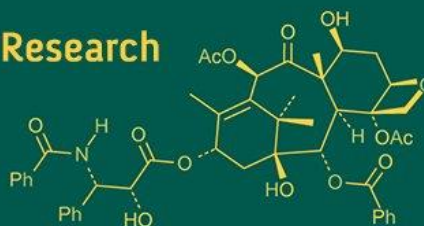


International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2026): 5.29
IJABR 2026; SP-10(7): 1082-1087
www.biochemjournal.com
Received: 22-05-2026
Accepted: 24-06-2026

Diksha Arya
M.Sc. Research Scholar,
Department of Food Science
and Nutrition, MPUAT,
Udaipur, Rajasthan, India

Dr. Sumitra Meena
Assistant Professor,
Department of Food Science
and Nutrition, MPUAT,
Udaipur, Rajasthan, India

Dr. Renu Mogra
HOD and Professor,
Department of Food Science
and Nutrition, MPUAT,
Udaipur, Rajasthan, India

Dr. Monika Rai
Assistant Professor, Human
Development and Family
Studies, MPUAT, Udaipur,
Rajasthan, India

Dr. Rupal Babel
HOD and Associate Professor,
Department of Apparel and
Textile Science, MPUAT,
Udaipur, Rajasthan, India

Lakshika Agrawal
M.Sc. Research Scholar,
Department of Food Science
and Nutrition, MPUAT,
Udaipur, Rajasthan, India

Corresponding Author:
Diksha Arya
M.Sc. Research Scholar,
Department of Food Science
and Nutrition, MPUAT,
Udaipur, Rajasthan, India

Formulation, standardization and quality evaluation of a polyherbal detox mix powder developed using natural plant ingredients

Diksha Arya, Sumitra Meena, Renu Mogra, Monika Rai, Rupal Babel and Lakshika Agrawal

DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i7Sm.9184>

Abstract

The growing consumer preference for natural, additive-free functional beverages has renewed interest in plant-based detox formulations as healthier alternatives to conventional sugar-sweetened and artificially flavoured drinks. In the present study, a polyherbal detox mix powder was developed using twelve locally available flowers, fruits, herbs and spices, namely blue pea flower, hibiscus, amla, lemon peel, moringa, tulsi, mint, clove, cinnamon, fennel, ginger and black pepper. Four trial formulations, differing in the relative proportion of ingredients, were prepared and evaluated for sensory quality using a nine-point hedonic scale by a panel of three semi-trained judges. One formulation received the highest or jointly highest scores for flavour, taste, texture, appearance and overall acceptability and was therefore selected for detailed physicochemical, nutritional, antioxidant and storage evaluation. The selected formulation exhibited a bulk density of 0.359 gram per millilitre, a hydration capacity of 4.597 gram, and a mildly acidic pH of 5.12. Proximate analysis revealed a moisture content of 6.53 percent, ash 7.05 percent, crude fat 1.80 percent, crude fibre 9.80 percent, crude protein 12.25 percent, carbohydrate 62.57 percent (by difference) and an energy value of approximately 318 kilocalorie per 100 gram. The formulation exhibited concentration-dependent free-radical scavenging activity, reaching 79.43 percent inhibition at 400 microgram per millilitre, with an estimated half-maximal inhibitory concentration of approximately 152.76 microgram per millilitre. Phytate content was low, at 0.277 gram per 100 gram. Over 45 days of ambient storage, the product retained an overall acceptability score above 8.0 on the nine-point scale, with only a modest rise in moisture content and a mild decline in pH. The developed detox mix powder represents a nutritionally sound, antioxidant-rich and storage-stable natural functional beverage suitable for regular consumption.

