Fatty Acid Composition and Organoleptic Quality of Four Clones of Durian (*Durio zibethinus*, Murr.)

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ABSTRACT

This study was undertaken to determine and relate the lipid content and fatty acid composition of four different durian (*Durio zibethinus*, Murr.) clones, i.e., D_{24}, D_2, D_{66} and D_8, with their respective organoleptic scores. Both lipid content and the fatty acid composition were found to vary among these clones. Clones D_{24} and D_2, which contained a higher proportion of lipids but lower unsaturated fatty acid contents, received high organoleptic scores when compared to clones D_{66} and D_8. It was found that the lower the palmitic:palmitoleic acid ratio in the lipid of a durian clone, the higher its organoleptic quality.

INTRODUCTION

Durian (*Durio zibethinus*, Murr.) is a delicious and highly prized fruit in Southeast Asia. A full description of the fruit and its proximate analyses have been reviewed by Stanton (1). The edible portion (aril) emanates a very strong odor much appreciated by the people of this region but nauseating to a foreigner. The delicate flavor of the fruit has been attributed to thiols/thioethers and esters of relatively low molecular weight (2). The mature fruits, after detaching from the tree, are often allowed to develop their full flavor by storing at room temperature for 1-4 days. Further storage causes a rapid loss of flavor due to unknown chemical changes that follow. The fruit is customarily consumed in open places to derive the full benefit of its delicate flavor. The idea, perhaps, is to release the strongly odorous volatiles in the air, resulting a low odor intensity in the surroundings.

There are a number of durian varieties available in this region and each variety has its own characteristic flavor. Some of these varieties are preferred over others largely because the aril from these fruits is more creamy and has a delicate balance of flavor. Whether these differences are due to volatile or nonvolatile substances is unknown. In general, the index of flavor quality of fruits is correlated with their acid and sugar contents (3). Lipids, too, are known to contribute to the mouth-feel and to modify the taste and flavor of other compounds in foods (4). Furthermore, the chemical composition of the lipid is an important factor in determining the textural and rheological properties of high-fat foods. This may also apply to fruits—particularly those that contain relatively higher proportions of lipids.

Bandyopadhyay and Gholap (5) have found that the ratio between palmitic and palmitoleic acids correlates well with the aroma and flavor index of mangoes. Depending on whether this ratio is more or less than 1, the mango has a mild or strong aroma.

Durian aril contains lipids in the range of 4-5%, the fatty acid composition of which was reported recently (6). The results exhibited a variation in fatty acid composition in the two unclassified varieties (identified only as yellow or cream-colored) examined. This investigation reports the fatty acid composition of the aril of four different but known durian varieties, i.e., clones D_2, D_8, D_{24} and D_{66}. An attempt is made to establish a relationship between variations in lipid content and its fatty acid composition and differences in organoleptic quality of each variety.

EXPERIMENTAL

Materials

Durian fruits were obtained from Universiti Pertanian Malaysia farm. The fatty acid methyl ester reference standards were obtained through Sigma Chemical Co., St. Louis, MO. Sodium methoxide reagent (0.5 M) was purchased from Supelco, Inc., Bellefonte, PA. All other reagents used were of analytical grade.

Methods

Preparation and organoleptic evaluation of fruits. Fruits with fully developed flavor were cut open and the pulp separated from the seeds. The pulp from individual fruit was freeze-dried and stored in a desiccator until used.

The freshly opened fruits were evaluated for their taste and flavor quality. A panel of 6 members was selected from the staff of the Department of Food Science and Technology. The taste panel was asked to arrange the samples in the manner of most preferred to least preferred. The most preferred sample was assigned a score of 4 and the least preferred a score of 1. The experiment could not be replicated because of the lack of additional samples and the fact that after opening the fruit, the flavor of the aril alters very rapidly.

Extraction of lipids and analysis. Extraction of lipids and preparation of methyl esters of the lipid fatty acids were done as described previously (6). Two fruits from each clone were analyzed individually for their fat content.

Gas liquid chromatography. The fatty acid methyl esters were analyzed on a Pye-Unicam Series 204 gas chromatograph fitted with flame ionization detectors. A glass column (1.5 m × 4 mm, id) packed with 10% w/w diethylene glycol succinate on 100-120 mesh Diatomite CAW was operated at 190 C with nitrogen as carrier gas at a flow rate of 40 ml/min. The injection port and detector temperatures were maintained at 200 C.

