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Organoleptic Evaluation and Determination of Watermelon (*Citrullus lanatus*) Quality Based on Flesh Samples Between Post-Harvest Day 4 and Post-Harvest Day 8

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Consumer demands for fresh fruit with enhanced health-promoting properties. Fruit qualities are usually evaluated by organoleptic properties; colour, odour, taste, touch, and texture. The initial sight of fruit is the first fruit evaluation made by consumers. However, this physical appearance does not represent fruit taste. Fruit organoleptic evaluation differs daily due to chemical changes happen during the ripening process which alters fruits' physiology. Thus, this study aims to evaluate and determine the organoleptic properties of watermelon (*Citrullus lanatus*) between post-harvest day 4 and day 8. Watermelon flesh was cut into small portions and served fresh to 38 respondents on post-harvest days 4 and 8. The flesh quality was then evaluated based on the fruit's aroma, colour and taste. The Wilcoxon signed rank test was used to analyse the data. By comparing the data from two consecutive days, the study showed that organoleptic evaluations of watermelon were significantly different in taste (post-harvest day 4; p=0.000) and colour (post-harvest day 8; p=0.002). However, no significant differences were observed in aroma (p=0.109). Organoleptic responses showed that watermelon on post-harvest day 4 has the best quality and most appealing taste compared to watermelon on post-harvest day 8.

Keywords: Watermelon; post-harvest; organoleptic evaluation

I. INTRODUCTION

Watermelon is a member of the cucurbit family (*Cucurbitaceae*) (Saad *et al.,* 2020) and scientifically known as *Citrullus lanatus,* a tropical fruit popular among Malaysians and around the world. In modern cultures, watermelon is consumed for its pleasant flavour, aromatic aroma, sweet taste, appealing texture, and applied in the food and pharmaceutical industries (Wen *et al.,* 2019).

According to the United States Department of Agriculture (USDA, 2012), matured watermelon contains high moisture content with 91% of the fruit's edible weight portion and may increase up to 93% upon ripening. Watermelon is an excellent source of dietary fibre and essential minerals including manganese, calcium, potassium, folate, and vitamins (C, B6, K, and A) (Alam *et al.,* 2013). Watermelon also serves as a source of phytochemical and antioxidant properties that are able to scavenge free radicals and protect cells against cancer (Wen *et al.,* 2020). Typically a watermelon weighs from 1.5 to 15 kilogrammes and is elongated, oval or round. Hannah and Krishnakumari supported that an average watermelon contains about 30% peel (also known as rind), 68% flesh and 2% seed (Angeline & Krishnakumari., 2015). Watermelon thrives more within the tropical regions and luxuriates in

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worldwide popularity for its aesthetic tastes and nutritional compositions (Souad *et al*., 2012).

In order to achieve the best flavour and texture of watermelon consumed, the fruit should be harvested in the optimal maturity period; approximately 65 to 75 days after planting (Devi *et al.,* 2020). Matured watermelon has firm, symmetrical, fresh, and attractive waxy surface peel features (Kyriacou *et al.,* 2018). In addition, matured watermelon composed of sucrose and glucose range from 20 to 40% of total sugars, while the proportion of fructose ranges from 30 to 50% that contributes for watermelon sweetness. The total sugar content in watermelon indirectly reflects watermelon's aroma. However, these sensorial evaluations of mature watermelon might change daily due to the chemical changes that happened during the fruit's ripening process and post-harvesting storage.

Recently, the consumer has shown great interest in fresh fruit with improved health-promoting properties. The purchase of fresh fruit is usually determined by the physical quality of the fruit (Abdipour *et al.,* 2019). The physical quality of fruit is commonly evaluated using organoleptic properties of colour, features, taste, touch, and smell (Hasani *et al.,* 2018). The sensation perceived by sensory organs (touch, sight, hearing, smell, and taste) while consuming fruit are referred to as organoleptic properties (Saliba-Colombani *et al.,* 2001).

