyses were performed using IBM SPSS Statistics version 25, and statistical significance was set at  $p < 0.05$ .

## RESULTS

Ten crop samples from broiler chickens were examined for *Candida* spp. following enrichment in peptone water and subsequent culture on CHROM agar Candida. Individual colony counts recovered from each crop sample are presented in Table 1. Among the isolates, *Candida albicans* indicated the highest colony counts, ranging from 8 to 10 colonies/plate, with a mean  $\pm$  SD of  $9.10 \pm 0.88$  colonies/plate, indicating the greatest recovery. *C. krusei* exhibited colony counts ranging from 5 to 8 colonies/plate, with a mean  $\pm$  SD of  $6.60 \pm 0.97$  colonies/plate. *C. tropicalis* exhibited colony counts ranging from 5 to 8 colonies/plate, with a mean  $\pm$  SD of  $6.10 \pm 0.99$  colonies/plate, indicating lower recovery. The Friedman test revealed a significant difference in colony counts among the three *Candida* species ( $\chi^2 (2) = 15.44$ ,  $p < 0.05$ ; Kendall's  $W = 0.77$ ). Pairwise comparisons using the Wilcoxon signed-rank test with Bonferroni adjustment indicated that *C. albicans* had significantly higher colony counts than *C. krusei* and *C. tropicalis* (both  $p < 0.05$ ). No significant difference was observed between *C. krusei* and *C. tropicalis* ( $p > 0.05$ ).



**Figure 1.** Representative colony morphology of presumptively identified *Candida* spp. recovered from broiler chicken crop samples cultured on CHROM agar™ Candida. Representative culture plates (A-B) showing colonies of **a:** *Candida albicans*, **b:** *Candida krusei*, and **c:** *Candida tropicalis*, differentiated based on their characteristic colony color and morphology.

**Table 1.** Colony counts of presumptive *Candida* spp. isolated from broiler chicken crop samples cultured on CHROM agar™ Candida

| Chicken   | <i>Candida albicans</i> | <i>Candida krusei</i> | <i>Candida tropicalis</i> |
|-----------|-------------------------|-----------------------|---------------------------|
| 1         | 9                       | 7                     | 5                         |
| 2         | 8                       | 7                     | 6                         |
| 3         | 9                       | 5                     | 6                         |
| 4         | 10                      | 6                     | 6                         |
| 5         | 8                       | 6                     | 7                         |
| 6         | 9                       | 7                     | 8                         |
| 7         | 10                      | 8                     | 5                         |
| 8         | 10                      | 6                     | 7                         |
| 9         | 8                       | 6                     | 5                         |
| 10        | 10                      | 8                     | 6                         |
| Mean ± SD | 9.10 ± 0.88             | 6.60 ± 0.97           | 6.10 ± 0.99               |
| Median    | 9.0                     | 6.5                   | 6.0                       |
| Range     | 8-10                    | 5-8                   | 5-8                       |

Values represent the number of colonies recovered per CHROM agar Candida plate (colonies/plate).

## DISCUSSION

The present study revealed that *Candida albicans*, *Candida krusei*, and *Candida tropicalis* were presumptively recovered from broiler chicken crops, with *C. albicans* indicating the highest mean colony count (Wyatt and Hamilton, 1975). A previous study by Wyatt and Hamilton (1975) has also demonstrated the recovery of *Candida* spp. from the crops of healthy broiler chickens. The occurrence of *Candida* spp. in broiler chicken crops observed in the present study was therefore consistent with previous evidence of *Candida* recovery from the avian crop (Wyatt and Hamilton, 1975).

The presence of *Candida* spp. in crop samples should not, however, be interpreted as evidence of clinical candidiasis. *Candida* spp. may occur as commensal yeasts in the avian gastrointestinal tract, whereas clinical candidiasis develops when host or gastrointestinal conditions favor fungal overgrowth and tissue invasion. Predisposing conditions described in poultry include immunosuppression, nutritional deficiencies, excessive antimicrobial exposure, poor

husbandry, and crop stasis. Accordingly, the detection of *Candida* spp. in the present study indicates recovery of these yeasts from the crop, not clinical disease or tissue invasion (Talapko et al., 2021).

The higher colony count of *C. albicans* observed in the present study may have been related to its established occurrence in the avian gastrointestinal tract and its frequent association with the crop. Wyatt and Hamilton (1975) similarly identified *C. albicans* as the predominant *Candida* species recovered from broiler chicken crops, accounting for 95% of the isolates in their survey. However, the present study did not investigate virulence factors, strain characteristics, host immune status, or interspecies interactions; therefore, the biological basis for the higher colony count of *C. albicans* remains undefined in the present data.

