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Case Report

Microbiology Test Results for White Edible Birds Nest with Fecal Contamination

Hasil Uji Mikrobiologi pada Sarang Burung Walet yang Terkontaminasi Feses

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ABSTRACT

Background: Southeast Asia's edible bird nest industry, particularly in Indonesia, has experienced rapid growth in recent years. Indonesia stands as the world's leading exporter of edible bird nests. However, concerns persist regarding the quality of edible bird nests produced in the country, specifically to do with meeting quality standards by ensuring freedom from microbial contaminants that can lead to foodborne illnesses. **Purpose:** To evaluate the microbiological contamination of cleaned edible bird nests sourced from Java Island, Indonesia. **Cases(s):** Yellow-brown discoloration of edible bird nests collected from bird houses of Javan origin. **Case Management:** Fifty samples of raw white edible bird's nest samples (cup-shaped) with yellow-brown discoloration (n=25) originating from Java Island and raw white edible bird's nest samples (cup-shaped) (n=25) were collected aseptically from the edible bird's nest warehouses in Surabaya. These samples of edible nests from Java Island were subjected to microbiological analysis. The findings revealed a disconcerting trend, with 25 samples from Java Island exhibiting contamination by *Escherichia coli* (40%) and coliform bacteria (100%), surpassing established contamination thresholds. **Conclusion:** This raises critical concerns about the safety and quality of edible bird nests from the region, highlighting the need for enhanced production and processing practices, as well as rigorous quality control measures to ensure consumer safety and to maintain the industry's reputation on a global scale. Addressing these issues is imperative not only to safeguard public health but also to sustain and further develop the lucrative edible bird nest industry in Indonesia.

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ABSTRAK

Latar Belakang: Industri sarang burung walet di Asia Tenggara, khususnya di Indonesia, telah mengalami pertumbuhan pesat dalam beberapa tahun terakhir. Indonesia merupakan pengekspor sarang burung walet terkemuka di dunia. Namun, masih ada kekhawatiran mengenai kualitas sarang burung walet yang diproduksi di negara ini, khususnya dalam memenuhi standar kualitas dengan memastikan bebas dari kontaminan mikroba yang dapat menyebabkan penyakit bawaan makanan. **Tujuan:** Penelitian ini bertujuan untuk mengevaluasi kontaminasi mikrobiologis pada sarang burung walet yang sudah dibersihkan yang bersumber dari Pulau Jawa, Indonesia. **Kasus:** Perubahan warna kuning kecokelatan pada sarang burung walet yang dikumpulkan dari rumah burung dari Jawa. **Penatalaksanaan Kasus:** Lima puluh sampel sarang burung walet putih mentah (berbentuk cawan) dengan perubahan warna kuning kecokelatan (n=25) yang berasal dari Pulau Jawa dan sampel sarang burung walet putih mentah (berbentuk cawan) (n=25) dikumpulkan secara aseptik dari gudang sarang burung walet di Surabaya. Sampel sarang burung walet dari Pulau Jawa ini dilakukan analisis mikrobiologis. Temuan tersebut mengungkap tren yang membingungkan, dengan 25 sampel dari Pulau Jawa menunjukkan kontaminasi oleh *Escherichia coli* (40%) dan bakteri coliform (100%) yang melampaui ambang batas kontaminasi yang ditetapkan. **Kesimpulan:** Hal ini menimbulkan kekhawatiran kritis tentang keamanan dan kualitas sarang burung walet dari wilayah tersebut, yang menyoroti perlunya peningkatan praktik produksi dan pemrosesan, serta langkah-langkah pengendalian kualitas yang ketat untuk memastikan keamanan konsumen dan menjaga reputasi industri dalam skala global. Mengatasi masalah ini sangat penting tidak hanya untuk menjaga kesehatan masyarakat tetapi juga untuk mempertahankan dan mengembangkan lebih lanjut industri sarang burung walet yang menguntungkan di Indonesia.

