Optimising Functional Foods (*Curcuma longa* and *Allium sativum*) Formulation for Improved Antioxidant Capacity

Adogu, Fidel Chiemela

Department of Biochemistry, University of Calabar, Calabar, Nigeria.

DOI: https://doi.org/10.51584/IJRIAS.2026.11070076

Received: 18 July 2026; Accepted: 23 July 2026; Published: 04 August 2026

ABSTRACT

The study investigated the optimisation of a blend of turmeric and garlic to ascertain the highest antioxidant capacity to support a more potent preventive use of the food substances in the management of diseases. Turmeric and garlic blends (TGB) were bought from Marian Market in Calabar, Cross River State, cleaned, blended and then constituted at 60:40%, 50:50%, and 40:60%. The antioxidant capacity and phytochemical composition of the blends were determined using standard procedures: ferric reducing antioxidant property (FRAP) and 1,1-diphenyl 1-2-picryl-hydrazyl (DPPH) radical scavenging activity. The sensory properties of the blends were also evaluated using a 5-point hedonic scale for acceptability on appearance, aroma, taste, mouthfeel, and overall acceptability. The turmeric and garlic formulation at a 50/50 % emerged as the highest in antioxidant capacity. The ameliorating effect of the 50% proportion needs to be evaluated in vivo studies to generate data on the supporting capabilities.

Keywords: Functional Foods, Food formulation, Antioxidant Capacity, Preventive Nutrition, Food Quality.

INTRODUCTION

Functional Foods are increasingly relevant, attributed to their richness in phytochemicals, fortification, and health benefits beyond basic nutrition. They are used for preventive healthcare to manage and lower the risk of chronic conditions and oxidative stress. Antioxidants, a category of compounds capable of counteracting oxidative stress and ameliorating its impact on human health, have garnered significant attention within the biomedical research community (Abuajah *et al*., 2015; Pizzino *et al.,* 2017). These compounds have not only exhibited substantial efficacy in terms of preventing and/or treating diseases but have also been perceived as having minimal adverse effects (Ghattamaneni and Brown, 2021; Lin *et al.,* 2022). Scholarly studies have highlighted the potent antioxidant and anti-inflammatory properties of curcumin, a primary bioactive compound in turmeric and garlic (curcumin and allicin), which have been found to have potent pharmacological properties (Prasad and Aggarwal, 2011). As antioxidants, turmeric and garlic extracts have been reported to scavenge free radicals, increase antioxidant enzymes, and inhibit lipid peroxidation (Sahebkar *et al*., 2015; Zeng *et al.*, 2017; Lin *et al*., 2020; Abd El-Hack *et al.,* 2021).

Turmeric and Garlic bioactive compounds have shown potential in supporting both preventive and pharmacological properties in fighting diseases. Thus, exploring the synergistic effect of these natural sources of antioxidants might present supporting evidence on enhancing the understanding of effective dose and the mechanism of action required for the rational use of turmeric and garlic in the management and treatment of human diseases. To improve health outcomes through healthy food choices and behaviours that encourage food selection and use, it is pertinent that combinations of rich bioactive food selections should not only be the driving force for improved quality but also the exploration of the formulations at different quantities. To promote the effectiveness of their antioxidant capacity for improved health outcomes and the quality of the associated foods, food formulation and analysis are key to data generation and decision-making. Exploring the overall potential of all antioxidants in a sample to scavenge reactive oxygen species (ROS) rather than the activity of a single specific molecule becomes relevant in driving food quality. The knowledge on nutrient quality, bioavailability, food analysis and metabolism has motivated a lot of studies to probe nutrient retention,

ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume XI Issue VII July 2026

consumption patterns, and efficient metabolism of nutrients in the body (Zhang *et al.,* 2021; Geng *et al.,* 2023). Thus, the need to optimise both selection and the right use for effective nutrition and preventive results.

