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Modern Javanese Canned Gudeg Viewed from Cultural, Food Safety, and Visual Design Perspectives

¹Maya Putri Utami, ²Anand Reyna Maulana,
³Ekawati Marhaenny Dukut, and ⁴Dyah Wulandari

¹Maya Putri Utami, ²Anand Reyna Maulana, ³Ekawati Marhaenny Dukut, and ⁴Dyah Wulandari

¹Visual Design Communication Department, Faculty of Architecture and Design, Soegijapranata Catholic University, Semarang

^{2,4} Food Technology Department, Faculty of Agricultural Technology, Soegijapranata Catholic University, Semarang

³ English Department, Faculty of Language and Arts, Soegijapranata Catholic University, Semarang

¹angeliyamaya@unika.ac.id, ²anandmlnn@gmail.com, ³ekawati@unika.ac.id,

⁴dyahwulandari@unika.ac.id

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¹Maya Putri Utami, ²Anand Reyna Maulana, ³Ekawati Marhaenny Dukut, and ⁴Dyah Wulandari

¹ Visual Design Communication Department, Faculty of Architecture and Design, Soegijapranata Catholic University

^{2,4} Food Technology Department, Faculty of Agricultural Technology, Soegijapranata Catholic University

³ English Department, Faculty of Language and Arts, Soegijapranata Catholic University

¹angeliamaaya@unika.ac.id, ²anandmlnn@gmail.com, ³ekawati@unika.ac.id, ⁴dyahwulandari@unika.ac.id

Abstract: Gudeg, a traditional culinary dish from Yogyakarta, Indonesia, is prepared by cooking young jackfruit with coconut milk and spices. It is commonly served with rice, eggs, chicken, and *sambal goreng krecek*, which is a spicy blended chili cooked with savory edible soft cowhide. Gudeg is interesting to discuss as it holds a rich history and is a cultural legacy that has been passed down through generations in Indonesia. Over time, gudeg producers have introduced an innovation of providing a visually attractive label on canned packages. This gives reason for research on gudeg using a cultural, food safety, and visual design perspective. The research found that culturally gudeg was the staple for the Mataram Kingdom army to survive the battle against enemies who wanted to colonialize the area. Next, the food safety test revealed that canned Gudeg Bagong had a microbial count of 1.3×10^1 CFU/ml, while canned Gudeg Andrawina Loka had a count of 2.4×10^2 CFU/ml. The findings demonstrated that the microbiological analysis met the standards set by Ministry of Health Regulation No. 416/MENKES/PER/IX/1990 and Indonesian Food and Drug Authority Regulation No. HK.00.06.1.S2.4011. Lastly, through visual design research, it was found among others that local and foreign tourists prefer to see

the actual photo display of gudeg set with its jackfruit, egg, chicken, and *sambal goreng krecek* contents.

Key words: *gudeg*, coliform, microbiology, history of *gudeg*

Abstrak: *Gudeg*, kuliner tradisional dari Yogyakarta, Indonesia, disiapkan dengan memasak nangka muda dengan santan dan rempah-rempah. Biasanya disajikan dengan nasi, telur, ayam, dan sambal goreng krecek, yang merupakan cabai campuran pedas yang dimasak dengan kulit sapi lunak yang gurih dan dapat dimakan. *Gudeg* menarik untuk dibahas karena menyimpan sejarah yang kaya dan merupakan warisan budaya yang diwariskan secara turun-temurun di Indonesia. Seiring berjalannya waktu, produsen *gudeg* melakukan inovasi dengan memberikan label yang menarik secara visual yang dikemas dalam kaleng. Hal ini memberikan alasan dilakukannya penelitian tentang *gudeg* dengan menggunakan perspektif budaya, keamanan pangan, dan desain visual. Hasil penelitian menemukan bahwa secara kultural, *gudeg* merupakan makanan pokok pasukan Kerajaan Mataram untuk bertahan dalam pertempuran melawan musuh yang ingin menjajah daerahnya. Selanjutnya, uji keamanan pangan menunjukkan bahwa *Gudeg Bagong* kaleng memiliki jumlah mikroba $1,3 \times 10^{-1}$ CFU/ml, sedangkan *Gudeg Andrawina Loka* kaleng memiliki jumlah mikroba $2,4 \times 10^{-2}$ CFU/ml. Temuan menunjukkan bahwa analisis mikrobiologi memenuhi standar yang ditetapkan oleh Peraturan Menteri Kesehatan No. 416/MENKES/PER/IX/1990 dan Peraturan Badan Pengawas Obat dan Makanan Indonesia No. HK.00.06.1.S2.4011. Terakhir, melalui penelitian desain visual, ditemukan antara lain bahwa wisatawan lokal dan mancanegara lebih suka melihat tampilan foto sebenarnya dari set *gudeg* dengan isi nangka, telur, ayam, dan sambal goreng krecknya.

