A COMPARATIVE STUDY ON THE BIOFUNCTIONAL PROPERTIES OF SELECTED MILLETS, PULSES AND GREEN LEAVES AND THEIR THERAPEUTIC EFFICIENCY AS DIETARY CONSTITUENTS

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ABSTRACT

Background: There is a need to explore comprehensive scientific data as a prerequisite to make food formulations and also to impart value addition. **Aim:** To assess the biopharmaceutical properties of the selected millets, pulses. and green leaves. **Materials and Methods:** Selected millets, pulses, and green leaves were subjected to successive solvent extraction by continuous hot extraction (Soxhlet) with 550 mL of double distilled water and ethanol. The antioxidant potential and antimicrobial activities of extracts were determined. **Results:** Significant differences ($p<0.05$) were observed in the antioxidant and antimicrobial activities of millets, pulses, and green leafy vegetables. Antioxidant activity increased in a concentration-dependent manner (25–150 mg/mL) in both ethanolic and aqueous extracts across DPPH, ABTS, TAA, and FRAP assays. Antimicrobial activity was greatest in spinach and fenugreek (Gram-positive: 31.33 mm; Gram-negative: 25.33 mm), followed by mint and moringa (28.33/23.33 mm and 27.33/23.33 mm, respectively). **Conclusion:** Millets, pulses, and green leafy vegetables are valuable natural sources of antioxidant and antimicrobial phytochemicals. Wheat among millets, horse gram and soybean among pulses, and spinach, moringa, and fenugreek among green leafy vegetables exhibited particularly high biological activity.

Keywords: Antioxidant, Antibacterial, Wheat, Horse gram, Soybean, Spinach, Moringa

INTRODUCTION

Cereals play a significant part in the human diet owing to their ease of preparation, long shelf life, and distinct flavor. Millets are well-known cereal grains in the grass subfamily *Panicoide*.[1] Millets are important foods in many underdeveloped countries because of their ability to grow under adverse weather conditions like limited rainfall. India has the largest millet producing country in the world with a total area of 23 million ha and small millets alone account for about 3.5 million hectares.[2] The major millets are pearl millet, foxtail millet, proso millet and finger millet. The most important minor millets cultivated in India are barn yard millet, kodo millet, little millet, guinea millet and browntop millet.[3] Millets are more nutritious and they are non-glutinous and non-acid forming and easy to digest. Millets are good sources of energy, protein, fatty acids, vitamins, minerals, dietary fibre and polyphenols. Furthermore, millets are rich sources of phytochemicals, micronutrients and antioxidants, such as phenolic acids and glycated flavonoids.[4]

The pulses belong to the Leguminosae family and are an excellent source of carbohydrate, dietary fiber, and protein. Cereals and pulses play a predominant role in the diets of developing countries, and the nutritional problem is associated with traditional, complementary foods.[5] Pulses are rich in protein, dietary fiber, and various micronutrients and biologically active substances. Therefore, the Indian Pulse and Grain Association has described pulses as a future major source for nutritional and health benefits.[6] Pulses are the richest source of dietary fibers and complex carbohydrates, facilitating low-glycemic index foods. Pulses help to lower cholesterol and triglycerides, as leguminous fibers cause hypoglycosuria because they consist of more amylose than amylopectin. The proteins from pulses are readily available, as shown by *in-vitro* digestibility.[7]

Medicinal plants remain a major source of bioactive compounds and are increasingly studied for their pharmacological potential as alternatives to synthetic drugs.[8,9] The Amaranthaceae family includes edible flowering plants such as spinach, *Spinacia oleracea*. *Spinacia oleracea* is a widely consumed leafy vegetable from the Amaranthaceae family, rich in nutritional and medicinal compounds.[10] Its leaves are not only tasty but also possess various medicinal properties that make it a valuable addition to one’s diet.[11,12]

In view of the present significant attributes to millets, pulses, and green leaves for food-to-food fortification, mainly for nutrient and mineral deficiencies, there is a need to explore comprehensive scientific data as a prerequisite for further subjects to make food formulations and also to impart value addition, especially under the homestead concept. With these viewpoints, the present study was carried out with the main purpose to assess the functional characteristics and biopharmaceutical properties of the selected millets, pulses, and green leaves.

MATERIALS AND METHODS

Sample collection and processing

All selected varieties of millets, pulses, and green leafy samples (Box I) were procured from the local market in Tumkur, Karnataka, India. The samples were thoroughly washed to eliminate adhering dust and soil particles, followed by sun-drying to remove residual moisture. Subsequently, the dried samples were finely grounded using a mechanical grinder and stored in airtight containers until further use for extraction, as well as nutritional and mineral analyses.

Box I. Selected varieties of millets, pulses, and green leaves

Common Name	Scientific Name
Millets	
Finger millet	*Eleusine coracana*
Kodo millet	*Paspalum scrobiculatum*
Pearl millet	*Pennisetum glaucum*
Foxtail millet	*Setaria italica*
Rice	*Oryza sativa*
Wheat	*Triticum aestivum*
Pulses	
Green gram	*Vigna radiata*
Horse gram	*Macrotyloma uniflorum*
Cow pea	*Vigna unguiculata*
Hyacinth bean	*Lablab purpureus*
Toor dal	*Cajanus cajan*
Urd dal	*Vigna mungo*
Soybean	*Glycine max*
Green Leaves	
Spinach	*Spinacia oleracea*
Moringa	*Moringa oleifera*
Mint	*Mentha spicata*
Fenugreek	*Trigonella foenum-graecum*
Coriander	*Coriandrum sativum*
Curry	*Murraya koenigii*

Extraction

Approximately 10 g of dried and powdered samples of millet, pulse, green leaf samples were subjected to successive solvent extraction by continuous hot extraction (Soxhlet) with 100 mL of double distilled water and methanol. All the extracts were concentrated by distilling the solvent in a rotary flash evaporator. The extracts were preserved in airtight containers and stored at room temperature until further use.

Antimicrobial activity

Antibacterial assay was carried out by agar well diffusion method as described by Das et al., (2013).[13] One hundred microliters (10^6 CFU/ml) fresh microbial culture was spread on a Muller Hilton agar plate with non-toxic swab. The antibacterial activity was screened for both organisms like gram-negative and gram-positive bacteria. *Escherichia coli* culture used as gram negative bacteria and *Staphylococcus aureus* used gram positive bacteria. Five wells of 6-mm diameter were punched off into the agar medium with sterile cork-borer (6mm) and three wells filled with 50µl, 100µl and 200µl extract of samples, one well filled with antibiotic Amoxicillin of 400µg as positive control, one well filled with methanol as negative control. All procedure done under aseptic conditions. The plates were allowed to stand for 1 h to allow for pre-diffusion of the extract into the medium. The plates were incubated aerobically in an upright position at 37 ± 2°C for 24–48h. The anti-bacterial screening was evaluated by measuring the zone of inhibition (mm).

Antioxidant activity

DPPH radical scavenging assay

The antioxidant potential using the DPPH (2,2 diphenyl-1-picrylhydrazyl) free radical scavenging assay was carried out as described by Gulcin and Alwasel, (2023).[14] A series of test sample concentrations [25-125µg/mL] were prepared. To each sample, 2.8 mL of methanol and 0.2 mL of 0.1 mM DPPH solution were added, making a final volume of 3.0 mL. The reaction mixtures were then incubated in the dark at room temperature for 30 minutes to facilitate the interaction. Methanol served as the blank, and ascorbic acid was used as the standard antioxidant for comparison. After incubation, the absorbance of each sample was recorded at 517 nm using a UV–Visible spectrophotometer.

