Understanding the importance of fresh mango quality attributes from the perspective of Indonesian domestic consumers

A M Kiloes1,2, Nurmalinda3, Y Handayani3 and D Pitaloka3

1School of Agriculture and Food Sciences, The University of Queensland, Gatton 4343, Queensland, Australia
2Indonesian Center for Horticulture Research and Development, Bogor, West Java, Indonesia
3Jakarta Assessment Institute of Agriculture Technology, DKI Jakarta, Indonesia

E-mail: a.kiloes@uq.net.au

Abstract. The domestic market is the primary market of the Indonesian locally produced mango. There is a positive transition in the economy in this market, highlighting the increase of healthy lifestyles and changes in fresh agri-food product preferences, including fresh mango. Understanding how consumers in this community have a variation in preferences is essential to formulate the strategy to improve the performance of the Indonesian mango value chain. This study aims to identify quality attributes of fresh mango considered important by Indonesian domestic consumers. An online consumer survey involving 435 consumers was conducted in February 2021 in Jakarta, the biggest city in Indonesia. Based on the hierarchical cluster analysis, consumers are divided into four clusters based on their perception of the importance of mango quality attributes. The results highlight the differences between four clusters of respondents in giving importance to intrinsic and extrinsic mango quality attributes, where three out of four clusters concern with quality attributes importance. The differences in respondent characteristics in each cluster can represent how different consumers give importance to a mango quality attribute. It can be valuable information to improve mango value chain performance by understanding that most consumers are concerned about mango quality attributes’ importance.

1. Introduction

Indonesia is one of the top five mango-producing countries globally, together with India, China, Thailand, and Mexico. These five countries contributed to almost 70% of world mango production. Indonesia itself contributes to almost 7% of this group of countries [1]. The Indonesian statistics mentioned that Indonesian mango production reaches more than two million tons in 2020, the second biggest for national fruit production after banana [2]. It is why this commodity is included as the top four priority fruits for the Indonesian Ministry of Agriculture [3]. However, Indonesia’s mango export performance is not as good as its production performance. Indonesia’s mango exports are very small, only less than 1% of total production. Indonesia also is not included in the world’s largest mango exporting countries, even in the Asian region [4].

Even though the Indonesian government, through the Ministry of Agriculture, targets to increase mango exports, the domestic market is still the main market for Indonesian produced mangoes [3,5].
Due to the large population, which reaches more than 260 million people, this market is a very potential target market for local and imported mangoes. This market is a large and growing domestic market that needs to be considered. Within this population, there is a positive transformation shown by an increase in the community’s income and education. It is also hoped that the number of middle-up income consumers will increase in this population in the future [6]. This transformation leads to an increased healthy lifestyle and increasing demand for healthy foods such as fruits and vegetables, including mango [7].

Like any other agricultural activities in the country, the Indonesian mango industry has its own challenges in a different value chain section. The Indonesian mango industry characterized by small and fragmented growers who has a low awareness of pest and disease control [8]. There are also problems in quality, such as fruit flies [9] and fungus attacks in the rainy season [8]. Lack of capital and low ownership of supporting agricultural facilities continued existing conventional practices that lead to the low productivity and quality of mango produced [10].

In improving the performance of the Indonesian mango value chain, it is necessary to understand what consumers want. As domestic consumers are the main market for locally produced mangoes, it is important to understand how Indonesian consumers perceive mango quality. It is important to know what attributes are considered important and influence consumer decisions to buy mangoes [11,12]. Not only physical attributes attached to the product itself, but also intangible attributes such as food safety, ethical production, and attributes related to marketing [13].

Understanding how consumers perceive the importance of product attributes is a complex process, given the diversity of consumer behavior that is influenced by each individual’s socio-economic background and behavior [14,15]. However, Indonesia is a large market where consumers are very diverse. Value chain actors need to understand consumers by not generalizing their perceptions as a whole [12]. Understanding how different consumer cluster perceive the importance of product attributes is important for improving value chain performance [15,16]. Leaving aside the variability that exists on the consumer could lead to unsustainable efforts to improve value chain performance and policies [15]. Therefore, this paper aims to analyze how different consumer cluster in Indonesia perceive the importance of mango quality attributes.

