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Physicochemical Properties of Selected Local Medicinal Soups Consumed in Southwest Nigeria

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ABSTRACT

Cottonseed (Gossypium herbaceum), bitter leaf (Vernonia) amydalina), cashew leaf (Anacardium occidentale), Piper nigrum (black pepper) and scent leaf (Ocimumgratissimum) are major ingredients used in preparation of the local soups namely; 'koroowu soup', 'black soup', 'cashew leaf soup' and 'ewe luje soup' consumed in certain parts of Nigeria. The ingredients for the soups were sorted according to the local preparations, separately blended into a paste and were either cooked or uncooked. The pastes were subjected to physicochemical (proximate, pH, total titratable acidity, mineral, phytochemical, antioxidant) and antimicrobial assays. The results showed that the cooked and uncooked pastes from these soups had pH ranged from 4.38-5.89, total titratable acidity (TTA) (0.05%-0.37%), moisture (9.30%-24.75%) and ash content (3.41%-7.17%). However, it was observed that the soup pastes were high in protein (10.39%-12.64%), fibre (13.82%-20.48%) and fat (21.11%-34.47%). The mineral content of the soups revealed that calcium ranged from 1.24ppm-8.74 ppm, zinc (1.3 ppm-1.65 ppm), potassium (4.04 ppm-20.94 ppm) and sodium content (14.27 ppm-67.00 ppm). The phytochemical composition of the pastes showed that saponin (4.59mg/g-62.91 mg/g) was the highest, followed by phytate (15.24 mg/g-61.39 mg/g), alkaloid (0mg/g-27.84 mg/g), tannin (2.39 mg/g-6.57 mg/g), oxalate (0.72 mg/g-2.12 mg/g). The soup samples were found to exhibit free radical scavenging property (DPPH) of 30.0%-100%, 2,2'-azino-bis(3-methylbenzothiazoline-6-sulphonic acid) (ABTS) scavenging ability (70.0-100%), and ferric reducing power (2.73 mg/g-20 mg/g). However, the aqueous extract from the soup pastes could not inhibit the growth of microorganism tested. Further studies should be carried out to identify the bioactive compounds responsible for the antioxidant activities recorded from the soup pastes.

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Introduction

There have been gradual revivals of interests in the use of various plants in the preparation of local beverages and soups that exhibitedgood medicinal properties without any adverse side effect [1,2]. Nigeria is a multi-cultural society with different traditional soups which are indigenous to different ethnic groups and tribes [3]. Examples include; 'irihibo-toh', 'iribo-erharhe', and 'afiaefere' soups , 'kontomire', 'ofensala' and 'igbagba' soups consumed in the South-East and 'kiaat' bark (Pteropcarpus angolensis) soup popular in Ondo State [4-6].

Vernonia amygdalina known as bitter leaf is employed in ethnomedicine in the treatment of fever, hiccups, kidney problems and stomach discomfort. It contains significant quantities of lipids , proteins with essential amino acids , carbohydrates and some minerals [7-10]. Scent Leaf (Ocimum gratissimum) is widely known and used for both medicinal and nutritional purposes. The crushed leaf juice is used in the treatment of convulsion, stomach pain and catarrh while the oil from the leaf has been found to possess antiseptic, antibacterial and antifungal activities [11,12] . Cashew (Anacardium occidentale) is a multipurpose tree, whose leaves, stems and bark extracts are used extensively for the treatment of different diseases [13]. Cottonseed (Gossypium hirsutum) is eatenlocally as soup because of its medicinal properties. It is used to relieve tension, treat fever, headache, and high blood pressure and prevent cancer [14].

Cottonseed soup popularly called 'obekorowu'or 'koowu'and scent leaf 'ewe luje' by the locals is majorly consumed in Ondo State while 'black soup' and 'cashew leaf soup' are eaten by the people of Edo State in Nigeria. Apart from the fact that the soups possess medicinal values as gathered from the consumers, they are easy to prepare. The application of local food materials in diets calls for more investigative data on the nature of their compositions and properties. Therefore, we carried out this study on the physicochemical and antimicrobial properties of the named local soups.