Therefore, this study aims to evaluate the quality of organoleptic watermelon flesh by examining three major parameters comprising of aroma, colour and taste. The organoleptic evaluation was carried out on two respective days; post-harvest day 4 and day 8 by the panellists.

II. MATERIALS AND METHOD

A. Sample Collection and Storage

Ten watermelons ranging from 2.0 to 3.0 kg (*Citrullus lanatus*) were obtained from Selangor Fruit Valley, Selangor, Malaysia. Watermelons collection was carried out in the morning. The fruit was selected with the similarity of size, maturity indication and colour. The damaged and unshaped fruit were removed from the sampling. Watermelons were identified by Forest Research Institute Malaysia (FRIM) with reference no. FRIM394/490/5/17(650). Watermelon samples were kept in a dry place at 25°C prior analysis.

B. Sample Preparation

The watermelons were washed and wiped with tissue paper. The watermelons were then peeled and their flesh cut into small portions of 15 g each. Watermelons flesh was prepared aseptically in clean and transparent disposable closed containers. Small portions of watermelons flesh was then served fresh to the panellists on two respective days; post-harvest day 4 and post-harvest day 8. During sample testing, panels were allowed to clean their mouths at time intervals with the provided plain water.

C. Organoleptic Evaluation

A 7-point organoleptic evaluation parameters for the acceptance of watermelon fleshes on post-harvest day 4 and day 8 were conducted with 38 panels from the Centre of Medical Laboratory Technology, Universiti Teknologi MARA (UiTM) Selangor Branch, Puncak Alam Campus (Ali, 2015). Of the panellists, 11 were men and 27 were women, with an age range of 18-24 years. The flesh quality was then evaluated based by the sensory characteristics of colour, taste and aroma by the evaluation scale of 1: devilish, 2: bad, 3: a little bad, 4: neither good nor bad, 5: a little good, 6: good, 7: excellent (Aberoum., 2015). The project was approved by the ethics commitee with reference no. REC/09/2020(MR231).

D. Statistical Analysis

The results of the organoleptic evaluation were presented as the mean score and analysed using the statistical package (spss) version 25.0. A non-parametric test (The Wilcoxon signed ranks test) was used to analyse the obtained data since the normality data were not normally distributed. The score difference was considered as significant if the p value was less than 0.05 ($p<0.05$).

III. RESULT AND DISCUSSION

The 7-point scale rating for the organoleptic evaluation of watermelon flesh on post-harvest day 4 and post-harvest day 8 was calculated for all panels and tabulated in Table 1. Watermelon taste on post-harvest day 4 has the highest rate (34 panels) and post-harvest day 8 has the attempt at colour with the highest vote (33 panels). This result showed that watermelon on post-harvest day 4 has an appealing taste compared to post-harvest day 8.

Table 1. The rating for the organoleptic evaluation of the watermelon flesh sample by the panellists

Range Score	Number of panels					
	Colour		Taste		Aroma	
	Day 4	Day 8	Day 4	Day 8	Day 4	Day 8
Excellent	23	33	34	17	15	20
Good	13	4	4	17	17	15
A little good	2	1	0	3	6	3
Neither good nor bad	0	0	0	1	0	0
A little bad	0	0	0	0	0	0
Bad	0	0	0	0	0	0
Devilish	0	0	0	0	0	0

The mean and standard deviation for the organoleptic properties of aroma, colour, and taste in two respective days are tabulated in Table 2. Watermelon on post-harvest day 4 has the highest mean acceptance for taste (6.8947±0.3110) followed by colour (6.5526±0.6017) and aroma (6.2368±0.7141). Meanwhile, watermelon on day 8 post-harvest has the highest mean acceptance for colour (6.8421±0.4366) followed by aroma (6.4878±0.6450) and taste (6.3158±0.7391). The statistical comparisons for the organoleptic evaluation of watermelon flesh between two respective days are tabulated in Table 3. Watermelon were significantly different in taste (post-harvest day 4; p=0.000) and colour (post-harvest day 8; p=0.002) when the two consecutive days were compared in the study. However, no significant differences were observed in aroma, with p=0.109 between post-harvest day 4 and day 8.