2. Materials and methods
A consumer survey was conducted in February 2021. The survey located in Jakarta, the largest city in Indonesia. Jakarta can also represent Indonesia because there is a high variability of consumers in this location. Due to the Covid-19 situation, which does not allow direct surveys to be carried out on the market, the survey was conducted online by distributing the questionnaire link through the WhatsApp personal messaging application to potential respondents. A total of 435 respondents were involved in the survey and completed the questionnaire by answering all the questions asked. The questions asked in the questionnaire included respondent characteristics such as age, occupation, education, and income, as well as a set of questions to understand how they rated the importance of mango fruit quality attributes. Respondents were asked to rate the importance of 27 mango attributes, consisting of 16 intrinsic and 11 extrinsic attributes. A 1-5 Likert scale were presented, and they were asked to choose the scale based on their perception of whether they consider a mango attribute very unimportant to very important. Given the COVID-19 situation that occurred at the time the research was conducted, consumers were asked to answer by ignoring the disruption of the situation, by being asked to answer how you judged in the optimal situation.

Cluster analysis using the hierarchical clustering method was carried out to segment respondents based on their perception of quality attributes’ importance [12,15,16]. Data analysis was conducted using R studio [17]. Descriptive analysis was then carried out to determine the characteristics of respondents in each respondent cluster.
3. Results and discussion

3.1. Consumers cluster

Clustering consumers into several groups has been done before in several previous studies [12,15,16]. This clustering is important to know the differences between each group in the products offered so that the actors involved in the value chain can adjust their strategies in the production process.

The cluster analysis results divide consumers into four clusters that show differences in how consumers perceive the importance of mango quality attributes. Table 1 presents the results of the analysis, where a heat-map approach is used to visualize the importance of each attribute across clusters.

| Attributes | Cluster 1, the average consumers (42.07%) | Cluster 2, the high standard consumers (19.54%) | Cluster 3, the emerging consumers (36.32%) | Cluster 4, the less aware consumers (2.07%) |
|------------|-------------------------------------------|-----------------------------------------------|------------------------------------------|-------------------------------------------|
| Aroma      | 4.07                                      | 4.35                                          | 4.13                                     | 3.11                                      |
| Taste      | 4.19                                      | 4.48                                          | 4.27                                     | 1.33                                      |
| Flesh Texture | 3.86                                      | 4.48                                          | 3.78                                     | 2.44                                      |
| Skin color | 3.74                                      | 4.25                                          | 3.94                                     | 2.11                                      |
| Appearance | 4.21                                      | 4.53                                          | 4.37                                     | 3.89                                      |
| Firmness   | 4.02                                      | 4.62                                          | 3.92                                     | 2.00                                      |
| Flesh Colour | 3.69                                      | 4.14                                          | 3.19                                     | 3.22                                      |
| Cleanliness | 4.45                                      | 4.88                                          | 4.57                                     | 2.00                                      |
| Juiciness  | 3.86                                      | 4.39                                          | 3.49                                     | 2.78                                      |
| Fibre      | 3.84                                      | 4.59                                          | 3.59                                     | 2.22                                      |
| Freshness  | 4.04                                      | 4.52                                          | 3.73                                     | 2.44                                      |
| Ripeness   | 4.02                                      | 4.55                                          | 4.06                                     | 4.11                                      |
| Pest infestation | 3.77                                    | 4.41                                          | 3.52                                     | 2.89                                      |
| Shape      | 3.77                                      | 4.47                                          | 3.84                                     | 1.89                                      |
| Graded     | 4.31                                      | 4.12                                          | 3.96                                     | 1.89                                      |
| Size       | 4.46                                      | 4.61                                          | 4.50                                     | 4.44                                      |
| Packaging  | 3.61                                      | 4.42                                          | 2.57                                     | 3.44                                      |
| Price      | 4.12                                      | 4.56                                          | 4.18                                     | 3.33                                      |
| Chemical-free | 4.42                                    | 4.91                                          | 4.23                                     | 2.22                                      |
| Variety    | 4.00                                      | 4.69                                          | 3.42                                     | 3.44                                      |
| Origin     | 3.67                                      | 4.35                                          | 2.88                                     | 2.44                                      |
| Seasonal   | 3.89                                      | 4.46                                          | 3.40                                     | 3.33                                      |
| Certified  | 3.65                                      | 4.44                                          | 2.64                                     | 3.33                                      |
| labeling   | 3.42                                      | 4.06                                          | 2.47                                     | 3.11                                      |
| Traceability | 3.68                                     | 4.36                                          | 2.58                                     | 3.22                                      |
| Organic    | 3.91                                      | 4.56                                          | 3.17                                     | 3.78                                      |
| Safety     | 4.28                                      | 4.61                                          | 3.53                                     | 3.44                                      |