Materials And Methods

Sample Collection and Preparation

Cottonseed (Gossypium herbaceum), Scent leaf (Ocimum gratissimum), bitter leaf (Vernonia amydalina), cashew leaf (Anacardium occidentale) and other ingredients such as palm oil, salt, Maggi, pepper and locust bean were purchased from a local market in Akure, Ondo State, Nigeria. All chemicals used were of analytical grade.

Cottonseed, scent leaf, bitter leaf, cashew leafwere sorted to remove unwanted particles, weighed and rinsed in water before other ingredients were added and blended following the local methods of preparation for the individual soup. After blending, the soups were divided into two; one portion was boiled for 5 min while the other was left uncooked. The soup was individually packaged into polythene bags, sealed and stored in the refrigerator until use. Table 1 shows the leaf constituents of the various soups.

Table 1: Constituents of the local soups

Cotton seed soup	Scent leaf soup	Cashew leaf soup	Black soup
Cotton Seed	Scent Leaf	Cashew leaf	Bitter Leaf
Scent Leaf		Locust Bean (Iru)	Scent Leaf

Determination of the proximate composition of soup samples
The proximate composition of the soup samples (moisture, ash, fibre, protein and carbohydrate) were determined using the method of Association of Official Analytical Chemists (AOAC, 2010).

Determination of mineral content of soup samples
Calcium, magnesium, zinc, and ironwere analyzed using Atomic Absorption Spectrophotometer (AAS) while Potassium was analyzed using flame photometry method (AOAC, 2010).

Determination of pH and total titratable acid (TTA) of soup samples
The pH of samples was determined using a calibrated pH meter (Mettler 350). Total titratable acidity was determined according to the method of AOAC (2010). About 2 g of the sample was weighed into a 100 ml volumetric flask with 20 ml of distilled water while two drops of phenolphthalein indicator were added and thoroughly shaken. The mixture was titrated against 0.1M NaOH till a change in colour was observed and acidity calculated.

Determination of phytochemical content of soups samples
These include oxalate which was determined using the method described by Day and with few modifications [15]. Phytate was determined according to the method of [16]. Spectrophotometric method of [17]. was used for saponin determination, alkaloid was determined according to the method described by Harbone [18]. with few modifications,while tannin was determined using the method of [19].

Determination of antioxidant properties of soups samples
The free radical scavenging ability of samples against 1,1-diphenyl-2-picrylhydrazyl (DPPH) was evaluated asdescribed by [20]. The reducing property of soup extract was determined by assessing the ability of the extract to reduce FeCl3 solution [21]. The 2, 2'-azino-bis (3-ethylbenthiazoline-6-sulphonic acid) ABTS radical scavenging activity of the aqueous-methanolic extract was determined as described by [22].

Determination of antimicrobial activities of soup samples
Clinical isolates of Staphylococcus aureus, Escherichia coli, Bacillus sp. and Salmonella sp. were obtained from Department of Microbiology, Federal University of Technology Akure.The extract was obtained from the soup sample by sieving using a muslin cloth. The different extract was tested for antimicrobial activity as described by [23].

Statistical Analysis
All analyses were carried out in triplicates. The results obtained were subjected to analysis of variance (ANOVA)using the Statistical Package for Social Sciences (SPSS) version 17.0.

Results And Discussion
The proximate composition of the soup samples is shown on Table 2. The values for cooked and uncooked soup pastes include moisture content (9.30%-24.75%), ash (3.41%-7.17%), fibre (6.90%-20.48%), fat (21.11%-34.47%) and protein (10.39%-17.08%). The high content of moisture in the samples may be due to the fact that they were in the paste form which is an indication that they have high perishability and are susceptible to bacterial spoilage [24]. The amount of ash present in all the soup pastes were more than 3% which means that they possess nutritional relevance because food containing ash content of 3% and above is ideal and recommended for human [25] . The high fibre content of the soup samples may be an indication that the soups are easily digestible because high crude fibre is said to improve digestibility. Reported a low-fat content in cottonseed soup without other ingredients added which was contrary to what was obtained in this result [26]. The increase in the fat content of the soup samples could be as a result of the addition of palm oil. The protein content of the soup showed that samples can contribute to the daily protein requirement for children, adults and patients already suffering from protein deficiency disorder and disease [27].