Turmeric Rhizome (*Curcuma longa*)

Turmeric Rhizome (*Curcuma longa*)

Garlic bulb (*Allium sativum L.*)

METHODOLOGY

Study area

The cross-sectional study was carried out in Calabar Municipal, the capital of Cross River State. Calabar Municipality lies between latitude 04° 15' and 5° N and longitude 8° 25' E. In the North, the Municipality is bounded by Odukpani Local Government Area (LGA) in the North-East by the great Kwa River. Its Southern shores are bounded by the Calabar River and Calabar South Local Government Area. It has an area of 331.551 square kilometres. Calabar Municipal Government Area plays a dual role. Apart from being the Capital city of Cross River State, it also plays its role as the headquarters of the Southern Senatorial District.

Sample sourcing and preparation

The botanical species of turmeric found in Nigeria is *Curcuma longa*. This species grows exceptionally well in the rich, loamy soils of South-South states like Cross River. Locally, it is known by names such as "Onjonigho'' in parts of Cross River. Fresh yellow variety of turmeric and fresh garlic bulbs were purchased from Marian Market, Marian, Calabar, Cross River State for the study. The purchased samples were randomly selected from the bulk purchase, weighed, sorted to remove stones, and washed to remove sand and debris. It was then peeled and rewashed to remove dirt and contamination before use. The peeled samples were diced to ease blending, and then blended.

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Turmeric and garlic blend formulation

The food blend formulation was carried out to determine the preferred, most acceptable, and highest-antioxidant-capacity blend for the study. This involved the preparation of the study food samples (turmeric and garlic) as a blend at different proportions. Figure 1 shows the flow chart of the blend sample preparation. One kilogram each of turmeric and garlic was blended with 250 ml of boiled and cooled water to a smooth consistency (water-to-sample ratio is 1kg of sample to 250 mls of water). The generated puree was placed on a 400mesh size sieve housed in a clean bowl to obtain the filtrate of the blended samples. The filtrate was then used to produce three different blends with the following proportions: 60/40 (%) Turmeric/Garlic, 50/50 (%) Turmeric/Garlic, and 40/60 (%) /Turmeric/Garlic. The blends were placed in an airtight container and stored in the refrigerator prior to the sensory evaluation, antioxidant capacity, phytochemical, proximate and mineral composition analyses.

