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Effects of Different Sweetening Agents on the Physicochemical, Functional, and Sensory Quality of Value-Added Black Jelly Mushroom (*Auricularia auricular-judae*) Drinks

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Abstract | The current trend favours health drinks that incorporate herbs and solid components such as aloe vera pieces, grass jelly, fruit jellies, and tapioca balls. These drinks typically sweetened, which contribute to increased calorie intake. This study explores the use of black jelly mushroom (*Auricularia auricular-judae*) with its gel-like texture in producing healthy drinks, aiming to diversify the market's range of wholesome beverages. The investigation involves creating a drink with suspended black jelly mushroom pieces and sweetening it with various agents like sucrose, xylitol, erythritol, stevia, and honey. The study evaluates the drinks' physicochemical, and functional properties, including sensory acceptability to see the potential utilization of low-calorie sweeteners. The analysis covers parameters like total soluble solids (TSS), caloric content, ash content, amount of ascorbic acid, total phenolic content, and antioxidant activity in both the solid mushroom pieces and the liquid components of the drinks. Sensory acceptability assessment involves attributes such as aroma, color, texture, taste, and overall acceptability. Results revealed that black jelly drinks sweetened with stevia had the lowest TSS and calorie content (1.2°Brix and 4.04 kcal/100 g, respectively). Conversely, beverages sweetened with honey showed the highest ascorbic acid content (96.67 mg/100 g). Notably, black jelly mushroom pieces sweetened with stevia exhibit the highest levels of ash, total phenolic content, and antioxidant activity, likely due to increased mineral and bioactive compound concentrations compared to other sweeteners. In conclusion, the black jelly drink sweetened with stevia is considered the healthiest due to its low calorie and good functional properties. However, despite these findings, the most favourable black jelly mushroom drink is the one sweetened with sucrose, scoring the highest in aroma, texture, and overall acceptability. The study also suggests the potential of utilizing sugar alcohols like xylitol and erythritol as alternative sweeteners for crafting healthier black jelly mushroom drinks, given their low-calorie content and preferable sensory attributes compared to stevia.

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Introduction

Contemporary consumers increasingly opt for products characterized by lower sugar content, reduced calorie and fat levels, and enhanced nutritional value. There is also a preference for functional and fortified products, including those enriched with minerals, vitamins, fiber, and featuring reduced-calorie sweeteners, as highlighted by Guiné *et al.* (2020). Consequently, to meet the growing demand for healthy drinks, the beverage industry is compelled to broaden and diversify its product range. Additionally, in adherence to government initiatives advocating for healthier beverage alternatives, many beverage companies have expanded their product lines to endorse health and well-being (Hallak *et al.*, 2022; Stamos *et al.*, 2019).

Considering the ongoing shifts in consumer preferences, there is an anticipated increase in the demand for healthier beverage options. The inclusion of herbs and solid components, such as aloe vera pieces, grass jelly, fruit jellies, and tapioca balls enhances the appeal and desirability of these drinks. Therefore, the development of value-added drinks featuring black jelly mushroom pieces, sweetened with various alternatives, is poised to emerge as a novel product catering to health-conscious consumers.

The delectable ear jelly fungus known as black jelly mushroom (*Auricularia auricula-judae*) belongs to the Auriculariaceae family. Its classification as a jelly fungus is attributed to its gelatinous texture (Wu *et al.*, 2021). Fresh and dried varieties of black jelly mushrooms are available in local markets throughout Asia, Europe, Indonesia, the South Pacific, Australia, Africa, North America, and South America (Bao *et al.*, 2016; Priya *et al.*, 2016).

Numerous herbalists harness the medicinal properties of black jelly mushrooms due to the high levels of melanin, carbohydrates, fiber, protein, amino acids, ergosterol, and ascorbic acids, and a very low level of fat. It is also rich in iron, and vitamins B1 and B2 (Islam *et al.*, 2021; Shahrajabian *et al.*, 2020). The chemical composition of black jelly mushrooms highlights their importance as a valuable raw material with various health-promoting properties. These include antioxidant effects to prevent oxidative damage caused by free radicals, regulation of blood glucose and lipid levels to alleviate conditions like

diabetes, hyperlipidemia, and obesity, stimulation of macrophages and inflammatory cytokines to prevent inflammation, anti-cancer properties by promoting cellular apoptosis, and prevention of gut microbial imbalance by fostering the growth of healthy gut microbiota (Islam *et al.*, 2021; Oli *et al.*, 2020).