Kata kunci : *gudeg*, coliform, mikrobiologi, sejarah *gudeg*

INTRODUCTION

Indonesia's tourism sector holds tremendous potential due to the country's abundant natural beauty, diverse cultures, historical heritage, warm hospitality, and delectable cuisine. The government of Indonesia consistently demonstrates its support for this industry by continuously improving tourism infrastructure, aiming to enhance accessibility and convenience for visitors

(Saputri, et al. 2018). Yogyakarta, often affectionately called Jogja, stands out as one of the most sought-after and captivating destinations for tourists exploring Indonesia. The location of the special region of Yogyakarta city is enclosed within Central Java's cities of Klaten, Purworejo, and Magelang as seen in the following map:

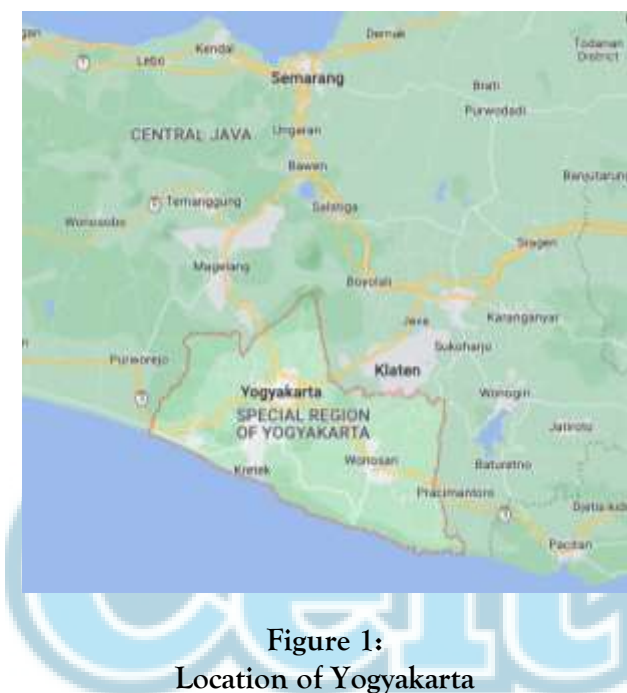


Figure 1:
Location of Yogyakarta

Yogyakarta entices travelers with its amalgamation of captivating aesthetics and historical significance, showcasing cultural diversity, iconic landmarks such as Borobudur and Prambanan temples, the bustling Malioboro street, esteemed educational institutions, thriving art scene, and a tantalizing culinary landscape. Gudeg, a well-known culinary gem, takes center stage among Yogyakarta's gastronomic delights. It is a dish crafted from young jackfruit simmered in a fragrant blend of coconut milk and spices (Abadi, et al. 2015).

The history of gudeg in Indonesia dates back to ancient times. ³ Gudeg is a traditional dish originating from Yogyakarta, a city located on the island of Java, Indonesia. This culinary specialty has been part of the region's food culture for centuries (Tyas, 2017). Although the exact origins of gudeg are uncertain, it is believed to have been influenced by the Hindu-Buddhist culture that thrived in Java in the past. Gudeg shares similarities with Indian cuisine in terms of its use of spices and seasonings, which can be traced back to this historical influence

(Komariah, et al. 2019). The Javanese community in the Yogyakarta region first developed gudeg as a signature rice dish. Initially, it consisted of young jackfruit cooked with a blend of spices, including bay leaves, galangal, lemongrass, coconut sugar, and grated coconut. The cooking process for gudeg is time-consuming, involving soaking the young jackfruit in seasoned coconut water and simmering it over low heat until the flavors penetrate the fruit (Murdijati and Eva, 2012).

As time passed, gudeg evolved and gained popularity among the Javanese people. Numerous variations and innovative versions of gudeg emerged, incorporating additional ingredients such as eggs, chicken, tofu, and *sambal krecek* (a spicy relish) to offer diverse flavors and textures (Wijaya, 2019). During the period of Dutch colonialism in Indonesia, gudeg also underwent influences from European cuisine. Some adaptations of gudeg featuring pork or beef emerged as a result of this colonial impact (Rahayu, 2018). Even today, gudeg remains an immensely popular dish in Yogyakarta and its surrounding areas. It is not only enjoyed by the local community but also serves as a culinary attraction for tourists visiting Yogyakarta. Gudeg has also spread to various regions in Indonesia and can now be savored in Indonesian restaurants across the country (Supartono, 2009). The journey of gudeg in Indonesia reflects also the rich culinary heritage and culinary diversity within the nation. This dish not only highlights the distinct flavors of Indonesia but also represents the cultural and historical diversity that characterizes the country (Nurindiani, 2022).

Gudeg is a traditional Indonesian dish that originates from Yogyakarta. Its main ingredient is young jackfruit, also known as *gori*, which is widely used across Indonesia. In Sumatera, particularly in the Minangkabau region, jackfruit is cooked as a curry. In West Java, it is prepared as *sayur asam*, a sour vegetable soup. In Central Java, young jackfruit is used in various dishes, including *sayur lodeh* (a soup with vegetables and coconut milk), *sayur megana* (a combination of chopped young jackfruit, grated coconut, and specific spices), *oseng-oseng gori* (a quickly cooked young jackfruit dish with less oil), and *gori* (a vegetable dish with young jackfruit). The flower heads of the jackfruit, called *babal* or *tongtolang*, are added to *rujak* (local cut-up fruit salad), where the fruit can often be served with sliced vegetables that are mashed or otherwise, seasoned with tamarind, sugar, chili, and other spices. This is a special delicacy for Jakarta and West Java people (Priyatmoko, 2018).

Gudeg itself is made by cooking young jackfruit with spices and served with rice, eggs, chicken, tofu, *sambal krecek* as already informed above, and

topped with a sprinkle of *areh* (a savory coconut milk) (Soewitomo, 2010). It is typically stored at room temperature, around 25 °C, and has a shelf life of about 2 to 3 days. As a traditional dish, its flavor depends on the quality of the raw ingredients, the combination of various components, and the preservation techniques used. The raw materials used in gudeg come from Indonesia's diverse natural resources and are combined with spices to create a unique taste (Tjitrowardojo, 2015).

