

The Potential Of Aromatic Ginger (Kaempferia Galanga) Identification In East Java Province As An Effort To Develop Sustainable Herbal Crops For Feed Additive In East Java Province, Indonesia

Wahyu Widodo^{1*}, Adi Sutanto¹, Imbang Dwi Rahayu¹,
Apriliansa Devi Anggraini¹, and Trisakti Handayani²

¹Department of Animal Science, Faculty of Agriculture and Animal
Science, University of Muhammadiyah Malang, Jl. Raya
Tlogo Mas no. 246. Malang 65144, Indonesia.

²Department of Civic Education, Faculty of Teacher Training and
Education, University of Muhammadiyah Malang, Jl. Raya Tlogo Mas
no. 246. Malang 65144, Indonesia.

*corresponding author: wahyu@umm.ac.id

Abstract

This research aims to identify the potential of aromatic ginger to develop sustainable herbal plants for feed additives in East Java Province, Indonesia. The first research stage on aromatic ginger production conditions used a quantitative approach. The research method used was a literature study. Data collection used secondary data. A quantitative descriptive data analysis was in formal and informal form. The second stage was to identify aromatic ginger in several districts in East Java using a qualitative approach. The research method used was observation. The subjects were several districts in East Java. The data was the physical appearance of aromatic ginger in several districts in East Java. Qualitative descriptive analysis was used for the physical appearance of aromatic ginger. The third stage was the marketing conditions of aromatic ginger in East Java Province. The survey method was used to obtain marketing data for aromatic ginger in several districts in East Java. Data analysis was quantitative and qualitative descriptive analysis. The results obtained from research were aromatic ginger production in East Java varies between districts. The major producer of aromatic ginger in East Java was Pacitan District. Aromatic ginger from

Lumajang District displays the best physical characteristics. The physical characteristics of aromatic ginger from Lumajang were superior in almost all parameters, namely yellow color, distinctive pungent aroma, clean appearance, spicy aromatic ginger taste, large size, and good freshness level. The cheapest price comes from aromatic ginger production in Malang District. The aromatic ginger from the Probolinggo District was the most expensive price.

Keywords: Aromatic ginger, East Java Province.

Introduction

Aromatic ginger is a type of tuber plant found in Indonesia that can be used as a medicinal plant. All parts of the aromatic ginger plant can be used fresh or dried because this plant is useful for increasing appetite and improving blood flow and the digestive tract. This is because aromatic ginger contains several active compounds such as curcumin, saponin, flavonoids, polyphenols, and essential oils which have very specific roles [1][2][3][4]. Meanwhile, according to [5][6][7][8][9][10] the active compound curcumin can inhibit the growth of viruses, fungi, and bacteria both Gram-positive and Gram-negative, such as *Escherichia coli*, *Shigella dysenteriae* and *Staphylococcus aureus*, which will cause bacterial disease and colibacillosis in poultry.

The potential of the aromatic ginger plant as a medicine needs to be developed. One of the potential aromatic ginger-producing areas is East Java. However, the East Java provincial government does not yet have a policy for sustainable aromatic ginger production. As a result, there are no plantations that carry out mass planting of aromatic ginger. Aromatic ginger planting is only done by farmers as a side business. Aromatic ginger has a high potential to replace Antibiotic Growth Promoters (AGP) which have been banned in Indonesia. So far, AGP's ability to increase the productivity and health of poultry has been reliable. The main problem with AGP is the negative effects that are dangerous for the health of chickens and consumers [11] [12].

Several districts in East Java have high aromatic ginger production. However, there are still many areas in East Java that do not pay attention to the potential of

aromatic ginger as an herbal plant. The pharmaceutical and herbal medicine industry requires raw materials for the active compounds in aromatic ginger. This opportunity to develop aromatic ginger requires encouragement from various parties. The government can issue policies that support increasing aromatic ginger plant production. The industrial world in collaboration with farmers can absorb large quantities of aromatic ginger production. If all parties are involved in developing aromatic ginger, then the problem of replacing dangerous chemicals such as AGP in poultry farming can be resolved [13][14].

One problem that still needs to be researched is the potential of aromatic ginger as an herbal plant. Aromatic ginger production has remained unstable in recent years in East Java. The natural cultivation of aromatic ginger causes a variety of production and crop appearance. Market conditions for aromatic ginger commodities that have not been established sustainably make prices unstable. Therefore, it was necessary to research identifying the potential of aromatic ginger in an effort to develop sustainable herbal plants in East Java province.

Materials and Methods

This research was in three stages, namely (1) research on the production conditions of aromatic ginger in East Java, (2) research on the identification of aromatic ginger in several districts in East Java, and (3) marketing conditions of aromatic ginger in several selected districts in East Java. The first research stage on aromatic ginger production conditions used a quantitative approach. The research method used was a literature study. Data collection used secondary data from a desk review of literature provided by the Indonesian Central Statistics Agency. The subject of this research was conducted by examining aromatic ginger production in East Java Province. The instruments used were: (1) researchers as the main instrument for research on aromatic ginger production ; (2) literature on aromatic ginger production in East Java Province taken from the website of the Indonesian Central Bureau of Statistics ; (3) field notes were used to record all aromatic ginger data on the website.

A quantitative descriptive data analysis was in formal and informal form. The formal form includes (1) a

description of aromatic ginger production data resulting from literature studies in the form of numbers or words or verbal phrases consisting of notes and documentation; and (2) charts, namely sentence points arranged systematically to facilitate the description of the research process in the form of documents on aromatic ginger production in East Java Province. Meanwhile, the informal form was in the form of a narrative, namely a sentence description that explains all the research activities of the aromatic ginger production literature study in the form of chapters. The presentation of aromatic ginger production data was made systematically and efficiently so that it was easy to understand and could provide optimal clarity.