The percentage inhibition was calculated using the following formula:

% of inhibition = Absorbance of control - Absorbance of sample / Absorbance of control × 100

Ferric reducing antioxidant power (FRAP) assay

2.5 mL of 200 mM phosphate buffer (pH 6.6) was mixed with 2.5 mL of 1% potassium ferricyanide and varying concentrations of test samples [25-125 µg/mL]. The mixture was incubated at 50°C for 20 minutes, followed by rapid cooling. After incubation, 2.5 mL of 10 % trichloroacetic acid (TCA) was added, and the mixture was centrifuged at 3000 rpm for 10 minutes. From the resulting supernatant, 2.5 mL was collected and combined with an equal volume of distilled water. Subsequently, 1mL of 1% ferric chloride ($FeCl_3$) was added, and the absorbance was measured at 700 nm using a UV–Visible spectrophotometer. An increase in absorbance indicated a higher reducing power of the sample. The percentage inhibition was calculated using the following formula:

% of inhibition = Absorbance of control - Absorbance of sample / Absorbance of control × 100

Hydrogen peroxide (H_2O_2) scavenging activity

The hydrogen peroxide (H_2O_2) scavenging activity was assessed using Hydrogen peroxide scavenging capacity. Briefly, various concentrations of test samples [25-125 µg/mL] were added to a reaction mixture containing 3.4 mL of 0.1 M phosphate buffer (pH 7.4) and 0.6 mL of 0.4 M H_2O_2. The mixture was incubated at room temperature for 10 minutes. Following incubation, the absorbance was measured at 230 nm using a UV- Visible spectrophotometer, with phosphate buffer serving as the blank. Ascorbic acid was employed as the standard antioxidant. The percentage of H_2O_2 scavenging activity was calculated using the following formula:

Scavenging (%) = Absorbance of control - Absorbance of sample / Absorbance of control × 100

STATISTICAL ANALYSIS

Data were entered in Microsoft Excel 2021 and statistical analysis was done using Statistical Software for Social Sciences (SPSS) version 21 (IBM SPASS statistics [IBM corporation: NY, USA]). Data were reported as mean and standard deviation and were also subjected to one-way ANOVA followed by Turkey's *post-hoc* multiple comparison for comparative analysis.

RESULTS

The DPPH radical scavenging activity of ethanolic extracts increased progressively with increasing extract concentration (25–150 mg) across all millets, pulses, and green leafy vegetables, indicating a clear dose-dependent antioxidant response. Among the millets, wheat exhibited the highest antioxidant activity (96.79%), followed by rice, whereas finger millet showed the lowest activity. Among the pulses, horse gram demonstrated the greatest radical scavenging activity (92.72%), closely followed by soybean, cowpea, and urad dal. Among the green leafy vegetables, spinach showed the highest antioxidant activity (90.47%), while mint exhibited comparatively lower activity. The observed increase in antioxidant activity with concentration was statistically significant within each sample ($p<0.05$), highlighting the strong free radical scavenging potential of the evaluated plant materials, particularly wheat, horse gram, and spinach (Table 1).

The ABTS radical scavenging activity of ethanolic extracts increased significantly with increasing extract concentration (25–150 mg) for all millets, pulses, and green leafy vegetables ($p<0.05$), demonstrating a dose-dependent antioxidant effect. Among the millets, wheat exhibited the highest ABTS scavenging activity (92.32%), whereas foxtail millet showed the lowest activity. Among the pulses, soybean demonstrated the greatest antioxidant capacity (94.01%), followed closely by horse gram and urad dal. Among the green leafy vegetables, moringa showed the highest ABTS radical scavenging activity (87.91%), while mint exhibited the lowest response. Overall, pulses displayed superior ABTS antioxidant activity compared with most millets and green leafy vegetables, indicating their strong free radical scavenging potential (Table 2).

The total antioxidant activity (TAA) of ethanolic extracts increased significantly with increasing extract concentration (25–150 mg) across all millets, pulses, and green leafy vegetables ($p<0.05$), indicating a concentration-dependent antioxidant response. Among the millets, wheat exhibited the highest TAA (5.18), while kodo millet showed the lowest activity. Among the pulses, soybean (5.56) and horse gram (5.51) demonstrated the greatest total antioxidant activity. Among the green leafy vegetables, spinach exhibited the highest TAA (4.98), whereas mint showed comparatively lower activity. Overall, pulses exhibited superior total antioxidant capacity compared with most millets and green leafy vegetables, suggesting their greater potential as natural sources of antioxidants (Table 3).

The ferric reducing antioxidant power (FRAP) of ethanolic extracts increased significantly with increasing extract concentration (25–150 mg) across all tested samples ($p<0.05$), demonstrating a concentration-dependent reducing capacity. Among the millets, wheat exhibited the highest FRAP value (4.70), whereas kodo millet showed the lowest reducing power. Among the pulses, horse gram demonstrated the greatest ferric reducing activity (4.81), followed closely by soybean (4.63). Among the green leafy vegetables, coriander (4.26) and spinach (4.21) exhibited the highest FRAP values, while moringa showed comparatively lower reducing activity. Overall, pulses displayed greater ferric reducing antioxidant potential than most millets and green leafy vegetables, reflecting their superior electron-donating capacity (Table 4).

The DPPH radical scavenging activity of aqueous extracts increased significantly with increasing extract concentration (25–150 mg) in all millets, pulses, and green leafy vegetables ($p<0.05$), indicating a clear dose-dependent antioxidant response. Among the millets, kodo millet exhibited the highest DPPH scavenging activity (87.59%), followed by foxtail millet and pearl millet. Among the pulses, cowpea showed the greatest antioxidant activity (95.36%), closely followed by toor dal and horse gram. Among the green leafy vegetables, moringa demonstrated the highest radical scavenging activity (80.11%), whereas coriander exhibited the lowest activity. Overall, aqueous extracts of pulses displayed superior DPPH radical scavenging capacity compared with millets and green leafy vegetables, highlighting their strong antioxidant potential (Table 5).

The ABTS radical scavenging activity of aqueous extracts increased significantly with increasing extract concentration (25–150 mg) across all tested samples ($p<0.05$), demonstrating a concentration-dependent antioxidant effect. Among the millets, foxtail millet exhibited remarkably higher ABTS scavenging activity (141.30) than all other samples, whereas rice showed the lowest activity. Among the pulses, green gram demonstrated the highest antioxidant capacity (89.94), followed by horse gram (84.68) and hyacinth bean (82.35). Among the green leafy vegetables, coriander and mint exhibited the highest ABTS scavenging activity (73.10 each), while curry leaves showed the lowest activity (51.56). Overall, aqueous extracts of selected pulses and foxtail millet displayed superior ABTS radical scavenging potential, indicating their strong antioxidant capacity (Table 6).

The total antioxidant activity (TAA) of aqueous extracts increased significantly with increasing extract concentration (25–150 mg) across all millets, pulses, and green leafy vegetables ($p<0.05$), demonstrating a dose-dependent antioxidant response. Among the millets, rice exhibited the highest TAA (4.75), followed closely by wheat (4.70), whereas pearl millet showed the lowest activity. Among the pulses, horse gram demonstrated the greatest total antioxidant activity (5.77), followed by soybean (5.42) and urad dal (5.07). Among the green leafy vegetables, moringa exhibited the highest TAA (4.42), while coriander showed the lowest activity (3.73). Overall, pulses consistently displayed greater total antioxidant capacity than millets and green leafy vegetables, indicating their superior antioxidant potential (Table 7).

The ferric reducing antioxidant power (FRAP) of aqueous extracts increased significantly with increasing extract concentration (25–150 mg) across all tested samples ($p<0.05$), indicating a concentration-dependent reducing capacity. Among the millets, wheat exhibited the highest FRAP value (4.36), whereas pearl millet showed the lowest reducing activity. Among the pulses, horse gram demonstrated the greatest ferric reducing power (4.56), followed closely by soybean (4.37), cowpea (4.26), and green gram (4.20). Among the green leafy vegetables, fenugreek exhibited the highest FRAP value (3.63), while coriander showed the lowest reducing activity (2.87). Overall, pulses consistently displayed greater ferric reducing antioxidant capacity than most millets and green leafy vegetables, underscoring their superior electron-donating potential (Table 8).

The antimicrobial activity varied markedly among the tested millets, pulses, and green leafy vegetables, with significant differences observed against both Gram-positive and Gram-negative bacteria ($p<0.05$). Among the millets, foxtail millet exhibited the greatest antibacterial activity, whereas finger millet showed no inhibitory effect. Among the pulses, hyacinth bean demonstrated the highest antimicrobial activity, while toor dal showed no detectable inhibition. Green leafy vegetables exhibited the strongest antibacterial effects overall, with spinach and fenugreek producing the largest zones of inhibition against both Gram-positive (31.33 mm) and Gram-negative (25.33 mm) bacteria, followed closely by mint and moringa. In general, Gram-positive bacteria were more susceptible than Gram-negative bacteria (Table 9 and Figure 1 & Figure 2).