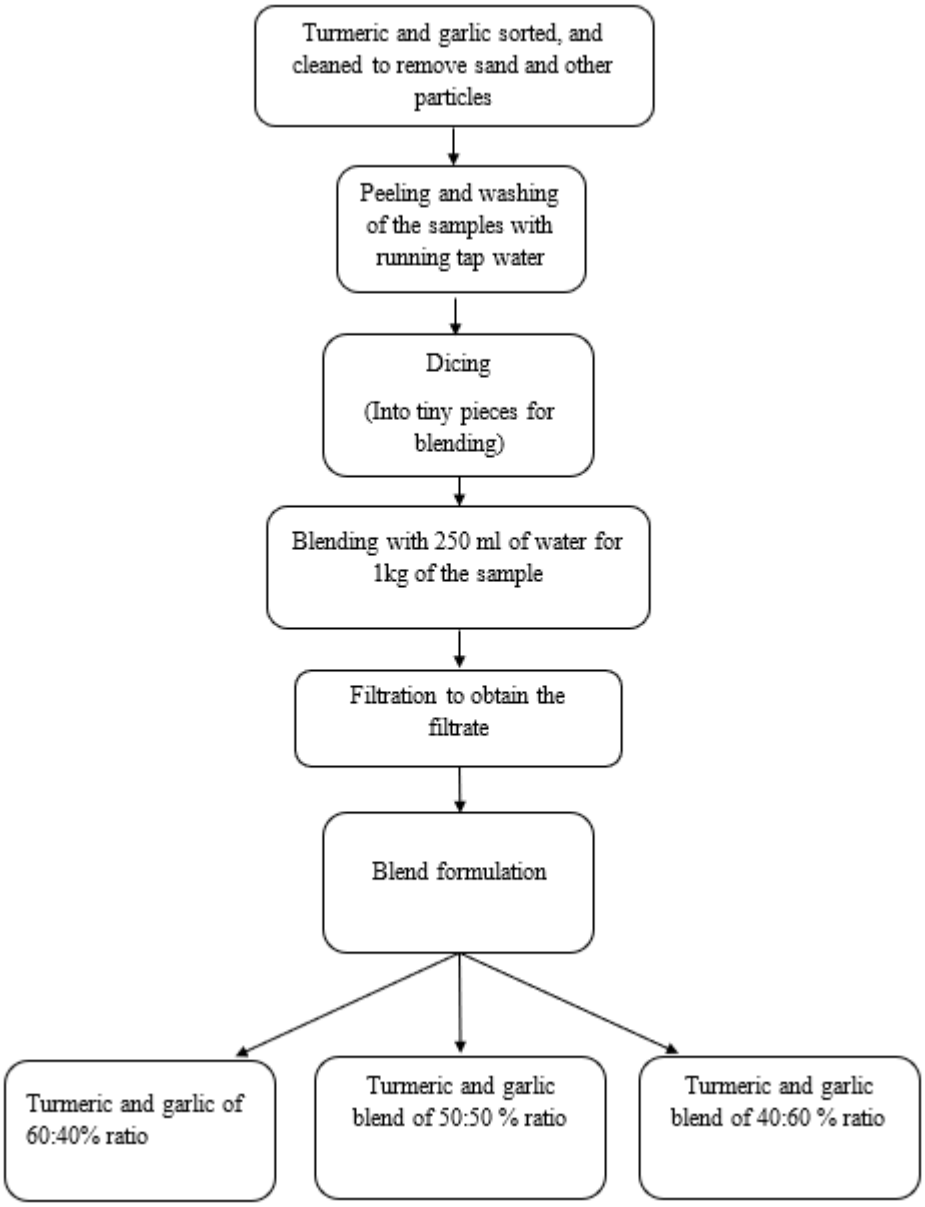

FIGURE 1: Flowchart of the preparation of turmeric and garlic blends

Sensory evaluation of the formulated blends

The formulated blends were subjected to sensory evaluation according to the study of Adogu (2018) for acceptability on appearance, aroma, taste, mouthfeel, and overall acceptability by a panel of twenty adult (18 years and above) testers. The selection of testers was made by individuals who have an appreciable knowledge

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and understanding of foods, and the ability to analyse and describe sensory attributes of food products. The test panellists were asked to rate the different compositions presented to them on a 5-point hedonic scale. The sensory evaluation of the samples was carried out in the Biochemistry laboratory, University of Calabar, Cross River State. The participants' verbal consent was obtained after they were informed about the study and expectations from the sensory evaluation, which is to aid the researcher in making an appreciable choice on the developed blend proportions of food samples from plant sources. The three samples were well labelled as indicated in the evaluation score sheet for ease of identification. A spoon, water, and serviette were provided for the exercise. The researcher demonstrated the evaluation procedure to the participant and also established that the samples to be evaluated are safe for consumption. The sensory properties were assessed on each parameter one sample at a time, with the rinsing of the spoon, drinking of water and cleaning with a serviette before assessing the next blend. After the exercise, the participants were thanked and the score sheets collected for compilation and analysis. See the sensory evaluation questionnaire used for this study below.

Sensory Evaluation Sheet

Dear participant, the sensory evaluation you are about to participate in is to help the researcher make an informed choice on some developed blend proportions of food products from plant sources. This valuable participation will aid decision-making on product selection or a PhD study. Kindly note that an ethical approval (Approval number:353HND3024) has been obtained for the study from the Animal Research Ethics Committee (FAREC-FBMS), Faculty of Basic Medical Science, University of Calabar, Calabar, Nigeria.

