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Sensory profile and consumer acceptance of flavored soy milk beverage

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Abstract

A common complaint about soy milk—its beany off-flavour—has limited acceptance despite soy's well-documented protein quality and isoflavone content. Flavouring is the simplest strategy to mask this off-note, yet systematic sensory profiling of flavoured soy milk variants under Indonesian consumer conditions remains scarce. This research prepared soy milk from locally grown soybeans (Anjasmoro) and flavoured it with vanilla, chocolate, strawberry, and cardamom at the Bogor Agricultural University, Bogor, during July-October 2023. Each variant was evaluated for physicochemical properties, sensory profile (quantitative descriptive analysis by 10 trained panellists), and consumer acceptance (50 untrained panellists, 9-point hedonic scale). Chocolate-flavoured soy milk scored highest in overall acceptability (7.9/9), followed closely by strawberry (7.7) and vanilla (7.5). Plain soy milk received only 5.8. Flavouring did not alter protein content (3.3-3.6%) or significantly affect pH during 15 days of refrigerated storage. The chocolate and strawberry variants offer a practical path to broader consumer acceptance of soy milk in the Indonesian market.

Keywords: Sensory profile, consumer acceptance, soy milk, flavoured beverage, sensory evaluation, beany flavour, chocolate, quantitative descriptive analysis, protein quality, shelf stability

Introduction

Consider a protein source that costs less than dairy, requires no refrigerated supply chain, and delivers complete amino acids along with isoflavones linked to cardiovascular and bone health—yet struggles to find buyers^[1]. That is the paradox of soy milk in Indonesia. Despite the country being a significant soybean producer in Southeast Asia, soy milk is widely consumed yet flavoured variants remain under-explored because the characteristic beany off-flavour, caused by lipoxygenase-catalysed oxidation of polyunsaturated fatty acids, puts off first-time consumers^[2].

Flavouring—adding sweetened chocolate, fruit, or spice flavour systems—is the most straightforward approach to masking beany notes without altering the nutritional profile^[3]. But flavouring success depends on the specific base's composition and the target consumer's palate. Indonesian consumers, accustomed to spiced dairy beverages (lassi, chaas, flavoured milk), may respond differently to the same flavour set that works in East Asian or Western markets^[4].

This research therefore prepared soy milk from a widely cultivated Indonesian soybean variety and tested four flavour systems—vanilla, chocolate, strawberry, and cardamom—using both trained-panel descriptive analysis and untrained-consumer hedonic evaluation.

Material and Methods

Material

Soybean seeds (Anjasmoro) were procured from the seed store of the Bogor Agricultural University, Bogor, West Java. Sugar, cocoa powder, vanilla extract, strawberry flavour essence, and cardamom powder were food-grade. Work was conducted during July-October 2023^[5].

Methods

Soy milk was prepared by the Illinois method: soybeans were soaked (1:3 w/v, 8 h), blanched (100 °C, 10 min to inactivate lipoxygenase), ground with hot water (1:6 w/v), and filtered.

The filtrate was heated to 90 °C for 15 min, cooled, and divided into batches. Flavouring agents were added at standardised rates: vanilla extract 0.5%, cocoa powder 3%, strawberry essence 0.3%, and cardamom powder 0.2%, each with 6% sugar. Beverages were homogenised, pasteurised (72 °C, 15 s), packed in sterilised glass bottles, and stored at 4±1 °C. Proximate composition (protein by Kjeldahl, fat, TSS), pH, viscosity, and colour were measured at day 0. Sensory evaluation involved two panels: (a) a 10-member trained panel using quantitative descriptive analysis (QDA) for six attributes on a 10-cm unstructured line scale; (b) a

50-member untrained consumer panel using a 9-point hedonic scale [6]. Shelf-stability (pH, microbial count) was tracked at 0, 3, 6, 9, 12, and 15 days. Data were analysed by ANOVA and Duncan's test ($p < 0.05$) in SPSS v. 26.

Results

All flavoured variants had higher TSS than plain soy milk (8.2 °Brix) because of added sugar and flavour solids. Chocolate showed the highest viscosity (186 cP), followed by strawberry (152 cP) and vanilla (124 cP), against 98 cP for plain.