The second stage of research was to identify aromatic ginger in several districts in East Java using a qualitative approach. The research method used was observation. The subjects of this research were several districts in East Java that have aromatic ginger production. The determination of research subjects was carried out selectively based on the results of observations. The selection was purposively taking into account the existence of districts that have high aromatic ginger production data. The selection of this category was based on the assumption that districts with high aromatic ginger production data also have a high availability of aromatic ginger in the field. The selected districts were Malang, Lumajang, Probolinggo, Jember, and Pacitan.

Data collection was done by taking aromatic ginger samples in each district. The data obtained was the physical appearance of aromatic ginger in several districts in East Java Province. Aromatic ginger was analyzed by physical appearance to determine certain characteristics of each aromatic ginger in each district. Qualitative descriptive analysis was used to solve the problem of the physical appearance of aromatic ginger which consists of color, texture, aroma, cleanliness, taste, size, and freshness.

The third stage of research was the marketing conditions of aromatic ginger in East Java Province using quantitative and qualitative approaches. The survey method was used to obtain marketing data for aromatic ginger in several districts in East Java. The instruments used were (1) researchers as the main instrument of aromatic ginger research; (2) an interview guide in the form of open

questions that allow any questions about marketing aromatic ginger to develop in a more specific direction; (3) field notes, used to record what was heard, seen, experienced and thought to collect aromatic ginger marketing data in the field; (4) a recording device as a tool to help record the results of aromatic ginger marketing interviews.

The subjects of this research were several districts in East Java that have aromatic ginger production. The determination of research subjects was carried out selectively based on the results of observations. This selection was purposive. The consideration was districts have high aromatic ginger production data so that in these districts there was a dynamic marketing chain. The selected districts were Malang, Lumajang, Probolinggo, Jember, and Pacitan. Data was processed through several stages: (1) open coding ; (2) axial coding; and (3) selective coding. The open coding stage was a broad assessment stage of aromatic ginger marketing data. This stage aims to familiarize researchers with the environmental atmosphere of the marketing subject of aromatic ginger in several districts and to obtain broader and in-depth information to expand their understanding of the marketing of aromatic ginger being researched. The axial coding stage was the stage of developing concepts and categories in aromatic ginger marketing research which has resulted in open coding. The selective coding stage was more comprehensive because it emphasizes the relationship between categories as a whole. The selective coding stage ends after the conceptual descriptions of aromatic ginger marketing undergo a verification and modification process.

Quantitative and qualitative descriptive analysis using a marketing approach model for agricultural food products. The first stage was describing the effectiveness of aromatic ginger marketing in several districts in East Java. The second stage was classifying aromatic ginger marketing in several districts in East Java. The third stage was the stage of concept building (synthesis) regarding the effectiveness of aromatic ginger marketing in several districts in East Java. The results of the analysis were presented in the form of a description by following the process stages: (1) data on aromatic ginger marketing problems in several districts in East Java, (2) reduction of aromatic ginger marketing data

problems in several districts in East Java, (3) verification of aromatic ginger marketing data problems in several districts in East Java and (4) to the conclusion.

Results and Discussion

1. Conditions of Aromatic Ginger Production in East Java Province

Aromatic ginger is one of the herbal plants that has been used traditionally in medicine and natural medicine in various cultures, including in Indonesia [15][16]. Research on aromatic ginger was carried out for the following reasons: a) **Potential medical properties**: through research, it was possible to identify and understand the medical properties of aromatic ginger in more detail. This plant has been used traditionally to treat various ailments such as digestive disorders, respiratory problems, pain, and inflammation. Further research could help find out if there is scientific support for these claims and what their mechanisms of action are. b) **Active components**: research on aromatic ginger can help identify the active compounds in it that are responsible for its therapeutic effects. By knowing these active components, we will be able to better understand how aromatic ginger can interact with the body and affect human and livestock health. c) **Potential as a natural medicine**: in the pharmaceutical world, the discovery of new medicines is very important. Aromatic ginger can be a source of inspiration for the development of new natural medicines or beneficial health supplements. d) **Side effects and drug interactions**: research can also help identify possible side effects or interactions of aromatic ginger with other drugs or supplements. This information will be invaluable to healthcare professionals and patients for safe and effective use. e) **Conservation of natural resources**: aromatic ginger plants have grown and developed naturally and are used in various health products. Research on aromatic ginger can help understand the procedures for cultivation, protection, and sustainable management so that this natural resource can be well maintained. f) **Industrial development**: if aromatic ginger has interesting potential in the health or cosmetics sector, research can open up opportunities for the development of related industries that can contribute to the regional or state

economy. All the findings resulting from this aromatic ginger research may provide benefits to society and science [17][18][19]

East Java Province was one of the leading aromatic ginger producers in Indonesia [16]. Aromatic ginger grows well in the East Java region because the climate and soil conditions are suitable for its growth. Aromatic ginger production in East Java was usually carried out by small farmers and commercial farmers. They plant aromatic ginger on their farms and care for it during the appropriate growth period. After reaching the harvest period, aromatic ginger was harvested, cleaned, and processed before being sold to local markets or further distribution to markets throughout Indonesia. Aromatic ginger production in East Java Province can be seen in Table 1.