A CULTURAL PERSPECTIVE OF GUDEG

The establishment of Yogyakarta in 1755 can be attributed to the origin of the Giyanti agreement, also known as the Palihan Nagari agreement, which was a pact involving the Dutch East India Company (VOC), the Mataram Kingdom represented by Sunan Pakubuwana III, and the Prince of Mangkubumi (Supartono, 2009). Gudeg, a traditional dish from Yogyakarta, however, is said to have originated two centuries beforehand. According to legend, the Mataram Kingdom, founded in the 1500s, was situated in an area abundant with jackfruit trees. Fearing the enemies, and out of the need for survival, the kingdom's inhabitants had no other staple but to prepare dishes using young jackfruit as the primary ingredient. By the 1700s, gudeg had gained popularity, coinciding with Yogyakarta's development as a city in the 1980s. Over time, gudeg has evolved from being sold at street food stalls to becoming a special menu item and a popular souvenir from Yogyakarta. Furthermore, gudeg is no longer solely packaged in traditional woven containers called *besek* (a food container made from bamboo) as it is now also available in cans. Gudeg has two variations: *gudeg basah* (wet gudeg), which is served with coconut milk broth known as *areh* and has a moist texture, and *gudeg kering* (dried gudeg), which is dried through a saute process, resulting in a reddish-brown color. Before gudeg canning, dried gudeg is typically packed in clay pots called *kendil* and can still be enjoyed until the next day.

The pioneers of gudeg vending originated from the Mbarek area near Bulaksumur. In the 1970s, this distinctive dish spread to the Wijilan area, which is close to the Keraton Kasultanan Yogyakarta, the palace of the Yogyakarta Sultanate. As gudeg gained popularity among local, domestic, and international tourists visiting Yogyakarta, packaging methods evolved from using leaves to bamboo baskets (*besek*), cardboard, and clay pots. The most modern packaging innovation is canned gudeg, which ensures a longer shelf life and allows for global distribution (see Figure 2). According to the available literature, two

canned gudeg products are currently available: Gudeg Yu Djum and Gudeg Bu Tjitro.



Figure 2:
Gudeg in *besek* packaging (left) and canned packaging (right)

Outside of Yogyakarta, the central city of Java, Semarang, gudeg is also recognized as the most famous dish, as reported by Radar Semarang (Afanía, 2022). Gudeg Bu Warini is produced by Mrs. Warini and is located on Ki Mangunsarkoro Street in Central Semarang District. Despite being managed by the fourth generation, it is claimed that the taste has remained unchanged since the 1920s. The dish is accompanied by flavorful *sambal goreng rambak jipang*, spicy tofu, tender shredded chicken, and sweet braised duck eggs (see Figure 3).



Figure 3:
Savory gudeg with *rambak jipang*, tofu, shredded chicken,
and half-portioned egg

The savory flavor of the gudeg when compared to the sweet gudeg of Yogyakarta, is believed to be influenced by Semarang's coastal proximity. Being a coastal area, people prefer to have dishes that are often more salty or savory. To enhance the dining experience, Bu Warini's menu also includes the addition of soft and chewy *koyor* (gelatinous cow skin). Unlike in Yogyakarta and Solo, where gudeg is typically served with warm white rice, gudeg Semarang Bu Warini is accompanied by fragrant, savory white porridge.

Reflecting on the history of gudeg within the Yogyakarta Palace in Indonesia has deep roots. Gudeg is a traditional dish that has been an integral part of the culinary culture in the palace for centuries (Yudhistira, 2022). Gudeg in the Yogyakarta Palace is closely tied to royal traditions and religious ceremonies. It is frequently served during special occasions like royal weddings and religious festivals (Naim and Syahputra, 2011). Throughout its history, gudeg in the Yogyakarta Palace has been prepared with great care and is considered a special dish. The cooking process involves using high-quality ingredients and intricate techniques (Prastowo *et al.* 2023). Gudeg in the Yogyakarta Palace also offers unique variations. Some types of gudeg in the palace incorporated luxurious ingredients such as Wagyu beef or free-range chicken. Additionally, exclusive spices and seasonings are used to enhance the flavor of gudeg in the palace (Gardjito *et al.* 2017). The tradition of cooking gudeg in the Yogyakarta Palace is still continued today. The palace's culinary artisans preserve and uphold the recipes and distinct cooking methods (Haryono, 1998). Gudeg in the Yogyakarta Palace not only contributes to the palace's cuisine but also plays a significant role in the cultural identity and culinary heritage of the local community. This dish reflects the cultural richness and royal traditions of Yogyakarta (Kompas, 2021). Overall, the history of gudeg in the Yogyakarta Palace showcases the cultural values and traditions that are highly cherished by the people of Yogyakarta. These traditions are still maintained and respected in the present time (Nurviana *et al.* 2012).