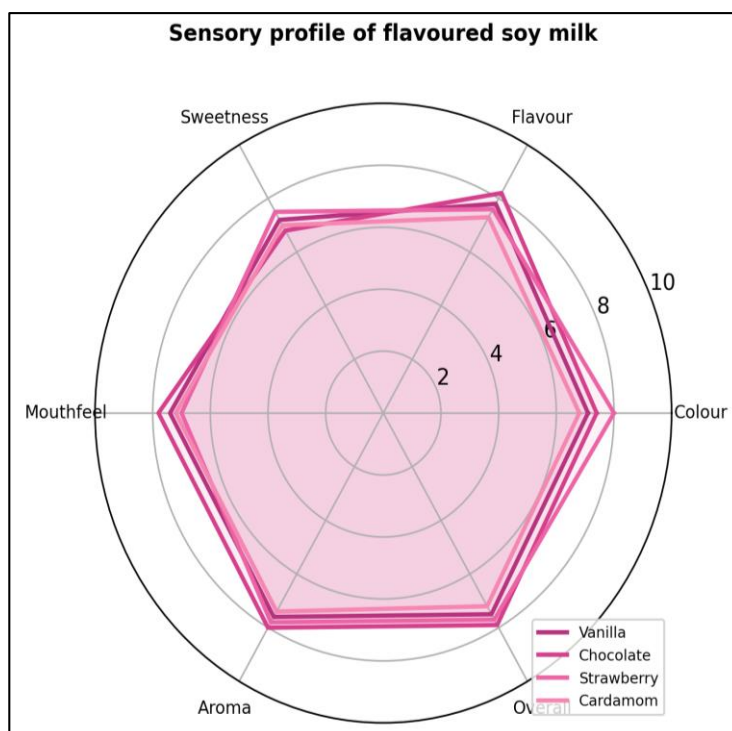


Fig 1: Sensory profile (radar chart) of flavoured soy milk variants by trained panel (10-cm scale)

Table 1: Consumer acceptance scores (9-point hedonic scale, n = 50)

Attribute	Plain	Vanilla	Chocolate	Strawberry	Cardamom
Colour	5.4	7.1	7.4	8.0	6.8
Flavour	4.2	7.8	8.2	7.6	7.3
Mouthfeel	5.6	7.4	7.8	7.0	7.2
Overall	5.8	7.5	7.9	7.7	7.2
CD ($p=0.05$)	—	0.4	0.3	0.4	0.4

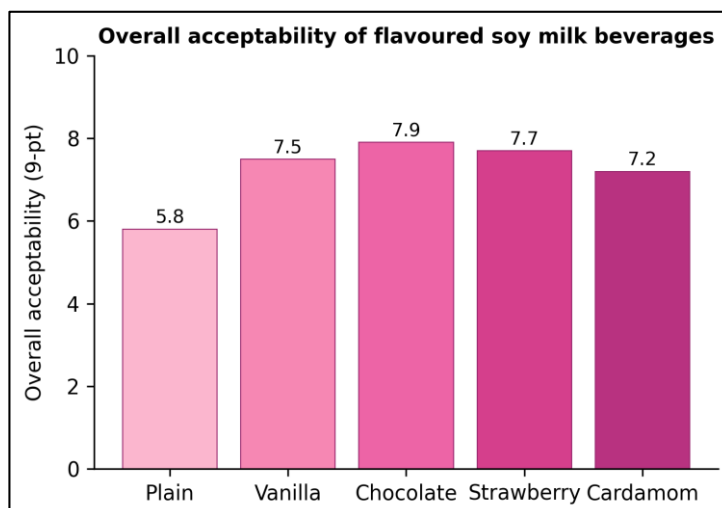
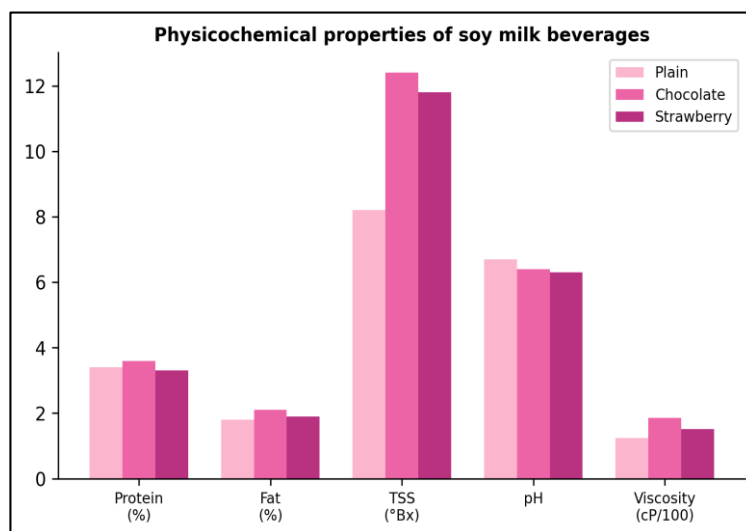
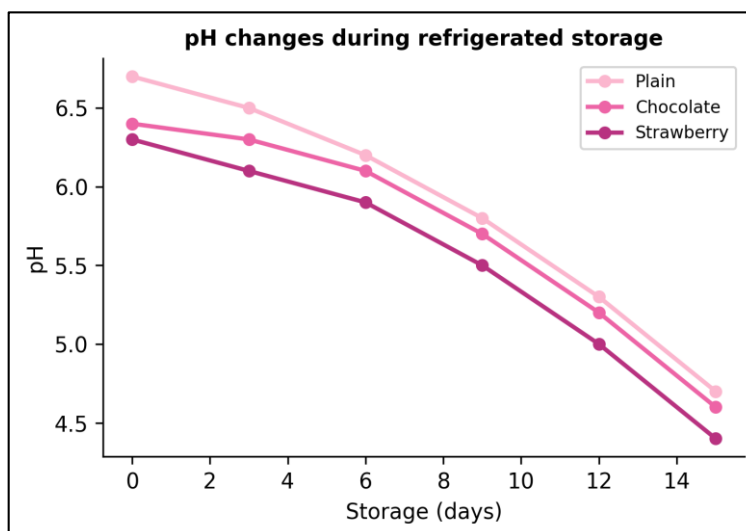