Table 1. Production of Aromatic Ginger Plants by Districts/Cities in East Java Province (kg), Years of 2017 and 2018

Districts/Cities	Aromatic Ginger Production	
	2017	2018
Districts		
Pacitan	1,544,132	4,385,800
Ponorogo	672,315	885,265
Trenggalek	149,983	342,038
Tulungagung	11,774	7,771
Blitar	61,725	60,322
Kediri	6,429	5,200
Malang	631,974	643,225
Lumajang	6,275	3,411
Jember	87,222	81,494
Banyuwangi	20,500	15,917
Bondowoso	. 540	3,474
Situbondo	-	-
Probolinggo	89,599	80,119
Pasuruan	320,940	1,023,551
Sidoarjo	6	33
Mojokerto	29,214	25,461
Jombang	87,921	7,766
Nganjuk	31,741	86,002
Madiun	55,006	54,304
Magetan	14,545	10,881

Ngawi	3,835	7,157
Bojonegoro	135,575	160,513
Tuban	9,529	8,875
Lamongan	6,181	8,899
Gresik	56	35
Bangkalan	2,148	5,873
Sampang	13,262	6,183
Pamekasan	884,100	782,650
Sumenep	60,857	55,116
Cities		
Kediri	-	-
Blitar	-	-
Malang	314	2,212
Probolinggo	369	9
Pasuruan	-	-
Mojokerto	-	-
Madiun	-	-
Surabaya	30	163
Batu	-	-
East Java	4,945,097	8,759,719

Source: [20]

The survey results in Table 1 show that several districts in East Java have the potential for major aromatic ginger-producing areas. Malang District produces aromatic ginger mainly in the Gunung Kawi area, Tirtoyudo area, and Dampit area. Lumajang District produces aromatic ginger mainly in the Candipuro area and Senduro area. The other main potential for aromatic ginger production were Jember District, Probolinggo District, and Pacitan District.

Aromatic ginger production in East Java varies greatly between districts/cities. In 2017 aromatic ginger production in East Java was 4,945,097 kg, while in 2018 it almost doubled to 8,759,719 kg. The main producer of aromatic ginger in East Java in 2018 was Pacitan District amounting to 4,385,800 kg. Meanwhile, several regions in East Java in 2018 did not display aromatic ginger production data, such as Situbondo District, Kediri, Pasuruan, Mojokerto, Madiun, and Batu City [20].

2. Identification of Aromatic Ginger in East Java Province

Aromatic ginger can be recognized or identified by several characteristics [21] as follows: (a) **Rhizome**: aromatic ginger is known because it has a distinctive rhizome, shaped like fingers, similar to human fingers. This rhizome is the part of the plant that is usually used in traditional medicine or cooking. (b) **Aroma**: aromatic ginger has a strong and distinctive aroma. The smell can be described as fragrant, spicy, and slightly pungent. (c) **Color**: Aromatic ginger rhizomes are generally brown or tan on the outside and white on the inside. (d) **Taste**: aromatic ginger has a spicy and fresh taste when chewed. The taste is similar to ginger, but sharper and more distinctive. (e) **Size and shape**: The aromatic ginger rhizome is usually smaller than the ginger rhizome. However, their size and shape can vary depending on the species. (f) **Leaves**: The aromatic ginger plant also has long, pointed leaves, and grows spread out from the base of the plant. (g) **Flowers**: aromatic ginger flowers usually form dense clusters and are yellowish-white in color.

Survey results in several districts in East Java show that the physical appearance of aromatic ginger varies. This was influenced by several factors such as environmental conditions, land, seeds, and the method of planting aromatic ginger. The physical appearances of aromatic ginger in several areas as a result of the survey can be seen in Figure 1.



Figure 1. The Physical Appearances of Aromatic Ginger from Several Districts in East Java

As shown in Figure 1 above, there were several physical differences in aromatic ginger in several sample areas in East Java. The following shows the physical appearance of aromatic ginger in several areas in East Java as in Table 2.

Table 2. Physical Observation Test of Aromatic Ginger from several Districts in East Java

Parameters	Districts				
	Malang	Probolinggo	Lumajang	Jember	Pacitan
Color	Yellowish White (2)	White (5)	Yellow (1)	Yellowish White (3)	White (4)
Texture	Various (5)	Somewhat varied (3)	Almost uniform (2)	Somewhat varied (4)	Uniform (1)
Aroma	Sting (1)	Slightly pungent (5)	Sting (2)	Sting (3)	Slightly pungent (4)
Cleanliness	Clean (5)	Clean (3)	Clean (1)	Clean (2)	Clean (4)
Flavor	Spicy (1)	Slightly spicy (5)	Spicy (2)	Slightly spicy (4)	Slightly spicy (3)
Size	Medium (4)	Medium (3)	Big (1)	Medium (2)	Small (5)
Freshness	Somewhat fresh (3)	Fresh (2)	Fresh (1)	Somewhat fresh (4)	Less fresh (5)

Note: Numbers 1 – 5 indicate the best display order

From the results of the physical tests in Table 2 above, it can be seen that aromatic ginger from Lumajang District displays

the best physical characteristics. The physical characteristics of aromatic ginger from Lumajang District were superior in almost all parameters, namely yellow color, distinctive pungent aroma, clean appearance, spicy aromatic ginger taste, large size, and good freshness level. Meanwhile, aromatic ginger from the Pacitan Districts area displays the lowest physical characteristics. The physical characteristics of aromatic ginger from the Pacitan District were shown by its white color, slightly pungent aroma, small size, and less fresh appearance. This was in line with the statement [21] which states the physical characteristics of aromatic ginger such as brownish color, spicy and fresh taste, and various sizes [15][22].