Gas chromatograph peaks were identified by comparison with pure methyl esters through retention time relative to methyl heptadecanoate. The area percentage of each fatty acid ester peak was obtained on Hewlett-Packard 3380A integrator coupled to the gas chromatograph.

RESULTS AND DISCUSSION

Lipid Content and Fatty Acid Composition

The lipid content of arils of four different durian clones examined varied from 4 to 5% on fresh weight basis (Table I). Durian clones D_{24} and D_2 contained approximately the same amount of lipids. However, compared to D_{24}, the clones D_{66} and D_8 were lower in their lipid content by ca. 14 and 26%, respectively. The lipids in each durian clone were composed of similar types of fatty acids, but the fatty acid concentration was variable among the four clones. Lipids in clone D_{24} contained 2.7% linolenic acid, whereas lipids in clones D_2, D_{66} and D_8 comprised 4.1, 7 and 6% linolenic acid, respectively. The ratio between total saturated and unsaturated fatty acids in clones D_{24}, D_2, D_{66}

TABLE I

Lipid Content and Fatty Acid Composition of Four Durian Clones[a]

Property/clone	D_{24}	D_2	D_{66}	D_8
Lipid content (%)	5.1	5.2	3.8	4.2
Fatty acid composition (area %)				
14:0	0.5	0.5	0.8	0.5
15:0	Trace[b]	Trace	Trace	Trace
16:0	39.8	35.9	33.8	32.3
16:1	8.5	5.2	6.4	2.3
17:0	Trace	Trace	Trace	Trace
18:0	0.8	1.0	0.9	2.2
18:1	45.8	51.0	48.7	53.6
18:2	1.8	2.4	2.8	3.2
18:3	2.7	4.1	7.0	6.0

[a]Average of 4 determinations.
[b]Trace = <0.1%.

TABLE II

Organoleptic Evaluation and Fatty Acid Composition Data of Durian

Clone	Organoleptic score	Saturated:unsaturated fatty acid ratio	Palmitic:Palmitoleic acid ratio
D_{24}	4	1.4	4.7
D_2	3	1.7	6.9
D_{66}	2	1.8	5.3
D_8	1	1.9	13.9

and D_8 was found to be ca. 1.4, 1.7, 1.8 and 1.9, respectively. The palmitic and palmitoleic acid ratio in the lipids of these clones in the same order was ca. 4.7, 5.3, 6.9 and 13.9.

Organoleptic Evaluation

Clone D_{24} was preferred most by all the panel members and was assigned the highest score (Table II). There was some controversy over the flavor distinction between clones D_2 and D_{66}, but the majority of the tasters showed second preference for D_2. Clone D_8 was the least preferred by all the tasters.

Relationship between Organoleptic Score and Lipid Composition

Durian clone D_{24} was most preferred, probably because of its high content of fat, which contributes to the texture characteristics and influences the volatility of flavor components occurring in the fruit (4,7). Differences in organoleptic acceptance scores between D_{24} and D_2 could be attributed to differences in their fatty acid composition as one of the factors, since the chemical composition of lipids influences the organoleptic characteristics of fat-containing foods (4). Moreover, the sorption capacity of lipids increases with the number of double bonds in their fatty acid residues. A higher proportion of the volatile aroma substances (e.g., esters, thiols/thioethers) in the edible flesh of clone D_2 (2), therefore, could be bound by its lipids which are more unsaturated compared to those in clone D_{24}. This binding effect would raise the "threshold" value of the volatile aroma compounds, hence differences in overall acceptability of the two clones. Lipids in clones D_{66} and D_8 are much more unsaturated and consequently received lower organoleptic scores. The concentration of linolenic acid in the lipids of the four clones also appeared to influence the organoleptic acceptance score; the lower the linolenic acid content, the higher the score.

The palmitic:palmitoleic acid ratio was also found to have a close relationship with the taste panel score (Table II). The lower this ratio, the higher the organoleptic acceptance score. A similar relationship was observed by Bandyopadhyay and Gholap (5) for mangoes. But, these observations need to be further investigated with respect to the maturity and degree of ripeness of the various durian clones in relation to their flavor.

Certainly, these are not the only factors that govern flavor perception in durian; other constituents, such as carbohydrates, proteins, water and the total concentration of flavor constituents in the fruit also influence the organoleptic characteristics.

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