Relationship Between Descriptive Attributes and Flavor Volatiles in Five Varieties of Thai Rices

Aussama Soontrunnarudrungsri, Koushik Adhikari, Delores Chambers, and Kaycee Dragastin

Sensory Analysis Center, Department of Human Nutrition, Kansas State University, Manhattan, Kansas, 66506

Introduction

Aroma is considered as an important property of rice that indicates the high quality and price in the market (Paule and Powers 1989, Ishitani and Fushimi 1994). Several aroma attributes have been studied in cooked rice which correspond to different aroma compounds (Widjaja et al. 1996). The most important volatile compound that indicate aromatic and non-aromatic rice is 2-acetyl-1-pyrroline that contributes to a popcorn-like aroma (Petrov et al. 1996). Rice normally requires a fair amount of time to be delivered from the farm to the consumer which includes the time for aging that impacts cooking and eating quality (Tran et al. 2005). During storage, the quality of rice may change mainly because of the the post harvest conditions. The storage time is one of the factors that affects the rice sensory quality (Tamaki et al. 1993, Tran et al. 2005).

This study was aimed to investigate the relationships between descriptive attributes and flavor volatiles of six Thai rice samples using Partial Least Square (PLS) Regression. The impact of the analytical data on consumer acceptability was also determined.

Material and Method

Samples:

• Five varieties of Thai rice samples were obtained from Rice Research Institute, Thailand including two one-year old unscented samples (Chainart1 and Suphanburi1), three one-year old scented samples (Gor Kor15, Kao Dak Mali105, and Prathumtani1) and one new crop scented sample (Kao Dak Mali105).

Descriptive Sensory Evaluation:

• The six highly trained panelists from the Sensory Analysis Center, Kansas State University (Manhattan, KS) participated in this study.

• Panelists individually evaluated the sensory attributes of the samples that obtained form the orientation sessions by using a 0-15 range numerical scale with 0.5 increments ballots.

• The samples were presented with three-digit random numbers. One sample was served at a time with the randomized order with 3 repeated measurements. Samples were served (~1/4 cup of cooked rice at 85 C) in Styrofoam cups (8 oz.) covered with watch glass.

Consumer Test:

• The consumer testing session was conducted in Department of Product Development, Kasetsart University, Thailand using a 9-point hedonic scale for overall liking using 98 screened participants.

Flavor Volatiles:

• The method was adapted from Grimm *et al.* (J. Agric. Food Chem. 2001, *49*, 245-249).

• Flavor volatiles were adsorbed from the samples using a 23-gauge 50/30 DVB/CAR/PDMS solid-phase microextraction(SPME) fiber, and desorbed into a Gas Chromatograph (Varian 2200) coupled to a Mass Spectrometer (Varian 3800).

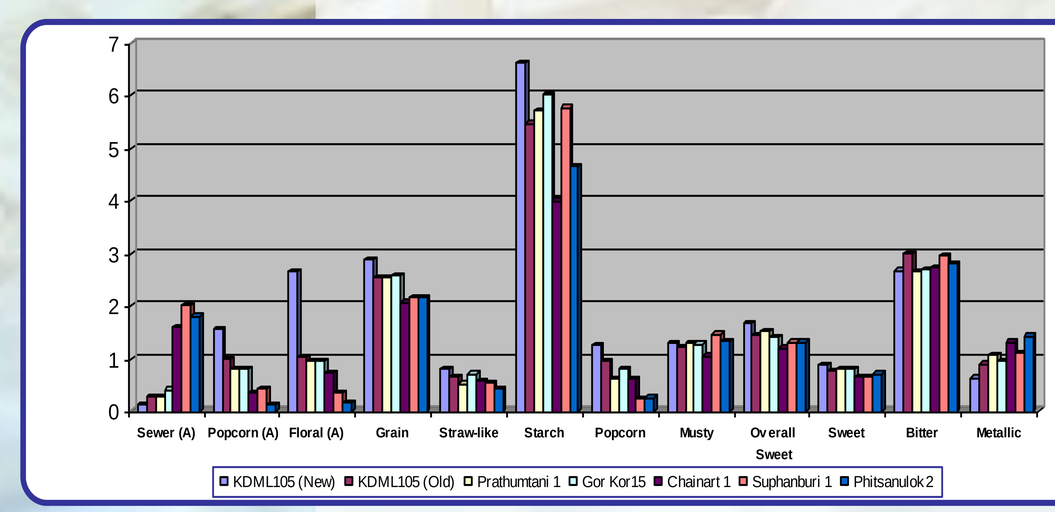
Statistical Analyses:

• Analysis of variance (repeated measures) procedure (Glimmix Procedure) using SAS® (Version 9.1, 2006, SAS Institute Inc., Cary, NC) was performed to determine the differences between samples for the measured attributes.