Keywords: Detox mix powder, polyherbal formulation, sensory evaluation, antioxidant activity, proximate composition; storage stability

1. Introduction

Non-communicable diseases such as obesity, type 2 diabetes and cardiovascular disorders continue to represent a major global health burden, with inadequate dietary diversity and excessive consumption of processed, sugar-sweetened beverages recognised as key modifiable risk factors [1]. In response, there has been a marked shift in consumer preference and international dietary policy towards plant-based, minimally processed foods and beverages capable of delivering micronutrients and bioactive compounds alongside dietary diversification [2]. Within this context, herbal “detox” beverages formulated from flowers, fruits, herbs and spices have gained considerable popularity as natural alternatives to artificially flavoured and preserved commercial drinks.

Several recent studies have explored the formulation and quality evaluation of polyherbal tea bag and beverage-mix products. Famurewa *et al.* [3] examined diffusivity and optimal mixing ratios for hibiscus-moringa tea bags, while Builders *et al.* [4] evaluated the physicochemical and stability properties of herbal tea blends derived from native medicinal plants. Kumari *et al.* [5] developed antioxidant-rich herbal tea bags, and Bendaali *et al.* [6] formulated isotonic drinks flavoured with herb and spice extracts. More recently, Bose *et al.* [7] reported the formulation of multi-herbal tea blends for functional health benefits, Pawar Banakar and Pawar [8] evaluated the quality of a herbal tea bag formulation, MVM and Sathiya [9]

developed a blue pea butterfly drink, and Raju *et al.* [10] demonstrated the antioxidant potential of polyherbal tea bags for the management of oxidative stress. Collectively, this body of literature confirms that carefully selected combinations of flowers, herbs, fruits and spices can yield beverage products with desirable sensory, nutritional and antioxidant characteristics.

Despite this growing literature, a powder-based, non-fermented detox mix formulated from a comprehensive combination of blue pea flower, hibiscus, amla, lemon peel, moringa, tulsi, mint, clove, cinnamon, fennel, ginger and black pepper and characterised simultaneously for its sensory, physicochemical, proximate, antioxidant, antinutritional and storage-stability properties has not been extensively documented. A powder format offers practical advantages over ready-to-drink liquid formulations, including concentrated packaging, ease of transport, extended shelf life, and flexibility of preparation by the consumer.

The present study was therefore undertaken to formulate and standardize a polyherbal detox mix powder through sensory screening of trial formulations, and to comprehensively characterise the selected formulation for its physicochemical properties, proximate composition, vitamin C content, antioxidant (free-radical scavenging) activity, antinutritional (phytate) content, and storage stability under ambient conditions over a 45-day period.

2. Materials and Methods

2.1 Locale and Duration of the Study

The present investigation was carried out in the Department of Food Science and Nutrition, College of Community and Applied Sciences, Maharana Pratap University of Agriculture and Technology, Udaipur, Rajasthan, India.

2.2 Procurement and Processing of Raw Material

Blue pea flower, hibiscus, amla, lemon peel, moringa, tulsi, mint, clove, cinnamon, fennel, ginger and black pepper were procured from the local market. Flowers were cleaned and shade-dried; the fruit materials (amla and lemon peel) were washed, sliced and dried under controlled conditions; the leafy herbs (moringa, tulsi and mint) were cleaned and shade-dried; and the spices (clove, cinnamon, fennel, ginger and black pepper) were cleaned and dried. All dried materials were pulverised into fine powder using a laboratory grinder and passed through a fine mesh sieve prior to formulation.

2.3 Formulation and Standardization of Trial Blends

Four trial formulations, coded T₁ to T₄, differing in the relative proportion of the twelve constituent ingredients, were prepared by blending the powdered raw materials in varying ratios. Following sensory screening (Section 2.4), one formulation was selected and standardised; its composition on a 100 gram batch basis is presented in Table 1.

2.4 Sensory Evaluation

The four trial formulations were reconstituted in hot water and evaluated by a panel of three semi-trained judges for colour, flavour, taste, texture, appearance and overall acceptability, using a nine-point hedonic scale [11], where a score of 9 corresponded to “liked extremely” and a score of 1 to “disliked extremely”. Each formulation was evaluated

in triplicate under controlled laboratory conditions.