Gudeg holds significant cultural value as a traditional dish from Yogyakarta, Indonesia. It is deeply rooted in Javanese culture and has become an important culinary heritage in the region. Gudeg represents the essence of traditional cuisine and is closely tied to the identity of Yogyakarta. The dish showcases the use of local ingredients like young jackfruit, coconut milk, coconut, teak leaves, and spices, highlighting the connection between food and the local environment. Although gudeg shares a common base, it offers different variations in terms of presentation (Handayani, 2016). These include *gudeg basah* with a thick coconut milk gravy, *gudeg kering* that is drier with less gravy and *gudeg manggar* served in young coconut leaves. The communal dining tradition

surrounding gudeg adds to its significance and is often becoming a cherished moment during family gatherings and social occasions in Yogyakarta (Rismiyanto, 2015). Gudeg is typically enjoyed with rice, free-range chicken, eggs, tofu, tempeh, and *sambal*. Yogyakarta has emerged as a renowned culinary destination for Gudeg, with numerous dedicated restaurants and food stalls. Because visitors often seek out the authentic gudeg experience when they visit Yogyakarta, gudeg exemplifies a traditional dish that enriches Indonesia's cultural culinary heritage, symbolizing Yogyakarta and playing a vital role in the country's culinary identity (Yu *et. al.* 2019).

FOOD TECHNOLOGY AND SAFETY PERSPECTIVE OF GUDEG

As previously informed, gudeg is available in different types, including *gudeg kering*, which is cooked until dry, and *gudeg basah*, which has a thicker coconut milk broth. Another variation is *gudeg manggar*, made with manggar leaves, and *gudeg krecek*, which incorporates *sambal goreng krecek*. However, it is worth noting that the specific variations of gudeg can vary depending on the restaurant (Saputri *et. al.* 2018). The making of *gudeg sayur nangka*, is intricate. It involves continuous stirring with coconut milk for 6 hours over low heat in a pot, as shown in Figure 4, to ensure that the gudeg cooked with the coconut milk intact. The specific taste and coloring are also due to the fire produced from the burning of firewood or branches.



Figure 4:
Traditional gudeg making

However, modern technology has made it possible to replace the stirring process with a machine, freeing up human labor for other tasks, such as preparing canned gudeg, as depicted in Figure 5.



Figure 5:
Packaging of canned gudeg

Canned gudeg offers various options, including the traditional gudeg with gudeg, eggs, chicken, and sambal *krecek*. Other variations include gudeg with only eggs, gudeg with chicken, or sambal *krecek* alone, or gudeg with *rempela hati* (liver gizzard), as offered by Gudeg Bu Hj. Ahmad.

The main vegetable for gudeg is jackfruit. It is scientifically known as *Artocarpus heterophyllus*. It is a tropical fruit that originates from jackfruit trees. In Indonesia, jackfruit is very large in size. It grows on trees, varying in size and weight, sometimes reaching several tens of kilograms. The jackfruit's skin is characterized by wrinkles and spikes. Its flesh is either yellow or orange, possessing a resilient texture and a sweet taste. Its strong and unmistakable aroma sets it apart. Jackfruit is commonly utilized as an ingredient in a variety of traditional Indonesian dishes, such as soups, curries, sweets, and desserts. Beyond its culinary uses, jackfruit boasts significant nutritional value. It contains essential nutrients like vitamin C, vitamin B6, fiber, potassium, and others. Moreover, jackfruit finds applications in the food industry for the production of candies, ice cream, snacks, and various other products. Within Indonesian culture, jackfruit is recognized as a unique fruit and holds a vital position in local cuisine. It serves as a symbol of Indonesia's tropical abundance and represents a traditional flavor emblem of the country (Baharuddin *et. al.* 2017).

The variation in taste between gudeg cooked in traditional and modern methods can encompass several factors. Below are some potential distinctions that may arise. First, in its cooking technique, traditional gudeg is typically prepared slowly using clay pots or bamboo over firewood. This gradual cooking process requires a significant amount of time, allowing the flavors and spices to fully infuse into the ingredients. Conversely, modern cooking methods often

involve the use of contemporary kitchen appliances such as gas or electric stoves, which enable faster cooking (Nurhikmat *et, al.* 2015).

Second, in the ingredients and spices, traditional gudeg relies on natural ingredients like bay leaves, galangal, lemongrass, and freshly grated coconut. Certain traditional spices may be scarce or infrequently used in modern cooking. In contemporary cooking, there may be substitutions with instant seasonings or alternative ingredients (Ninna, 2017). Texture wise, gudeg is moist and tender. The slow cooking process in traditional methods often results in a softer and more tender gudeg texture, as the ingredients have ample time to cook thoroughly. On the other hand, modern cooking methods may yield a quicker process, potentially leading to less absorption of flavors into the ingredients and a different texture (Triwitono, 1993). Distinct flavor profiles, traditional cooking techniques tend to produce unique and authentic flavor profiles due to the utilization of customary ingredients and time-honored methods passed down through generations. In contrast, modern cooking methods may offer innovative and experimental flavor combinations by incorporating new ingredients or drawing influences from international cuisines (Dina, 2018) . Although there are taste disparities between traditionally and modernly cooked gudeg, both methods possess their own merits and appeal. Individual preferences and requirements can also influence how these taste distinctions are evaluated (Abadi and Budhy, 2017)

With the passage of time, gudeg packaging has undergone continuous advancements to remain competitive in the global market, primarily through the process of canning. Canning has been chosen as a packaging method due to its various benefits, such as convenience, durability, portability, and the ability to maintain the quality of the product. Among the gudeg producers in Yogyakarta that have managed to survive is gudeg Bagong and Andrawina Loka. Unfortunately, in Semarang, there has not been any gudeg industry that felt the need of canning yet. It is unfortunate, because the gudeg Yogyakarta producers consistently introduce innovations to attract tourists, and one such innovation is the utilization of canning as a packaging solution. Canning serves the purpose of prolonging the shelf life of gudeg. However, it is important to note that storing food in cans can result in a decline in quality over time due to natural chemical reactions that impact the taste, texture, color, and aroma of the processed food. Moreover, the presence of microorganisms can further deteriorate the quality as these microorganisms generate gas and acid through chemical reactions (Nurhikmat *et, al.* 2015).