Instead of using sucrose which contributes to 4 calories per gram, that may result in sugar-related diseases. To make drinks healthier, one can use low-calorie sweeteners like stevia, xylitol, and erythritol, derived from natural or synthetic sources. These sweeteners are considered healthy due to their low fat and fructose content and have a pleasant taste with very low-calorie content and intense sweetness, making them attractive to both consumers and food manufacturers. Stevia, a popular natural sweetener, may reduce the risk of diabetes. It is a natural zero-caloric prebiotic sweetener with 200 times sweeter than sugar. Stevia is also heat-stable, pH-stable, and non-fermentable. It contributes 0 – 0.2 calories per gram (Pielak *et al.*, 2020).

Xylitol, a five-carbon sugar alcohol, offers dental and intestinal health benefits with 2.4 calories per gram. It has the same sweetness as sucrose and is commonly used as a natural food sweetener and sugar substitute for diabetics (Saha and Kennedy, 2020). Erythritol, another sugar alcohol, is a low-calorie sweetener with health benefits and safety proven for consumption. It possess 60–70 % sweeter than sucrose, but it is almost non-caloric. It is also considered as sweet antioxidant and intended for use as a bulk sweetener in beverages, and bakery products. Erythritol contributes to 0 – 0.24 calorie per gram (Chattopadhyay *et al.*, 2014; Castro-Muñoz *et al.*, 2022; den Hartog *et al.*, 2010).

Honey is another sweetening agent used in this study. It is a natural sweetener with antioxidants and trace nutrients. It has long been used to sweeten drinks and other foods. Honey contributes 5.5–6.0 calories per gram (Saha, 2015). Therefore, this study aims to investigate the effects of different sweetening agents on the physicochemical, functional and sensory quality of value-added black jelly drinks with reference to sucrose. The potential low-calorie sweetener which could give beneficial effects and sensorially acceptable could also be determined for this black jelly drinks.

Materials and Methods

Materials

The primary raw material, black jelly mushroom, underwent a series of processes to transform into black jelly mushroom drinks. Fresh black jelly mushrooms (*Auricularia auricula-judae*) were sourced from the wet market in Kangar, Perlis. The initial step involved shredding the mushrooms into slices. Preparation of black jelly mushroom drinks.

Preparation of black jelly mushroom drinks

The primary raw material, black jelly mushroom, underwent a series of processes to transform into black jelly mushroom drinks. Fresh black jelly mushrooms (*Auricularia auricula-judae*) were sourced from the wet market in Kangar, Perlis. The initial step involved shredding the mushrooms into slices approximately 3 mm thick and 2 cm long, suitable for beverage preparation. These slices were then blanched in boiling water for 2 minutes. Subsequently, the prepared black jelly mushroom slices were carefully placed into glass bottles (35 g black jelly pieces/bottle) for further processing.

Continuing the process, the hot liquid component, comprising filtered water (150 mL), sweetener, lemongrass (2 g), and lime juice (2 mL), was poured into 220 mL glass bottles with the pre-prepared black jelly pieces, utilizing a hot filling process. The composition in each glass bottle comprised 18% blanched black jelly mushroom pieces and 82% liquid component. To preserve freshness, the final products were stored in a refrigerator at 4±1°C before undergoing analyses. The production of black jelly mushroom drinks was carried out in triplicate batches for comprehensive analyses, encompassing physicochemical and functional properties, and sensory evaluation.

Determination of physicochemical and functional properties

Determination of total soluble solid (TSS): The TSS of the liquid component in the black jelly drinks featuring various sweeteners were measured using a digital refractometer (Atago, PAL 3, Japan), and the results are presented in °Brix. The refractometer operates on the principle that light encountering a prism exhibits unique characteristics. The solution, comprising sucrose and other utilized sweeteners, applied to the prism surface significantly influenced

the direction and refraction of the light (Dogare, 2014).