2.5 Physicochemical Analysis

The selected formulation was analyzed for bulk density, hydration capacity, hydration index, swelling capacity, swelling index, pH, moisture content and solubility, following standard procedures previously applied to plant-based flours and powders [12, 13]. All determinations were carried out in triplicate.

2.6 Proximate Composition

Moisture, ash, crude fat, crude fibre and crude protein content were determined according to standard methods of the Association of Official Analytical Chemists [14, 15]. Carbohydrate content was calculated by difference, and energy value was calculated using the standard Atwater general factors (4 kilocalorie per gram protein, 9 kilocalorie per gram fat and 4 kilocalorie per gram carbohydrate).

2.7 Vitamin C Content

Ascorbic acid content was determined by the 2,6-dichlorophenol indophenol visual titration method, in triplicate.

2.8 Antioxidant Activity

The free-radical scavenging activity of the detox mix powder extract was determined using the 2,2-diphenyl-1-picrylhydrazyl assay, following the principle described by Molyneux [16] and as previously applied to plant leaf and flower extracts by Ara and Nur [17]. Extract concentrations of 100, 200, 300 and 400 microgram per milliliter were assayed against an ascorbic acid standard at the corresponding concentrations, and percentage inhibition was calculated relative to a control. The half-maximal inhibitory concentration was estimated by linear interpolation between adjacent data points.

2.9 Antinutritional Factor

Phytate content of the selected formulation was determined in triplicate using standard analytical procedure.

2.10 Storage Stability Study

The selected formulation was packed in moisture-resistant infusion pouches and stored under ambient conditions for 45 days. Sensory attributes (colour, aroma, taste, flavour and overall acceptability) and physicochemical parameters (moisture content, pH and overall acceptability) were assessed at 15-day intervals, namely on Day 0, 15, 30 and 45.

2.11 Statistical Analysis

All data are expressed as mean plus or minus standard deviation of three replicate or panel observations. One-way analysis of variance was used to test for differences among formulations and across storage intervals, and the critical difference at the 5 percent level of significance was calculated for each parameter.

3. Results and Discussion

3.1 Standardization of the Detox Mix Powder

The composition of the standardized detox mix powder formulation, on a 100 gram batch basis, is presented in Table 1. Amla powder was the single largest ingredient by weight (17.00 g/100 g), followed by ginger (12.76 g/100 g),

and moringa and fennel (10.64 g/100 g each), with the remaining flowers, herbs and spices each contributing between 2.98 and 8.52 g/100 g. This composition reflects a deliberate emphasis on ascorbic-acid-and polyphenol-rich fruit and spice components (amla, ginger) alongside fibre- and micronutrient-dense leafy herbs (moringa) as the principal functional contributors to the blend.

3.2 Sensory Evaluation of Trial Formulations

The mean sensory scores of the four trial formulations (T_1 to T_4) for colour, flavour, taste, texture, appearance and overall acceptability are presented in Table 2. One-way analysis of variance indicated that the differences among the four formulations were statistically non-significant for all six attributes (p greater than or equal to 0.05), suggesting that the observed variation reflected normal panel variation rather than a strong formulation effect at the sample size tested. Despite this, one formulation (T_4) consistently received the highest or jointly highest mean scores for flavour, taste, texture, appearance and overall acceptability, and the second-highest score for colour. The superior sensory performance of this formulation may be attributed to its balanced proportion of blue pea flower, hibiscus, amla, moringa, tulsi, mint and selected spices, which together imparted an attractive natural colour, pleasant flavour, balanced taste and desirable texture. This formulation was therefore selected for detailed physicochemical, nutritional, antioxidant and storage evaluation, and is referred to as the standardized formulation for the remainder of this paper.