CANNED GUDEG MICROBIOLOGICAL ANALYSIS TEST

Gudeg Bagong and Andrawina Loka are among the gudeg producers in Yogyakarta who have remained successful to this day. They continuously introduce innovations to attract tourists, such as adopting canning as a packaging method. The purpose of canning is to prolong the shelf life of gudeg. However, the storage of gudeg in cans can result in a decrease in quality over time due to natural chemical reactions that alter its taste, texture, color, and aroma. Moreover, the presence of microorganisms contributes to the deterioration of quality, as their activities generate gas and acid through chemical reactions. As stated by Nurhikmat, Suratmo, Bintoro, and Sentana, (Nurhikmat *et al.* 2015)., it is essential to conduct tests on canned food to assess its quality and shelf life. Therefore, microbiological tests are conducted on canned food to guarantee its safety and quality. These tests include the detection of pathogenic microorganisms, counting the total number of microorganisms, assessing pH levels, evaluating microbiological stability, and detecting spoilage microorganisms (Vanderlinde, *et al.* 2022) The pathogen detection test aims to identify harmful microorganisms like *Salmonella*, *E. coli*, or *Staphylococcus aureus* that can cause illnesses if consumed. This test involves culturing techniques and molecular methods for species identification (Singh, *et al.* 2015). The total microorganism count test determines the overall number of microorganisms in canned food. Excessive counts may indicate contamination or ineffective preservation methods. Common techniques involve serial dilution and plating on suitable agar media [35]. The pH test ensures that the food's acidity falls within a safe range to prevent the growth of pathogenic microorganisms. A low or acidic pH helps maintain the safety and quality of canned food (Persulesy, *et al.* 2020). The microbiological stability test involves storing canned food under appropriate conditions to assess its safety and quality throughout its shelf life (Tapsoba *et al.* 2022). The spoilage microorganism detection test detects the presence of microorganisms that can cause spoilage, altering taste, color, or texture. Examples include yeast, mold, or lactic acid bacteria (Guerrero, *et al.* 2009). Microbiological testing is crucial for quality control and food safety in canned food products. These tests ensure that the food is safe to consume and meets established standards (Yudhistira, 2022). However, the main focus of this article is placed on microbiological testing, specifically the Total Plate Count (TPC) and the detection of pathogens.

The samples used for analysis are canned gudeg products from Gudeg Andrawina Loka and Gudeg Bagong. The composition of Andrawina Loka canned gudeg includes ingredients such as jackfruit, duck eggs (25.94%), *krecek* (4.32%), free-range chicken floss (13.49%), peanut shells (3.46%), coconut milk,

shallots, garlic, red chili, coriander, lengga, candlenut, salt, brown sugar, and lemongrass. On the other hand, the composition of Bagong Canned Gudeg consists of jackfruit (33.36%), Javanese sugar (containing sulfite preservatives), duck eggs (15.17%), matured tempeh, coconut oil, shredded chicken (4.55%), *krecek*, bird's eye chili, salt, candlenut, shallots, red chili, and garlic. The Andrawina Loka canned gudeg was produced in October 2022, while the Bagong canned gudeg was produced in August 2022. The equipment and materials used for the analysis include petri dishes, test tubes, spreaders, beakers, micropipettes, mortar and pestle, blue tip 1000 ul pipette, sterile distilled water, 96% alcohol, nutrient agar (NA), compact dry EC, incubator, and laminar air flow (LAF).

The microbiological analysis conducted in this research involved the utilization of Nutrient Agar for Total Plate Count (TPC) measurement. 2-gram portion of each gudeg sample was taken and ground using a mortar and pestle. Subsequently, the ground sample was transferred into a sterile water-filled test tube. Dilutions ranging from 10^0 to 10^4 were prepared, and then 1 mL of each dilution was inoculated onto Nutrient Agar plates. These plates were then incubated for 48 hours at 37°C to facilitate bacterial growth. For the detection of *E. coli* bacteria, Compact Dry EC was employed. Similarly, 2-gram portion of each gudeg sample was ground using a mortar and pestle and placed in a test tube containing sterile water. Dilutions from 10^0 to 10^4 were prepared, and then 1 mL of each dilution was applied onto Compact Dry EC plates. These plates were incubated at 37°C for 48 hours to allow for bacterial growth. The purpose of this microbiological analysis was to determine the total microbial count in accordance with the Indonesian National Standards (SNI) 01-2897-1992. As the quality and safety of food products can be significantly influenced by their packaging, conducting microbiological analyses is essential to ensure compliance with the aforementioned SNI and to guarantee food safety. The results of the Total Plate Count (TPC) is presented in Table 1.