Table 2. The mean and standard deviation for the pannelists' evaluations of watermelon flesh

Organoleptic evaluation		Mean	Standard Deviation
Aroma	Day 4	6.2368	0.7141
	Day 8	6.4878	0.6450
Colour	Day 4	6.5526	0.6017
	Day 8	6.8421	0.4366
Taste	Day 4	6.8947	0.3110
	Day 8	6.3158	0.7391

Table 3. The statistical comparison of watermelon samples between post-harvest day 4 and day 8

Organoleptic evaluation	Z value	Sig. (2-tailed)
Aroma	-1.602	0.109
Colour	-3.051	0.002
Taste	-4.030	0.000

The result obtained shows that watermelon has a sweeter taste on post-harvest day 4 and that it declines on post-harvest day 8. This may be due to the reduction in total sugar and soluble solid content that occur during post-harvest storage. A study by Yau *et al.* (2010) showed that watermelon contains a high amount of fructose content is in excellent condition since the degree of sweetness of fructose is 1.5 to 2.0 times higher than sucrose. However, the optimal level for fructose content in fruit is only during the first week of the post-harvesting period and declines after day 8 (Saad *et al.,* 2020). The study by Miguel *et al.* (2008) added that the soluble solid content of fruit was mostly affected by the storage period and to a lesser extent by cultivar. A study reported the soluble solid content of watermelon declines after day 7 at 20°C and after day 14 at 23°C due to prolonged post-harvest storage (Miguel *et al.,* 2008). Hence, the reduction of these fructose and soluble solid content during post-harvest storage contributed significantly to the organoleptic evaluation of watermelon taste.

Watermelon flesh colour is an important quality trait that is primarily determined by the synthesis and accumulation of carotenoid (lycopene) in chromoplast during ripening process (Soteriou *et al.,* 2014). Lycopene, a red pigment

carotenoid, is responsible and is found in greater quantities in watermelon than tomatoes (Soteriou *et al.,* 2014). The result for the organoleptic evaluation of colour showed a significant difference between post-harvest day 4 and day 8. This might be due to increased colour intensity as well as increased lycopene content during post-harvesting storage (Sabeetha *et al.,* 2017). A study by Khairi *et al.* (2018) supported that lycopene synthesis increased until post-harvest day 8 and starts to decline on day 9. This is in line with the study performed by Perkins-Veazie & Collins (2006) who showed that watermelon colour intensity increases by up to 40% on day 10 of storage compared to fresh watermelon. Thus, this study showed that post-harvest day 8 watermelon has a more intense red colour compared to post-harvest day 4 due to lycopene synthesis that occured during fruit storage.

Watermelon was wellknown with its crisp texture and aroma. However, this study showed that there is no significant differences observed on watermelon's aroma between the two respective days. Aroma of watermelons is mainly influenced by nonenol/nonenal and their derivatives that are easy to be oxidised or etherified (Shi *et al.,* 2020). The aroma may deteriorates once watermelons are cut. However, study also supported that the exposure of visible light may inactivating the related enzymes and delaying aroma deterioration (Shi *et. al.,* 2020; Yan *et al.,* 2020).

IV. CONCLUSION

The organoleptic evaluation and determination of watermelon quality based on flesh samples were successfully determined by the evaluation of aroma, colour and taste by 38 panelists. The study's finding revealed that watermelon taste (post-harvest day 4; p=0.000) and colour (post-harvest day 8; p=0.002) differed significantly between the two consecutive days. However, no significant differences were observed in the aroma, with p=0.109. The study showed that consumers are more likely to be attracted with watermelon's taste and colour intensity at post-harvest day 4 than day 8.

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