3.3 Physicochemical Properties

The physicochemical characteristics of the standardized detox mix powder are presented in Table 3. The bulk density was 0.359 ± 0.002 gram per millilitre, indicating a light, free-flowing powder with good handling and packaging characteristics, comparable to values reported for herbal tea and functional beverage powders [4]. The hydration capacity and hydration index were 4.597 ± 0.045 gram and 4.597 ± 0.045 , respectively, indicating favourable water absorption, consistent with the presence of fibre-rich ingredients such as moringa, mint, tulsi, amla and lemon peel, and broadly comparable to the hydration behaviour reported for fibre-rich plant flours by Wani *et al.* [13]. The swelling capacity and swelling index were 1.25 ± 0.05 millilitre and 1.40 ± 0.01 , respectively, indicating moderate swelling on reconstitution. The pH of the formulation was 5.12 ± 0.03 , a mild acidity attributable primarily to the amla, hibiscus and lemon peel content of the blend, and comparable to pH values reported for herbal detox beverages by Pawar Banakar and Pawar [8]. The moisture content, at 6.53 ± 2.05 percent, fell within the range generally considered acceptable for dehydrated herbal powder formulations, while the solubility of 19.93 ± 0.40 percent reflects the appreciable proportion of insoluble dietary fibre naturally present in a multi-ingredient herbal blend of this kind, a pattern also reported for other fruit-and flour-derived powders [18].

3.4 Proximate Composition

The proximate composition of the standardized formulation is presented in Table 4. Crude protein (12.25 ± 0.52 percent) and crude fibre (9.80 percent) both reflect meaningful contributions from the leafy herb components (moringa, tulsi, mint) and the fruit and peel components (amla, lemon

peel) of the blend; moringa in particular is well documented as a comparatively protein-and micronutrient-dense leaf powder. Ash content (7.05 ± 0.24 percent) was relatively high for a plant-based powder blend, consistent with the mineral-rich flower and leaf components (blue pea, hibiscus, moringa) of the formulation. Crude fat (1.80 ± 0.30 percent) was low, as expected for a blend composed predominantly of dried leaves, flowers, fruit peel and spice powder rather than any oil-bearing seed material. Carbohydrate, calculated by difference at 62.57 percent, formed the largest single component of the blend on a dry-weight basis, and the resulting energy value of approximately 318 kilocalorie per 100 gram is consistent with a concentrated dry powder intended for consumption in small, reconstituted servings (Table 6) rather than as a bulk food.

3.5 Vitamin C Content

The vitamin C content of the standardized formulation was 5.66 ± 7.23 milligram per 100 gram. This value is markedly lower than the very high ascorbic acid content reported in the literature for fresh amla, which is expected given that amla is present only as a minor, dried component of a multi-ingredient blend; drying at elevated temperature is known to accelerate the loss of ascorbic acid and other heat-labile constituents from amla [19], and a similar processing-related loss of heat-sensitive bioactive constituents has been reported for dried ginger, another heat-sensitive constituent of the present blend [20]. The comparatively high variability observed between replicate determinations in the present study suggests that this value would benefit from further replication with closer attention to sample homogeneity before being treated as a definitive figure.

3.6 Antioxidant Activity

The free-radical scavenging activity of the standardized formulation, presented in Table 5, increased in a concentration-dependent manner, from 42.36 ± 0.82 percent inhibition at 100 microgram per millilitre to 79.43 ± 0.61 percent inhibition at 400 microgram per millilitre, with a corresponding half-maximal inhibitory concentration of approximately 152.76 microgram per millilitre. At the highest concentration tested, the formulation retained approximately 85 percent of the scavenging activity of the ascorbic acid standard at the same concentration (79.43 percent versus 93.87 percent), indicating strong intrinsic antioxidant capacity for a multi-ingredient blend. This finding is consistent with the polyherbal antioxidant literature; the maximum scavenging activity obtained here is comparable to values reported for other polyherbal tea formulations [10], and may be explained by the combined contribution of anthocyanin pigments from blue pea and hibiscus, ascorbic acid and polyphenols from amla and lemon peel, and gingerol-and piperine-type compounds from ginger and black pepper. Leafy herbs and fruit and vegetable materials of the type used in this formulation are well documented as rich sources of phenolic and flavonoid antioxidants [21], while spices such as clove, cinnamon and ginger are disproportionately rich in phenolic compounds relative to their consumption volume [22], and have been identified among the most polyphenol-dense dietary sources in large-scale comparative analyses [23]. Dietary flavonoids of the type contributed by these ingredients are further associated with cardiovascular-related bioactivity [24] and anti-inflammatory effects [25] upon regular consumption,