Determination of calorie content

The calorie content of black jelly mushroom drinks with different sweeteners were measured using a bomb calorimeter (IKA –Calorimeter C 200) with benzoic acid as a standard (Xu *et al.*, 2018).

Determination of ash content

The samples, weighing approximately 0.5 g, were placed into crucibles. Subsequently, both the samples and crucibles underwent heating in a muffle furnace at a temperature of 550 °C overnight. Afterward, the crucibles were removed and allowed to cool in a desiccator before the weighing procedure. The ash content was computed using the formula outlined in Equation 1 (Lim, 2010). These determinations were carried out in triplicate for both the black jelly mushroom pieces and the liquid component of the drinks.

$$\text{Ash (\%)} = \frac{W3 - W1}{W2 - W1} \times 100 \dots (1)$$

Where; W1 = weight of crucible; W2 = weight of crucible + dry sample; W3 = weight of crucible + ash.

Determination of ascorbic acid (Vitamin C)

The concentration of ascorbate was assessed with a slight adaptation of the method outlined by Jagota and Dani (1982). Absorbance readings were taken at 760 nm using a UV-visible spectrophotometer. The quantification of ascorbic acid was derived from a standard curve generated through various concentrations of ascorbic acid (ranging from 0 to 50 µg/ml).

Determination of total phenolic content (TPC)

Spectrophotometry was employed to quantify the total phenolic content (TPC) in both black jelly mushroom pieces and the liquid component of the drinks. Approximately 0.2 mL of the sample extracts was dispensed into vials containing 1.0 mL of a 1/10 dilution of Folin-Ciocalteu's reagent. Following a 10-minute incubation period, 0.8 mL of a 7.5% (w/v) sodium carbonate solution was added to each sample. The mixture was allowed to stand at room temperature for 30 minutes before measuring the absorbance at 743 nm. Total phenolic content was determined by extrapolating values from a calibration

curve established using gallic acid solution (ranging from 0.2 to 4 mg/L). TPC was expressed as milligrams of gallic acid equivalent (mg GAE) per gram of the sample (Garcia-Mier *et al.*, 2021).

Determination of antioxidant activities

The DPPH assay was employed to assess antioxidant activity in both black jelly mushroom pieces and the liquid component of the drinks. Approximately 2.0 g of black jelly mushroom and 10 mL of methanol were placed in a 15 mL falcon tube, followed by agitation in a mechanical shaker at 200 rpm for 1 hour. Subsequently, the mixture was filtered and stored at 4°C. For the liquid components, the same procedures were repeated using 2.0 g of the liquid component from each sample.

To evaluate antioxidant and free radical scavenging activities, 1.0 mL of the sample extract was combined with 4 mL of 0.15 mM methanolic DPPH solution. Subsequently, a UV-Vis spectrophotometer was utilized to measure the radical scavenging activities at 517 nm. The DPPH scavenging activity was determined using Equation 2 (Garcia-Mier *et al.*, 2021).

$$\text{DPPH radical scavenging activity (\%)} = \left(1 - \frac{A}{B}\right) \times 100 \dots (2)$$

Where; A = absorbance of the sample; B= absorbance of the control (without sample).

This formula allowed for the calculation of the percentage of DPPH scavenged by the sample extract.

Sensory evaluation

The sensory acceptability of five samples of black jelly mushroom drinks, prepared with various sweeteners, was assessed by 30 randomly chosen semi-trained panelists from the staff and students of Universiti Malaysia Perlis (UniMAP). In the sensory evaluation sessions, each panelist received five drink samples and a questionnaire to evaluate the attributes of aroma, color, texture, taste, and overall acceptability. Ratings for the acceptability of the black jelly mushroom drinks were determined using a hedonic scale ranging from 1 to 7, with 1 indicating dislike very much, 4 indicating neither like nor dislike, and 7 indicating like very much.