Table 1:
TPC Gudeg Bagong & Andrawina Loka Results

Sample	TPC CFU/mL
Gudeg Bagong	1.3×10^{-1} CFU/ml
Gudeg Andrawina Loka	2.4×10^2 CFU/ml

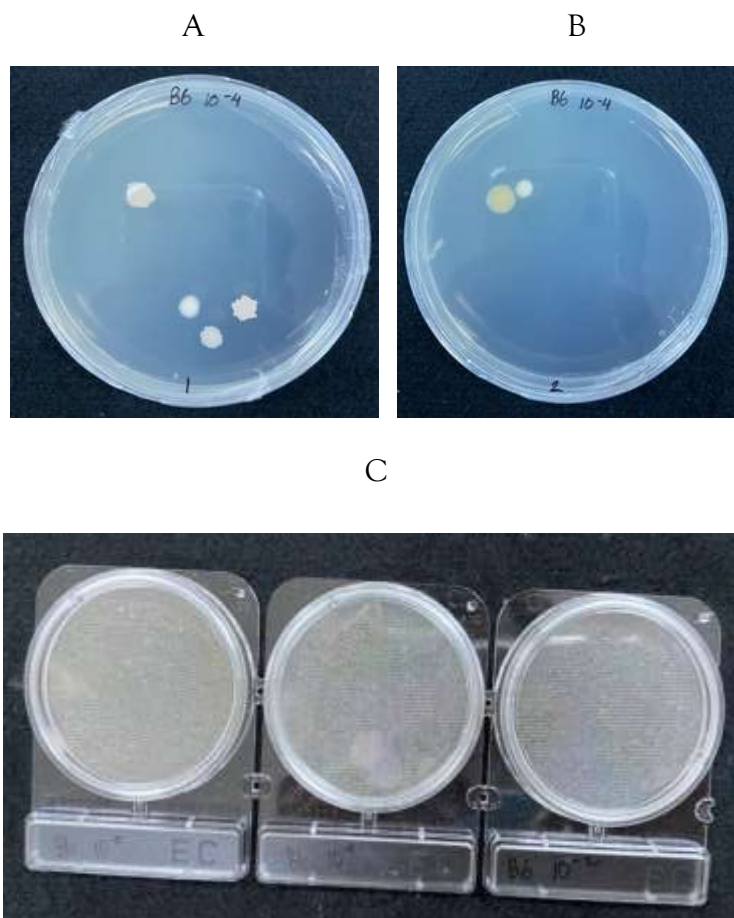


Figure 6:
Result of TPC Gudeg Bagong and Andrawina Loka (A and B),
Test Results for the Presence of *Escherichia coli* in Gudeg Bagong and
Andrawina Loka (C)

The microbiological analysis conducted on Bagong Canned Gudeg sample yielded a Total Plate Count (TPC) result of 1.3×10^{-1} CFU/ml, while the Andrawina Loka Canned Gudeg sample had a TPC result of 2.4×10^{-2} CFU/ml. These findings indicate that both samples have undergone microbiological assessment and are deemed safe for consumption, in accordance with the standards outlined in Ministry of Health Regulation No. 416/MENKES/PER/IX/1990 and Indonesian Food and Drug Authority Regulation No. HK. 00.06.1.S2.4011. The TPC results for the Bagong Gudeg and Andrawina Loka sample are depicted in Figure 6.

It is important to take note also of the frequent occurrence of *E. coli* contamination in food, which can result in diarrhea among individuals. Based on data from Integrated Disease Surveillance (IDS) conducted in health centers and hospitals, the incidence of diarrhea showed fluctuations over a five-year period from 2002 to 2006, ranging from 6.7 per 1000 in 2002 to 9.6 per 1000 in 2006 (with incidence rates varying between 4.5-25.7 per 1000). Furthermore, the Household Health Survey (HHS) conducted in 2001 indicated that diarrhea ranked as the second most prevalent infectious disease, with a morbidity rate of 4.0% and a mortality rate of 3.8% (Pratama, 2019). Therefore, it is crucial to address this issue by conducting tests to detect the presence of *Escherichia coli* in Bagong and Andrawina Loka canned gudeg.

Based on the provided images, it is evident that the Compact Dry EC test shows a lack of color, indicating a negative result for EC in the canned gudeg samples. Conversely, a positive result is indicated by the presence of a purple color, which occurs as a result of specific enzymes produced by EC causing the degradation of chromogenic substrates (Saridewi *et al.* 2016). The detection of pathogens in food serves several crucial purposes; Disease prevention, pathogen detection tests aid in identifying food that is contaminated with harmful microorganisms like *Salmonella*, *E. coli*, or *Campylobacter*. Early detection allows for the implementation of control measures to prevent the spread of diseases through the consumption of contaminated food (Mahardika, 2013). Ensuring food safety, pathogen testing is an integral part of a comprehensive food safety system. By identifying food contaminated with pathogens, appropriate control and corrective measures can be implemented to ensure that the food produced and consumed is safe for human health (Sunardi, 2014). Upholding reputation and consumer trust, regular and thorough pathogen detection tests enable food producers to ensure that their products meet stringent safety standards. This helps to maintain the company's reputation and the trust consumers place in their products (Tristyanto, 2016). Compliance with regulations and standards: Pathogen testing in food is a requirement stipulated by food regulatory authorities and standard agencies. By conducting suitable tests, food producers ensure compliance with established regulations and standards, thereby maintaining food safety (Arifah, 2010). Monitoring product quality: Pathogen testing also contributes to the monitoring of food product quality. The presence of pathogens in food can indicate contamination or production process issues that need to be addressed [46]. In summary, pathogen detection tests in food play significant roles in preserving food safety, preventing disease transmission, safeguarding company reputation, ensuring compliance with regulations, and monitoring the quality of food products (Porotu, *et al.* 2015).