DISCUSSION

The present study comprehensively evaluated the antioxidant and antimicrobial activities of ethanolic and aqueous extracts of selected millets, pulses, and green leafy vegetables using complementary antioxidant assays (DPPH, ABTS, TAA, and FRAP). Irrespective of the assay employed, antioxidant activity increased significantly with increasing extract concentration, indicating a clear dose-dependent response. This finding is consistent with previous reports demonstrating that higher concentrations of plant extracts provide greater amounts of phenolic acids, flavonoids, tannins, carotenoids, and other phytochemicals capable of donating electrons or hydrogen atoms to neutralize free radicals and reduce oxidizing agents.[15-17]

Among the millets, wheat consistently exhibited the highest DPPH, ABTS, TAA, and FRAP activities in ethanolic extracts, while foxtail millet and kodo millet showed comparatively higher antioxidant activities in aqueous extracts, particularly in the ABTS assay. These differences are primarily attributable to variations in phenolic composition and solvent polarity. Wheat contains appreciable quantities of ferulic acid, p-coumaric acid, alkylresorcinols, and flavonoids, whereas foxtail and kodo millet are rich in bound phenolics and dietary antioxidants that become more extractable under aqueous conditions. Previous investigations have similarly reported that antioxidant capacity varies considerably among millet species owing to differences in genotype, grain structure, environmental conditions, and processing methods.[16-18]

The superior performance of ethanolic extracts observed for most millet samples further confirms that ethanol is more efficient than water for extracting moderately polar phenolic compounds and flavonoids. Numerous studies have shown that extraction solvent markedly influences antioxidant yield because phenolics differ in polarity, molecular weight, and solubility. Consequently, ethanol generally provides higher recovery of antioxidant compounds than aqueous extraction, particularly for flavonoids and phenolic acids responsible for radical scavenging and ferric reducing activities.[17,19]

Pulses demonstrated the highest overall antioxidant capacity among the three food groups investigated. Horse gram and soybean consistently exhibited superior TAA and FRAP values, while cowpea, green gram, urad dal, and toor dal also showed strong radical-scavenging activity across both extraction systems. These findings corroborate recent studies identifying legumes as excellent sources of phenolic acids, flavonoids, tannins, isoflavones, phytosterols, and antioxidant peptides that collectively contribute to their high biological activity. Besides their nutritional value, pulses have gained increasing attention as functional foods because their phytochemicals exhibit antioxidant, anti-inflammatory, hypoglycaemic, cardioprotective, and chemopreventive properties.[20,21]

Horse gram exhibited the greatest total antioxidant capacity and reducing power among the evaluated pulses. This observation may be explained by its high concentrations of gallic acid, ferulic acid, catechins, quercetin, rutin, and condensed tannins, which effectively scavenge reactive oxygen species and inhibit lipid peroxidation. Similarly, soybean demonstrated excellent antioxidant activity owing to its abundant isoflavones, including genistein and daidzein, together with tocopherols and phenolic acids. Previous investigations have consistently reported that these compounds protect biomolecules against oxidative stress by donating electrons, chelating transition metals, and enhancing endogenous antioxidant defence systems.[20,21]

Green leafy vegetables also exhibited substantial antioxidant activity, although their values were generally lower than those of pulses. Among the vegetables studied, spinach, moringa, fenugreek, coriander, curry leaves, and mint demonstrated appreciable antioxidant potential in both extraction systems. Spinach showed the highest antioxidant activity in several ethanolic assays, whereas moringa exhibited superior activity in aqueous extracts. These findings agree with recent reports describing leafy vegetables as rich sources of flavonoids, phenolic acids, carotenoids, chlorophylls, ascorbic acid, and tocopherols, which collectively contribute to protection against oxidative stress and chronic diseases.[19,22]

The antimicrobial evaluation demonstrated marked variation among the tested plant extracts, with green leafy vegetables exhibiting greater antibacterial activity than millets and pulses. Among the leafy vegetables, spinach, fenugreek, mint, and moringa produced the largest zones of inhibition against both Gram-positive and Gram-negative bacteria, whereas finger millet and toor dal showed little or no detectable activity. These findings are consistent with recent studies reporting that edible leafy vegetables possess broad-spectrum antimicrobial properties because of their high concentrations of phenolic acids, flavonoids, alkaloids, terpenoids, tannins, and essential oils, which act synergistically to inhibit microbial growth.[23,24]

The greater susceptibility of Gram-positive bacteria observed in the present study agrees with previous reports evaluating plant-derived antimicrobials. Gram-positive bacteria possess a relatively simple peptidoglycan cell wall that allows easier penetration of phytochemicals, whereas Gram-negative bacteria contain an additional outer lipopolysaccharide membrane that restricts the entry of many antimicrobial compounds. Consequently, phenolics and flavonoids generally produce larger inhibition zones against Gram-positive organisms than against Gram-negative bacteria.[24,25]

The superior antimicrobial activity of spinach, moringa, mint, and fenugreek can be attributed to their diverse phytochemical composition. Spinach is rich in flavonoids, carotenoids, chlorophyll derivatives, and phenolic acids, whereas moringa contains quercetin, kaempferol, chlorogenic acid, glucosinolates, and isothiocyanates. Fenugreek is characterized by abundant saponins, trigonelline, flavonoids, and polyphenols, while mint contains menthol, menthone, rosmarinic acid, and other essential oil constituents. These compounds disrupt bacterial cell membranes, alter membrane permeability, inhibit essential enzymes, interfere with nucleic acid synthesis, and suppress biofilm formation, thereby contributing to their broad-spectrum antibacterial activity.[22-24]

Although millets exhibited comparatively lower antibacterial activity, foxtail millet showed moderate inhibition against both bacterial groups, while wheat also demonstrated appreciable antimicrobial effects. Previous investigations have suggested that millet phenolic acids, tannins, and flavonoids contribute to antibacterial activity, although their concentrations vary considerably among species and are influenced by genotype, environmental conditions, and processing methods.[17,18] Similarly, among pulses, hyacinth bean demonstrated the greatest antibacterial activity, whereas soybean, cowpea, and horse gram showed moderate inhibition. These differences likely reflect variation in the concentration of phenolic compounds, lectins, bioactive peptides, and protease inhibitors, which are known to possess antimicrobial properties.[20]

The findings of the present investigation further demonstrate that antioxidant and antimicrobial activities are closely related but not always directly proportional. While pulses exhibited the greatest antioxidant capacity, green leafy vegetables showed superior antibacterial activity. This suggests that different classes of phytochemicals contribute preferentially to different biological functions. Polyphenols and flavonoids are major contributors to free radical scavenging, whereas terpenoids, glucosinolates, alkaloids, and essential oils play a more prominent role in antimicrobial activity. The synergistic interaction among these phytochemicals probably explains the overall biological efficacy of the investigated plant materials.[19,23]

A major strength of this study is the simultaneous evaluation of commonly consumed millets, pulses, and green leafy vegetables using four complementary antioxidant assays together with antimicrobial assessment. The use of both ethanolic and aqueous extracts provided valuable information regarding solvent-dependent extraction of bioactive compounds. Since individual antioxidant assays evaluate different mechanisms of action, the combined application of DPPH, ABTS, TAA, and FRAP offers a comprehensive assessment of antioxidant potential. This integrated approach provides a broader understanding of the functional properties of these traditional plant foods than studies relying on a single assay.

CONCLUSION

This study findings reinforced that fact that millets, pulses, and green leafy vegetables are valuable natural sources of antioxidant and antimicrobial phytochemicals. Wheat among millets, horse gram and soybean among pulses, and spinach, moringa, and fenugreek among green leafy vegetables exhibited particularly high biological activity.