We must also pay attention to the environmental and social aspects of aromatic ginger to ensure that sustainability and long-term benefits are achieved for society as a whole, including in the livestock sector. The role of aromatic ginger in the livestock sector, especially in super native chicken farming, is as a feed additive and treatment [23][24][25][26][27][28][29][16] as explained here: (a) **Improved immune system**: aromatic ginger contains compounds such as curcuminoids, essential oils, and flavonoids which can improve the chicken's immune system. Aromatic ginger helps fight infection and disease, keeps chickens healthy, and increases their productivity. (b) **Overcoming digestive disorders**: aromatic ginger can help relieve digestive problems in chickens, such as diarrhea or other digestive disorders. The active compounds in aromatic ginger can help stabilize intestinal flora and reduce inflammation in the digestive tract. (c) **Anti-inflammatory and analgesic**: aromatic ginger has anti-inflammatory and analgesic properties which can help relieve inflammation and pain in chickens due to injury or disease. (d) **Expectorant**: aromatic ginger can act as an expectorant which helps thin the phlegm and mucus in the chicken's respiratory tract, thereby helping reduce symptoms such as colds and coughs. (e) **Antimicrobial effect**: the compounds in aromatic ginger have antimicrobial properties, which can help fight bacterial and fungal infections in chickens. (f) **Stress reliever**: several compounds in aromatic ginger can help relieve stress in chickens, which can affect their health and productivity. (g) **Food supplement**: aromatic ginger can be added as a supplement to chicken feed. This can help

improve the chicken's immune system, help with digestive disorders, and provide other health benefits. (h) **Digestive treatment**: aromatic ginger can be used as an herbal medicine to treat digestive problems in chickens, such as diarrhea or other digestive disorders. Aromatic ginger that has been crushed or made into powder can be mixed into drinking water or chicken feed. (i) **Respiratory tract treatment**: to help overcome respiratory problems in chickens, aromatic ginger can be used as an expectorant to help thin phlegm and mucus. Aromatic ginger that has been crushed or made into powder can be mixed into chicken drinking water. (j) **Treatment of wounds and burns**: aromatic ginger can also be used as an external medicine to help treat wounds and burns in chickens. Aromatic ginger is crushed and applied to the injured area.

Aromatic ginger production is specifically directed towards human and livestock health. Opportunities for developing aromatic ginger in the health industry show an increasing trend due to awareness of the dangers of using chemical substances that cause various diseases [30]. Aromatic ginger as a natural ingredient from herbal plants can function as a substitute for these dangerous ingredients [31][32][33][34]. **The health perspective of aromatic ginger products for humans and livestock can be explained in the following points:** (a) **Medical properties**: aromatic ginger has been used traditionally in medicine and natural medicine because of its medical properties. The active compounds in aromatic ginger, such as curcuminoids, essential oils, and zingiberene, have anti-inflammatory, antimicrobial, and antioxidant properties. This can provide health benefits for humans and livestock who use aromatic ginger products or consume them as herbs or supplements. (b) **Improving public health**: the use of aromatic ginger products which are beneficial for the health of humans and livestock can improve the welfare of society as a whole. Healthier communities tend to experience reduced healthcare costs and increased productivity, which can have a positive impact on the economy. (c) **Health and cosmetics market**: aromatic ginger is also used in cosmetic and beauty care products because of its benefits for caring for skin and hair. These products contribute to a large health and beauty market, and consumers are increasingly looking for natural and herbal products.

3. Marketing Conditions of Aromatic Ginger in East Java Province

It was known that the production situation can change from time to time because it is influenced by various factors such as weather conditions, market demand, and local agricultural practices. The price of aromatic ginger can fluctuate from time to time depending on factors such as harvest season, supply and demand, and local market conditions. Information about the price of aromatic ginger in East Java, both producers and consumers in the following way: (a) **Farmers or traders**: price data can be obtained directly from farmers or aromatic ginger traders at markets or local distribution centers to get information about prices at the time of transactions. (b) **Check online sites**: several trading sites and online markets can provide information about the latest aromatic ginger prices in various regions of Indonesia, including East Java. (c) **Social media**: sometimes aromatic ginger farmers or traders can share information about the latest prices via social media platforms. The marketing model for aromatic ginger and its prices in several districts was shown in Table 3.

Table 3. Price Data and Market Survey for Aromatic Ginger from several Districts in East Java Province

Parameters	Districts				
	Malang	Probolinggo	Lumajang	Jember	Pacitan
Price (IDR/Kg)	15,000	30,000	17,000	20,000	17,000
Availability	As requested	Infinite	As requested	Infinite	Infinite
Nature of Sales	Retail	Retail, Wholesale	Retail	Retail, Wholesale	Retail, Wholesale
Consumer	Household	Household, Industry	Household	Household, Industry	Household, Industry
Marketing Media	Directly, Call	Directly, Online Media	Directly, Call	Directly, Online Media	Directly, Online Media

It can be seen from Table 3 that the cheapest price comes from aromatic ginger production from Malang District at IDR 15,000 per kilogram. Meanwhile, the aromatic ginger with the most expensive price comes from Probolinggo District at IDR 30,000 per kilogram. This shows that there was no standardization of aromatic ginger prices in the East Java Province. This condition lead to the gaming of aromatic

ginger prices, especially by intermediary traders, which was detrimental to aromatic ginger farmers. The next effect was that aromatic ginger farmers were less interested in planting aromatic ginger. Ultimately, in the long term, aromatic ginger production will become unstable and will tend to decline. This was under the statement [35] which states that aromatic ginger plants were plants that cannot be relied on to increase income [36].