The first cluster is referred to as average consumers. This cluster has the most number of members among other clusters, consisting of 42.07% of the total respondents involved. This cluster is mentioned as average consumers because they give average importance to mango quality attributes compared to consumers who are members of other clusters. Consumers who are members of this cluster give the highest importance to size, followed by cleanliness, chemical-free, graded, and appearance. Packaging is the attribute with the lowest importance, but the distance is not too far from the attribute that is considered the most important.

The second cluster is 19.54% of the total respondent population. This cluster is referred to as High standard consumers. This labelling is because consumers in this cluster consider all quality attributes as
important attributes. For example, cleanliness is the attribute that is considered the most important, while graded is the attribute with the lowest importance. However, the comparison of importance between the two attributes is not far apart.

The third cluster is the second most members, amounting to 36.32% of the total population of respondents. This cluster is labelled as emerging consumers. Consumers in this cluster give much high importance to intrinsic attributes but still give low importance to extrinsic attributes. The attribute with the highest importance is cleanliness, followed by size, appearance, and taste. Chemical-free is an attribute with the next level of importance, which is an extrinsic attribute. In contrast, the attribute with the lowest importance is traceability which is also an extrinsic attribute.

The last cluster accounts for 2.07% of the total respondents’ population. It is the smallest size of the identified clusters. This cluster is labelled as less aware consumers due to their perception of giving low importance to almost all mango quality attributes. The most important attribute is size, followed by ripeness, appearance, organic, and safety. The attribute with the lowest importance is taste.

3.2. Clusters characteristics

The majority of respondents in clusters 1-3 are in the age range of 31-40 years. In clusters 1 and 2, respondents in the age range of 31-40 years reached more than 35% of the total respondents in the two clusters. In clusters 1 and 3, the second age range is between 21-30 years, while in cluster 2, the second age range is between 41-50 years. Different things are found in cluster 4, where the majority of respondents in this cluster are in the age range of 41-50 years, and the second age range is between 31-40 years.

There is almost no difference in the composition of work in each cluster. Most of the respondents in each cluster work as private employees. The majority of respondents in cluster 1 are grouped in others for their occupation because most respondents are housewives. Likewise, in each cluster’s second and third ranks, the second most jobs are as entrepreneurs and government officers.

A striking difference is seen in the characteristics of consumer education. In clusters 1 and 3, the majority of respondents have education equivalent to high school. While in cluster 2, the majority of respondents have a bachelor’s degree education. In cluster 4, the education level of high school and bachelor degrees has the same composition. In addition, it can also be seen that respondents with postgraduate education are mostly in cluster 2. This can show that the higher the education, the higher the consumer’s assessment of the importance of mango quality attributes.

Differences are also seen in the characteristics of consumer income. The majority of consumers in cluster 1 have an income between IDR 2.6-5 million per month. While the majority of consumers in cluster 2 have an income between IDR 5.1-7.5 million per month, followed by consumers who earn IDR 7.6-10 million per month. It can also show that the higher the income of consumers, their assessment of the importance of product attributes will be higher.

Although the majority of respondents are average respondents who give average importance to each attribute, it does not mean that consumers in other clusters are not important. The characteristics of consumers in cluster 2 indicate that they may be willing to pay more for mangoes that have the attributes they want. It is not impossible that in the future, the number of respondents who fall into the cluster 2 category will increase, along with the increase in income and people’s purchasing power. The Covid-19 situation that occurred at the time the research was conducted also did not seem to have much effect on the respondents’ assessment of various characteristics. Although this still needs to be tested further.
4. Conclusions
Based on the survey results, it can be concluded that mango consumers in the Indonesian domestic market can be divided into several groups with different preferences, which is indicated by how they assess the importance of a quality attribute. In general, characteristics of respondents, education and income can affect the respondents’ assessment of the importance of a product attribute. This study is still assessing the quality attributes individually. In fact, a product will consist of various kinds of inherent attributes, where the presence of other attributes in the product will also affect consumer preferences and perceptions. In the future, it is necessary to conduct research on how consumers perceive mango quality by considering the combination of inherent quality attributes.