You will be expected to evaluate 3 samples on the following: Appearance, aroma, taste, mouthfeel, and overall acceptability using a 5-point hedonic scale as described below.

1 Dislike extremely
2 Dislike
3 Neither like nor dislike
4 Like
5 Like extremely

The samples will be represented by the following codes: Sample 1 – TG6/4. Sample 2 – TG5/5, and Sample 3 – TG4/6.

S/n	Sensory Parameters	TG6/4	TG5/5	TG4/6
1	Appearance			
2	Aroma			
3	Texture			
4	Taste			
5	Overall acceptability			

Please comment freely on your experience on this exercise……..

……

……

Thank you.

Determination of the antioxidant capacity of the blends

Determination of the ferric reducing antioxidant property (FRAP)

The reducing property of the sample was determined by assessing the ability of the extract to reduce $FeCl_3$ solution as described by Oyaizu (1986). One millilitre of the sample extract was first incubated with 1ml of

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0.2 M sodium phosphate buffer and potassium ferricyande at 50 °C for 30 min. The mixture was then acidified with 1ml of 10% tricloroacetic acid (TCA). The mixture was then centrifuged, and 1ml of the supernatant was mixed with 1 mL of distilled water and 1ml of 0.1% iron chloride. The absorbance was taken at a wavelength of 700nm.

Percentage FRAP = [(FRAP value of sample) / (FRAP value of standard)] × 100.

Determination of the DPPH radical scavenging activity

Antioxidant potential of the samples was assessed by using 1,1-diphenyl 1-2-picryl-hydrazyl (DPPH) reagent as described by Fidriannyl *et al.* (2013). Sample solution of the samples was extracted using methanol solvent. DPPH reagent was prepared by dissolving 2.4g in 100 ml of methanol and diluted with methanol to obtain an absorbance at 517 nm. An aliquot of 0.1 ml of the sample extract was added to 3 ml of the DPPH solution. After incubation for 15 min in the dark, the absorbance of the mixture was measured at 517 nm. Ascorbic acid was used as a control. The following formula was applied to determine the DPPH radical scavenging activity;

Percentage inhibition = [(Absorbance of standard – Absorbance of sample)/ (Absorbance of standard)] × 100.

Phytochemical Analytical Methods

Determination of the alkaloid content of the blend (Harborne, 1973 and Trease, 1989)

Exactly 2g of sample was weighed into a 100ml beaker and 20 mL of 80% absolute alcohol was added. The mixture was transferred to a 250ml flask and more alcohol was added to make up to 100ml and 1g magnesium oxide was added. The mixture was digested in a boiling water bath for 1.5hrs under a reflux condenser with occasional shaking. The mixture was filtered while hot through a small Buchner funnel. The residue was returned to the flask and digested for 30min with 50ml alcohol, after which the alcohol was evaporated, adding hot water to replace the alcohol lost.

When all the alcohol had been removed, 3 drops of 10% HCl were added. The whole solution was later transferred into a 250ml volumetric flask, 5ml of zinc acetate solution and 5ml of potassium ferrocyanide solution were added, thoroughly mixed to give a homogeneous solution.

The flask was allowed to stand for a few minutes, filtered through dry filter paper and 10ml of the filtrate was transferred into a separatory funnel, and the alkaloids present were extracted vigorously by shaking with five successive portions of chloroform. The residue obtained was dissolved in 10ml hot distilled water and transferred into a Kjeldahl tube with the addition of 0.20g sucrose and 10ml Conc.H_2SO_4 and 0.02g selenium for digestion to a colourless solution, and then precipitated with a base like ammonia and weighed the collected solid.

% Alkaloid content = (Weight of dried alkaloids / Weight of sample) x 100

Determination of the saponin content of the blend (Harborne, 1973 and Trease, 1989).

The Spectrophotometric method was used for Saponin Analysis. Exactly 1g of finely ground sample was weighed into a 250ml beaker, and 100ml of isobutyl alcohol was added. The mixture was shaken on a vortex shaker to ensure uniform mixing. Thereafter, the mixture was filtered through a Whatman No.1 filter paper into a 100ml beaker and 20ml of 40% saturated solution of magnesium carbonate was added.