Other survey parameters in Table 3 show that aromatic ginger marketing was mostly done traditionally by selling directly to household consumers. Several districts were already marketing aromatic ginger to industries such as Probolinggo, Jember, and Pacitan. The sustainability of aromatic ginger production depends on the industry that uses aromatic ginger to downstream aromatic ginger products such as making herbal medicine, medicine, health drinks, and cosmetic raw materials. Aromatic ginger farmers can be directed to look at wider marketing opportunities by entering into the use of aromatic ginger as a raw material for various kinds of products that are beneficial to humans [37]. Aromatic ginger has several economic benefits that can have a positive impact on society and certain industries [38][39][40][11]. Some of the economic benefits of aromatic ginger include: (a) **Agriculture and agribusiness**: aromatic ginger is a spice plant that has high economic value. Aromatic ginger cultivation and production can provide income to farmers and business actors in the agricultural and agribusiness sectors. Apart from that, aromatic ginger can also be a source of income for small farmers who work on agricultural land on a limited scale. (b) **Herbal medicine and traditional medicine industry**: aromatic ginger is an important ingredient in the herbal medicine and traditional medicine industry. Many herbal medicine products or traditional medicines contain aromatic ginger because its properties are known in traditional medicine. This industry can make a significant contribution to the economy of a region or country. (c) **Exports and trade**: Indonesia is one of the largest aromatic ginger producers in the world. Aromatic ginger can be exported to various countries that have a demand for spices. Aromatic ginger exports can increase the country's income and contribute to the trade balance. (d) **Cosmetics and beauty care industry**: aromatic ginger is also used in cosmetic and beauty care products because of its

properties for caring for skin and hair. These products can include soap, cream, or facial masks containing aromatic ginger. This cosmetic industry can provide added value to aromatic ginger and increase the economic value of this plant. (e) **Innovative product development:** aromatic ginger continues to be researched to identify its active compounds and potential use in various new products, including in the pharmaceutical industry. The development of innovative products can provide new opportunities in the use of aromatic ginger and have an impact on related industries. (f) **Development of culinary tourism and agrotourism:** areas, where aromatic ginger is cultivated, can exploit tourism potential by developing culinary tourism and agrotourism. Tourists can be invited to see directly the process of aromatic ginger cultivation, taste foods made from aromatic ginger, and buy processed aromatic ginger products as souvenirs.

Utilization of aromatic ginger production on a national scale must take into account the food economic conditions in Indonesia. Aromatic ginger is one of the promising herbal plants and has the potential to be developed [25][42][43]. The economic benefits of aromatic ginger can be optimal if it is accompanied by sustainable agricultural practices and directed industrial development. The food economic perspective on aromatic ginger plants can be explained in the following points: (a) **Economic value:** Aromatic ginger has significant economic value as a spice plant and food ingredient. Aromatic ginger farming provides a livelihood for farmers and workers in the agricultural sector. Apart from that, trade and exports of aromatic ginger can also contribute to the economy of a region or country. (b) **Food industry contribution:** Aromatic ginger is used in the food industry to provide taste, aroma, and health benefits to various food products. This includes processed foods, snacks, drinks, and other food products. Aromatic ginger's contribution to the food industry can create added value and business opportunities for companies and food producers. (c) **Availability and diversity of food:** aromatic ginger as a food ingredient can provide variety and diversity in cooking and food. This can enrich people's food consumption and contribute to the availability of healthy and nutritious food.

Identification of aromatic ginger in the field of halal food is an important point. This is because aromatic ginger consumers in Indonesia are Muslim. Therefore, the halal perspective of aromatic ginger [44][45][46] can be described as follows: (a) Aspects of the plant itself: in Islam, the halalness of food ingredients and medicines is measured based on their source and whether the ingredients are safe and do not contain haram ingredients. Aromatic ginger, as a herbal plant, is naturally halal for consumption because it comes from natural sources and this plant is not included in the list of haram foods. (b) Processing and mixing aspects: although aromatic ginger itself is a halal ingredient, in the food and pharmaceutical industries, aromatic ginger is often processed or mixed with other ingredients to make products such as herbal medicine, supplements, or processed foods. Therefore, it is necessary to pay attention to the label and the ingredients used in the product, while ensuring that there are no haram ingredients involved in the production process or mixture. (c) Label inspection: check the product label carefully to ensure that there are no haram ingredients listed on it. (d) Halal certification: in several countries, there are halal certification bodies that provide halal labels to products that meet halal standards. Existing aromatic ginger products must certainly have halal certification from a trusted institution.

Conclusions

1. Aromatic ginger production in East Java varies greatly between districts. The main producer of aromatic ginger in East Java was Pacitan Regency. Meanwhile, several regions in East Java did not display aromatic ginger production data, such as Situbondo district, Kediri, Pasuruan, Mojokerto, Madiun, and Batu City.
2. Aromatic ginger from Lumajang District displays the best physical characteristics. The physical characteristics of aromatic ginger from Lumajang were superior in almost all parameters, namely yellow color, distinctive pungent aroma, clean appearance, spicy aromatic ginger taste, large size, and good freshness level. Meanwhile, aromatic ginger from the Pacitan District area displays the lowest physical characteristics. The physical characteristics of aromatic ginger from the Pacitan area were shown by its white color, slightly pungent aroma,

small size, and less fresh appearance.

3. The cheapest price comes from aromatic ginger production in Malang District. Meanwhile, the aromatic ginger with the most expensive price comes from Probolinggo District. This shows that there was no standardization of aromatic ginger prices in the East Java Province. Marketing aromatic ginger was mostly done traditionally by selling it directly to household consumers. Several regions were already marketing of aromatic ginger to industries such as Probolinggo, Jember, and Pacitan.