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TABLES

Table 1: Antioxidant activities of ethanolic extracts of millets, pulses, and green leaves (DPPH assay)

Samples	25mg	50mg	75mg	100mg	125mg	150mg
Millets						
Finger millet	16.93 ± 1.11[a]	31.78 ± 1.75[ab]	41.08 ± 1.15[abc]	51.44 ± 1.37[abcd]	65.20 ± 1.51[abcde]	66.98 ± 1.11[abcde]
Wheat	21.94 ± 1.03[a]	42.96 ± 1.33[ab]	65.96 ± 1.28[abc]	81.21 ± 0.68[abcd]	95.97 ± 1.05[abcde]	96.79 ± 0.98[abcde]
Rice	21.11 ± 1.23[a]	36.33 ± 2.33[ab]	48.61 ± 1.70[abc]	64.29 ± 3.93[abcd]	85.74 ± 1.81[abcde]	86.92 ± 1.15[abcde]
Pearl millet	23.99 ± 2.21[a]	40.78 ± 1.33[ab]	50.85 ± 1.17[abc]	63.35 ± 0.81[abcd]	70.70 ± 0.91[abcde]	71.91 ± 1.09[abcde]
Kodo millet	19.69 ± 0.47[a]	37.94 ± 1.89[ab]	52.00 ± 1.00[abc]	63.90 ± 1.35[abcd]	69.23 ± 2.05[abcde]	71.68 ± 1.66[abcde]
Foxtail millet	16.44 ± 1.24[a]	31.30 ± 2.10[ab]	45.23 ± 2.25[abc]	58.37 ± 0.56[abcd]	67.79 ± 0.89[abcde]	69.13 ± 0.39[abcde]
Pulses						
Cow pea	29.31 ± 0.98[a]	45.03 ± 0.64[ab]	61.84 ± 1.40[abc]	78.94 ± 1.22[abcd]	90.81 ± 1.12[abcde]	91.77 ± 1.38[abcde]
Hyacinth bean	20.96 ± 1.13[a]	38.89 ± 1.08[ab]	60.85 ± 0.85[abc]	74.58 ± 1.68[abcd]	85.92 ± 0.81[abcde]	88.44 ± 1.60[abcde]
Urad dal	31.02 ± 1.04[a]	53.06 ± 1.23[ab]	71.75 ± 0.77[abc]	82.67 ± 1.87[abcd]	89.69 ± 1.80[abcde]	90.70 ± 1.01[abcde]
Green gram	30.24 ± 0.52[a]	51.68 ± 1.76[ab]	61.61 ± 1.82[abc]	77.66 ± 1.77[abcd]	89.07 ± 2.12[abcde]	90.32 ± 2.35[abcde]
Horse gram	27.32 ± 0.68[a]	49.09 ± 1.11[ab]	65.99 ± 1.43[abc]	83.22 ± 0.76[abcd]	91.29 ± 2.30[abcde]	92.72 ± 2.75[abcde]
Toor dal	17.34 ± 1.05[a]	38.89 ± 1.35[ab]	61.15 ± 2.17[abc]	78.00 ± 0.76[abcd]	86.92 ± 0.62[abcde]	88.20 ± 0.68[abcde]
Soyabean	26.91 ± 1.09[a]	39.00 ± 1.17[ab]	65.89 ± 0.90[abc]	82.94 ± 1.14[abcd]	90.88 ± 1.17[abcde]	92.17 ± 0.55[abcde]
Green leaves						
Moringa	17.81 ± 1.02[a]	38.90 ± 1.19[ab]	57.91 ± 1.30[abc]	70.74 ± 1.41[abcd]	85.79 ± 1.33[abcde]	87.15 ± 0.58[abcde]
Curry	20.40 ± 0.98[a]	42.42 ± 2.84[ab]	61.07 ± 3.21[abc]	73.28 ± 1.54[abcd]	84.85 ± 2.27[abcde]	88.53 ± 1.06[abcde]
Spinach	21.07 ± 1.05[a]	49.27 ± 1.07[ab]	68.57 ± 1.86[abc]	81.45 ± 1.77[abcd]	89.76 ± 1.14[abcde]	90.47 ± 1.17[abcde]
Coriander	20.46 ± 1.81[a]	41.39 ± 2.52[ab]	61.56 ± 1.70[abc]	73.72 ± 2.30[abcd]	85.89 ± 3.13[abcde]	90.86 ± 2.19[abcde]
Mint	19.96 ± 0.57[a]	43.84 ± 2.32[ab]	61.84 ± 1.39[abc]	72.84 ± 1.14[abcd]	75.45 ± 1.59[abcde]	77.99 ± 0.73[abcde]

Fenugreek	19.40 ± 1.02[a]	41.40 ± 4.22[ab]	61.81 ± 4.40[abc]	73.87 ± 4.51[abcd]	84.04 ± 2.79[abcde]	89.74 ± 2.30[abcde]

Values were expressed Mean; n=3; [a-e]different letters in same row are significantly different ($p<0.05$, Turkey's test)

Table 2: Antioxidant activities of ethanolic extracts of millets, pulses, and green leaves (ABTS assay)

Samples	25mg	50mg	75mg	100mg	125mg	150mg
Millets						
Finger millet	17.11 ± 0.97[a]	29.05 ± 1.22[ab]	39.08 ± 1.24[abc]	48.66 ± 1.56[abcd]	63.76 ±0.96[abcde]	66.54 ± 1.64[abcde]
Wheat	19.13 ± 0.79[a]	36.90 ± 1.11[ab]	57.78 ± 1.29[abc]	75.78 ± 1.38[abcd]	89.42 ± 0.69[abcde]	92.32 ± 0.67[abcdef]
Rice	17.67 ± 0.81[a]	28.22 ± 0.52[ab]	38.81 ± 0.28[abc]	59.25 ± 1.42[abcd]	78.85 ± 0.44[abcde]	81.15 ± 0.44[abcdef]
Pearl millet	20.95 ± 1.24[a]	39.01 ± 1.21[ab]	47.28 ± 0.46[abc]	58.00 ± 1.10[abcd]	65.79 ± 1.47[abcde]	66.87 ± 1.20[abcde]
Kodo millet	18.83 ± 0.35[a]	28.92 ± 1.23[ab]	47.88 ± 1.02[abc]	57.25 ± 0.98[abcd]	65.67 ± 1.68[abcde]	66.72 ± 1.11[abcde]
Foxtail millet	13.12 ± 0.88[a]	28.22 ± 0.05[ab]	40.21 ± 0.89[abc]	55.21 ± 1.26[abcd]	62.38 ± 0.64[abcde]	63.80 ± 1.10[abcde]
Pulses						
Cow pea	24.32 ± 1.89[a]	39.81 ± 0.45[ab]	54.24 ± 0.83[abc]	68.59 ± 1.63[abcd]	86.94 ± 0.70[abcde]	88.79 ± 0.67[abcde]
Hyacinth bean	20.28 ± 0.92[a]	38.07 ± 0.52[ab]	59.75 ± 0.43[abc]	73.83 ± 0.72[abcd]	82.83 ± 0.60[abcde]	83.72 ± 0.64[abcde]
Urad dal	32.49 ± 0.35[a]	51.05 ± 0.54[ab]	63.85 ± 1.05[abc]	77.73 ± 1.22[abcd]	88.12 ± 0.41[abcde]	89.87 ± 0.90[abcde]
Green gram	26.87 ± 0.99[a]	44.45 ± 1.13[ab]	57.87 ± 0.84[abc]	71.87 ± 0.66[abcd]	87.84 ± 0.51[abcde]	88.93 ± 0.62[abcde]
Horse gram	25.30 ± 1.37[a]	39.73 ± 0.36[ab]	59.56 ± 1.91[abc]	79.82 ± 0.57[abcd]	89.89 ± 0.31[abcde]	92.19 ± 0.29[abcde]
Toor dal	18.60 ± 1.49[a]	29.73 ± 0.50[ab]	57.86 ± 2.40[abc]	72.38 ± 0.12[abcd]	80.51 ± 0.24[abcde]	81.21 ± 0.24[abcde]
Soyabean	25.73 ± 1.10[a]	37.92 ± 1.10[ab]	62.85 ± 1.14[abc]	80.73 ± 0.94[abcd]	92.50 ± 1.49[abcde]	94.01 ± 1.27[abcde]
Green leaves						
Moringa	19.81 ± 0.42[a]	32.88 ± 0.57[ab]	54.87 ± 0.44[abc]	71.19 ± 0.52[abcd]	86.82 ± 0.51[abcde]	87.91 ± 0.64[abcde]
Curry	19.86 ± 0.61[a]	37.27 ± 0.38[ab]	55.66 ± 1.60[abc]	77.27 ± 1.19[abcd]	81.14 ± 0.75[abcde]	83.37 ± 0.64[abcde]
Spinach	19.19 ± 0.49[a]	37.86 ± 1.52[ab]	55.82 ± 1.31[abc]	77.82 ± 1.15[abcd]	84.25 ± 0.69[abcde]	85.10 ± 0.68[abcde]
Coriander	19.88 ± 0.30[a]	37.37 ± 1.37[ab]	55.53 ± 1.28[abc]	75.21 ± 1.05[abcd]	85.03 ± 1.25[abcde]	85.67 ± 0.80[abcde]
Mint	20.07 ± 0.52[a]	39.04 ± 0.41[ab]	56.15 ± 0.70[abc]	74.83 ± 0.69[abcd]	77.00 ± 0.76[abcde]	76.65 ± 0.42[abcde]
Fenugreek	20.17 ± 1.18[a]	38.31 ± 0.57[ab]	53.01 ± 1.69[abc]	75.33 ± 1.82[abcd]	81.54 ± 1.14[abcde]	83.79 ± 2.14[abcde]