The mixture obtained with saturated MgCO3 was again filtered through a Whatman No.1 filter paper to obtain a clear colourless solution. 1ml of the colourless solution was pipetted into 50ml volumetric flask, and 2ml of 5% $FeCl_3$ solution was added, and made up to the mark with distilled water.

It was allowed to stand for 30min for the blood red colour to develop. 0-10ppm standard Saponin solutions were prepared from saponin stock solution. The standard solutions were treated similarly with 2ml of 5%

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$FeCl_3$ solution as done for the 1 mL sample above. The absorbance of the sample as well as standard saponin solutions was read after colour development in a Spectrophotometer at a wavelength of 380 nm.

% Saponin = (Weight of dried saponin residue / Weight of initial plant material) x 100

Determination of the tannin content of the sample (Harborne, 1973 and Trease, 1989).

Exactly 0.20g of the mixture was measured into a 50ml beaker. 20 ml of 50% methanol was added, covered with parafilm and placed in a water bath at 77- 80 °C for 1 hour. It was shaken thoroughly to ensure uniform mixing. The extract was filtered using a double-layered Whatman No. 41 filter paper into a 100ml volumetric flask. 20 mL water was added, 2.5 mL Folin-Denis reagent and 10ml of 17% Na_2Co_3 were added and mixed properly.

The mixture was made up to the mark with water, mixed well and allowed to stand for 20min. The bluish–green colour will develop at the end of the range 0-10ppm were treated similarly to a 1 mL sample above. The absorbance of the Tannic acid standard solutions as well as samples was read after colour development on a spectrophotometer at a wavelength of 760nm.

Tannin concentration (mg/mL) = (Absorbance of sample / Absorbance of standard) x Concentration of standard tannin solution

Determination of the phenol content of the blend (Harborne, 1973 and Trease, 1989)

Exactly 0.20g of sample was weighed into a 50ml beaker, then 20ml of acetone was added and homogenised properly for 1hr to prevent lumping. The mixture was filtered through a Whatman No.1 filter paper into a 100ml Volumetric Flask using acetone to rinse and made up to mark with distilled water with thorough mixing.1ml of sample extract was pipetted into 50ml Volumetric flask, 20ml water added, 3ml of phosphomolybdic acid added followed by the addition of 5ml of 23% $NaCO_3$ and mixed thoroughly, made up to mark with distilled water and allowed to stand for 10min to develop bluish-green colour. Standard Phenol of concentration range 0-10mg/ml was prepared from 100mg/l stock Phenol solution from Sigma-Aldrich chemicals, USA. The absorbance of the sample as well as that of standard concentrations of Phenol were read on a Digital Spectrophotometer at a wavelength of 510nm.

Total Phenolic Content (mg GAE/g extract) = (C x V x D) / m:

C: Concentration of gallic acid equivalents (mg GAE/mL) derived from the standard curve.

V: Total volume of the sample used in the assay (mL).

D: Dilution factor (if the extract was diluted before analysis).

m: Mass of the dry extract used in the assay (g).

Determination of the flavonoid content of the blend (Allen, 1992)

Exactly 0.50g of finely ground sample was weighed into a 100ml beaker, and 80ml of 95% Ethanol added and stirred with a glass rod to prevent lumping. The mixture was filtered through a Whatman No.1. filter into a 100ml volumetric flask and made up to the mark with Ethanol. 1ml of the extract was pipetted into 50ml volumetric flask, and four drops of concentrated HCl were added via a dropping pipette, after which 0.5g of magnesium turnings was added to develop a magenta red colouration.

Standard flavonoid solution (0.5 mL) of range 0- 5 ppm was prepared from a 100 ppm stock solution and treated similarly with HCL and magnesium turnings like the sample. The absorbance of magenta red colouration of sample and standard solutions was read on a Spectrophotometer at a wavelength of 520nm.