lending further support to the potential functional value of the developed formulation.

3.7 Antinutritional Factor

The phytate content of the standardized formulation was 0.277 ± 0.0152 gram per 100 gram. This is a comparatively low value and given the small quantity of detox mix powder consumed per reconstituted serving (Table 6), the corresponding phytate intake per serving is negligible; the formulation can reasonably be considered nutritionally safe with respect to this antinutritional factor at the intended serving size.

3.8 Nutritional Composition Per Serving

The nutritional composition of the formulation at the recommended serving size of 5 gram, reconstituted in 150 millilitre of hot water, is presented in Table 6. At this serving size, the formulation provides a modest 16 kilocalorie, positioning it as a low-calorie functional beverage suitable for regular consumption without materially contributing to daily energy intake; its principal functional value lies in its antioxidant and phytochemical contribution rather than in macronutrient supply.

3.9 Storage Stability

The effect of 45 days of ambient storage on the sensory and physicochemical quality of the standardized formulation is presented in Tables 7 and 8. Sensory scores for colour, aroma, taste, flavour and overall acceptability began at a very high level on Day 0 (all above 8.8 on the nine-point scale) and declined gradually but statistically significantly over the storage period for every attribute; nevertheless, all attribute scores remained above 8.0 ("liked very much") at Day 45, indicating good sensory shelf stability. Moisture content increased significantly, from 6.53 ± 0.05 percent at Day 0 to 7.35 ± 0.09 percent at Day 45, while pH declined mildly but significantly, from 5.12 ± 0.03 to 4.98 ± 0.06 ,

over the same period. The gradual moisture gain is consistent with the hygroscopic nature of a fine herbal powder blend and points to some residual moisture permeability through the infusion-pouch packaging under ambient conditions, while the mild acidification trend is plausibly linked to slow oxidative or hydrolytic changes in the organic acid and phenolic constituents contributed by the lemon peel, amla and hibiscus components of the blend. These trends are broadly consistent with the storage-stability behaviour reported for other herbal detox and tea-bag formulations, which have similarly identified moisture uptake and gradual physicochemical drift as the principal limiting factors for shelf life [26, 27], rather than any single catastrophic failure mode, and are consistent with the general sensitivity of detox-type beverage products to their storage environment [28]. On the basis of the results obtained, the developed detox mix powder may be considered to have a practical shelf life of at least 45 days under ambient storage in infusion pouches, while continued monitoring beyond 45 days would be needed to establish the outer limit of acceptable storage.

Table 1: Composition of the standardized detox mix powder formulation (per 100 gram batch)

Ingredient	Amount (g/100 g)
Blue pea flower powder	6.38
Hibiscus powder	8.52
Amla powder	17.00
Lemon peel powder	4.26
Moringa leaf powder	10.64
Tulsi leaf powder	8.52
Mint leaf powder	6.38
Clove powder	3.40
Cinnamon powder	8.52
Fennel powder	10.64
Ginger powder	12.76
Black pepper powder	2.98
Total	100.00

Table 2: Sensory evaluation scores of the four trial detox mix powder formulations