Statistical analysis

All analyses were conducted in replicates, and the

experimental results were presented as mean values $\pm$ standard deviation using Microsoft Excel software version 2007. Significant analysis of variance was carried out through a one-way analysis of variance (ANOVA) in the statistical package Minitab software (version 14) for means comparison. Subsequently, Tukey's multiple comparisons test was employed to discern significant differences between means at a significance level of $p < 0.05$ for various samples.

Results and Discussion

Physicochemical and functional properties

Total soluble solid (TSS): Table 1 displays the total soluble solids of black jelly drinks with various sweeteners. The results indicate that the °Brix values for black jelly drinks sweetened with sucrose and honey were significantly higher ($P < 0.05$), registering at 5.17 and 4.90, respectively, compared to those with other sweeteners. In contrast, black jelly drinks incorporating stevia exhibited the significantly lowest ($P < 0.05$) total soluble solids content at 1.20, followed by erythritol (4.25) and xylitol (4.72).

Table 1: The total soluble solids, calorie and ash contents of black jelly drinks using different sweeteners.

Treat-ment	Total soluble solid (°Brix)	Calorie content (kcal)/100 g sample	Ash content (%)
Sucrose	5.167 $\pm$ 0.662 ^a	252.506 $\pm$ 3.242 ^a	3.742 $\pm$ 0.006 ^{bc}
Xylitol	4.717 $\pm$ 0.172 ^{ab}	71.852 $\pm$ 4.425 ^b	3.632 $\pm$ 0.010 ^c
Erythritol	4.250 $\pm$ 0.084 ^b	55.061 $\pm$ 7.186 ^c	3.205 $\pm$ 0.184 ^c
Stevia	1.200 $\pm$ 0.219 ^c	4.036 $\pm$ 0.094 ^d	6.156 $\pm$ 0.005 ^a
Honey	4.900 $\pm$ 0.219 ^a	239.458 $\pm$ 3.074 ^a	5.045 $\pm$ 0.271 ^{ab}

Note: Values are means of 3 replicates. Means ($n=3$) $\pm$ standard deviation. a-d: Values bearing different superscript within the same column are significantly different at 5% ($P < 0.05$).

The elevated TSS values in drinks sweetened with sucrose and honey can be attributed to the higher sugar content dissolved in the liquid. Sucrose, composed of monosaccharides fructose and glucose, contributes to this increased sweetness. Moreover, honey contains various oligosaccharides, including panose, sucrose, maltose, kojibiose, isomaltose, erlose, trehalose, raffinose, and turanose, with concentrations varying depending on the honey source (Lane *et al.*, 2019). It's noteworthy that the quantity of each sweetener used was adjusted to achieve an equivalent level of sweetness in all the drinks.

Calorie content

Table 1 also reveals significant variations ($P < 0.05$) in the calorie contents among the black jelly mushroom drinks crafted with various sweeteners. Specifically, drinks sweetened with sucrose and honey exhibited notably higher calorie contents at 252.506 kcal/100 g and 239.458 kcal/100 g, respectively. Xylitol-containing drinks followed with 71.852 kcal/100 g, and those sweetened with erythritol registered 55.061 kcal/100 g. In contrast, black jelly drinks incorporating stevia displayed the lowest calorie content, measuring 4.036 kcal/100 g.

The calorie content of sucrose ranks highest among various sweeteners, measuring 4 kcal/g, followed by honey at 3 kcal/g, xylitol at 2.4 kcal/g, and erythritol at 0.2 kcal/g. Stevia, in contrast, contains no calories ([Chattopadhyay et al., 2014](#)). According to the [Malaysia Food Regulation \(1985\)](#), specifically in the table of Fifth A (rule 18C) and list 1 for nutrient content conditions for dietary claims, food items aiming for a low energy/calorie claim should not exceed 40 kcal (170 kJ) per 100 g (solids). Consequently, the black jelly drinks sweetened with stevia, boasting a calorie content of only 4.036 kcal/100 g, meet the criteria for being labeled as a low energy/calorie beverage. However, despite xylitol and erythritol imparting significantly lower calories compared to sucrose and honey, their calorie content still surpasses the maximum limit for a low energy/calorie claim.