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Total flavonoid content (mg QE/g) = (Concentration of QE from standard curve (mg/ml) x Volume of sample solution (ml) x Dilution factor) / Sample weight (g)

Determination of the steroids content of the blend (Baccou *et al*., 1977)

Exactly 0.50g of sample was weighed into a 100ml beaker, and then 20ml of Chloroform-Methanol (2:1) mixture was added to dissolve the extract upon shaking for 30minutes on a shaker. The whole mixture was later filtered through a Whatman No.1 filter paper into another dry, clean 100ml Conical Flask/Beaker. The resultant residue was repeatedly treated with a chloroform-methanol mixture until free of steroids. 1 mL of the filtrate was pipetted into a 30ml test tube, and 5ml of alcoholic KOH was added and shaken thoroughly to obtain a homogeneous mixture.

The mixture was later placed in a water bath set at 37 - 40ºC for 90minutes.It was cooled to room temperature and 10 mL of petroleum ether was added, followed by the addition of 5ml distilled water. This was evaporated to dryness on the water bath. Six millilitres of Liebermann-Burchard reagent was added to the residue in a dry bottle and absorbance taken at a wavelength of 620nm on a Spectrophotometer.

% Yield = Weight of steroids / Weight of sample ×100

Determination of the terpene content of the blend (Harborne*,* 1973 and Trease, 1989)

Exactly 0.50g of sample was weighed into a 50ml Conical Flask, 20ml of 2:1 Chloroform-Methanol mixture was added, shaken thoroughly and allowed to stand for 15 minutes. The mixture was centrifuged for another 15 minutes. The supernatant obtained was discarded, and the precipitate was re-washed with another 20ml chloroform-methanol mixture for re-centrifugation.

The resultant precipitate was dissolved in 40ml of 10% Sodium Dodecyl Sulphate solution.1ml of 0.01 M ferric chloride solution was added to the above at 30s interval, shaken well, and allowed to stand for 30 minutes. Standard Terpenes of concentration range 0-5mg/ml was prepared from 100mg/l stock Terpenes solution from Sigma-Aldrich chemicals, USA. The absorbances of the sample as well as that of standard concentrations of Terpenes were read on a Spectrophotometer at a wavelength of 510nm.

Total Terpenoid Content (mg/g or mg/mL) = (Peak Area of Sample / Peak Area of Standard) x (Concentration of Standard) / (Weight or Volume of Sample)

Determination of the glycoside content of the blend (Harborne*,* 1973 and Trease, 1989)

Exactly 10ml of extract was pipetted into a 250 mL conical flask. 50 mL chloroform was added and shaken on a Vortex Mixer for 1hr. The mixture was filtered into a 100 mL Conical flask, and 10ml pyridine 2ml of 2% sodium nitroprusside were added, shaken thoroughly for 10 minutes. 3ml of 20% NaOH was later added to develop a brownish-yellow colour.

Glycoside standards of concentrations which range from 0-5mg/ml were prepared from 100mg/ml stock Glycoside standard. The series of standards 0-5mg/ml were treated similarly to the sample above. The absorbance of the sample as well as standards was read on a Spectrophotometer at a wavelength of 510nm.

Data and Statistical Analysis

The sensory evaluation data generated with a five-point hedonic scale as follows (5 = like extremely, 4 = like, 3 = neither like nor dislike, 2 = dislike, and 1 = dislike extremely) were analysed using Microsoft Excel and converted into tables and means to make the data presentation meaningful. All chemical analyses and measurements were conducted in triplicate and expressed as the standard error of the mean. The generated data from the data analysis were subjected to a statistical analysis using One-way analysis of variance (ANOVA) with the determination of the Student *t*-test for significant differences at $P \leq 0.05$.

