

Table 2. Color index, %Brix and reducing sugar and acidity of mangosteen in three maturity stages

Stage	L*	a*	b*	Brix (%)	Reducing Sugar Content (g/100g)	Titratable Acidity (%)	pH
2	35.39 ± 4.93 ^a	11.54 ± 3.51 ^a	22.75 ± 3.49 ^a	2.14 ± 0.54 ^c	5.07 × 10 ⁻⁶ ± 0.11 × 10 ⁻⁷ ^c	2.03 ± 0.41 ^a	3.49 ± 0.18 ^c
5	27.99 ± 2.07 ^c	9.03 ± 1.37 ^c	7.22 ± 2.94 ^c	4.54 ± 0.99 ^b	8.93 × 10 ⁻⁶ ± 0.11 × 10 ⁻⁷ ^b	1.27 ± 0.26 ^b	3.86 ± 0.18 ^b
6	31.09 ± 2.76 ^b	10.57 ± 1.59 ^b	12.59 ± 2.69 ^b	7.18 ± 0.82 ^a	10.70 × 10 ⁻⁶ ± 0.01 × 10 ⁻⁷ ^a	0.78 ± 0.21 ^c	4.34 ± 0.45 ^a

*Data collected are calculated in mean ± standard deviations. Different superscripts are indicating the data is significant at $p < 0.05$ by analysis of the Tukey HSD test

Brix and reducing sugar

Brix is usually used to measure the total soluble solids in the fruit, indicating the fruit's sweetness. Table 2 shows the %Brix value of different maturity stages for mangosteen and ranged from 2.14 - 7.18%. The %Brix values in mangosteen with maturity stage 6 were the highest (7.18%); whereas the %Brix values in mangosteen with maturity stage 2 had the lowest (2.14%).

The %brix value increased from maturity stage 2 to maturity stage 6. The results are supported by Castro et al. [28], which has the %brix value ranging from 15.2 - 19.1 due to the prolonged storage and maturation process. %Brix values increased from stage 2 to stage 6, because the accumulated starch in the mangosteen has been converted to sucrose during maturation [29].

Reducing sugar is one of the metrics for determining the maturity level of fruit. The maturity stage 6 mangosteen had the highest amount of reducing sugar content (10.70 × 10⁻⁶ g/100 g), and the maturity stage 2 had the lowest amount of reducing sugar content (5.07 × 10⁻⁶ g/100 g). The reducing sugar of mangosteen and increase from stage 2 to stage 6 (5.07 × 10⁻⁶ g/100 g) and (10.70 × 10⁻⁶ g/100 g), respectively. The reducing sugar increased as the maturity level increased, which indicates that the starch accumulated became hydrolyzed into glucose, fructose, and sucrose during the ripening progress [30].

Titratable acidity and pH value

Titratable acidity measured the total concentration of acid in the fruit, and pH values were used to measure hydrogen ionic concentrations in the solution, referred to as the degree of acidity or alkalinity [31]. Both pH and titratable acidity measure the number of organic acids in a fruit [32]. Maturity stage 2 mangosteen had the highest percentage of reducing sugar (2.03), followed by stage 5 mangosteen (1.27) and stage 6 mangosteen (0.78). The mangosteen's pH value of maturity stage 2, 5, and 6 ranged from 3.49 - 4.34. The highest pH of the mangosteen is the maturity stage 6 mangosteen with a value of 4.34. The lowest pH of the mangosteen is the maturity stage 2 mangosteens with a value of 3.49.

The amount of titratable acidity was decreased from 2.03% for stage 2 mangosteens to 0.78% for stage 6 mangosteen. A previous study showed that mangosteen's titratable acidity decreased from 0.74 of maturity stage 1 - 0.60 of maturity stage 4 [3]. The values of pH ranged from 3.49 - 4.34. This showed that an increase of pH corresponded to a decrease in titratable acidity as observed by Islam et al. [33]. The phenomenon was due to the organic acids used in respiration and conversion to sugars during the maturation process. The titratable acidity value was inversely proportional to the pH value. With lower titratable acidity and increases in the pH value at an