VISUAL DESIGN PERSPECTIVE OF CANNED GUDEG

In addition to ensuring the safety of canned gudeg products, the packaging of gudeg as a traditional Javanese delicacy also plays a significant role in its product distribution. Packaging serves as an important factor in capturing consumers' interest, as it serves as the first impression of the product before they make a purchase decision (Utami, 2020). Hence, a quantitative research approach was also utilized to determine the impact of visual packaging on consumers. A total of 40 questionnaires were randomly distributed to respondents. The results derived from the questionnaires are outlined below:

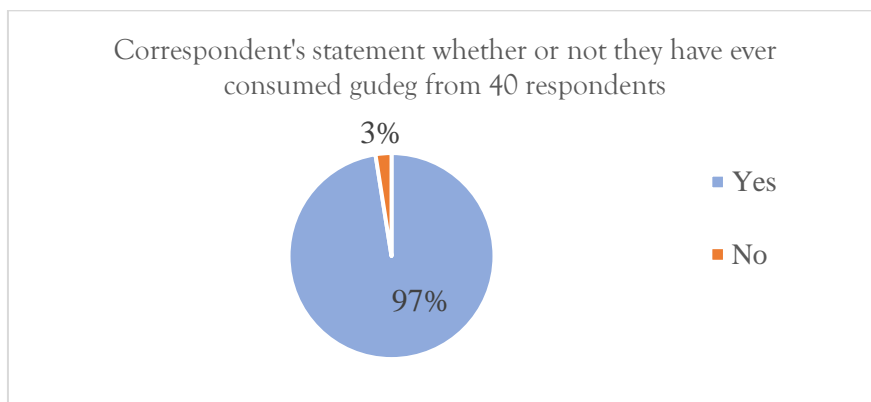


Figure 7:
Respondents' responses were based on whether they had ever consumed gudeg

First of all, only 3% of the respondents never consumed gudeg. This means that gudeg is proven to be a popular dish for most Indonesians.

In finding out whether respondents know the characteristics of Javanese culture based on a visual design, based on Figure 8's result, it can be inferred that most respondents have previous experience consuming gudeg, indicating their familiarity with this food. The questionnaire included four different pictures depicting motifs from various regions, aiming to assess the respondents' ability to recognize Javanese motifs. This assessment is important to determine the respondents' familiarity with Javanese characteristics and motifs, which in turn influences their perception of Javanese elements in packaging. The results of the questionnaire revealed that 87.5% of respondents selected the Javanese motif, indicating that a majority of respondents possess a good understanding of Javanese elements.



Figure 8:
Respondents' responses were based on the visual design
of canned gudeg packaging

First, the design and patterns used in labeling a product play a crucial role in food packaging. The impacting elements consist of various aspects. First, it allows the (catching attention of consumers. This is done by using eye-catching packaging designs that can make food products stand out on store shelves and attract consumers. The appealing patterns with vibrant colors and visually captivating elements create a strong visual appeal to consumers (Spence, 2015).

Second, brand recognition that shows unique and distinctive packaging designs helps consumers identify and differentiate brands from similar products in the market. The consistent use of logos, fonts, and visual brand elements establishes a strong brand image and reminds consumers of the brand (Peynaud, 2005).

Third, effective product communication helped well-designed packaging effectively communicate the product information in a clear and understandable manner. Readable labels, icons, and relevant images provide details about ingredients, nutrition, usage instructions, and important warnings.

Fourth, target market alignment makes sure that packaging designs should align with the intended target market. For instance, packaging for children's products may feature bright colors and appealing images, while products targeting a more mature audience may have elegant and sophisticated designs.

Fifth, product image and perception make consumers aware of the design and patterns in food packaging that influence the consumers' perceptions of the product's quality, value, and overall image. Knowing the product image perception makes consumers understand the reason for visually appealing and luxurious designs that can create an impression of high-quality products, in comparison to environmentally friendly designs that convey messages of sustainability and ethical values.

Sixth, functional considerations make packaging designers take into account the functional factors of packaging, such as ease of opening, handling, and product storage. Well-designed packaging is known to facilitate consumers in accessing, using, and storing the product conveniently (Stern, 1981). In summary, the design and patterns in food packaging have a significant impact on capturing consumer attention, brand recognition, conveying product information, aligning with the target market, shaping product image, and considering functional aspects. By utilizing appropriate design strategies, companies can enhance product appeal, influence purchasing decisions, and foster a strong relationship between consumers and the brand (Madzharov, *et al.* 2015).

Using cans for food packaging provides several benefits and serves important purposes. Previous paragraphs have stated that canned gudeg are proven to have safeguarding qualities against contamination from external sources like bacteria, fungi, and air. The sealed and airtight cans, in other words, ensure the cleanliness and safety of the enclosed food (Margono, 2018). Canned food is also known to provide an extended shelf life by shielding them from physical damage, light, oxygen, and moisture, which can compromise their quality and safety. This enables the food to remain fresh and suitable for consumption of a longer duration (Wang, *et al.* 2022)., Cans are containers that are sturdy and stackable that facilitate the storage and transportation of food, thus canned gudeg helps realize convenient storage and better distribution. They

provide reliable physical protection during transit, preventing damage and product loss.

Canned food offers also high convenience in terms of usability, in addition to being user-friendly. The food can be directly served from the cans without the need for transferring it to another container. This makes it particularly convenient for outdoor activities like camping or picnics. Cans effectively preserve the taste, texture, and nutritional value of food compared to certain other packaging methods. The tight packaging and protection from light and air help preserve the food's taste and nutrition quality over an extended period.