Table 2: Proximate composition (%) of Soup samples

Sample	Moisture	Ash	Fibre	Fat	Protein	Carbohydrate
CCS	20.91±0.28^{ab}	3.41±0.59^{c}	16.20±0.06^{c}	34.47±0.33^{a}	10.39±0.15^{e}	12.29±0.65^{e}
UCS	24.75±0.53^{a}	4.60±0.10^{b}	20.48±0.24^{a}	25.94±0.36^{d}	12.42±0.06^{g}	13.85±1.13^{e}
CSL	9.30±0.07^{d}	5.38±0.30^{b}	13.82±0.17^{d}	32.69±0.37^{b}	10.78±0.07^{f}	28.14±0.31^{b}
USL	19.91±0.31^{b}	5.56±0.13^{b}	18.53±0.17^{b}	24.43±0.08^{e}	12.64±0.12^{e}	18.93±0.21^{d}
CCaS	15.35±1.92^{bc}	5.33±0.33^{b}	11.93±0.57^{g}	21.11±0.46^{f}	17.70±0.23^{a}	30.78±1.73^{a}
UCas	16.22±1.92^{bc}	4.45±0.32^{bc}	10.06±0.11^{e}	22.08±0.32^{e}	16.08±0.03^{d}	31.11±2.45^{b}
CBS	16.33±4.22^{bc}	7.17±0.31^{a}	12.13±0.11^{f}	29.39±0.33^{c}	17.08±0.13^{b}	21.24±3.95^{c}
UBS	18.42±0.13^{cd}	5.67±0.55^{b}	6.90±0.14g	32.47±0.43^{b}	16.23±0.11^{c}	20.33±0.28^{c}

Mean ± Standard Error of mean, values with the same superscript in the same column are not significantly different (P>0.05)

CCS- Cooked cottonseed soup; UCS- Uncooked cottonseed soup; CSL- Cooked scent leaf soup
USL- Uncooked scent leaf soup; CCaS- Cooked Cashew Leaf Soup; UCaS- Uncooked Cashew Leaf Soup;CBS- Cooked Black Soup;UBS- Uncooked Black Soup

The result in Table 3 revealed that the calcium content in the soup samples varied from 1.24 ppm-8.74 ppm, Iron (0.07 ppm-5.25 ppm), zinc (1.53 ppm-1.65 ppm), potassium (4.04 ppm-22.51 ppm), sodium (14.27 ppm-67.00 ppm). Calcium is the most abundant mineral in the body with 99% of calcium enclosed inside teeth and bones [28]. According to , a deficiency of calcium in the body has been implicated in osteoporosis. The iron content of the local soups from this work was in line with those of Colocassia esculenta and O. gratissimum reported by [29-30]. Iron is a very important component of haemoglobin, the substance in red blood cells responsible for transporting oxygen from the lungs to every other part of the body. Iron deficiency is highly prevalent in most developing countries [31]. It was observed that the zinc content of the soup samples was retained after cooking but lower than what was reported for fresh scent leaf by Adepoju and Oyewole [30]. Zinc is an indispensable trace element in the body and supports normal development and growth during childhood and pregnancy [28]. The ability of the local soups to restore energy to the weak as reported by the local people may be explained by the appreciable amount of mineral available in the local soup pastes.