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RESULTS

Sensory evaluation of the turmeric and garlic blends

The sensory evaluation of the blends is shown in Table 1. The obtained scores from all measured parameters showed no significant differences at $p < 0.05$. For the overall acceptability, the turmeric/garlic 60:40% had the highest mean score for preference, followed by the turmeric/garlic 50:50% and turmeric/garlic 40:60%. With regard to overall acceptability, the mean score obtained for the turmeric/garlic blend with a 60:40% ratio showed more acceptability to the panellists, while the mean score of turmeric/garlic with the ratio of 40:60% showed the lowest acceptability score. Although the scores obtained for all parameters showed no significant differences, the turmeric/garlic 60/40 % blend had the highest mean score for aroma, texture, taste and overall acceptability. Generally, the scores for all the blends indicated that they were neither liked nor disliked on the 5-hedonic scale used for the sensory evaluation.

Table 1. Sensory evaluation of turmeric and garlic blends

Blend samples	Appearance	Aroma	Texture (Mouthfeel)	Taste	Overall acceptability
TGB (60/40%)	3.60 ± 0.17^{a}	3.65 ± 1.21^{a}	3.60 ± 0.18^{a}	3.45 ± 0.17^{a}	3.80 ± 0.17^{a}
TGB (50/50%)	3.65 ± 0.18^{a}	3.30 ± 1.45^{a}	3.40 ± 0.22^{a}	3.20 ± 0.25^{a}	3.60 ± 0.23^{a}
TGB (40/60%)	3.90 ± 0.12^{a}	3.60 ± 1.26^{a}	3.45 ± 0.17^{a}	3.25 ± 0.10^{a}	3.50 ± 0.11^{a}

**TG (60/40%) blend – Turmeric (50%) + Garlic (50%) blend proportion mixing ratio

TG (50/50%) blend – Turmeric (50%) + Garlic (50%) blend proportion mixing ratio

TG (40/60%) blend – Turmeric (50%) + Garlic (50%) blend proportion mixing ratio

All values are expressed as Mean ± SEM of triplicate results. The same superscript on the same column indicates no significant difference. Significant difference exists at $p < 0.05$.

Antioxidant capacity of the turmeric and garlic blends

The antioxidant capacity of the blends is shown in Table 2. The results showed that the 50/50 % turmeric and garlic blend had significantly ($p<0.05$) higher FRAP (77.19±0.05) and DPPH (68.65±0.06) compared to the other blends. There was no significant difference ($p<0.05$) in the values obtained for the FRAP between the 60/40% (turmeric and garlic blend) and the 40/60 % (turmeric and garlic) blends, while there was a significant difference between their DPPH values.

Table 2. Antioxidant capacity of the turmeric and garlic blends

Antioxidant Capacity Analysis	TG (60/40) blend ratio	TG (50/50) blend ratio	TG (40/60) Blend
FRAP (µmol Fe^{2+} equivalent)	56.70 ± 1.31^{a}	77.19 ± 0.05^{b}	60.29 ± 0.06^{a}
DPPH (% Inhibition)	59.61 ± 0.62^{a}	68.65 ± 0.06^{b}	65.09 ± 0.06^{c}

***Three (3) samples produced for antioxidant capacity analysis.

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TGB (60:40) ratio = 60% filtrate from blended turmeric rhizome (1kg) with 250 ml of water and 40% filtrate from blended garlic clove (1kg) with 250 ml of water.

TGB (50:50) % ratio =50% filtrate from blended turmeric rhizome (1kg) with 250 ml of water and 50% filtrate from blended garlic clove (1kg) with 250 ml of water.

TGB (40:60) % ratio = 40% filtrate from blended turmeric rhizome (1kg) with 250 ml of water and 60% filtrate from blended garlic clove (1kg) with 250 ml of water.

**FRAP – Ferric Reducing Antioxidant Power and DPPH -2,2-Diphenyl-1-picrylhydrazyl

All values are expressed as Mean ± SEM of triplicate results. Different superscript on the same row indicates significant differences. Significant difference exists at $p < 0.05$.