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Kata kunci: Coliform; *Escherichia coli*; Kualitas; *Staphylococcus sp.*

INTRODUCTION

The edible nest swiftlet bird is capable of producing saliva with a high market value (Looi and Omar, 2016). The swiftlet, in its nest, produces this saliva, resulting in what is often called an edible bird's nest (Kong *et al.*, 2022). The edible bird nest is a product generated by the swiftlet and holds high economic value in the international market (Lee *et al.*, 2023). The market value of edible bird nests is high due to their numerous beneficial properties, especially among the Chinese community (Lee *et al.*, 2021). In recent years, Indonesia has witnessed an unprecedented surge in the production and exporting of edible bird nests (El Sheikha, 2021), solidifying its position as the world's foremost exporter of this highly sought-after delicacy. However, this remarkable growth in the industry has not come without its challenges. While the Indonesian edible bird nest market thrives, concerns have emerged regarding the quality and safety of these nests, particularly concerning their susceptibility to microbial contamination, which poses a substantial risk of foodborne illness. This work examines a comprehensive study to evaluate the microbiological contamination levels found in cleaned edible bird's nests sourced from Java Island, Indonesia. Bacteria are one of the factors contributing to the low quality of animal-origin food (Odeyemi *et al.*, 2020). Edible bird nests from Java Island have not been comprehensively studied regarding the detection of bacteria. It is known that edible bird nests from Java Island are of a lower quality than those from Kalimantan (Lukman and Wibawan, 2018). The exact reasons for the low quality of edible bird nests originating from Java Island based on microbiology have not been determined conclusively. Therefore, this research aims to conduct testing to detection whether there is any bacteria in the edible bird's nests from Java Island. This study is intended to determine the distribution of bacteria in the same. It is expected that this will help to address the issue of the low quality of these nests.

These findings raise substantial questions and concerns regarding the safety and quality of edible bird's nests originating from the region, underscoring the urgent need to implement enhanced production and processing practices. Moreover, this study underscores the importance of stringent quality control measures to ensure consumer safety and protect the industry's reputation on a global scale. In light of these pressing issues, addressing the microbiological contamination found in edible bird's nests is paramount for safeguarding public health and the sustenance and continued growth of Indonesia's highly lucrative edible bird nest industry. This research seeks to shed light on the magnitude of the problem and advocate for the adoption of rigorous measures to uphold the integrity of Indonesia's edible bird nest industry while securing its place on the international stage.

CASE

Sample

Fifty samples of raw white edible bird's nest samples (cup-shaped) with yellow-brown discoloration (n=25) originating from Java Island and raw white edible bird's nest samples (cup-shaped) (n=25) were collected aseptically from the edible bird's nest warehouses in Surabaya. All samples had any feathers aseptically, and they were cleaned using free microorganism potable water, using a steaming process. The samples were transported to the Veterinary Microbiology Laboratory of Universitas Wijaya Kusuma Surabaya, Surabaya, Indonesia, in an icebox within three hours. Photographs that are representative of the cleaned Java white edible bird's nest and Kalimantan white edible bird's nest are presented in Figure 1.

RESULTS

Prevalence

Based on the results of the study of free-range chicken intestine samples in traditional markets in Payakumbuh City, it was found that the prevalence of worm infections was 62%, with 31 out of 50 intestine samples being positive for worms (Table 1).

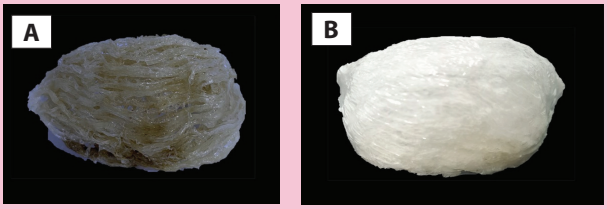

Figure 1. A. Cleaned Java white edible bird's nest; B. Cleaned Kalimantan white edible bird's nest.

Culturing and Isolation of Bacteria Derived from White Edible Bird Nests with Yellow-Brown Discoloration as Well as Normal Color.

The cultural investigation of the samples was performed using the standard procedure for edible bird's nests (SNI 8998:2021) (Badan Standardisasi Nasional, 2021). For this purpose, 25 g of each edible bird nest sample was mixed with 225 ml of sterile Buffered Peptone Water (BPW). Subsequently, a ten-fold dilution series was prepared up to the factor 10-9. A total of 1 ml from each dilution was transferred into a petri dish and mixed with 8 ml plate-count agar (Oxoid, UK) in duplicate. The plates were incubated aerobically at 35°C for 24 h. All obtained isolates were subcultured on trypticase soy agar (TSA) (Merck, Germany) and subjected to fermentation tests for glucose, mannitol, sucrose, lactose, maltose, the catalase test, and Gram staining. The bacteria that exhibited the morphological and biochemical characteristics of Staphylococcus species were further confirmed at the genus level using Baird Parker Agar (BPA). The bacteria that exhibited the morphological and biochemical characteristics of Gram-negative bacteria were further confirmed at the genus level using Eosin Methylene Blue (EMB) gar. The plates were incubated aerobically at 35°C for 24 h. The most probable number (MPN) examination was performed in this study to estimate the fecal coliform bacteria concentration, a common water quality measure in edible bird nest harvesting.