Ash content

The ash contents of black jelly drinks sweetened with different sweeteners are also presented in **Table 1**. The ash content percentage in black jelly drinks sweetened with stevia exhibited the highest significance ($P < 0.05$) at 6.15%, followed by honey (5.04%) and sucrose (3.74%). On the other hand, sugar alcohols erythritol and xylitol displayed lower ash contents (3.20% and 3.63%, respectively), with no significant difference ($P > 0.05$) between them. The ash content represents the inorganic residue (minerals) remaining after the ignition and complete oxidation of organic matter. Black jelly pieces sweetened with stevia demonstrated higher ash content due to the minerals present in both black jelly and stevia, which are known to be rich in potassium (K), calcium (Ca), sodium (Na), magnesium (Mg), copper (Cu), manganese (Mn), iron (Fe), and zinc (Zn) ([Khalid et al., 2021](#)).

Ascorbic acid (Vitamin C)

Table 2 outlines the ascorbic acid content in black jelly drinks prepared with various sweeteners. Significant differences ($P < 0.05$) were observed in the ascorbic acid contents of both black jelly pieces and the liquid components across drinks sweetened with different sweeteners. Specifically, black jelly pieces sweetened with honey and sucrose displayed higher ascorbic acid contents at 71.205 and 70.598, respectively, in comparison to xylitol (63.548), erythritol (63.449), and stevia (61.794).

In the liquid component, the highest ascorbic acid content was observed in black jelly drinks sweetened with honey (96.677), followed by those sweetened with sucrose (87.796), xylitol (82.430), erythritol (81.027), and the lowest levels were found in drinks sweetened with stevia (72.655). The increased presence of ascorbic acid in honey-sweetened drinks can be attributed to the significant amount of vitamin C (ascorbic acid) naturally occurring in honey. Ascorbic acid, renowned for its reductive properties, is commonly utilized as an antioxidant in various food and beverage contexts, owing to its importance in therapeutic applications and biological metabolism ([Da Silva et al., 2012](#)).

Table 2: The ascorbic acid content, total phenolic content and antioxidant activities of black jelly drinks using different sweeteners.

Treatment	Ascorbic acid (mg/100 g sample)	Total phenolic content (mg GAE/g sample)	Antioxidant activities (%)
Black jelly pieces			
Sucrose	70.598 ± 0.092 ^a	0.727 ± 0.029 ^c	7.40 ± 0.579 ^c
Xylitol	63.548 ± 0.497 ^b	0.221 ± 0.021 ^d	30.38 ± 0.674 ^d
Erythritol	63.449 ± 0.300 ^b	0.126 ± 0.021 ^d	42.17 ± 0.781 ^c
Stevia	61.794 ± 0.118 ^b	2.765 ± 0.021 ^a	71.32 ± 0.814 ^a
Honey	71.205 ± 0.464 ^a	1.991 ± 0.041 ^b	56.64 ± 0.375 ^b
Liquid component			
Sucrose	87.796 ± 0.431 ^b	0.742 ± 0.048 ^c	25.90 ± 1.389 ^d
Xylitol	82.430 ± 0.163 ^c	0.189 ± 0.014 ^d	57.35 ± 0.628 ^c
Erythritol	81.027 ± 0.217 ^c	0.189 ± 0.027 ^d	71.17 ± 0.773 ^b
Stevia	72.655 ± 0.089 ^d	2.765 ± 0.042 ^a	85.70 ± 0.404 ^a
Honey	96.677 ± 0.562 ^a	2.038 ± 0.036 ^b	83.46 ± 0.278 ^a

Note: Values are means of 3 replicates. Means ($n=3$) ± standard deviation. a-e: Values bearing different superscripts within the same column are significantly different at 5% ($P < 0.05$).