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References

- [1] Rajput, N., Muhammad, N., Yan, R., Zhong, X., and Wang, T, 2013. Effect of Dietary Supplementation of Curcumin on Growth Performance, Intestinal Morphology and Nutrients Utilization of Broiler Chicks. *J. Poult Sci.* 50: 44-52. https://www.istage.jst.go.jp/article/jpsa/50/1/50_0120065
- [2] Riasari, H., Rachmaniar, R., Wahyuni, S. 2019. Evaluation of Patch of Rhizoma Extracts Aromatic ginger (*Kaempferia galanga* L.) as Anti-Inflammatory with Enhancer. *Indonesian Journal of Pharmaceutical Science and Technology.* 6(2), 2019; 59-64. <https://jurnal.unpad.ac.id/ijpst/article/view/18932>
- [3] Ganapathy, G., & Nair, A. R. (2017). Curcuminoids in *Zingiber zerumbet* Rhizomes: Bioguided Fractionation and Chromatographic Identification of Antimicrobial and Antioxidant Metabolites. *Journal of Herbs, Spices and Medicinal Plants*, 23 (2), 169–181. <https://doi.org/10.1080/10496475.2017.1283555> . <https://www.cukerala.ac.in/cukpdfs/IQAC/3.4.5/3.4.5.DBMB.056.pdf>

- [4] Kapitan, OB, Ambarsari, L., & Falah, S. (2018). In Vitro Antibacterial Ethanol Extract of Puni (Zingiber zerumbet) from Timor Island. *Sandalwood Savanna*, 2 (02), 29–32. <https://doi.org/10.32938/sc.v2i02.82>.
- [5] Diaz-Sanchez, S., D'Souza, D., Biswas, D., & Hanning, I. (2015). Botanical Alternatives to Antibiotics For Use in Organic Poultry Production. *Poultry Science*, 1-12. <https://pubmed.ncbi.nlm.nih.gov/25743421/>
- [6] Ghasemzadeh, A., Jaafar, HZE, Ashkani, S., Rahmat, A., Juraimi, AS, Puteh, A., & Muda Mohamed, MT (2016). Variation In Secondary Metabolite Production As Well As Antioxidant And Antibacterial Activities Of Zingiber Zerumbet (L.) At Different Stages Of Growth. *BMC Complementary and Alternative Medicine*, 16 (1), 1–10. <https://doi.org/10.1186/s12906-016-1072-6>
- [7] Rahayu, ID, W. Widodo, I. Prihartini, & A. Winaya. "Antibacterial activity of ethanolic extracts from Zingiber zerumbet Rhizome Against Salmonella spp ." *Biodiversity* 20(11): 3322–3327. 2019. <https://smujo.id/biodiv/article/view/4591>
- [8] Widodo, W., Rahayu, IB, Sutanto A., Apriiana, DA, Sahara, H., Safitri, S., and Yaro, A., 2021. Curcuma xanthorrhiza Roxb. as feed additive on the carcass and fat weight percentage, meat nutrient, and nutrient digestibility of super kampong chicken. *Researcherlinks.Com*. Retrieved July 26, 2021, from <https://researcherlinks.com/current-issues/Curcuma-xanthorrhiza-Roxb-Feed-Additive/14/29/3840/html>
- [9] Rahayu, ID, Widodo, W., Sutanto, A., & Anggraini, AD (2020). The Lempuyang Gajah [Zingiber Zerumbet (L.) Smith] Extract Supplementation in Broilers Feed to Suppress Foodborne Disease "Salmonellosis" for Consumers' Health Safety Effort, 477 (Iccd), 343–347. <https://doi.org/10.2991/assehr.k.201017.076>
- [10] Widodo, W., Rahayu, ID, Sutanto, A., Anggraini, AD, Sahara, H., Safitri, S., & Yaro, A. (2021). Curcuma xanthorrhiza Roxb. as Feed Additive on the Carcass and Fat Weight Percentage, Meat Nutrient, and Nutrient Digestibility of Super Kampong Chicken. *Sarhad Journal of Agriculture*, 37 (Special Issue 1), 41–47. <https://doi.org/10.17582/JOURNAL.SJA/2021/37.S1.41.47>
- [11] Thung TY, NA Mahyudin, DF Basri, CWJ Wan Mohamed Radzi, Y. Nakaguchi, M. Nishibuchi, S. Radu. (2016). Prevalence and Antibiotic Resistance of Salmonella enteritidis and Salmonella typhimurium in Raw Chicken Meat at Retail Markets in Malaysia. *Poult Sci* .95 (8): 1888-1893. <https://pubmed.ncbi.nlm.nih.gov/27118863/>

