Research note
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SENSORY EVALUATION OF SALADS INCORPORATED WITH EDIBLE BLOOMS OF *HULTHOLIA MIMOSOIDES*

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The plant known as Cheemullu,Kumullu, Karthikamullu in Kerala exists under the formal name *Hultholia mimosoides*(Lam.) formerly known as *Caesalpinia mimosoides* (Lam). The plant functions as an edible species and local groups in the area use its flowers for culinary purposes. The plantpossesses three distinct abilities which include antioxidant properties with anti-inflammatory benefits along with anticancer effects and antimicrobial activity (Rangsinth *et al*.,2019). The Fabaceae family spiny shrub *Hultholia mimosoides* Lam. grows in the regions of Southeast Asia. Research shows that *Caesalpinia* plants with more than 500 species contain three main phytochemical compounds that include flavonoids together with diterpenes and steroids which exhibit multiple therapeutic activities that range from anti-inflammatory properties to anticancer treatment and antidiabetic properties and also provide antimicrobial protection and antirheumaticbenefits.The vibrant yellow blooms of *Hultholia mimosoides* are traditionally consumed in rural areas of Kerala and have potential culinary applications as decorative elements in salads. Rich in health benefits, these flowers offer both aesthetic appeal and nutritional value. This study investigates their use in salads and presents a sensory evaluation to assess their acceptability, paving the way for their broader incorporation into modern culinary practices.

The study was conducted in the Department of Community Science, College of Agriculture, Vellayani, Kerala Agricultural University, Thiruvananthapuram. The flowers of *Hultholia mimosoides* were procured from rural areas of Thiruvananthapuram district. The flowers were collected in ziplock pouches and stored in refrigerated temperature. Purple cabbage and peanuts were purchased from Thiruvananthapuram local market.

The composition of salad includes *Hultholia mimosoides* flowers together with purple cabbage and peanuts at total proportions of 100%. The percentages of salad mixture ingredients were modified to total 100% based on the information presented in Table 1. All the ingredients were selected to verify any physical damage, contamination and undesirable materials. The methodology of Domínguez-Domínguez *et al*., (2021)was followed for salad preparation. All the ingredients were then washed in 1% sodium hypochlorite solution for 3-5 minutes. Purple cabbage was sliced into long segments, approximately 5 cm × 1 cm in size, suitable for salad presentation. Peanuts were washed, immersed and pulverized before being added into salad. Additional ingredients such as lime, honey, pepper and salt were utilized to make the salad dressing and incorporated according to flavor requirements. All the salad ingredients were weighed separately to guarantee

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Table 1: Proportion of salad ingredients

Formulation	*Hultholia mimosoides* flowers (%)	Purple Cabbage(%)	Peanuts(%)
S_1	20	60	20
S_2	15	65	20
S_3	10	70	20
S_4	5	75	20
C	0	80	20

proportion, the ingredients were manually placed in disposable plates for sensory evaluation.

Sensory evaluation of the salads

Sensory evaluation of the prepared salads was performed using a 9 point hedonic scale testing using 35 semi trained panelists. The evaluation utilized a hedonic scale ranging from 1, indicating 'dislike extremely', to 9, representing 'like extremely'. The sensory evaluation of salads was used to evaluate the sensory attributes appearance, aroma, texture, taste and overall acceptability.The sensory evaluations were conducted in an environment with regulated temperature and lighting. Five salad samples were provided to each evaluator. The samples were presented in white disposable cups, each marked with a randomized three-digit code. To prevent flavor carry over, panelists were instructed to consume water and cleanse their palate between tasting different samples.

Statistical analysis

Statistical analysis was performed using non parametric Kruskalwallis test to determine significant differences between treatments using GRAPES1.1.0 software.

The comprehensive sensory evaluation data results displayed in Table 2 systematically documents the sensory panelists responses to multiple organoleptic attributes across all experimental salad formulations, providing the analytical foundation upon which the most appealing *Hultholia mimosoides* incorporated salad treatment was identified and subsequently selected for further development and recommendation.