The present findings are also relevant to previous observations from Banda Aceh, where *Candida* spp. were isolated from crop samples of broiler and indigenous chickens collected at the Peunayong poultry slaughterhouse (Erina et al., 2019). Erina et al. (2019) reported *Candida* spp. in all examined crop samples, providing local evidence of *Candida* in chicken crops in the study area. However, direct comparison between the two studies should be made cautiously because of differences in study design, sampling populations, culture procedures, and reporting criteria.

The statistical analysis further demonstrated that *C. albicans* had significantly higher colony counts than both *C. krusei* and *C. tropicalis*. In contrast, the difference between *C. krusei* and *C. tropicalis* was not significant. The observed pattern indicated that the overall difference among the three species was driven primarily by the higher colony counts of *C. albicans*. Because the present study was designed to characterize colony counts under the specified culture conditions, these statistical differences should not be interpreted as evidence of differences in pathogenicity or colonization capacity.

## CONCLUSION

*Candida albicans*, *Candida krusei*, and *Candida tropicalis* were presumptively recovered from the crops of broiler chickens sampled at a poultry slaughterhouse in Banda Aceh, Indonesia. *C. albicans* indicated the highest colony count and was significantly more abundant than *C. krusei* and *C. tropicalis*, whereas no significant difference was observed between *C. krusei* and *C. tropicalis*. The present findings indicated that *Candida* spp. occurred in broiler chicken crops and were differentially recovered under the culture conditions used in this study. Further investigations involving larger sample sizes, molecular confirmation, and sampling across different stages of poultry production and processing are warranted to better characterize the distribution and potential significance of *Candida* spp. This study was limited by its small sample size, sampling from a single slaughterhouse, and lack of molecular confirmation. Therefore, further studies involving larger sample sizes and broader sampling are warranted.

## DECLARATIONS

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### Author's contributions

Nur Rahmi, Sedrisa Lidya Pertiwi, and Sucia Fadillah contributed to the study's conception and design. Nur Rahmi wrote the first draft of the manuscript. All authors commented on previous versions. Analysis of data was checked by Nur Rahmi, Sedrisa Lidya Pertiwi, and Sucia Fadillah. All authors read and approved the final version of the manuscript.

### Availability of data and materials

The data to support this study's findings are available upon reasonable request to the corresponding author.

### Competing interests

The authors have no conflict of interest.

### Ethical considerations

The authors confirm that the present manuscript is original and has not been published or submitted for publication elsewhere. ChatGPT (OpenAI) was used solely for language editing, grammar correction, and sentence clarity. The authors reviewed and revised all AI-assisted text and take full responsibility for the final content. No AI tools were used to generate, analyze, or manipulate the data or results.

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## REFERENCES

- Dewi NMSC, Suamba IK, and Widhianthini W (2022). Analysis of farmer income and marketing efficiency of broiler chickens (Case Study of UD. Kubu Saren and its Farmer Partners). Journal of Agribusiness and Agritourism, 11(1): 93. DOI: <https://www.doi.org/10.24843/JAA.2022.v11.i01.p09>
- Domán M, Makrai L, Vásárhelyi B, Balka G, and Bányai K (2023). Molecular epidemiology of *Candida albicans* infections revealed dominant genotypes in waterfowls diagnosed with esophageal mycosis. Frontiers in Veterinary Science, 10: 1215624. DOI: <https://www.doi.org/10.3389/fvets.2023.1215624>
- Erina E, Roslizawaty R, and Wahyuli S (2019). Isolation of *Candida sp.* and *Aspergillus sp.* from crops (*Ingluviens*) of broiler and indigenous chicken in Peunayoung market, Banda Aceh. Jurnal Agripet, 19(1): 51-58. DOI: <https://www.doi.org/10.17969/agripet.v19i1.13162>
- Haroun M, Tratat C, Mathew RT, Munir M, Sattar MN, Shawky M, Kochkar H, Aldakhilallah ON, Ghafoor A, Turk KGB et al. (2026). Avian candidiasis: A comprehensive review of pathogenesis, diagnosis, and control. Veterinary Sciences, 13(2): 171. DOI: <https://www.doi.org/10.3390/vetsci13020171>
- Hastiono S (1987). Addition of oxytetracycline feed additive to broiler feed 1. Its effect on crop yeast count. Jurnal Penyakit Hewan, 19(34): 65-69.
- Talapko J, Juzbašić M, Matijević T, Pustijanac E, Bekić S, Kotris I, Škrlec I, and Včev A (2021). *Candida albicans*-The virulence factors and clinical manifestations of infection. Journal of Fungi, 7(2): 79. DOI: <https://www.doi.org/10.3390/jof7020079>
- Thompson JC (1969). Techniques for the isolation of the common pathogenic fungi in air sampling, dilution plating, and the ringworm fungi. Medium, 2: 110-120.
- Wyatt RD and Hamilton PB (1975). *Candida* species and crop mycosis in broiler chickens. Poultry Science, 54(5): 1663-1666. DOI: <https://www.doi.org/10.3382/ps.0541663>

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