- [12] Khatun, R., Howlader, MA, Islam, MN, Alam, MK, Mahmud, MS, & Rahman, MH (2015). Exploration of the Causes of Infectious Illness and Detection of Antibiotic Residues in Warehouse Poultry. *American Journal of Food Science and Health*, 1 (2), 57-62.
https://www.researchgate.net/publication/299441741_Exploration_the_Causes_of_Infectious_Illness_and_Detection_of_Antibiotic_Residues_in_Warehouse_Poultry
- [13] Ibrahim, WA & El-ghany, WAA, 2014. Short Communication A Comparative Study on The Use of Real-time Polymerase Chain Reaction (RT-PCR) And Standard Isolation Techniques For The Detection Of Salmonellae In Broiler Chicks. *International Journal of Veterinary Science and Medicine*, 2(1), pp. 67–71. Available at:
<http://dx.doi.org/10.1016/j.ijvsm.2013.11.001>.
- [14] Ramiah, SK, Zulkifli, I., Rahim, NAA, Ebrahimi, M., & Meng, GY 2014. Effects of Two Herbal Extracts and Virginiamycin Supplementation on Growth Performance, Intestinal Microflora Population and Fatty Acid Composition in Broiler Chickens. *Asian-Australasian Journal of Animal Sciences*, 27 (3), 375–382.
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4093267/>
- [15] Khiyaaroh, A., & Triratnawati., A. (2021). Jamu: Javanese Doping During the Covid-19 Pandemic. *Indonesian Journal of Medical Anthropology*, 2 (2).
<https://doi.org/10.32734/ijma.v2i2.6385>
- [16] Asmara, IY, Garnida, D., Sulisyati, M., Tejaningsih, S., & Partasasmita, R. (2018). Ethnoveterinary medicine and health management of Pelung Chicken in West Java, Indonesia. *Smujo.Id*, 19 (4).
<https://doi.org/10.13057/biodiv/d190441>
- [17] Srivastava, N., Ranjana, Singh, S., Gupta, A.C., Shanker, K., Bawankule, DU, & Luqman, S. (2019). Aromatic ginger (*Kaempferia galanga* L.) extracts with ameliorative and protective potential as a functional food, beyond its flavor and nutritional benefits. *Toxicology Reports*, 6 .
<https://doi.org/10.1016/j.toxrep.2019.05.014>
- [18] Hertiani, T., Pratiwi, SUT, Irianto, IDK, & Febriana, A. (2010). *Kaempferia galanga* L. Rhizome As a Potential Dental Plaque Preventive Agent. *Indonesian Journal of Cancer Chemoprevention*. <https://doi.org/10.14499/indonesianjancanchemoprev1iss1pp19-25>
- [19] Ali, MS, Dash, PR, & Nasrin, M. (2015). Study of sedative activity of different extracts of *Kaempferia galanga* in Swiss albino mice. *BMC Complementary and Alternative*

- Medicine, 15 (1). <https://doi.org/10.1186/S12906-015-0670-Z>
- [20] Statistical Yearbook of Indonesia 2020. (2020). Indonesian Central Statistics Agency. Indonesian Statistics 2020, 1101001. <https://www.bps.go.id/indicator/55/63/1/production-tanaman-biofarmaka-obat-.html>
- [21] Silalahi, M. (2019). Aromatic ginger (*Kaempferia galanga*) and its Bioactivity. *Journal of Informatics and Science Education*, 8 (1). <https://doi.org/10.31571/saintek.v8i1.1178>
- [22] Hashiguchi, A., San Thawtar, M., Duangsodsri, T., Kusano, M., & Watanabe, K.N. (2022). Biofunctional properties and plant physiology of *Kaempferia* spp.: Status and trends. In *Journal of Functional Foods* (Vol. 92). <https://doi.org/10.1016/j.jff.2022.105029>
- [23] Utami, LP, Tandean, PG, & Liliawanti, L. (2020). Effect of Giving Aromatic ginger Extract (*Kaempferia galanga* L.) on Increasing the Growth Inhibitory Zone of *Staphylococcus aureus* Bacteria. *Wijaya Kusuma Medical Scientific Journal* , 9 (2). <https://doi.org/10.30742/jikw.v9i2.883>
- [24] Kieliszek, M., Edris, A., Kot, A.M., & Piwowarek, K. (2020). Biological activity of some aromatic plants and their metabolites, with an emphasis on health-promoting properties. In *Molecules* (Vol. 25, Issue 11). <https://doi.org/10.3390/molecules25112478>
- [25] Darsini, N. (2022). Short Communication: The species of Temu-finding that sold in Badung Market with its utilization and anatomical study. *Udayana Biology Journal* , 26 (2). <https://doi.org/10.24843/jbiounud.2022.v26.i02.p14>
- [26] Astuti, FD, Sugiharto, S., Yudiarti, T., Widiastuti, E., Wahyuni, HI, & Ayaşan, T. (2022a). bacterial content, and morphological measurements of broilers supplemented with *Lactobacillus casei*-fermented mixture of red rice and aromatic ginger. *Veterinaryworld.Org*. <https://doi.org/10.14202/vetworld.2022.818-826>
- [27] Sari, TV, Hasanah, U., Harahap, RIH, Zakhulu, P., and Trisna, A. (2022). Chemical and physical quality of broiler meat with drinking water containing boiled and fermented water of various cooking spices as phytobiotics. *Iopscience.Iop.Org* . <https://doi.org/10.1088/1755-1315/977/1/012137>
- [28] Astuti, FD, Sugiharto, S., Yudiarti, T., Widiastuti, E., Wahyuni, HI, & Ayaşan, T. (2022b). Growth performance, blood variables, intestinal bacterial content, and morphological measurements of broilers supplemented with *Lactobacillus casei*-fermented mixture of red rice and aromatic ginger. *Veterinary World*, 15 (4).