Values were expressed Mean; n=3; [a-f]different letters in same row are significantly different ($p<0.05$, Turkey's test)

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Table 3: Antioxidant activities of ethanolic extracts of millets, pulses, and green leaves (TAA assay)

Samples	25mg	50mg	75mg	100mg	125mg	150mg
Millets						
Finger millet	0.93 ± 0.05^{a}	1.82 ± 0.04^{ab}	2.10 ± 0.09^{ab}	2.94 ± 0.05^{abc}	3.81 ± 0.20^{abcd}	4.22 ± 0.19^{abcde}
Wheat	1.90 ± 0.11^{a}	2.84 ± 0.17^{ab}	3.86 ± 0.17^{abc}	4.18 ± 0.07^{abc}	4.93 ± 0.05^{abcd}	5.18 ± 0.06^{abcd}
Rice	1.08 ± 0.13^{a}	2.48 ± 0.13^{ab}	3.07 ± 0.12^{abc}	3.71 ± 0.07^{abcd}	4.52 ± 0.35^{abcde}	4.81 ± 0.08^{abcde}
Pearl millet	0.96 ± 0.02^{a}	1.37 ± 0.07^{ab}	1.95 ± 0.06^{abc}	2.37 ± 0.09^{abcd}	3.11 ± 0.06^{abcde}	3.51 ± 0.05^{abcdef}
Kodo millet	0.20 ± 0.05^{a}	0.98 ± 0.04^{ab}	1.88 ± 0.12^{abc}	2.28 ± 0.15^{abcd}	3.10 ± 0.10^{abcde}	3.53 ± 0.21^{abcdef}
Foxtail millet	0.88 ± 0.05^{a}	1.57 ± 0.12^{ab}	2.13 ± 0.10^{abc}	2.61 ± 0.07^{abcd}	3.36 ± 0.13^{abcde}	3.62 ± 0.33^{abcde}
Pulses						
Cow pea	1.42 ± 0.19^{a}	2.24 ± 0.18^{ab}	2.99 ± 0.11^{abc}	3.52 ± 0.26^{abc}	4.51 ± 0.40^{abcd}	4.94 ± 0.06^{abcd}
Hyacinth bean	1.24 ± 0.04^{a}	1.86 ± 0.17^{a}	2.64 ± 0.05^{ab}	3.59 ± 0.40^{abc}	4.42 ± 0.38^{abcd}	4.62 ± 0.35^{abcd}
Urad dal	0.92 ± 0.14^{a}	1.73 ± 0.06^{ab}	2.82 ± 0.06^{abc}	3.62 ± 0.12^{abcd}	4.49 ± 0.09^{abcde}	4.69 ± 0.07^{abcde}
Green gram	1.21 ± 0.26^{a}	2.07 ± 0.27^{ab}	2.90 ± 0.23^{abc}	3.73 ± 0.24^{abcd}	4.24 ± 0.20^{abcd}	4.62 ± 0.25^{abcd}
Horse gram	1.87 ± 0.29^{a}	3.08 ± 0.28^{ab}	3.58 ± 0.32^{ab}	4.43 ± 0.36^{ab}	5.39 ± 0.45^{abc}	5.51 ± 0.26^{abc}
Toor dal	1.41 ± 0.11^{a}	2.51 ± 0.25^{ab}	3.24 ± 0.17^{abc}	3.97 ± 0.04^{abcd}	4.43 ± 0.12^{abcde}	4.59 ± 0.20^{abcde}
Soyabean	1.82 ± 0.06^{a}	2.86 ± 0.02^{ab}	3.53 ± 0.11^{abc}	4.43 ± 0.19^{abcd}	5.25 ± 0.33^{abcde}	5.56 ± 0.21^{abcde}
Green leaves						
Moringa	1.00 ± 0.11^{a}	1.67 ± 0.25^{ab}	2.66 ± 0.17^{abc}	3.23 ± 0.04^{abcd}	4.16 ± 0.12^{abcde}	4.43 ± 0.20^{abcde}
Curry	1.03 ± 0.06^{a}	1.79 ± 0.32^{ab}	2.73 ± 0.12^{abc}	3.49 ± 0.25^{abcd}	4.19 ± 0.13^{abcde}	4.47 ± 0.14^{abcde}
Spinach	0.87 ± 0.09^{a}	1.58 ± 0.13^{a}	2.77 ± 0.10^{ab}	3.65 ± 0.19^{abc}	4.27 ± 0.06^{abc}	4.98 ± 0.60^{abc}
Coriander	1.08 ± 0.12^{a}	1.80 ± 0.38^{ab}	2.74 ± 0.28^{abc}	3.59 ± 0.20^{abcd}	4.19 ± 0.18^{abcd}	4.40 ± 0.11^{abcde}
Mint	1.05 ± 0.02^{a}	2.12 ± 0.08^{ab}	2.69 ± 0.11^{abc}	3.50 ± 0.08^{abcd}	4.09 ± 0.04^{abcde}	4.29 ± 0.02^{abcdef}
Fenugreek	1.09 ± 0.04^{a}	1.80 ± 0.28^{ab}	2.69 ± 0.19^{abc}	3.55 ± 0.20^{abcd}	4.21 ± 0.19^{abcde}	4.44 ± 0.11^{abcde}

Values were expressed Mean; n=3; $^{a\text{-}f}$different letters in same row are significantly different ($p<0.05$, Turkey's test)

Table 4: Antioxidant activities of ethanolic extracts of millets, pulses, and green leaves (FRAP assay)