Sample	Colour	Flavour	Taste	Texture	Appearance	Overall Acceptability
T1	6.67 ± 2.31	7.33 ± 2.08	7.67 ± 2.31	7.33 ± 1.15	7.33 ± 2.08	7.67 ± 1.53
T2	7.67 ± 0.58	7.67 ± 1.53	7.67 ± 1.15	8.00 ± 1.00	8.00 ± 1.00	7.67 ± 0.58
T3	6.67 ± 1.53	7.00 ± 1.73	6.00 ± 1.00	7.00 ± 1.73	6.67 ± 1.53	6.67 ± 1.53
T4	7.00 ± 1.73	8.33 ± 2.08	8.33 ± 2.08	8.67 ± 1.53	8.00 ± 1.73	8.33 ± 1.08
S.E.	0.96	1.08	1.00	0.80	0.94	0.88
C.D. (5%)	3.12 (NS)	3.52 (NS)	3.26 (NS)	2.61 (NS)	3.07 (NS)	2.88 (NS)

Values are mean $\pm$ standard deviation of three panellist observations. S.E. – standard error; NS – non-significant at 5 percent level of significance (one-way analysis of variance, error degrees of freedom = 8).

Table 3: Physicochemical properties of the standardized detox mix powder

Parameter	Value (Mean $\pm$ SD)
Bulk density (g/mL)	0.359 ± 0.002
Hydration capacity (g)	4.597 ± 0.045
Hydration index	4.597 ± 0.045
Swelling capacity (mL)	1.25 ± 0.05
Swelling index	1.40 ± 0.01
pH	5.12 ± 0.03
Moisture content (%)	6.53 ± 2.05
Solubility (%)	19.93 ± 0.40

Table 4: Proximate composition of the standardized detox mix powder (per 100 gram)

S. No.	Nutritional Parameter	Value (Mean $\pm$ SD)
1	Moisture (%)	6.53 $\pm$ 2.05
2	Ash (%)	7.05 $\pm$ 0.24
3	Crude fat (%)	1.80 $\pm$ 0.30
4	Crude fibre (%)	9.80
5	Crude protein (%)	12.25 $\pm$ 0.52
6	Carbohydrate (% by difference)	62.57
7	Energy (kcal)	318

Crude fibre is reported as a single confirmed reading; carbohydrate was calculated by difference and energy by the standard Atwater general factors, and are therefore reported without a separate standard deviation.

Table 5: Free-radical (DPPH) scavenging activity of the standardized detox mix powder

Sample Concentration (μ g/mL)	% Scavenging (Mean $\pm$ SD)
100	42.36 $\pm$ 0.82
200	56.84 $\pm$ 0.74
300	68.51 $\pm$ 0.69
400	79.43 $\pm$ 0.61
Ascorbic acid standard (400 μ g/mL)	93.87 $\pm$ 0.48

Table 6: Nutritional composition of the detox mix powder per serving (5 g in 150 mL hot water)

Nutritional Composition	Per Serving
Energy (kcal)	16
Fat (g)	0.09
Crude fibre (g)	0.49
Crude protein (g)	0.61
Carbohydrate (g)	3.13
Vitamin C (mg)	0.28

Table 7: Effect of storage period on sensory qualities of the detox mix powder

Day	Colour	Aroma	Taste	Flavour	Overall Acceptability
0	8.80 $\pm$ 0.17	8.90 $\pm$ 0.10	8.85 $\pm$ 0.15	8.82 $\pm$ 0.12	8.88 $\pm$ 0.11
15	8.65 $\pm$ 0.18	8.72 $\pm$ 0.14	8.68 $\pm$ 0.16	8.60 $\pm$ 0.15	8.66 $\pm$ 0.13
30	8.42 $\pm$ 0.16	8.45 $\pm$ 0.18	8.38 $\pm$ 0.19	8.32 $\pm$ 0.18	8.40 $\pm$ 0.17
45	8.18 $\pm$ 0.20	8.15 $\pm$ 0.21	8.08 $\pm$ 0.22	8.02 $\pm$ 0.19	8.10 $\pm$ 0.20
S.E.	0.09	0.10	0.11	0.10	0.09
C.D. (5%)	0.28	0.30	0.32	0.31	0.29