- <https://doi.org/10.14202/vetworld.2022.818-826>
- [29] Ridditid, W., Sae-wong, C., Reanmongkol, W., & Wongnawa, M. (2008). Antinociceptive activity of the methanolic extract of *Kaempferia galanga* Linn. in experimental animals. *Journal of Ethnopharmacology*.
<https://doi.org/10.1016/j.jep.2008.04.002>
- [30] Widodo, W., Rahayu, ID, Sutanto, A., Hendroko Setyobudi, R., & Mel, M. (2019). The Effectiveness of Curcuma (*Curcuma xanthorrhiza* Roxb.) Addition in the Feed toward Super Kampong Chicken Performances. 56(4).
<https://paspk.org/wp-content/uploads/2020/05/LS-574-MS.pdf>
- [31] Anggraini, M., Ayu, G., & Saputri, R. (2021). Comparison of Moisture Content and Condition of Essential Oil on Rhizome Aromatic ginger (*Kaempferia aromatic* ginger L.) With Different Drying Treatment. *Journal of Pharmaceutical Analysis*, 6 (2): 79-83.
<https://ejournalmalahayati.ac.id/index.php/analisfarmasi/issue/archive>.
- [32] Nanasombat, S., Kuncharoen, N., Ritcharoon, B., & Sukcharoen, P. (2018). Antibacterial activity of Thai medicinal plant extracts against oral and gastrointestinal pathogenic bacteria and prebiotic effect on the growth of *Lactobacillus acidophilus*. *Chiang Mai Journal of Science*, 45 (1).
<https://www.thaiscience.info/Journals/Article/CMJS/10989270.pdf>
- [33] Amuamuta, A., Plengsuriyakarn, T., & Na-Bangchang, K. (2017). Anticholangiocarcinoma activity and toxicity of the *Kaempferia galanga* Linn. Rhizome ethanolic extract. *BMC Complementary and Alternative Medicine*, 17 (1).
<https://doi.org/10.1186/s12906-017-1713-4>
- [34] Subaryanti, S., Sulistyaningsih, YC, Iswantini, D., & Triadiati, D. (2021). Essential Oil Components, Metabolite Profiles, and Idioblast Cell Densities in Aromatic ginger (*Kaempferia galanga* L.) at Different Agroecology. *Agrivita.Ub.Ac.Id*.
<https://doi.org/10.17503/agrivita.v43i2.2631>
- [35] Sucipto, S., Sulistiyowati, TI, Utami, B., & Qamaria, RS (2020). Family Medicinal Plant Cultivation Movement as Community Care Towards a Healthy Village in Semen Village, Kediri Regency. *Scholar: Journal of Community Service*, 2 (2).
<https://doi.org/10.32503/cendekia.v2i2.1002>
- [36] Nurhayati, APD, Ghaissani, SS, Setiawan, E., Sa'adah, NN, Ashuri, NM, Abdulgani, N., Hidayati, D., Navastara, DA, Prasetyo, D., & Rosdiana, L. (2022) . Environmentally Friendly Herbal Products in Oro-oro Ombo Village- Batu

- Malang, East Java Province in an Effort to Increase Community Productivity. *Sewagati*, 6 (4).
<https://doi.org/10.12962/j26139960.v6i4.98>
- [37] Sutanto, A., Widodo, W., Rahayu, ID, & Anggraini, AD (2020). Technical and Economic Aspects on the Use of Herbal Medicine to Improve the Income of Broiler Poultry as Determining Success of Broiler Business. *Atlantis-Press.Com* . <https://www.atlantis-press.com/proceedings/iccd-20/125945257>
- [38] Preetha, T.S., Krishnan, P.N., Thankappan, C., Preetha, S., Suvarna Preetha, T., & Sudarsanan Hemanthakumar, A. (2016). A comprehensive review of *Kaempferia galanga* L. (Zingiberaceae): A highly sought after medicinal plant in Tropical Asia. In ~ 270 ~ *Journal of Medicinal Plants Studies* (Vol. 4, Issue 3).
<https://www.plantsjournal.com/archives/2016/vol4issue3/PartD/4-3-8-414.pdf>
- [39] Williamson, E.M. (2006). Systems of traditional medicine from South and South East Asia. *Pharmaceutical Journal*, 276 (7399). https://www.researchgate.net/publication/290799213_Systems_of_traditional_medicine_from_South_and_South_East_Asia
- [40] Dibha, A. F., Wahyuningsih, S., Kharisma, VD, Ansori, ANM, Widyananda, MH, Parikesit, AA, Rebezov, M., Matrosova, Y., Artyukhova, S., Kenijz, N., Kiseleva, M., Jakhmola, V., & Zainul, R. (2022). Biological activity of aromatic ginger (*Kaempferia galanga* L.) against SARS-CoV-2 main protease. *International Journal of Health Sciences*, 6 (S1).
<https://doi.org/10.53730/ijhs.v6ns1.4779>
- [41] Muqaddim, M. (2017). Phytochemical and Biological Investigation of *Kaempferia* aromatic ginger Leaves. The Department of Pharmacy in Partial Fulfillment of the Requirements for the Degree of Bachelor of Pharmacy (Hons.).
https://dspace.bracu.ac.bd/xmlui/bitstream/handle/10361/9491/ID%2012146004_PHR.pdf?sequence=1&isAllowed=y
- [42] Vidya, VR (2021). In vitro Microrhizome Induction and Essential Oil Production from Aromatic Ginger *Kaempferia galanga*: An Economically Important Medicinal Herb. *Bioscience Biotechnology Research Communications*, 14 (4). <https://doi.org/10.21786/bbrc/14.4.34>
- [43] Raina, A.P., & Abraham, Z. (2016). Chemical profiling of essential oil of *Kaempferia galanga* L. germplasm from India. *Journal of Essential Oil Research*, 28 (1).
<https://doi.org/10.1080/10412905.2015.1077165>
- [44] Shikov, A.N., Pozharitskaya, O.N., Makarov, V.G., &

Makarova, M.N. (2009). New technology for the preparation of herbal extracts and soft halal capsules on its base. *American-Eurasian Journal of Sustainable Agriculture*, 3 (2).

https://www.researchgate.net/publication/258840109_New_Technology_for_Preparation_of_Herbal_Extracts_and_Soft_Halal_Capsules_on_its_Base

- [45] Hafsani, H., Kiramang, K., Thaha, AH, & Rasyid, MR (2021). Broiler farms practice without AGP as an Islamic conception in the strategy to achieve "nurturing" food. *Journal of Islam and Science*, 8 (1). <https://doi.org/10.24252/jis.v8i1.19549>
- [46] Rajendran, SA, & Kamarulzaman, NH (2017). Preserving Halal Integrity in Herbs and Herbal Industry Supply Chain. *Journal of Contemporary Islamic Studies*, 3 (2). <https://ir.uitm.edu.my/id/eprint/30365/1/30365.pdf>