• Partial Least Squares Regression plots (PLS & L-PLS plots) were created by using The Unscrambler® 9.2, 2005, CAMO Software Inc Woodbridge NJ

Result

Descriptive Sensory Evaluation:



Consumer Test:

• There were 98 consumers participated in the study; 71% female and 29% male.
• 58% of the consumer are rice buyer
• Most of consumers (72%) had rice 14-21 meals per week
• 99% of consumers liked jasmine rice

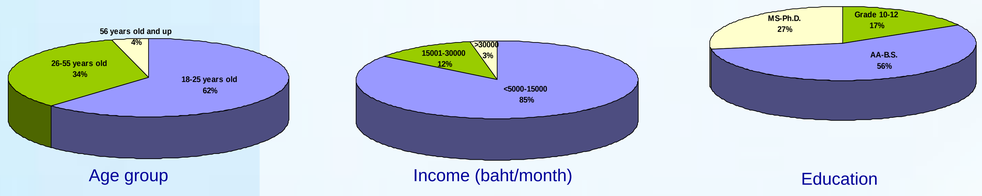


Figure 2: Demographic information from consumer test

Flavor Volatiles:

The following flavor volatiles were identified –

HEXANAL, 2-HEPTANONE, HEPTANAL, 2-ACETYL-1-PYRROLINE, BENZALDEHYDE, 1-OCTEN-3-OL, 6-METHYL-5-HEPTEN-2-ONE, 2-PENTYLFURAN, OCTANAL, LIMONENE, NONANAL, and INDOLE

Relationship between descriptive attributes and flavor volatiles:

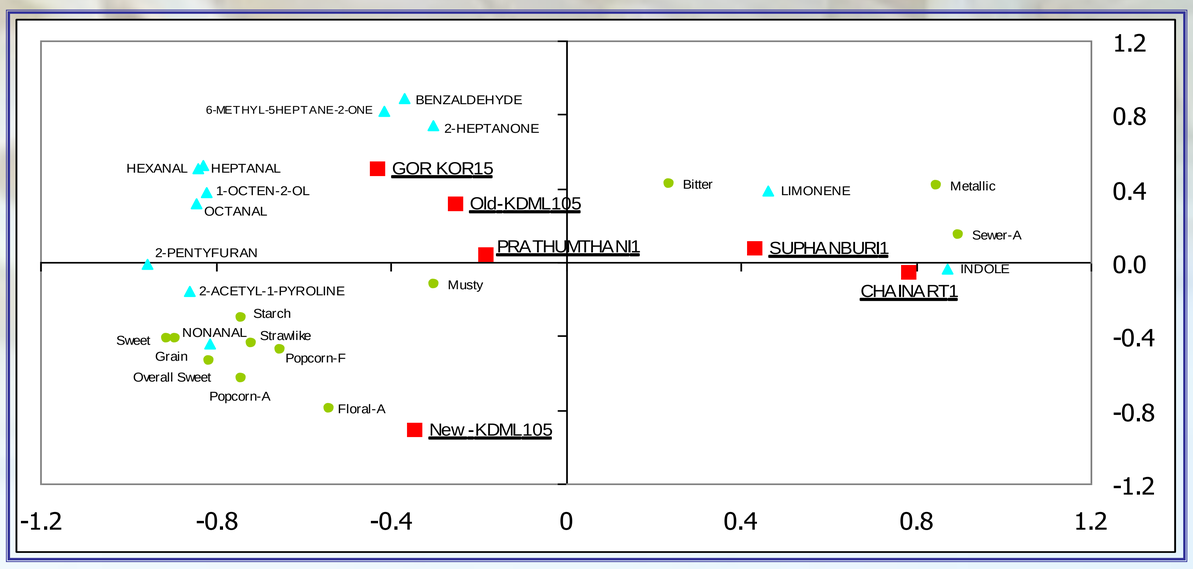


Figure3: PLS Plot of rice variety with sensory descriptive and gas chromatography data

• Popcorn aroma and flavor characterized the scented rice varieties.
• The unscented rices had higher intensity of sewer/animal (sulphur) and metallic flavor.
• 2-Acetyl-1-pyrroline (2-AP) is responsible for the popcorn flavor.
• Indole is indicative of sewer/animal flavor.
• New crop of Kao Dak Mali105 had high intensity of floral and popcorn notes, which probably were contributed by nonanal and 2-AP.
• Old crop of scented rice samples; Kao Dak Mali105, Gor Kor15 and Prathumtani1, had more musty note which is mainly because of 1-octen-3-ol.
• Bitterness in Gor Kor 15 and Kao Dak Mali 105 might have been because of limonene or other compounds such as benzaldehyde.