The results revealed a disconcerting trend, with cleaned white edible bird's nests (yellow-brown discoloration) originating

Table 1. The Microbiology Results for The White Edible Bird's Nests (Yellow-Brown Discoloration) (n=25) from Java Island Compared to the White Edible Bird's Nests (normal) (n=25) from Kalimantan Island

Isolation Source	Sample ID	Bacteria		Coliform (MPN/g)
		E. coli (cfu/g)	*S. aureus* (cfu/g)	
White edible bird's nest (yellow-brown discoloration) (n=25) origin from Java Island	SBW1	3.2 x 105	Negative	>1100
	SBW2	1.5 x 105	Negative	1100
	SBW3	1.9 x 102	Negative	210+
	SBW4	2.3 x 102	Negative	>1100
	SBW5	3.5 x 102	Negative	>1100
	SBW6	1.3 x 103	Negative	>1100
	SBW7	5.2 x 102	Negative	75
	SBW8	Negative	Negative	7
	SBW9	1.1 x103	Negative	>1100
	SBW10	2.8 x 104	Negative	>1100
	SBW11	Negative	Negative	7
	SBW12	Negative	Negative	75
	SBW13	Negative	Negative	>1100
	SBW14	Negative	Negative	>1100
	SBW15	Negative	Negative	21
	SBW16	1.6 x 103	Negative	1100
	SBW17	1.7 x 102	Negative	>1100
	SBW18	4.1 x 102	Negative	>1100
	SBW19	Negative	Negative	>1100
	SBW20	8.6 x 102	Negative	>1100
	SBW21	Negative	Negative	1100
	SBW22	Negative	Negative	>1100
	SBW23	2.1 x 102	Negative	7
	SBW24	1.4 x 103	Negative	>1100
	SBW25	Negative	Negative	>1100
White edible bird nest (normal) (n=25) origin from Kalimantan Island	SBW26	1.0 x 101	1.0 x 101	7
	SBW27	1.0 x 101	1.0 x 101	7
	SBW28	Negative	Negative	<3
	SBW29	Negative	Negative	<3
	SBW30	Negative	1.0 x 101	<3
	SBW31	Negative	1.0 x 101	<3
	SBW32	Negative	1.0 x 101	<3
	SBW33	Negative	1.0 x 101	<3
	SBW34	Negative	1.0 x 101	<3
	SBW35	Negative	Negative	7
	SBW36	Negative	Negative	7
	SBW37	Negative	Negative	7
	SBW38	Negative	Negative	7
	SBW39	Negative	Negative	9
	SBW40	Negative	Negative	150
	SBW41	Negative	Negative	150
	SBW42	Negative	Negative	<3
	SBW43	Negative	Negative	<3
	SBW44	Negative	Negative	<3
	SBW45	Negative	Negative	<3
	SBW46	Negative	Negative	<3
	SBW47	Negative	Negative	<3
	SBW48	Negative	Negative	<3
	SBW49	Negative	Negative	<3
	SBW50	Negative	Negative	<3

from Java Island showing contamination by *E. coli* (40%, the highest: 3.2 x 105 cfu/g) and coliform bacteria (100%, the highest: >1100) that exceeded the established contamination thresholds for *E. coli* and coliform bacteria (SNI 8998:2021) (Badan Standardisasi Nasional, 2021). No *S. aureus* was detected (Table 1) compared to the cleaned white edible bird's nests (normal) origin Kalimantan Island. All samples met the maximum limit requirements for microbial contamination in edible bird nests.

DISCUSSION

Southeast Asia's edible bird nest industry, specifically Indonesia, has witnessed remarkable growth in recent years, establishing Indonesia as the leading global exporter of these coveted delicacies. This growth can be attributed to the increasing demand for edible bird nests due to their nutritional and cultural significance. However, this rapid industry expansion has not been without challenges, particularly concerning food safety and the quality of edible bird nests produced in Indonesia. One of the primary concerns in this industry is the presence of microbial contaminants that pose a potential risk to public health. In this study, we aimed to assess the microbiological contamination found in cleaned edible bird nests obtained from Java Island, Indonesia.