Samples	25mg	50mg	75mg	100mg	125mg	150mg
Millets						

Finger millet	0.60 ± 0.05^{a}	1.13 ± 0.02^{a}	1.78 ± 0.09^{ab}	2.72 ± 0.11^{abc}	3.33 ± 0.40^{abcd}	3.76 ± 0.09^{abcd}
Wheat	1.21 ± 0.08^{a}	1.93 ± 0.03^{ab}	2.50 ± 0.10^{abc}	3.61 ± 0.05^{abcd}	4.01 ± 0.07^{abcde}	4.70 ± 0.10^{abcdef}
Rice	0.82 ± 0.04^{a}	1.68 ± 0.09^{ab}	2.25 ±0.10^{abc}	2.92 ± 0.05^{abcd}	3.19 ± 0.06^{abcd}	3.74 ± 0.21^{abcde}
Pearl millet	0.65 ± 0.02^{a}	1.06 ± 0.13^{a}	1.41 ± 0.38^{ab}	2.10 ± 0.10^{abc}	2.87 ± 0.06^{abcd}	3.57 ± 0.04^{abcde}
Kodo millet	0.77 ± 0.17^{a}	0.82 ± 0.22^{a}	1.44 ± 0.14^{ab}	1.85 ± 0.03^{ab}	2.73 ± 0.10^{abc}	3.22 ± 0.08^{abcd}
Foxtail millet	0.72 ± 0.11^{a}	1.36 ± 0.11^{ab}	1.82 ± 0.04^{abc}	2.06 ± 0.04^{abc}	2.72 ± 0.05^{abcd}	3.27 ± 0.15^{abcde}
Pulses						
Cow pea	0.96 ± 0.10^{a}	1.62 ± 0.06^{ab}	2.76 ± 0.02^{abc}	2.98 ± 0.08^{abc}	3.82 ± 0.07^{abcd}	4.33 ± 0.09^{abcde}
Hyacinth bean	0.92 ± 0.03^{a}	1.60 ± 0.05^{ab}	2.40 ± 0.08^{abc}	3.26 ± 0.03^{abcd}	3.64 ± 0.02^{abcde}	4.00 ± 0.08^{abcdef}
Urad dal	0.54 ± 0.16^{a}	1.55 ± 0.22^{ab}	2.33 ± 0.04^{abc}	2.84 ± 0.14^{abcd}	3.32 ± 0.15^{abcde}	3.79 ± 0.04^{abcde}
Green gram	0.80 ± 0.05^{a}	1.73 ± 0.06^{ab}	2.61 ± 0.16^{abc}	3.20 ± 0.06^{abcd}	3.75 ± 0.03^{abcde}	4.22 ± 0.09^{abcdef}
Horse gram	1.57 ± 0.09^{a}	2.51 ± 0.04^{ab}	2.95 ± 0.12^{ab}	3.71 ± 0.04^{abc}	4.33 ± 0.18^{abcd}	4.81 ± 0.28^{abcd}
Toor dal	1.02 ± 0.03^{a}	1.77 ± 0.09^{ab}	2.61 ± 0.05^{abc}	3.35 ± 0.29^{abcd}	3.49 ± 0.31^{abcd}	4.05 ± 0.03^{abcde}
Soyabean	1.42 ± 0.25^{a}	2.79 ± 0.09^{ab}	3.02 ± 0.03^{ab}	3.65 ± 0.00^{abc}	4.20 ± 0.24^{abcd}	4.63 ± 0.08^{abcd}
Green leaves						
Moringa	0.77 ± 0.01^{a}	1.40 ± 0.08^{ab}	2.06 ± 0.04^{abc}	2.57 ± 0.06^{abcd}	3.08 ± 0.04^{abcde}	3.57 ± 0.21^{abcdef}
Curry	0.87 ± 0.06^{a}	1.45 ± 0.04^{ab}	2.13 ± 0.15^{abc}	2.79 ± 0.04^{abcd}	3.64 ± 0.14^{abcde}	4.19 ± 0.06^{abcdef}
Spinach	0.68 ± 0.06^{a}	1.27 ± 0.02^{ab}	2.43 ± 0.04^{abc}	3.01 ± 0.03^{abcd}	3.88 ± 0.08^{abcde}	4.21 ± 0.07^{abcdef}
Coriander	0.86 ± 0.04^{a}	1.40 ± 0.05^{ab}	2.08 ± 0.05^{abc}	2.61 ± 0.08^{abcd}	3.67 ± 0.13^{abcde}	4.26 ± 0.03^{abcdef}
Mint	0.88 ± 0.00^{a}	1.33 ± 0.04^{ab}	2.20 ± 0.03^{abc}	2.70 ± 0.04^{abcd}	3.24 ± 0.02^{abcde}	3.99 ± 0.05^{abcdef}
Fenugreek	0.88 ± 0.05^{a}	1.43 ± 0.01^{ab}	2.00 ± 0.06^{abc}	2.67 ± 0.01^{abcd}	3.50 ± 0.01^{abcde}	4.14 ± 0.11^{abcdef}

Values were expressed Mean; n=3; $^{a-f}$different letters in same row are significantly different ($p<0.05$, Turkey's test)

Table 5: Antioxidant activities of aqueous extracts of millets, pulses, and green leaves (DPPH assay)

Samples	**25mg**	**50mg**	**75mg**	**100mg**	**125mg**	**150mg**
Millets						
Finger millet	21.40 ± 5.72^{a}	33.66 ± 1.06^{ab}	43.91 ± 3.26^{ab}	56.66 ± 6.83^{abc}	66.62 ± 0.38^{abc}	68.70 ± 0.44^{abcd}
Wheat	18.52 ± 1.28^{a}	33.25 ± 0.51^{ab}	46.31 ± 0.40^{abc}	53.44 ± 0.82^{abcd}	67.54 ± 1.18^{abcde}	68.22 ± 0.57^{abcde}
Rice	19.58 ± 1.05^{a}	38.23 ± 2.71^{ab}	52.66 ± 0.74^{abc}	66.91 ± 1.14^{abcd}	76.63 ± 1.48^{abcde}	77.62 ± 1.70^{abcde}
Pearl millet	19.41 ± 1.15^{a}	37.99 ±	57.09 ±	70.49 ±	78.84 ±	80.40 ± 2.16^{abcde}

		1.46^{ab}	1.15^{abc}	1.08^{abcd}	0.95^{abcde}	
Kodo millet	23.14 ± 2.08^{a}	37.82 ± 0.51^{ab}	48.97 ± 1.14^{abc}	66.89 ± 0.23^{abcd}	86.95 ± 0.50^{abcde}	87.59 0.58^{abcde}
Foxtail millet	22.77 ± 1.10^{a}	42.58 ± 1.06^{ab}	56.42 ± 1.46^{abc}	69.25 ± 1.68^{abcd}	76.71 ± 1.49^{abcde}	81.13 ± 1.46^{abcde}
Pulses						
Cow pea	24.51 ± 0.17^{a}	46.24 ± 1.07^{ab}	64.39 ± 7.43^{abc}	80.63 ± 5.49^{abcd}	94.33 ± 4.28^{abcde}	95.36 ± 0.30^{abcde}
Hyacinth bean	25.90 ± 0.52^{a}	46.13 ± 0.59^{ab}	61.21 ± 1.12^{abc}	76.92 ± 2.88^{abcd}	85.17 ± 0.24^{abcde}	87.24 ± 0.43^{abcde}
Urad dal	25.90 ± 2.91^{a}	46.13 ± 4.00^{a}	61.21 ± 9.05^{ab}	76.92 ± 11.49^{ab}	85.17 ± 12.48^{abc}	87.24 ± 12.63^{abc}
Green gram	25.54 ± 1.05^{a}	38.72 ± 1.59^{ab}	62.91 ± 2.48^{abc}	76.91 ± 1.57^{abcd}	85.51 ± 0.81^{abcde}	86.46 ± 0.42^{abcde}
Horse gram	29.14 ± 1.33^{a}	49.87 ± 1.63^{ab}	62.43 ± 1.04^{abc}	76.97 ± 1.01^{abcd}	89.93 ± 1.33^{abcde}	91.72 ± 1.00^{abcde}
Toor dal	30.02 ± 2.15^{a}	49.15 ± 1.78^{ab}	69.41 ± 0.53^{abc}	83.04 ± 0.60^{abcd}	89.82 ± 1.26^{abcde}	91.78 ± 0.43^{abcde}
Soyabean	21.61 ± 0.17^{a}	38.75 ± 1.07^{ab}	57.23 ± 7.43^{abc}	71.99 ± 5.49^{abcd}	83.55 ± 4.28^{abcde}	87.11 ± 0.30^{abcde}
Green leaves						
Moringa	19.17 ± 0.82^{a}	43.35 ± 1.22^{ab}	60.55 ± 3.28^{abc}	72.22 ± 2.13^{abcd}	78.42 ± 3.57^{abcd}	80.11 ± 3.75^{abcde}
Curry	15.25 ± 2.25^{a}	35.46 ± 7.54^{ab}	53.18 ± 16.04^{ab}	67.06 ± 0.67^{abc}	76.66 ± 1.05^{abc}	78.11 ± 0.28^{abc}
Spinach	10.74 ± 0.84^{a}	32.08 ± 1.36^{ab}	49.48 ± 0.62^{abc}	61.86 ± 1.13^{abcd}	67.32 ± 0.71^{abcde}	78.70 ± 0.38^{abcde}
Coriander	14.76 ± 0.29^{a}	34.20 ± 0.65^{ab}	55.30 ± 2.08^{abc}	66.64 ± 0.78^{abcd}	73.30 ± 0.46^{abcde}	74.30 ± 2.86^{abcde}
Mint	18.58 ± 0.16^{a}	37.71 ± 1.69^{ab}	53.99 ± 2.59^{abc}	66.45 ± 0.61^{abcd}	77.87 ± 0.22^{abcde}	78.91 ± 1.66^{abcde}
Fenugreek	19.46 ± 3.31^{a}	41.53 ± 12.22^{a}	58.12 ± 19.48^{a}	70.40 ± 21.24^{ab}	78.77 ± 19.84^{abc}	79.93 ± 19.67^{abcd}

Values were expressed Mean; n=3; $^{a\text{-}e}$different letters in same row are significantly different ($p<0.05$, Turkey's test)

Table 6: Antioxidant activities of aqueous extracts of millets, pulses, and green leaves (ABTS assay)