The difference in the level of importance given by consumers in various clusters shows that mangoes produced and sold in the Indonesian domestic market need to have specifications that can meet the demands of domestic consumers. Only one cluster has low concern for the importance of mango quality attributes. Other clusters have given a high level of importance to quality attributes. This result shows that the Indonesian mango industry needs to also improve the quality for the domestic market, in addition to improving the quality for export. This can be done either by strengthening the position of key actor such as farmers and traders at various levels, or increasing support from supporting actors such as the government.

Acknowledgement
The authors would like to thank the agricultural extension workers in DKI Jakarta Province, who assisted in the data collection process.

References
[1] Evans E A, Ballen F H and Siddiq M 2017 Mango Production, Global Trade, Consumption
Trends, and Postharvest Processing and Nutrition Handbook of Mango Fruit: Production, Postharvest Science, Processing Technology and Nutrition ed M Siddiq, J K Brecht and J S Sidhu (John Wiley & Sons Ltd) pp 1–16

[2] Indonesian Statistics 2020 The Indonesian production of Fruits 2019 (Jakarta: Indonesian Statistics)

[3] Qanti S R, Reardon T and Iswariyadi A 2017 Triangle of linkages among modernising markets, sprayer–traders, and mango-farming intensification in Indonesia Bull. Indones. Econ. Stud. 53 187–208

[4] Arifin B 2013 On the competitiveness and sustainability of the Indonesian agricultural export commodities ASEAN J. Econ. Manag. Account. 1 81–100

[5] Reardon T, Stringer R, Timmer C P P, Minot N and Daryanto A 2015 Transformation of the Indonesian agrifood system and the future beyond rice: a special Issue Bull. Indones. Econ. Stud. 51 369–73

[6] Rastogi V, Tamboto E, Tong D and Sinburimsit T 2013 Asia’s Next Big Opportunity Indonesia’s Rising Middle-Class and Affluent Consumers (Boston: The Boston Consulting Group)

[7] Natawidjaja R S, Rum I A, Sulistyowati L and Saidah Z 2014 Improving the participation of smallholder mango farmers in modern retail channels in Indonesia Int. Rev. Retail. Distrib. Consum. Res. 24 564–80

[8] Rasmikayati E, Wibawa G, Andriani R, Fatimah S and Saefudin B R 2018 Study of potential and constraints in mango farming and marketing in Indramayu District Sosiohumaniora 20 215–21

[9] Ruswandi A 2017 Economic value of fruit flies control on gedong gincu mango: case study at Jembar Wangi Village Tomo Subdistrict, Sumedang CR J. 3 25–36

[10] Kusumo R A B, Rasmikayati E, Mukti G W, Fatimah S and Saefudin B R 2018 Factors affecting mango farmers decision in using off seasin technology in Cirebon Regency Mimb. Agribisnis 4 57–69

[11] Yaseen A, Mehdi M, Simon S, Burhan A, Somogyi S and Ahmad B 2016 Consumer preferences to pay a price premium for quality attributes in Pakistani grown mangoes Pakistan J. Commer. Soc. Sci. 10 615–37

[12] Badar H, Ariyawardana A and Collins R 2015 Capturing consumer preferences for value chain improvements in the mango industry of Pakistan Int. Food Agribus. Manag. Rev. 18 131–48

[13] Trieneckens J, Wognum P M, Beulens A J M and Van Der Vorst J G A J 2012 Transparency in complex dynamic food supply chains Adv. Eng. Informatics 26 55–65

[14] Ares G and Gámbaro A 2008 Food choice and food consumption frequency for Uruguayan consumers Int. J. Food Sci. Nutr. 59 211–23

[15] Macharia J, Collins R and Sun T 2013 Value-based consumer segmentation: the key to sustainable agri-food chains Br. Food J. 115 1313–28

[16] Adhikari R P, Collins R and Sun X 2012 Segmenting consumers to inform agrifood value chain development in Nepal Int. Food Agribus. Manag. Rev. 15 93–114

[17] Pamulaparty L, Rao C and Rao M 2016 Cluster analysis of medical research data using R Glob. J. Comput. Sci. Technol. 16