Total phenolic content (TPC)

Table 2 displays the total phenolic content in gallic

acid equivalent (mg GAE/g) of black jelly drinks sweetened with various sweeteners. Significant differences ($P < 0.05$) were observed in the total phenolic contents of both black jelly pieces and the liquid component across drinks sweetened with different sweeteners. In black jelly pieces, stevia exhibited the highest total phenolic content at 2.765, followed by honey (1.991) and sucrose (0.727), while xylitol (0.221) and erythritol (0.126) had comparatively lower values. A similar trend was noted for total phenolic contents in the liquid components, where stevia also displayed the highest total phenolic content (2.765), followed by honey (2.038), sucrose (0.742), and the lowest values were found in xylitol and erythritol, both having the same mean content of 0.189 mg GAE/g.

Phenolic compounds are chemically characterized as compounds containing hydroxylated aromatic rings, with the hydroxyl group directly attached to the phenyl, substituted phenyl, or another aryl group. Stevia displays a higher Total Phenolic Content (TPC) value primarily attributed to the presence of bioactive compounds in its leaves, including phenolics (Garcia-Mier et al., 2021). Similarly, honey is also abundant in phenolic acids and flavonoids, showcasing a diverse range of biological effects and serving as natural antioxidants (Olas, 2020).

Antioxidant activities

Table 2 also illustrates the antioxidant activities of black jelly drinks sweetened with various sweeteners. Significant differences ($P < 0.05$) were observed in the antioxidant activities of both black jelly pieces and the liquid component among drinks sweetened with different sweeteners. In black jelly pieces, the highest antioxidant activity was observed in drinks sweetened with stevia (71.32), followed by honey (56.64), erythritol (42.17), xylitol (30.38), and the lowest was in sucrose-sweetened drinks (7.40). Meanwhile, the antioxidant activities in the liquid component of black jelly drinks using stevia and honey exhibited significantly higher ($P < 0.05$) antioxidant activities at 85.70 and 83.46, respectively, compared to other sweeteners used. In contrast, drinks sweetened with sucrose demonstrated significantly the lowest ($P < 0.05$) antioxidant activity.

In recent years, numerous studies have delved into the biochemical and biological attributes of stevia and honey. Stevia, renowned for its sweetening

properties, possesses diverse therapeutic values, such as aiding in the treatment of patients with diabetic-related obesity, hypertension, cardiac diseases, and showcasing antioxidant, antimicrobial, and antifungal activities (Khiraoui et al., 2017). Honey, utilized for both medical and domestic purposes over an extended period, has gained prominence for its antioxidant properties only in recent times. With the growing demand for antioxidant sources in the food industry, honey is emerging as a popular choice due to its richness in phenolic acids and flavonoids (Olas, 2020).

Sensory acceptability

Figure 1 illustrates the sensory acceptability ratings for the attributes of aroma, color/ appearance, taste, texture, and overall acceptability of five black jelly drinks sweetened with different sweeteners. Significant differences ($P < 0.05$) were observed in the aroma acceptability among the black jelly drinks. The aroma ratings for black jelly drinks ranged from 2.767 to 5.633, indicating preferences falling between dislike slightly and like moderately. Some comments highlighted that sucrose and erythritol imparted a strong sweet smell with generally similar aromas. Consequently, black jelly drinks sweetened with sucrose (5.633) received the highest score in aroma acceptability, followed by erythritol (5.267), xylitol (4.633), and stevia (4.633). On the other hand, honey scored the lowest in aroma acceptability, primarily due to the unpleasant aroma perceived by the panelists.

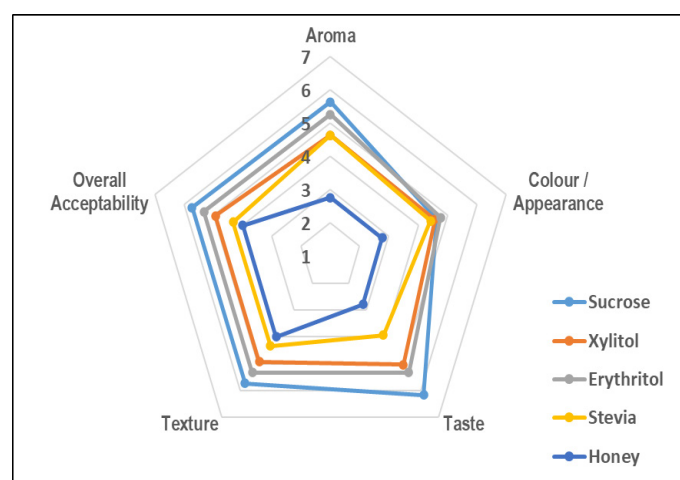


Figure 1: The sensory acceptability of black jelly mushroom drinks using different sweeteners.