Appearance

The appearance attribute evaluation revealed significant visual differences among the salad formulations, with the *Hultholia mimosoides* flower incorporated treatments exhibiting enhanced chromatic appeal,

Fig. 1. *Hultholiamimosoides* flowers

particularly sample S_3 which received the highest mean scores due to its balanced color contrast between the vibrant purple cabbage and the distinctive floral elements compared to control sample devoid of the flowers.

Aroma

The aroma attribute assessment demonstrated notable olfactory distinctions among the salad treatments, with the *Hultholia mimosoides* flower incorporated formulations presenting a uniquely pleasant fragrance profile. Sample S_3, containing the optimal 10:70 ratio of flowers to purple cabbage, received superior ratings (9) for its harmonious aromatic balance, which effectively combined the subtle floral notes with the characteristic fresh vegetable scents, creating an inviting sensory experience that appealed strongly to the evaluating panelists.

Texture

The texture attribute evaluation of the prepared salad formulations revealed significant tactile differences among treatments, with the *Hultholia mimosoides* flower incorporated samples demonstrating enhanced textural complexity. Sample S_3 with its 10:70 ratio of flowers to purple cabbage achieved the highest texture scores (9) due to its optimal balance of crispness and tenderness. Panelists particularly appreciated the textural contrast created by the delicate flower petals interspersed among the firmer cabbage components, which provided a multi-dimensional mouthfeel that enhanced the overall eating experience without compromising structural integrity during consumption.

Taste

The taste attribute analysis revealed pronounced flavor distinctions among the salad formulations, with *Hultholia mimosoides* flower added treatments demonstrating exceptional taste profiles. Sample S_3, featuring the 10:70 ratio of flowers to purple cabbage, garnered the highest taste scores (9) from panelists who particularly valued its well-balanced flavor complexity. The distinctive tangy notes contributed by the *Hultholia mimosoides* flowers complemented the mild peppery undertones of the purple cabbage, creating a harmonious taste experience that avoided overwhelming bitterness while providing sufficient flavor intensity to engage the palate. This optimal flavor equilibrium distinguished S_3 from other treatments and substantially contributed to its overall sensory superiority.The control sample garnered the lowest score (6.2) for taste attribute assessment, primarily due to the absence of *Hultholia mimosoides* flowers which resulted in a noticeably less complex flavor profile.

According to Figure 2, Sample S_3 scored highest mean value of (9) for all the attributes among all the samples and control sample scored the lowest score (6.3) for overall acceptability. The research conducted by Mleck *et al*. (2021) examines edible flowers for gastronomic purposes by assessing their organoleptic properties as well as taste and total impression. Flower appearance along with their colors shapes consumer buying habits. The fragrance of salads was evaluated in all samples as pleasant with various levels of intensity. Sample S_3 was identified as the salad formulation with the most pleasant scent (9) liked extremely by the panelists, because the scale ranged from liked extremely (=9) through neither like or dislike (=5) to dislike extremely (=1). Buds of the flowers will be odorless, hence only fully ripened blossoms were collected. The other salad formulations were rated from 6.8, 7.7, 8.2, corresponding to a lower intensity scent. Research by Mleck *et al*., (2021) concluded that edible flowers can serve as a natural source for food supplements loaded with bioactives.

A study by Simoni *et al*., (2018) analyzed the salad acceptance of edible flowers through a study conducted with 35 participants. The

Table 2. Sensory evaluation of salads **n=35**

Sl.No	Appearance	Aroma	Texture	Taste	Overall acceptability
S_1	8.6^{b}	7.8^{c}	7.7^{c}	6.9^{d}	7.7^{c}
S_2	8.6^{b}	7.8^{c}	8.2^{b}	7.8^{c}	8.1^{cb}
S_3	9.0^{a}	9.0^{a}	9.0^{a}	9.0^{a}	9.0^{a}
S_4	8.1^{c}	8.6^{b}	8.2^{b}	8.6^{b}	8.4^{b}
C	6.3^{d}	6.1^{d}	6.8^{d}	6.2^{d}	6.3^{d}
χ^2value	131.5	144.810	132.390	142.919	142.862
p value	0.00	0.00	0.00	0.00	0.00

acceptance criteria for edible flowers in salads consist of color, texture, aroma, and overall aspects but flavor remains the only trait that leads to rejection. The research also stated that people accept edible flowers yet they will not respond unless detailed information about the flowers and different dish options are provided.