Samples	25mg	50mg	75mg	100mg	125mg	150mg
Millets						
Finger millet	20.84 ± 5.01^{a}	32.62 ± 4.76^{a}	47.29 ± 13.15^{a}	60.01 ± 17.87^{ab}	73.70 ± 16.32^{abc}	76.72 ± 15.63^{abcd}
Wheat	19.28 ± 0.63^{a}	28.29 ± 8.86^{a}	38.63 ± 19.40^{a}	51.24 ± 28.82^{a}	62.61 ± 37.48^{a}	64.51 ± 39.15^{a}
Rice	17.95 ± 1.03^{a}	25.89 ± 6.44^{a}	32.61 ± 12.17^{a}	42.35 ± 21.09^{a}	53.77 ± 31.30^{a}	55.13 ± 32.67^{a}
Pearl millet	24.69 ± 4.96^{a}	43.17 ± 6.02^{a}	51.94 ± 7.54^{ab}	64.61 ± 10.43^{abc}	72.91 ± 10.94^{abcd}	73.98 ± 10.95^{abcde}
Kodo millet	22.08 ± 5.97^{a}	34.34 ± 7.96^{a}	53.23 ± 8.05^{ab}	65.09 ± 12.61^{abc}	72.82 ± 10.95^{abcd}	75.17 ± 12.95^{abcde}
Foxtail millet	39.52 ± 0.61^{a}	63.73 ± 7.38^{a}	87.93 ± 13.71^{a}	119.97 ± 22.76^{a}	137.43 ± 27.76^{a}	141.30 ± 28.88^{a}
Pulses						

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Cow pea	20.56 ± 8.49^{a}	33.55 ± 10.54^{a}	46.50 ± 13.73^{a}	60.93 ± 15.06^{a}	75.57 ± 18.89^{ab}	77.50 ± 19.11^{abc}
Hyacinth bean	19.39 ± 0.63^{a}	38.28 ± 1.28^{ab}	55.98 ± 6.35^{abc}	68.52 ± 8.64^{abc}	80.21 ± 3.86^{abcd}	82.35 ± 1.93^{abcd}
Urad dal	29.77 ± 4.53^{a}	40.20 ± 9.63^{a}	47.50 ± 16.24^{a}	59.01 ± 23.89^{a}	69.23 ± 31.79^{a}	70.16 ± 32.58^{a}
Green gram	24.77 ± 4.34^{a}	41.26 ± 4.10^{ab}	56.60 ± 1.96^{abc}	73.51 ± 3.49^{abcd}	88.35 ± 1.41^{abcde}	89.94 ± 2.35^{abcde}
Horse gram	22.53 ± 3.27^{a}	35.94 ± 6.41^{a}	55.23 ± 5.70^{ab}	72.23 ± 12.53^{abc}	82.04 ± 13.14^{abcd}	84.68 ± 13.38^{abcde}
Toor dal	19.76 ± 3.20^{a}	30.81 ± 6.92^{a}	41.41 ± 20.89^{a}	50.35 ± 28.60^{a}	60.70 ± 31.69^{a}	63.28 ± 31.83^{a}
Soyabean	22.61 ± 6.80^{a}	30.25 ± 7.11^{a}	41.57 ± 19.48^{a}	51.08 ± 27.93^{a}	58.25 ± 33.70^{a}	58.70 ± 33.96^{a}
Green leaves						
Moringa	19.76 ± 0.17^{a}	30.81 ± 10.11^{a}	41.41 ± 18.85^{a}	50.35 ± 27.05^{a}	60.70 ± 35.78^{a}	63.28 ± 37.69^{a}
Curry	16.74 ± 5.18^{a}	26.87 ± 9.87^{a}	35.61 ± 17.40^{a}	46.17 ± 28.22^{a}	50.47 ± 29.15^{a}	51.56 ± 29.58^{a}
Spinach	17.02 ± 4.46^{a}	31.29 ± 12.59^{a}	45.95 ± 19.32^{a}	62.41 ± 28.18^{a}	70.36 ± 24.86^{a}	73.43 ± 21.27^{ab}
Coriander	17.19 ± 4.03^{a}	32.41 ± 10.09^{a}	46.85 ± 10.68^{a}	67.24 ± 13.51^{ab}	71.71 ± 8.82^{abc}	73.10 ± 8.95^{abcd}
Mint	17.19 ± 2.54^{a}	32.41 ± 5.60^{a}	46.85 ± 8.55^{a}	67.24 ± 9.71^{ab}	71.71 ± 8.26^{abc}	73.10 ± 6.97^{abcd}
Fenugreek	17.78 ± 2.61^{a}	33.76 ± 6.85^{a}	47.76 ± 11.27^{a}	65.75 ± 16.43^{ab}	69.74 ± 12.97^{abc}	70.66 ± 12.25^{abcd}

Values were expressed Mean; n=3; $^{a-e}$different letters in same row are significantly different ($p<0.05$, Turkey's test)

Table 7: Antioxidant activities of aqueous extracts of millets, pulses, and green leaves (TAA assay)

Samples	25mg	50mg	75mg	100mg	125mg	150mg
Millets						
Finger millet	0.96 ± 0.01^{a}	1.69 ± 0.32^{a}	2.13 ± 0.16^{ab}	2.78 ± 0.30^{abc}	3.67 ± 0.48^{abcd}	4.08 ± 0.45^{abcde}
Wheat	1.38 ± 1.01^{a}	2.29 ± 1.14^{a}	3.29 ± 1.15^{a}	3.59 ± 1.08^{a}	4.33 ± 1.05^{ab}	4.70 ± 0.89^{abc}
Rice	1.22 ± 0.20^{a}	2.51 ± 0.05^{ab}	3.18 ± 0.06^{abc}	3.83 ± 0.12^{abcd}	4.65 ± 0.15^{abcde}	4.75 ± 0.16^{abcde}
Pearl millet	1.10 ± 0.21^{a}	1.64 ± 0.50^{a}	2.31 ± 0.61^{a}	2.93 ± 0.83^{ab}	3.65 ± 0.86^{abc}	3.99 ± 0.67^{abcd}
Kodo millet	0.65 ± 0.77^{a}	1.41 ± 0.79^{a}	2.32 ± 0.60^{a}	2.79 ± 0.75^{ab}	3.70 ± 0.92^{abc}	4.08 ± 0.76^{abcd}
Foxtail millet	1.03 ± 0.27^{a}	1.83 ± 0.33^{a}	2.44 ± 0.49^{ab}	3.07 ± 0.71^{abc}	3.75 ± 0.51^{abcd}	4.22 ± 0.41^{abcde}
Pulses						
Cow pea	1.33 ± 0.40^{a}	1.99 ± 0.57^{a}	3.05 ± 0.16^{ab}	3.62 ± 0.09^{abc}	4.63 ± 0.12^{abcd}	4.87 ± 0.10^{abcd}
Hyacinth bean	1.21 ± 0.01^{a}	1.97 ± 0.02^{ab}	2.64 ± 0.02^{abc}	3.82 ± 0.03^{abcd}	4.65 ± 0.03^{abcde}	4.83 ± 0.03^{abcdef}
Urad dal	1.20 ± 0.58^{a}	2.13 ± 0.64^{a}	3.06 ± 0.34^{ab}	3.88 ± 0.58^{abc}	4.84 ± 0.53^{abcd}	5.07 ± 0.52^{abcd}
Green gram	1.17 ± 0.25^{a}	2.03 ± 0.33^{a}	2.86 ± 0.68^{ab}	3.49 ± 0.73^{abc}	4.05 ± 0.52^{abcd}	4.52 ± 0.47^{abcd}
Horse gram	1.98 ± 0.10^{a}	3.15 ± 0.26^{ab}	3.64 ± 0.17^{abc}	4.62 ± 0.06^{abcd}	5.59 ± 0.12^{abcde}	5.77 ± 0.09^{abcde}
Toor dal	1.64 ± 0.32^{a}	2.80 ± 0.36^{a}	3.41 ± 0.30^{ab}	4.17 ± 0.41^{abc}	4.87 ± 0.69^{abcd}	4.98 ± 0.72^{bcd}
Soyabean	1.75 ± 0.18^{a}	2.69 ± 0.32^{a}	3.33 ± 0.28^{ab}	4.15 ± 0.46^{abc}	5.21 ± 0.39^{abcd}	5.42 ± 0.40^{abcd}
Green leaves						

