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Sensory Evaluation of Mangoes Grown in Aceh Tamiang District, Aceh, Indonesia

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Abstract: The colour, flavour, and taste of fruit products are factors critical to consumer acceptance and the success of these products. The aim of this study was to evaluate the sensory characteristics of five mangoes grown in Aceh Tamiang region. The sensorial evaluation of mangoes was conducted by using a 9 points hedonic scale. One hundred panelists were selected on the basis of their ability to discriminate and scale a broad range of different attributes. Flavour characteristics of *Mangifera odorata* collected from all region were found to be superior among colour and taste. However, this species was rated inferior for other sensory attributes (colour, taste, and overall acceptability). Mangifera indica was recorded for maximum taste, flavour and overall acceptance score.

Key words: Sensory characters, Mangifera, Aceh Tamiang, Aceh

1. Introduction

Mango is one of Indonesia's leading fruit commodities. The annual production of mango fruit plants in 2017 about 2.2 million tons increased by 21.4% for the period 2016-2017 (BPS, 2018). This caused Indonesia to become a producer of mangoes in the world. Nevertheless, Indonesia has only been able to export mangoes approximately 719.3 tons annually (BPS, 2018). This is caused by the low quality of the mangoes produced. The drop in export potential can be ascribed to a number of reasons like quality, supply chain, lack of

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infrastructure, low yields, cargo space, inland transport, processing and packing, weak marketing, ruthless competition and standardization (Akhtar *et al.*, 2009).

The mango species cultivated in Indonesia are still limited to *M. indica*. In fact, Indonesia with its tropical climate has the potential to cultivate various other local mango species as superior commodities. The limited information regarding consumer perceptions of local mangoes is an obstacle to the development of local fruits in Indonesia. Perception of sensory quality and nutritional value on fruit has an important role in consumer satisfaction (Gadze *et al.*, 2011). Fruit sensory analysis by panelist is useful methods in evaluating fruit quality (Colaric *et al*., 2005). Sensory quality is understood as the interaction between products and consumers. This is needed to build a relationship between the physical and chemical composition of a product and its sensory attributes such as color, texture, aroma (volatile compounds) and taste (sweet, sour, salty and bitter sensations), and between sensory perception and acceptance for consumers (Escribano *et al*., 2010). Taste, aroma, texture, and appearance are generally considered to be one of the most important sensory attributes. The aim of this study was to evaluate the sensory characteristics of five mangoes grown in Aceh Tamiang region.

2. Methods

This study was conducted in Aceh Tamiang District consisting of three sub-district, i.e. Sekerak, Manyak Payed, and Karang Baru on Juni – August 2018.