Table 3: Mineral composition (ppm) of selected soup samples

Sample	Calcium	Iron	Zinc	Potassium	Sodium
CCS	2.41±0.05e	0.21±0.02d	1.65±0.04a	8.10±0.05e	34.62±0.04e
UCS	2.10±0.02f	0.07±0.01f	1.57±0.02ab	10.10±0.03d	24.97±0.05f
CSL	8.74±0.01a	0.40±0.02b	1.55±0.04ab	20.94±0.03b	67.00±0.03a
USL	4.24±0.04b	5.25±0.03a	1.55±0.02ab	6.76±0.03f	47.91±0.02b
CCaS	1.50±0.03g	0.34±0.03c	1.55±0.03b	4.04±0.03g	21.45±0.03g
UCaS	1.24±0.02h	0.16±0.01e	1.53±0.01ab	4.50±0.01g	14.27±0.05h
CBS	3.77±0.04c	0.35±0.03c	1.54±0.01b	11.34±0.03c	42.94±0.04c
UBS	3.54±0.05d	0.16±0.01e	1.53±0.03b	22.51±0.02a	39.95±0.03d

Mean ± Standard error of mean, values with the same superscript in the same column are not significantly different ($P \leq 0.05$)

CCS- Cooked cottonseed soup; UCS- Uncooked cottonseed soup; CSL- Cooked scent leaf soup
USL- Uncooked scent leaf soup;CCaS- Cooked Cashew Leaf Soup;UCaS- Uncooked Cashew Leaf Soup; CBS- Cooked Black Soup;UBS- Uncooked Black Soup

Table 4 showed that the pH value of the soups ranged from 5.38-5.89, the total titratable acid ranged from 0.05%-0.25% and the temperature (26.70C-29.70C). It was observed that the soup samples were not acidic, as the pH were close to neutral. The pH of the soup samples was observed to be lower compared to the result reported for some curry paste soup [5].

Table 4: Temperature, pH, and Total Titratable Acid of soup samples

Sample	Temperature (°C)	pH	Total Titratable Acid (%)
CCS	26.9	5.89	0.09
UCS	27.1	5.87	0.06
CSL	28.2	5.38	0.09
USL	27.3	5.71	0.05
CCaS	29.7	5.48	0.25
UCaS	27.1	5.02	0.23
CBS	27.0	5.88	0.13
UBS	26.7	5.80	0.12

CCS- Cooked cottonseed soup; UCS- Uncooked cottonseed soup; CSL- Cooked scent leaf soup
USL- Uncooked scent leaf soup; CCaS- Cooked Cashew Leaf Soup; UCaS- Uncooked Cashew Leaf Soup;CBS- Cooked Black Soup;UBS- Uncooked Black Soup

The phytochemical composition of soup samples is shown in Table 5 with tannin (2.39 mg/g-6.57 mg/g), oxalate (0.45 mg/g-2.12 mg/g), Saponin (4.59 mg/g-62.91mg/g), alkaloid (0mg/g-27.86mg/g), and phytate (15.24mg/g-61.39mg/g). The advantageous effects of saponins are mainly due to their anti-hypercholesterolemic activity [32]. Some plants that possess alkaloids are known to decrease blood pressure and balance the nervous system in case of mental illness [33]. Phytochemicals are naturally occurring nonnutritive plantchemicals that possess protection and prevention properties against some diseases [34]. The phytochemical composition in the samples was higher compared to what was reported for both dried and powdered Telfairia occidentalis leaves [35].

Table 5: Phytochemical composition (mg/g) of the selected soup local samples

Sample	Tannin	Oxalate	Phytate	Saponin	Alkaloid
CCS	2.39±0.01g	0.77±0.05d	21.01±0.40c	21.09±0.55c	19.91±0.06d
UCS	2.63±0.01f	1.53±0.00b	61.39±0.40a	31.73±0.09b	27.86±0.04a
CSL	2.77±0.01e	0.72±0.00d	19.78±0.00c	6.36±0.55de	24.84±0.06b
USL	3.28±0.02c	2.12±0.14a	22.66±0.40b	62.91±0.18a	17.15±0.08e
CCas	5.92±0.06b	1.26±0.09c	18.13±0.82d	4.59±3.95f	0
UCaS	6.57±0.05a	1.89±0.06a	20.60±0.07c	10.45±0.09d	0
CBS	2.74±0.06d	0.68±0.13e	20.19±0.41c	7.64±0.18de	21.21±0.05c
UBS	3.15±0.05e	0.45±0.02e	15.24±0.41e	31.55±0.09b	9.61±0.09f