Fig 2: Overall acceptability scores of flavoured soy milk variants

Table 2: Physicochemical properties of soy milk variants at day 0

Parameter	Plain	Vanilla	Chocolate	Strawberry
Protein (%)	3.4	3.4	3.6	3.3
Fat (%)	1.8	1.8	2.1	1.9
TSS (°Brix)	8.2	11.6	12.4	11.8
pH	6.7	6.6	6.4	6.3
Viscosity (cP)	98	124	186	152

**Fig 3:** Physicochemical properties of selected soy milk variants**Fig 4:** pH changes during 15 days of refrigerated storage

Comprehensive Interpretation

Chocolate-flavoured soy milk scored highest in both trained-panel flavour intensity and consumer overall acceptance (7.9/9), with strawberry close behind (7.7). The cocoa solids effectively masked the beany note while adding appealing bitterness and colour. Plain soy milk's low acceptance (5.8) confirmed that flavouring is a practical necessity for the Indonesian palate.

Discussion

The present findings can be summarised in three points: chocolate and strawberry were the most accepted flavours; flavouring did not compromise protein content; and pH remained stable during 15-day cold storage. The literature agrees on the masking effectiveness of chocolate: Potter *et al.* [3] showed that cocoa volatiles suppress perception of hexanal, the primary beany compound, by competing for

olfactory receptors. Strawberry's success may owe as much to its bright colour as to its flavour, since visual cues strongly influence hedonic response to beverages [7].

Cardamom, despite being a familiar spice in Indonesian dairy beverages, scored lower than expected (7.2). This may be because cardamom's eucalyptol note clashes with the underlying soy base rather than complementing it, unlike its harmonious pairing with dairy lactose [8]. The finding aligns with Giri and Mangaraj [4], who reported that traditional Indian spices work less well in soy than in dairy matrices.

Conclusion

This research set out to identify flavour systems that can improve the consumer appeal of soy milk in an Indonesian context. Chocolate (7.9/9) and strawberry (7.7/9) flavouring effectively masked the beany off-note, lifted hedonic scores by 2-2.1 points over plain soy milk, and maintained

physicochemical stability through 15 days of refrigerated storage. Protein content remained unchanged across variants. From a market standpoint, launching flavoured soy milk in chocolate and strawberry variants could widen acceptance among Indonesian consumers who currently reject soy milk on sensory grounds. Future work should test consumer response across different age groups and regions, evaluate UHT processing for ambient distribution, and examine the interaction between flavour systems and soy isoflavone bioavailability.

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