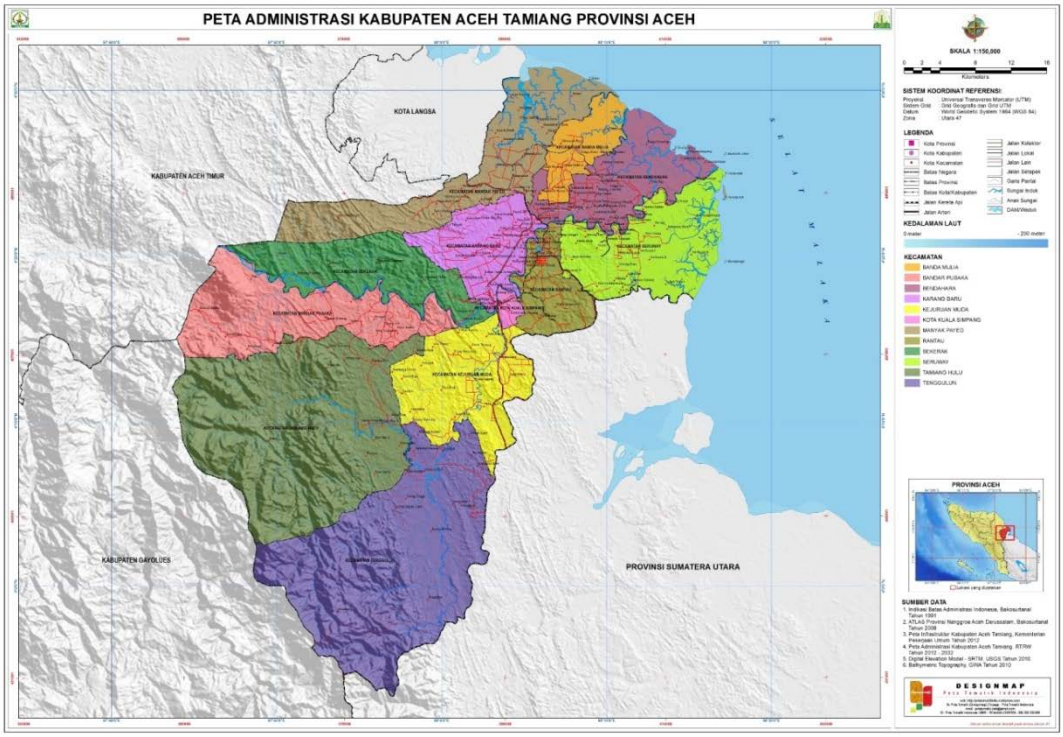

Figure 1. Study site for collect data

The sensorial evaluation of various mango was performed by using 9 points hedonic scale as described by Larmond (1977). One hundred twenty panelists from three sub-district were selected on the basis of their ability to discriminate and scale a broad range of different attributes. The judges randomly tested the colour, flavour, taste and overall acceptability in five mango samples. The judges were provided with prescribed questionnaires to record their observation. The information contained on the performance was 9 = Like extremely; 8 = Like very much; 7 = Like moderately; 6 = Like slightly; 5 = Neither like nor dislike; 4 = Dislike slightly; 3 = Dislike moderately; 2 = Dislike very much; 1 = Dislike extremely.

Statistical analysis

The recorded data were subjected to two-way analysis of variance (ANOVA) to assess the effect of variety and region on sensory profile of mangoes as described by Steel *et al*., (1996). Duncan's Multiple Range Test was applied to assess significant statistical differences between means at 5% level of probability.

3. Results and Discussions

Sensorial evaluation of various mango showed that the level of panelist acceptance of color, flavor, and taste in each study location varied. The scores for a various sensory attribute of five species mango in relation to their regions of production showed in Table 1.

Table 1. Sensory profile of various mango grown in three major areas of Aceh Tamiang

Sites	Species	Sensory characteristics			
		Colour	Taste	Flavour	Acceptability
Sekrak	*Mangifera indica*	8.00 ± 0.08^{b}	8.32 ± 0.16^{c}	8.20 ± 0.16^{c}	8.00 ± 0.10^{c}
	Mangifera odorata	7.12 ± 0.10^{a}	8.15 ± 0.14^{c}	8.22 ± 0.12^{c}	8.04 ± 0.12^{c}
	Mangifera foetida	7.05 ± 0.09^{a}	7.33 ± 0.14^{b}	7.00 ± 0.14^{b}	7.02 ± 0.14^{b}
	Mangifera sumatrana	7.00 ± 0.08^{a}	6.26 ± 0.10^{a}	6.32 ± 0.11^{a}	6.81 ± 0.10^{a}
	Mangifera laurina	7.02 ± 0.09^{a}	7.35 ± 0.12^{b}	7.63 ± 0.10^{b}	7.66 ± 0.13^{b}
Manyak Payed	*Mangifera indica*	8.30 ± 0.07^{b}	8.22 ± 0.06^{c}	8.20 ± 0.10^{b}	8.30 ± 0.12^{b}
	Mangifera odorata	8.07 ± 0.11^{b}	8.15 ± 0.04^{c}	8.18 ± 0.12^{b}	8.10 ± 0.14^{b}
	Mangifera foetida	8.07 ± 0.12^{b}	7.13 ± 0.04^{b}	7.23 ± 0.14^{a}	7.06 ± 0.10^{a}
	Mangifera sumatrana	7.00 ± 0.08^{a}	6.21 ± 0.10^{a}	7.11 ± 0.11^{a}	7.82 ± 0.10^{a}
	Mangifera laurina	7.22 ± 0.08^{a}	7.05 ± 0.10^{b}	7.33 ± 0.10^{a}	7.24 ± 0.12^{a}
Karang Baru	*Mangifera indica*	8.20 ± 0.07^{c}	8.30 ± 0.06	8.00 ± 0.10^{c}	8.10 ± 0.10^{b}
	Mangifera odorata	8.03 ± 0.11^{bc}	8.12 ± 0.04	8.38 ± 0.12^{c}	8.00 ± 0.12^{b}
	Mangifera foetida	8.13 ± 0.11^{c}	8.13 ± 0.02	7.30 ± 0.10^{b}	7.26 ± 0.10^{a}
	Mangifera sumatrana	7.00 ± 0.09^{a}	6.88 ± 0.08	6.81 ± 0.11^{a}	7.30 ± 0.10^{a}
	Mangifera laurina	7.83 ± 0.12^{b}	8.08 ± 0.10	7.24 ± 0.10^{b}	7.16 ± 0.12^{a}

Means sharing similar superscript a-d are statistically non-significant at 5% level of probability