Mean ± Standard Error of mean, values with the same superscript in the same column are not significantly different (P≥0.05)

CCS- Cooked cottonseed soup; UCS- Uncooked cottonseed soup; CSL- Cooked scent leaf soup
USL- Uncooked scent leaf soup; CCaS- Cooked Cashew Leaf Soup; UCaS- Uncooked Cashew Leaf Soup; CBS- Cooked Black Soup; UBS- Uncooked Black Soup

The soups were found to exhibit abilities to scavenge DPPH free radicals (Figure 1). Both cooked and uncooked cashew leaf soups demonstrated the highest free radical scavenging activity (100%) followed by black soup (40%), cooked scent leaf soup (35%) and the leastvalue of 30.08% from uncooked cotton seed soup. The ability of the soups to scavenge ABTS is shown in Figure 2 and ranged from 70.91µmol/g-100µmol/g. Ferric reducing the power of the soup samples ranged from 2.73mg/g-11.98mg/g as shown in Figure 3. The values obtained for the free radical scavenging activity of samples investigated in this study were lower when compared to what was reported for some selected plant leaves [1]. Antioxidant properties exhibited by the soups may be attributed to the bioactive components present in the soup ingredients [5].

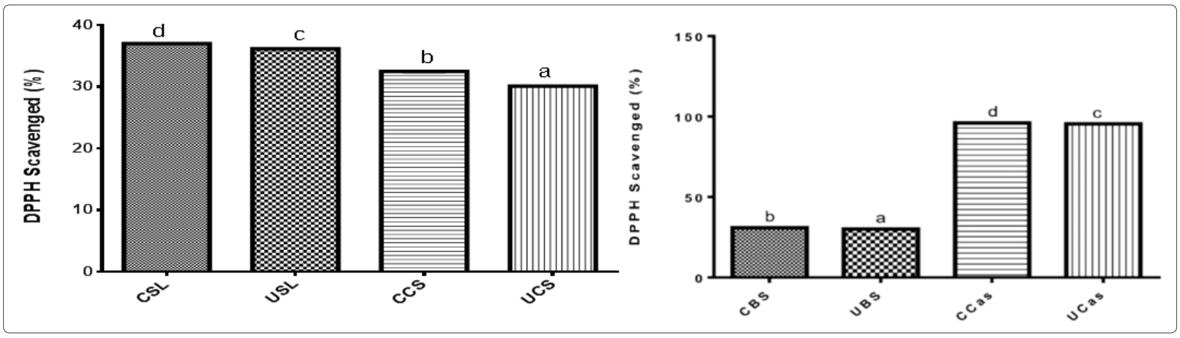

Figure 1: Free radical scavenging ability (DPPH) (%) of the soup samples

CSL- Cooked scent leaf soup
USL- Uncooked scent leaf soup
CCS- Cooked cottonseed soup
UCS- Uncooked cottonseed soup
CBS- Cooked Black Soup
UBS- Uncooked Black Soup
CCaS- Cooked Cashew Leaf Soup
UCaS- Uncooked Cashew Leaf Soup