Quantitative phytochemical composition

Table 3 shows the result of the quantitative phytochemical analysis of the study samples, semi-fresh turmeric, semi-fresh garlic and the turmeric and garlic blend. The phytochemical values obtained for the selected blend (50/50 % turmeric and garlic) showed an improved quantity across all the phytochemicals analysed except for flavonoids, where the semi-fresh turmeric sample recorded the highest value in comparison with the semi-fresh garlic and the blend.

Table 3. **Quantitative phytochemical composition of turmeric, garlic, turmeric/garlic blend samples**

Phytochemicals	Turmeric	Garlic	TG (50/50%) Blend
Alkaloid (%)	3.14 ± *0.00*	5.64 ± *0.00*	6.17 ± *0.00*
Tannin (mg TAE/g)	2.51 ± *0.00*	4.02 ± *0.01*	4.32 ± *0.02*
Saponin (mg/g)	4.91 ± *0.00*	3.68 ± *0.01*	5.04 ± *0.01*
Phenol (mg PE/g)	5.07 ± *0.00*	0.97 ± *0.00*	4.90 ± *0.00*
Flavonoids (mg QE/g)	5.28 ± *0.01*	2.11 ± *0.01*	5.23 ± *0.04*
Steroids (mg/g)	4.02 ± *0.00*	0.62 ± *0.01*	1.97 ± *0.02*
Terpenes (mg TE/g)	3.56 ± *0.00*	0.53 ± *0.00*	2.56 ± *0.02*
Glycosides (mg GE/g)	1.26 ± *0.23*	0.06 ± *0.00*	0.07 ± *0.00*

**TG (50/50%) blend – Turmeric (50%) + Garlic (50%) blend proportion

All values are expressed as Mean ± SEM of triplicate results.

DISCUSSION

The sensory evaluation of foods is an important aspect of food quality that reveals preference and food acceptability, which aids consumption of quality and nutritious foods. The different proportions of the blends showed that there was no significant difference $p<0.05$ in the appearance, aroma, mouthfeel, taste and overall acceptability between the three (3) blends. Despite the no significant difference obtained on the sensory evaluation, it was noticed that the 60/40 % and 40/60 % turmeric/garlic blend ratios recorded higher mean values in all the parameters for 60/40 % and in 4/5 of the parameters for 40/60 %, with an overall acceptability score of 3.80 and 3.50, respectively, against the selected blend that obtained a mean score of 3.60. This indicates that 60/40 % was preferred by the participants in all the parameters measured. Phytochemical analysis is useful to detect the presence of the bioactive principal constituents in the plant, which subsequently may lead to the discovery and development of medicinal drugs (Refaz *et al*., 2023). The synergistic effects between bioactive compounds, trace elements, metals and other food constituents have been linked to higher

antioxidant capacity (Liu *et al.*, 2015; Brzezińska-Rojek *et al.,* 2023; Savescu *et al.,* 2025). A high antioxidant capacity is crucial for health as it helps neutralise harmful free radicals, supports anti-ageing and anti-inflammatory management, preventing oxidative stress which is linked to various chronic diseases like cancer, cardiovascular diseases, neurodegenerative disorders, and ageing (Abuajah *et al.,* 2015).

CONCLUSION

For an effective assessment of food quality, both the source, handling, preparation, storage, acceptability, benefits and effects in the body become a very crucial aspect to be investigated. All these were considered and explored in this study to ascertain the highest antioxidant capacity of known food substances with high bioactive compounds for use in experimental studies. The 50/50% proportion showed the highest antioxidant capacity with the two standard antioxidant assay procedures deployed. The turmeric garlic blend at 50% proportion also showed improved quantities of bioactive compounds in comparison to the individual samples. Thus, the beneficial outcome of this finding needs to be explored through an in vivo study to ascertain the ameliorative, supplementary and synergistic attributes in nutrition and in supporting improved health conditions.

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