Colour: Visual examination by the consumers is of significant importance that constitutes the fitness of any food for consumption and the fruit's colour is one of the important quality parameters (Akhtar *et al.*, 2009). Panelists rated mangoes of *Mangifera odorata* to be the best among the tested varieties for colour followed by *Mangifera indica*. Relatively lower scores were assigned to varieties *Mangifera laurina.* The changes in peel colour occur during ripening of the mangoes from green to yellow (Satyan *et al*., 1986). No significant difference for colour scores could be observed when the regions were pooled irrespective of the species. Aina and Oladunjoye (1993) reported that colour changes in mangoes are primarily associated with several biochemical changes, both degradation, and synthesis of various classes of molecules including carotenoids in fruit. The mangoes collected from different production sites were not exactly at the similar ripening stage thus may vary in colour and other sensory characteristics.

Flavour: Flavour is the sensory impression of a food or other substance and is mainly determined by the chemical senses of taste and smell (Akhtar *et al.,* 2009). The overall flavour impression is the result of the aromatic compounds detected by the epithelium in the olfactory organ in the nose and the tastes perceived by the taste buds in the mouth (Akhtar *et al.*, 2009). *Mangifera odorata* seemed to be highly acceptable for flavour since the scores assigned to this species were the highest as compared to four species (*M. indica, M. foetida, M. Sumatrana, M. laurina*). Sensory traits are not generally interrelated and contribute independently towards the overall sensory perception of the fruits (Akhtar *et al.*, 2009). Changes in mango flavour also known could not be ascribed to any single component (Engel and Tressl, 1983) since various components (*cis-ocimene* and *β-myrecene*) contribute to the typical green aroma of unripe mango (Gholap and Bandyopadhyay, 1975). Transformational changes in fatty acid profile especially from palmitic acid to palmitoleic acid of mango during ripening may be correlated with the changes in aroma and flavour characteristics (Gholap and Bandyopadhyay, 1975). The length of time the fruit is stored is also reported can affect in ripe fruit characteristics and flavour intensity (Macrae *et al*., 1989).

Taste: Organic acid and sugars ratio primarily creates a sense of taste which is perceived by specialized taste buds on the tongue (Akhtar *et al.*, 2009). The sweetness of many fruits is influenced by the sugar and sourness from organic acids in the fruit (Kays, 1991). The score presented in Tabel 1 for a taste of various mango clearly indicated that the *M. indica* was perceived to be the best for taste among all the species under experimentation. *M. odorata* and *M. laurina* did not indicate any significant difference for taste while the panelist assigned the lowest scores for taste to the *M. sumatrana*. Mangoes from Sekrak were rated to be inferior in quality as far as taste was concerned when evaluated across the species. Mangoes representing *M. indica* collected from Sekrak were assigned the highest score for taste while the fruit of *M. sumatrana* collected from all three locations were least accepted by the panel members. Sugar and acids are a primary taste compounds, enhance the human

perception of specific flavour notes in mango, including aroma, but pH, acidity and TSS are also related well to sourness and astringency (Malundo *et al*., 2001). Abbasi *et al.*, (2009) attributed the change in the taste mango to storage time and reported that the taste score of mango increased from 3.54 to 8.42 after four weeks of storage.

Overall acceptability: In this study, two species, *M. indica* and *M. odorata*, were equally acceptable to the panelists. The degree of ripeness at which fruit is tested plays a major role in the assessment of its sensory qualities and acceptability (Mtebe *et al*., 2006). A number of biochemical reactions or metabolic activities are known to be involved in the ripening process of mango fruit such as increased respiration, ethylene production, change in structural polysaccharides causing softening, degradation of chlorophyll and synthesis of carotenoids, changes in carbohydrates or starch conversion into sugars, organic acids, lipids, phenolics and a number of volatile compounds (Akhtar *et al.*, 2009). All these changes lead to the ripening of fruit with softening of texture to acceptable quality. These factors predominantly contribute to developing a total sensory profile of the mango fruit (Herianus *et al*., 2003).

Flavour, volatiles, texture and chemical constituents are some of the key components that contribute to the production and acceptance of high-quality fresh mango by the consumer (Mamiro *et al*., 2007). Sensory profile of the mangoes especially colour has a great impact on consumers decision to buy a fruit or its products (Gössinger *et al*., 2008). The reception of the color, taste, and taste of the fruit by the panelist is very important to increase the potential of local fruit imports.

M. odorata has the potential to be made a superior fruit. The results of the sensory analysis showed that in general the level of panelist acceptance of *M. odorata* fruit on taste, color, and flavor was similar to *M. indica* fruit. In the mango season, *M. odorata* is marketed in traditional markets around the Aceh Tamiang district. Interviews with the local people in this study site showed that they consumed *M. odorata* because of its sweet and fragrant taste.