Regarding the color attribute, no significant differences ($P > 0.05$) were detected in the color/appearance acceptability among black jelly drinks sweetened with different sweeteners. The color/appearance

scores of black jelly drinks ranged from 4.4 to 4.7, generally falling between neither like nor dislike and like slightly. Physically, the liquid component of black jelly drinks sweetened with honey exhibited a slightly darker color, but these variations did not impact the overall acceptability among the panelists. The taste acceptability of black jelly drinks exhibited significant differences ($P < 0.05$) among various sweeteners. Black jelly drinks sweetened with sucrose received the highest acceptability score (6.167), followed by erythritol (5.333), xylitol (5.033), and stevia (3.933). Meanwhile, honey scored the lowest (2.800) in the taste attribute. This preference could be attributed to the panelists' familiarity with the sweetness of sucrose. Additionally, erythritol and xylitol were perceived as having a sugar-like sweetness, contributing to their favorable taste ratings (O'Donnell and Kearsley, 2012). In contrast, stevia received the second-lowest score, mainly due to its characteristic bitter aftertaste, which may be unacceptable to some panelists. However, the majority of panelists expressed a dislike for black jelly drinks sweetened with honey.

Significant differences ($P < 0.05$) were also observed in the texture acceptability of the black jelly pieces in the black jelly drinks sweetened with different sweeteners. The texture of black jelly pieces generally received scores ranging from 4.000 to 5.733, falling between neither like nor dislike and like moderately. Some comments suggested that the black jelly pieces in drinks with sucrose and erythritol exhibited a similar chewable and smooth texture, potentially contributing to their higher scores (5.733 and 5.333, respectively) in sensory acceptability. Following were xylitol (4.933) and stevia (4.333), with honey scoring the lowest (4.000).

Significant differences ($P < 0.05$) were noted in the overall acceptability among black jelly drinks sweetened with different sweeteners. The overall acceptability scores for black jelly drinks ranged from 3.333 to 6.200, indicating preferences falling between dislike moderately and like moderately. Sucrose emerged as the most preferred sweetener by the panelists, followed by erythritol, xylitol, and stevia. Honey, on the other hand, obtained the lowest overall acceptability score.

Conclusions and Recommendations

In conclusion, this study explored the physicochemical,

functional properties, and sensory acceptability of value-added black jelly mushroom (*Auricularia auricular-judae*) drinks using various sweeteners, including sucrose, xylitol, erythritol, stevia, and honey. Sucrose and honey contributed to higher total soluble solids ($^{\circ}\text{Brix}$) due to increased sugar content in the liquid. Notably, honey exhibited the highest ascorbic acid content among the sweeteners. However, black jelly pieces sweetened with stevia displayed the highest ash content, total phenolic contents, and antioxidant activities, attributed to its rich mineral content and bioactive compounds, offering therapeutic benefits. The most preferred value-added black jelly drink was the one sweetened with sucrose, receiving the highest scores in aroma, taste, texture, and overall acceptability attributes.

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Novelty Statement

This study pioneers the exploration of incorporating black jelly mushroom into health drinks with different sweeteners. It highlights the potential adaptability of utilizing sliced or shredded black jelly mushroom as a solid component in the creation of healthy beverages. Additionally, the study delves into the effects of low-calorie sweeteners on physicochemical and functional properties, as well as sensory acceptability, significantly enhancing the overall appeal of these health drink products.

Author's Contribution

Roshita Ibrahim: Data curation, conceptualization, methodology, writing, review and editing and visualization.

Mohd Firza Ahmad Fauzi: Data curation, methodology, writing

Mohd Nizam Lani: Conceptualization, , review and editing and visualization.

Conflict of interest

The authors have declared no conflict of interest.

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