Table 8: Effect of storage period on physicochemical parameters of the detox mix powder

Storage Interval (days)	Moisture (%)	pH	Overall Acceptability Score
0	6.53 $\pm$ 0.05	5.12 $\pm$ 0.03	8.88 $\pm$ 0.11
15	6.78 $\pm$ 0.07	5.08 $\pm$ 0.04	8.66 $\pm$ 0.13
30	7.06 $\pm$ 0.08	5.03 $\pm$ 0.05	8.40 $\pm$ 0.17
45	7.35 $\pm$ 0.09	4.98 $\pm$ 0.06	8.10 $\pm$ 0.20
S.E.	0.05	0.02	0.09
C.D. (5%)	0.16	0.07	0.29

4. Conclusion

A polyherbal detox mix powder was successfully formulated from twelve locally available flowers, fruits, herbs and spices, and standardized on the basis of sensory evaluation of four trial formulations. The selected formulation demonstrated favourable physicochemical properties, a nutritionally meaningful proximate composition, concentration-dependent antioxidant activity, low antinutritional phytate content, and good sensory and physicochemical stability over 45 days of ambient storage. These findings indicate that the developed detox mix powder is a nutritionally sound, antioxidant-rich and

storage-stable natural functional beverage suitable for regular consumption, and that it holds promise as an economical, additive-free alternative to commercially available processed beverages. Given the use of locally available and affordable raw materials, the formulation also presents potential for small-scale and household-level production. Further research, including in-vivo evaluation of health benefits, consumer acceptability studies across larger and more diverse populations, and extended storage trials under varied packaging conditions, is recommended to further establish the commercial and nutritional potential of this formulation.

5. Acknowledgements

The authors gratefully acknowledge the Department of Food Science and Nutrition, College of Community and Applied Sciences, Maharana Pratap University of Agriculture and Technology, Udaipur, for providing the laboratory facilities required for this study, and thank the sensory panel members for their participation in the evaluation trials.

Conflict of Interest

The authors declare that they have no conflict of interest.