E. coli is a commonly used indicator organism for fecal contamination (Khan and Gupta, 2020), and its presence in edible bird's nests is of particular concern as it indicates potential exposure to fecal material, which can harbor harmful pathogens. The present study found that 40% of samples investigated from Java Island were highly contaminated by *E. coli* up to 3.2 x 105. In comparison, edible bird's nest from Kalimantan were mostly negative for *E. coli* in this study. Coliform bacteria, encompassing a group of bacteria including *E. coli,* serve as a broader indicator of hygiene and sanitation (Tambi *et al.,* 2023). The present study showed high coliform bacteria contamination from cleaned edible bird's nests with a yellow-brown discoloration. The Kalimantan edible bird's nest showed only a small number of coliform bacteria. In the present study, *S. aureus* was not determined to be present in the edible nests harvested from Java Island. *Staphylococcus* species raise concerns, as certain strains can produce toxins that may cause foodborne illnesses (Chajęcka-Wierzchowska *et al.,* 2020). In this study, Kalimantan showed as having a small number of *S. aureus.* However, this number met the maximum limit requirements for microbial contamination in edible bird nests.

The previous study showed that bacteria and fungi can still be detected in the raw cleaned edible bird's nest, such as *Acinetobacter sp., Acinetobacter radioresistens, Acinetobacter calcoaceticus, Brevibacillus sp., Brevibacterium sp., Bacillus sp., Bacillus badius, Bacillus cereus, Bacillus flexus, Bacillus lichniformis, Caryphanon sp., Deinococcus sp., Enterobacter cloacae, Enterobacter hormaechei Exiguobacterium sp., Solibacillus silvestris, Staphylococcus sp., Staphylococcus pasteuri, Staphyloccus saprophyticus, Staphylococcus sciuri, Sporosarcina saromensi* (Wong *et al.,* 2018), *Aspergillus spp.* and *Penicillium spp.* (Sani *et al,.* 2015). Therefore, steaming is urgently needed

after the cleaning treatment. These findings underscore a critical issue regarding the safety and quality of edible bird nests from Java Island, Indonesia. Although the presence of microbial contaminants in edible bird's nests with a yellow-brown discoloration from Java was high, it does not point to a systematic problem within the production and processing practices of the industry since the Kalimantan edible bird's nest met the maximum limit requirements for microbial contamination in edible bird's nests. The emphasis is on the regional source. The results of the present study indicate that Java Island has more fecal pollution than Kalimantan Island. Fecal pollution could lead to the transmission of pathogens and, therefore, to water or foodborne diseases. The fecal material can originate from source discharges such as raw sewage, stormwater, effluent from wastewater treatment plants, and farm sources (Savichtcheva and Okabe, 2006). A poultry farm is an option for swiftlets to look for food as many flies can be obtained on a poultry farm (Connolly, 2016). Compared to Kalimantan's forest, the main site for swiftlets searching for food while flying (Mursidah *et al.,* 2021), the fecal pollution can be less than that found on a poultry farm.

This situation not only jeopardizes public health but it also endangers the industry's reputation on a global scale if the steaming process is not undertaken. To address these pressing concerns, it is imperative to implement an enhanced natural environment for swiftlets, such as rainforests. This is due to the high insect availability in the natural forest. Although suburban and rural landscapes may function as secondary feeding areas or new farming methods include constructing buildings used by nesting swiftlets, this method does not include breeding and domesticating the swiftlets (Suzuki *et al.,* 2020). A previous study (Fujita and Leh, 2020) indicates the importance of natural forests as a primary feeding area. Safeguarding public health is paramount, and rigorous quality control measures are necessary to restore and maintain consumer confidence in the safety and quality of edible bird nests. Furthermore, the industry's reputation is at stake, as contamination concerns could adversely affect consumer perceptions and international trade.

CONCLUSION

In conclusion, edible bird's nests of Javan origin has lower quality according to the microbiology assessment than Kalimantan's nests. Addressing the issue of microbiological contamination in white edible bird's nests of Java Island origin is not only a matter of ensuring public health; it is also crucial for the sustainability and continued growth of the lucrative edible bird nest industry in Indonesia. This study serves as a call to action for industry stakeholders, regulatory bodies, and researchers to work collaboratively to enhance this valued commodity's safety and quality standards.

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CONFLICT OF INTEREST

No conflicts of interest are declared.

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ETHICAL PPROVAL

This case study does not use animal so it doesnot need ethical approval.

AUTHOR'S CONTRIBUTION

Conceptualization: SGN, Methodology: SGN and DAKS, Investigation: SGN, FNA, HAP, dan HDE. Resources: SGN, FNA, HAP, dan HDE. Writing - original draft preparation: Writing - review editing: SGN, FNA, HAP, dan HDE. Funding acquisition: SGN

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