4. Conclusions

Flavour characteristics of *Mangifera odorata* collected from all region were found to be superior among colour and taste. However, this species was rated inferior for other sensory attributes (colour, taste, and overall acceptability). *Mangifera indica* was recorded for maximum taste, flavour and overall acceptance score.

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References

[1]. Abbasi, N.A., I. Zafar, M. Maqbool, and I.A. Hafiz .2009. Postharvest quality of mango (*Mangifera indica* L.) fruit as affected by chitosan coating. *Pakistan Journal of Botany*, 41(1): 343-357.

[2]. Aina, J.O. and O.O. Oladunjoye. 1993. Respiration, proteolytic activity and textural changes in ripening African Mango (*Irvingia gobenesis*) fruit. *Journal of Science o f Food and Agriculture*, 63: 451-454.

[3]. Akhtar, S., S. Mahmood, S Naz, M. Nasir and M. T. Saultan. 2009. Sensory evaluation of mangoes (*Mangifera indica* L.) grown in different regions of Pakistan. *Pak. J. Bot*., 41(6): 2821-2829

[4]. BPS. 2018. Statistics of annual fruit and vegetable plants Indonesia 2017. Jakarta: BPS-Statistics Indonesia.

[5]. Colaric M., R. Veberic, F Štampar, M Hudina. 2005. Evaluation of peach and nectarine fruit quality and correlations between sensory and chemical attributes. *Journal of the Science of Food and Agriculture* 85: 2611-2616

[6]. Escribano S., FJ Sanchez, A Lazaro. 2010. Establishment of a sensory characterization protocol for melon (*Cucumis melo* L.) and its correlation with physical-chemical attributes: indications for future genetic improvements. *Eur Food Res Technol*, 231: 611-621

[7]. Engel, K.H. and R. Tressl. 1983. Studies on the volatile components of two mango varieties. *Journal of Agricultural Food Chemistry*, 31: 796-801.

[8]. Gadže J, M Prlic, M Bulic, M Leko, M Barbaric, D Vego, M Raguž. 2011. Physical and chemical characteristics and sensory evaluation of pomegranate fruit of (*Punica granatum* L.) cv. ”Glavaš”. *Pomologia Croatica* 17: 87-97.

[9]. Gholap, A.S. and C. Bandyopadhyay. 1975. Comparative assessment of aromatic principles of ripe Alphonso and Langra Mango. *Journal of Food Science and Technology*, 12: 262-263.

[10]. Gössinger, M., F. Mayer, N. Radocha, M. Höfler, A. Boner, E. Groll, E. Nosko, R. Bauer and E. Berghofer. 2008. Consumer’s colour acceptance of strawberry nectars from puree. *Journal of Sensory Studies*, 24:78-92.

[11]. Herianus, J.D., L.Z. Singh and S.C. Tan. 2003. Aroma volatiles production during fruit ripening of 'Kensington Pride’ mango. *Post Harvest Biol. Tec*., 27: 323-336.

[12]. Kays, S.J. 1991. *Post harvest physiology of perishable plant products*; Vas Nostrand Rein Hold Book, AVI Publishing Co, pp. 149-316.

[13]. Larmond, E. 1977. *Laboratory methods of sensory evaluation of foods*. Publication 1673. Canada Deptt. of Agric Ottawa.

[14]. Macrae, E.A., J.H. Bowen and M.G.H. Stec. 1989. Maturation of Kiwi fruit (*Actinidia Deliclosa* Cv. *Hayward*) from two orchards; Differences in composition of the tissue zones. *Journal of Science of Food and Agriculture*, 47: 401-416.

[15]. Malundo, T.M.M., R.L. Shewfelt, G.O. Ware and E.A. Baldwin. 2001. Sugars and acids influence flavour properties of mango (*Mangifera indica*). *Journal of American Society of Horticultural Sciences*, 126: 115-121.

[16]. Mamiro, P., L. Fweja, B. Chove, J. Kinabo, V. George and K. Mtebe. 2007. Physical and chemical characteristics of off vine ripened mango (*Mangifera indica* L.) fruit (Dodo). *African Journal of Biotechnology*, 6: 2477-2483.

[17]. Mtebe, K., P. Mamiro and L. Fweja. 2006. Sensory attributes, microbial quality and aroma profiles of off vine ripened mango (*Mangifera indica* L.) fruit. *African Journal of Biotechnology*, 5:201-205.

[18]. Satyan, S.H., G.R. Chaplin and M.E. Willcox. 1986. An assessment of fruit quality of various mango cultivars. *Proceedings of First Australian Mango Workshop, Queensland*, 324-333.