Relationship between consumer and analytical data:

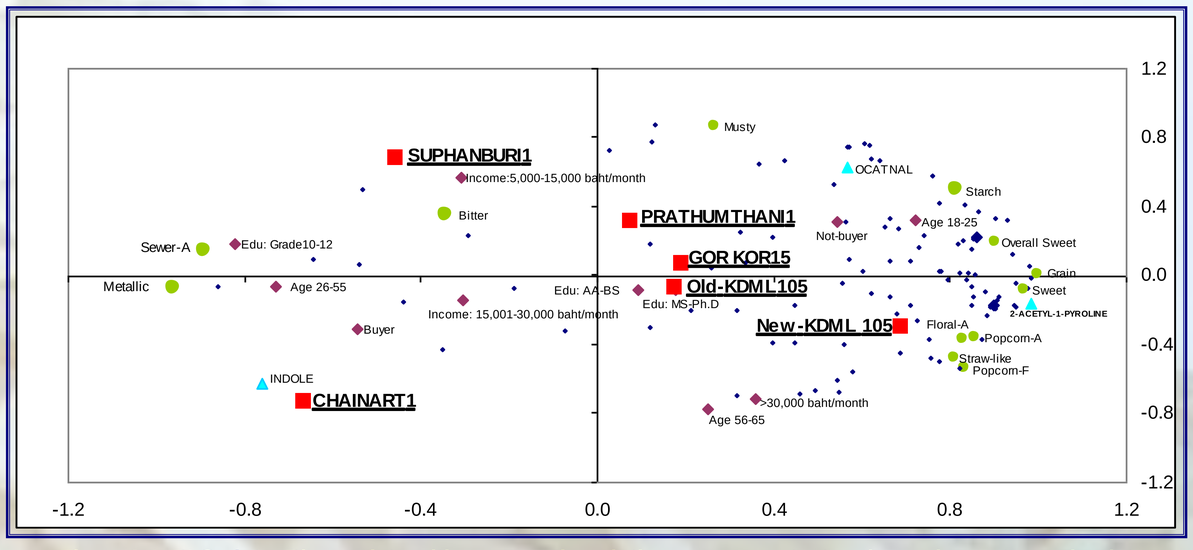


Figure4: L-PLS plot – Rice variety with sensory descriptive, consumer test and gas chromatography data

• Most consumers liked the new crop of Kao Dak Mali105, while Chainart1 and Suphanburi1 (both unscented) were the least acceptable to the consumers.

• The consumer demographic data showed that high income and high education consumers liked the new crop of Kao Dak Mali105 rice.

Conclusion

• The most preferred out of the six rice samples was the new crop of Koa Dak Mali 105 which had high intensity of floral aroma, popcorn aroma and flavor.
• Comparing between new crop and old crop samples of scented rice (Koa Dak Mali105); the old crop sample had less positive attributes such as popcorn and floral aromas; popcorn, grain, floral and overall sweet flavors.
• 2-Acetyl-1-pyrroline (2-AP) is responsible for popcorn flavor which could be used to indicate scented rice.
•The unscented rice samples (Chainart1 and Suphanburi1) had higher sewer aroma than both new and old crop of scented rice since they tended to have more concentration of indole.

References

Ishitani K, Fushimi C. 1994. Influence of pre-and post-harvest conditions on 2-acetyl-1-pyrroline concentration in aromatic rice. Plant Production Sci. The Koryo 183:73-80.

Paule CM, Powers JJ. 1989. Sensory and chemical examination of aromatic and nonaromatic rices. J. Food Sci. 54(2):143-6.

Petrov M, Danzart M, Glampaoli P, Faure J, Richard H. 1996. Rice aroma analysis: discrimination between a scented and a non-scented rice. Sciences Des Aliment. 16:347-60.

Tamaki M, Tashiro T, Ishikawa M, Ebata M. 1993. Physico-ecological studies on quality formation of rice kernel. IV effect of storage on eating quality of rice. Jpn. J. Crop Sci 62:540-6.

Tran TU, Suzuki K, Okadome H, Ikezaki H, Homma S, Ohtsubo K. 2005. Detection of changes in taste of japonica and indica brown and milled rice (*Oryza sativa* L.) during storage using physicochemical analyses and taste sensing system. J. Agric. Food Chem 53:1108-18.

Widjaja R, Craske JD, Wootton M. 1996. Comparative studies on volatile components of non-fragrance and fragrance rices. J. Sci. Food Agric 70:151-61.