Food sensory attributes play a fundamental role for both consumer markets and production centers due to their strong relationship with product quality metrics and user acceptance levels. (Jadhav *et al*., 2023).The field of sensory science shows rising interest in edible flower preferences yet most research has been performed without professional panel evaluation techniques. Edible flowers possess high perishability linked to transpiration and respiration processes which create primary factors for both quality decline and post-harvest losses. The metabolic rate of fresh flowers together with shelf life duration depends heavily on temperature because it affects the natural breakdown processes of harvested flowers(Demasi *et al*., 2021; Bhat *et al*., 2023).

The unique color, appearance, and flavor of edible flowers in culinary cuisines make them valuable for specific dishes. But they may also include harmful compounds like alkaloids and

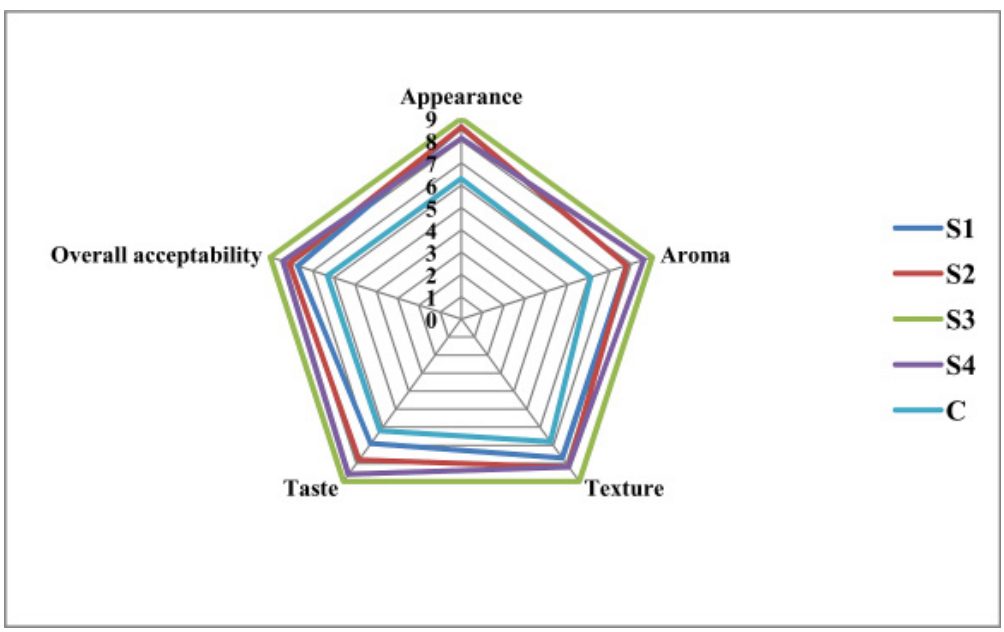

Fig. 2. Sensory evaluation of salads

anti-nutritional elements that might disrupt the metabolism or absorption of nutrients. There is lacking data on the application and appropriate dosages of edible flowers.

The study proves that *Hultholia mimosoides* flowers supply a nutritious salad option which provides marketable taste and visual value. The unique visual appeal of these flowers also brings out a natural tangy flavor which makes vegetable salads more enjoyable to the senses. The combination of *Hultholia mimosoides* flowers to purple cabbage in a ratio of 10:70 resulted in the highest sensory judgment scores for all considered attributes and it brings new nutritional variety to regular meals. Appearance and aroma of the salads can impact the liking of *Hultholia mimosoides* flowers, purple cabbage and peanut salad without causing any aversion. These neglected floral resources enable a connection between consumers and traditional food components. The investigation validates *Hultholia mimosoides* flowers as a valuable food ingredient which meets requirements of aesthetic appeal, nutritional excellence and authentic flavor in contemporary culinary development.

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