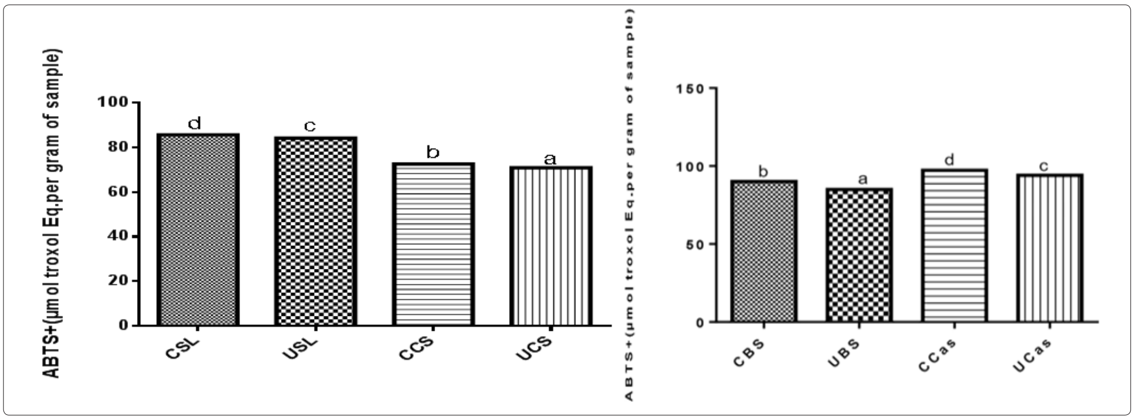

Figure 2: ABTS scavenging ability (µmol/g) of the soup samples
CSL- Cooked scent leaf soup
USL- Uncooked scent leaf soup
CCS- Cooked cottonseed soup
UCS- Uncooked cottonseed soup
CBS- Cooked Black Soup
UBS- Uncooked Black Soup
CCaS- Cooked Cashew Leaf Soup
UCaS- Uncooked Cashew Leaf Soup

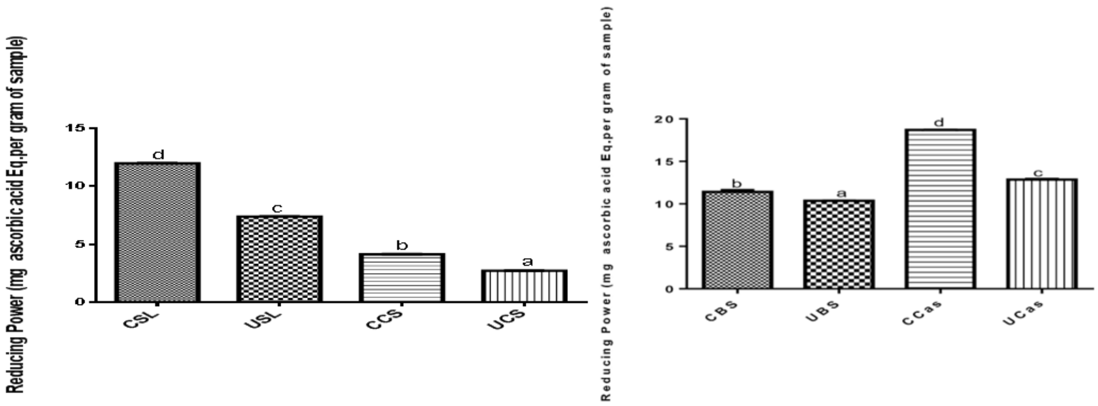

Figure 3: Ferric Reducing antioxidant power (FRAP) (mg/g) of the soup samples

CSL- Cooked scent leaf soup
USL- Uncooked scent leaf soup
CCS- Cooked cottonseed soup
UCS- Uncooked cottonseed soup

CBS- Cooked Black Soup
UBS- Uncooked Black Soup
CCaS- Cooked Cashew Leaf Soup
UCaS- Uncooked Cashew Leaf Soup

The result of the antibacterial activity of the soup samples showed that the aqueous extracts of the soups demonstrated no inhibition against Escherichia coil, Bacillus spp., Staphylococcus aureus and Salmonella typhi.

Conclusion

Investigation of the physicochemical properties of the soup pastes revealed that they are rich in nutrients considering the proximate and mineral content. Extracts from the local soups demonstrated very good antioxidant properties which may be linked to the presence of some bioactive compounds as revealed in the result of the phytochemical composition of the soups. It may be concluded that the medicinal properties reported by the local consumer of the soups may be attributed to the nutritional and antioxidant activities observed [36-52].

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