References

- World Health Organization. Going digital for noncommunicable diseases: the case for action. Geneva: World Health Organization; 2024.
- Food and Agriculture Organization of the United Nations. Plant-based foods and sustainable healthy diets. Rome: FAO; 2023.
- Famurewa JA, Adepeju AB, Fasare D. Evaluation of diffusivity and acceptable mixing ratio for production of hibiscus-moringa tea bags. *Arid Zone Journal of Engineering Technology and Environment*. 2017;13(4):513-522.
- Builders PF, Arhewoh MI, Kunle OO. Preparation and evaluation of the physicochemical and stability properties of herbal tea blends derived from native medicinal plants. *Journal of Phytomedicine and Therapeutics*. 2021;19(2):448-465.
- Kumari P, Anisha V, Bala N. Development of antioxidant rich herbal tea bags. *International Journal for Research in Applied Science and Engineering Technology*. 2021;9(8):2519-2520.
- Bendaali Y, Vaquero C, Escott C, Gonzalez C, Morata A. Isotonic drinks based on organic grape juice and naturally flavored with herb and spice extracts. *Beverages*. 2023;9(2):49.
- Bose PSC, Reddy SA, Naik BR, Rao TV. Formulation and preliminary evaluation of multi-herbal tea blends for functional health benefits. *Journal of Pharmacognosy and Phytochemistry*. 2025;14(5):28-30.
- Pawar Banakar S, Pawar GS. Development and quality assessment of herbal tea bag. *International Journal of Advanced Biochemistry Research*. 2025;9(10 Suppl):1553-1556.
- MVM JV, Sathiya V. Development and acceptability assessment of blue pea butterfly drink: a study on formulation and nutritional properties. *Innovare Agriculture*. 2025;8:e42115.
- Raju CN, Chandrika SB, Ramya J, Chiranjeevi P. Preparation and evaluation of polyherbal tea bags with antioxidant activity for management of oxidative stress. *Journal of Herbal Medicine and Toxicology*. 2024;18(2):67-74.
- Ranganna S. *Handbook of Analysis and Quality Control for Fruit and Vegetable Products*. 2nd ed. New Delhi: Tata McGraw-Hill; 1986.
- Narayana K, Narasinga Rao MS. Functional properties of raw and heat processed winged bean (*Psophocarpus tetragonolobus*) flour. *Journal of Food Science*. 1982;47(5):1534-1538.
- Wani IA, Sogi DS, Gill BS. Physicochemical and functional properties of flours from three black gram (*Phaseolus mungo* L.) cultivars. *International Journal of Food Science and Technology*. 2013;48(4):771-777.
- Association of Official Analytical Chemists. *Official Methods of Analysis*. 15th ed. Washington (DC): AOAC; 1990.
- Association of Official Analytical Chemists. *Official Methods of Analysis*. 17th ed. Washington (DC): AOAC; 2000.
- Molyneux P. The use of the stable free radical diphenylpicrylhydrazyl (DPPH) for estimating antioxidant activity. *Songklanakarin Journal of Science and Technology*. 2004;26(2):211-219.
- Ara N, Nur H. *in vitro* antioxidant activity of methanolic leaves and flowers extracts of *Lippia alba*. *Research Journal of Medical Sciences*. 2009;4(1):107-110.
- Huang S, Martinez MM, Bohrer BM. The compositional and functional attributes of commercial flours from tropical fruits (breadfruit and banana). *Foods*. 2019;8(11):586.
- Raaf A, Suriaini N, Djafar F, Syamsuddin Y, Supardan MD. Effect of drying temperature on the moisture loss, acidity and characteristics of amla fruit. *IOP Conference Series: Earth and Environmental Science*. 2021;667(1):012047.
- Bag BB. Ginger processing in India (*Zingiber officinale*): a review. *International Journal of Current Microbiology and Applied Sciences*. 2018;7(4):1639-1651.
- Chandra S, Khan S, Avula B, Lata H, Yang MH, ElSohly MA, *et al.* Assessment of total phenolic and flavonoid content, antioxidant properties, and yield of aeroponically and conventionally grown leafy vegetables and fruit crops. *Evidence-Based Complementary and Alternative Medicine*. 2014;2014:253875.
- Shahidi F, Ambigaipalan P. Phenolics and polyphenolics in foods, beverages and spices: antioxidant activity and health effects—a review. *Journal of Functional Foods*. 2015;18:820-897.
- Perez-Jimenez J, Neveu V, Vos F, Scalbert A. Identification of the 100 richest dietary sources of polyphenols: an application of the Phenol-Explorer database. *European Journal of Clinical Nutrition*. 2010;64(Suppl 3):S112-S120.
- Dabeek WM, Marra MV. Dietary quercetin and kaempferol: bioavailability and potential cardiovascular-related bioactivity in humans. *Nutrients*. 2019;11(10):2288.
- Serafini M, Peluso I, Raguzzini A. Flavonoids as anti-inflammatory agents. *Proceedings of the Nutrition Society*. 2010;69(3):273-278.
- Madhu Mitha M, Divya B, Jain S. Formulation and quality analysis of detox drink. *International Journal of Home Science*. 2016;2(3):153-155.
- Shamim N, Paul V, Prasad R, Chattree A. The accelerated stability study of herbal tea bag—an Ayurvedic formulation. *UGC Care Group Journal*. 2020;10:1-6.
- Kiralan S, Gokduman S. Effect of storage conditions on removal of 32 pesticide residues in detox waters. *Environmental Science and Pollution Research*. 2025;32(33):19945-19952.