While there are numerous advantages to using cans for food packaging, it's important however to acknowledge that certain foods may experience changes in taste and texture when canned. Additionally, the use of cans has environmental implications to consider, such as waste generation and energy consumption during the production and recycling processes (De gisi, et al. 2019). In other words, employing cans for food packaging offers various advantages, including protection against contamination, extended durability, ease of storage and distribution, user-friendliness, and preservation of taste and nutrition. However, it's also crucial to consider environmental factors and select packaging that aligns with the specific requirements and food type [56]. Below, is the result of how respondents react toward the decision of buying canned gudeg.

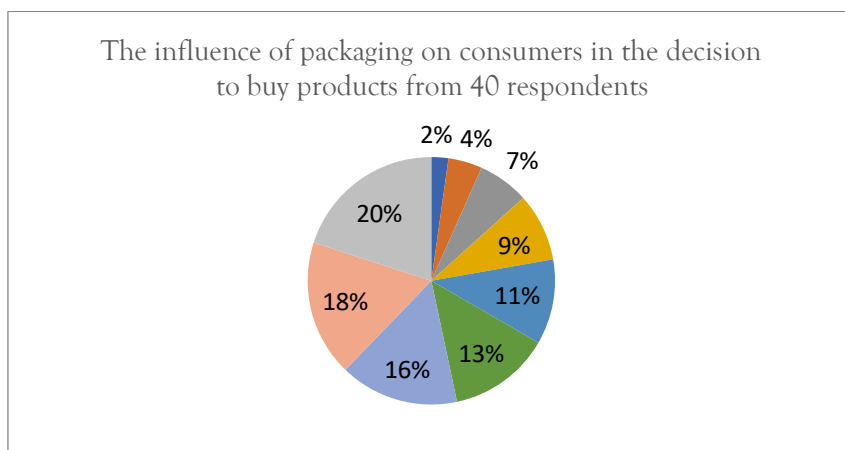


Figure 9:
Respondents' responses were based on how important product packaging was in buying products

Data from Figure 9 indicates that 20% of the respondents acknowledge the impact of packaging on their choices when buying food and drinks. This observation highlights the essential role of packaging in influencing consumers' purchasing decisions and emphasizes the significance of considering it when selling souvenir products.

Meanwhile, Figure 10 shows the majority of respondents that believe canned packaging is suitable for carrying gudeg as souvenirs. This indicates that consumers consider canned packaging as an effective option for giving gudeg as gifts to friends and family. This supports the theory above that canned packaging can also be used as an alternative for other traditional products, by ensuring their durability and convenience as souvenirs.

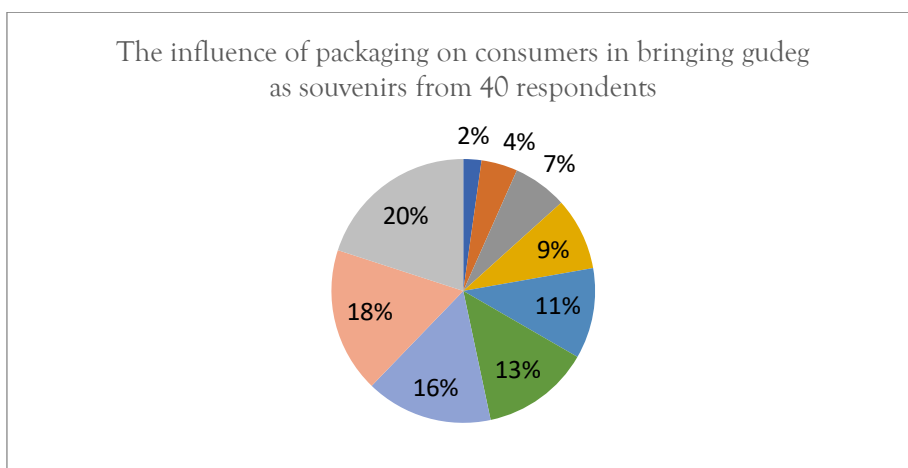


Figure 10:
As many as 20% of respondents' responses were based agree on the convenience of canned packaging for souvenirs

The questionnaire results also revealed three key factors in consumers' perception of a product's origin: (1) motif/pattern, (2) color, and (3) brand/name. The motif/pattern is a distinctive element that varies depending on the product's origin and serves as a strong representation of its source. Color plays a crucial role in helping consumers identify that the gudeg product comes from Java. Lastly, the brand/name holds significant importance as it represents the product's identity, which can enhance consumer loyalty and trust, particularly for traditional Javanese products like gudeg. Therefore, the decision of gudeg Bagong and Andrawina to choose canned packaging is effective in conveying the product's origin and enhancing consumer confidence in the quality and safety of gudeg products.

CONCLUSION

Gudeg, a traditional dish from Yogyakarta, offers a variety of options including dried, wet, manggar, and *sambal goreng krecek* gudeg. Its delightful taste and distinctive Indonesian flavor, derived from the use of young jackfruit and traditional spices, have made it popular among tourists. To adapt to changing times, gudeg producers have embraced innovation, by producing canned packaging, which is proven by microbiological tests to be more durable and safer. The microbiological tests for Bagong Canned Gudeg and Andrawina Loka Canned Gudeg, are found to have met the safety standards set by the Ministry of Health Regulation No. 416/MENKES/PER/IX/1990 and the Indonesian Food and Drug Authority Regulation No. HK. 00.06.1.S2.4011. Thus, in addition to the creative and interesting packaging, respondents expressed high satisfaction with the quality and quantity of canned gudeg innovation. This satisfaction becomes a factor that will continually position gudeg as a worthwhile cultural heritage from Indonesia.

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