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Moringa	0.93 ± 0.23^{a}	1.87 ± 0.07^{ab}	2.71 ± 0.15^{abc}	3.17 ± 0.14^{abc}	4.00 ± 0.42^{abcd}	4.42 ± 0.12^{abcd}
Curry	0.79 ± 0.41^{a}	1.59 ± 0.65^{a}	2.38 ± 0.82^{a}	3.11 ± 0.75^{ab}	3.99 ± 0.59^{abc}	4.17 ± 0.55^{abc}
Spinach	0.62 ± 0.36^{a}	1.40 ± 0.46^{a}	2.22 ± 1.05^{a}	3.05 ± 1.29^{a}	3.52 ± 1.21^{ab}	3.84 ± 1.39^{abc}
Coriander	0.89 ± 0.29^{a}	1.51 ± 0.77^{a}	2.25 ± 0.98^{a}	3.05 ± 1.00^{a}	3.51 ± 1.22^{ab}	3.73 ± 0.94^{abc}
Mint	0.95 ± 0.16^{a}	1.75 ± 0.69^{a}	2.36 ± 061^{ab}	3.04 ± 0.70^{abc}	3.97 ± 0.28^{abcd}	4.15 ± 0.32^{abcd}
Fenugreek	0.96 ± 0.17^{a}	1.59 ± 0.64^{a}	2.52 ± 0.60^{a}	3.19 ± 0.64^{abc}	3.87 ± 0.65^{abcd}	4.10 ± 0.56^{abcd}

Values were expressed Mean; n=3; $^{a-f}$different letters in same row are significantly different ($p<0.05$, Turkey's test)

Table 8: Antioxidant activities of aqueous extracts of millets, pulses, and green leaves (FRAP assay)

Samples	25mg	50mg	75mg	100mg	125mg	150mg
Millets						
Finger millet	0.97 ± 0.59^{a}	1.72 ± 0.99^{a}	2.28 ± 0.72^{a}	3.05 ± 0.71^{ab}	3.37 ± 0.56^{abc}	3.85 ± 0.33^{abc}
Wheat	1.09 ± 0.21^{a}	1.87 ± 0.13^{a}	2.40 ± 0.05^{ab}	3.39 ± 0.45^{abc}	3.67 ± 0.49^{abcd}	4.36 ± 0.72^{abcd}
Rice	0.78 ± 0.11^{a}	1.59 ± 0.30^{ab}	2.42 ± 0.11^{abc}	3.00 ± 0.08^{abcd}	3.40 ± 0.31^{abcd}	3.92 ± 0.11^{abcde}
Pearl millet	0.66 ± 0.01^{a}	1.05 ± 0.14^{a}	1.33 ± 0.36^{a}	2.04 ± 0.04^{ab}	2.60 ± 0.43^{abc}	3.09 ± 0.81^{abc}
Kodo millet	0.74 ± 0.13^{a}	1.08 ± 0.26^{a}	1.58 ± 0.40^{a}	2.17 ± 0.51^{ab}	2.85 ± 0.35^{abc}	3.42 ± 0.46^{abc}
Foxtail millet	1.06 ± 0.51^{a}	1.76 ± 0.56^{a}	2.27 ± 0.74^{a}	2.68 ± 0.93^{a}	3.45 ± 1.13^{ab}	3.80 ± 0.93^{abc}
Pulses						
Cow pea	1.05 ± 0.02^{a}	1.71 ± 0.11^{ab}	2.68 ± 0.12^{abc}	3.06 ± 0.02^{abcd}	3.75 ± 0.21^{abcde}	4.26 ± 0.13^{abcdef}
Hyacinth bean	0.78 ± 0.29^{a}	1.51 ± 0.23^{a}	2.56 ± 0.17^{ab}	3.23 ± 0.28^{abc}	3.50 ± 0.26^{abcd}	3.62 ± 0.42^{abcd}
Urad dal	0.65 ± 0.34^{a}	1.49 ± 0.15^{ab}	2.49 ± 0.25^{abc}	2.97 ± 0.07^{abc}	3.46 ± 0.37^{abcd}	3.95 ± 0.35^{abcd}
Green gram	0.91 ± 0.26^{a}	1.83 ± 0.12^{ab}	2.59 ± 0.30^{abc}	3.26 ± 0.08^{abc}	3.75 ± 0.10^{abc}	4.20 ± 0.08^{abc}
Horse gram	1.37 ± 0.51^{a}	2.18 ± 0.63^{a}	2.70 ± 0.63^{a}	3.36 ± 0.71^{ab}	4.04 ± 0.89^{abc}	4.56 ± 0.87^{abc}
Toor dal	1.02 ± 0.07^{a}	1.73 ± 0.16^{ab}	2.65 ± 0.02^{abc}	3.12 ± 0.08^{abcd}	3.58 ± 0.12^{abcde}	3.95 ± 0.17^{abcdef}
Soyabean	1.36 ± 0.50^{a}	2.46 ±0.71^{a}	2.88 ± 0.30^{ab}	3.46 ± 0.30^{abc}	3.90 ± 0.22^{abcd}	4.37 ± 0.44^{abcd}
Green leaves						
Moringa	0.67 ± 0.11^{a}	1.33 ± 0.43^{a}	1.92 ± 0.35^{a}	2.30 ± 0.54^{ab}	3.09 ± 0.55^{abc}	3.50 ± 0.78^{abc}
Curry	0.70 ± 0.10^{a}	0.94 ± 0.30^{a}	1.37 ± 0.58^{a}	2.07 ± 0.49^{ab}	2.90 ± 0.24^{abc}	3.47 ± 0.38^{abc}
Spinach	0.35 ± 0.28^{a}	0.76 ± 0.42^{a}	1.45 ± 0.89^{a}	1.95 ± 1.36^{a}	2.67 ± 1.09^{a}	2.88 ± 1.08^{a}
Coriander	0.54 ± 0.19^{a}	0.85 ± 0.40^{a}	1.33 ± 0.65^{a}	1.81 ± 0.83^{a}	2.33 ± 0.80^{a}	2.87 ± 0.92^{ab}
Mint	0.72 ± 0.15^{a}	1.04 ± 0.30^{a}	1.70 ± 0.30^{a}	2.22 ± 0.46^{ab}	2.76 ± 0.43^{abc}	3.09 ± 0.73^{abc}
Fenugreek	0.66 ± 0.05^{a}	0.99 ± 0.27^{a}	1.73 ± 0.28^{ab}	2.30 ± 0.45^{abc}	3.37 ± 0.50^{abcd}	3.63 ± 0.28^{abcd}

Values were expressed Mean; n=3; $^{a-f}$different letters in same row are significantly different ($p<0.05$, Turkey's test)

Table 9: Antimicrobial activities of millets, pulses, and green leaves extracts

Samples	Gram +ve bacteria	Gram -ve bacteria
Positive control	39.67 ± 0.58	45.67 ± 2.08

Negative control	0.00 ± 0.00	0.00 ± 0.00
Millets		
Finger millet	0.00 ± 0.00^{ab}	0.00 ± 0.00^{a}
Wheat	17.00 ± 1.00^{a}	14.67 ± 1.15^{ab}
Rice	15.00 ± 1.00^{a}	11.67 ± 0.58^{ab}
Pearl millet	12.67 ± 1.15^{a}	9.67 ± 0.58^{ab}
Kodo millet	14.00 ± 2.00^{a}	11.33 ± 1.15^{ab}
Foxtail millet	21.33 ± 1.15^{ab}	13.33 ± 1.15^{abc}
Pulses		
Cow pea	15.00 ± 1.00^{a}	11.00 ± 1.00^{a}
Hyacinth bean	$21.33\ 1.53^{ab}$	16.33 ± 0.58^{ab}
Urad dal	13.00 ± 1.00^{a}	11.00 ± 1.00^{a}
Green gram	12.33 ± 2.08^{a}	11.67 ± 1.53^{a}
Horse gram	13.33 ± 1.15^{a}	9.67 ± 0.58^{abc}
Toor dal	0.00 ± 0.00^{abc}	0.00 ± 0.00^{ab}
Soyabean	9.33 ± 0.58^{abc}	9.33 ± 0.58^{ab}
Green leaves		
Moringa	27.33 ± 1.13^{a}	23.33 ± 0.58^{a}
Curry	21.33 ± 1.15^{ab}	19.33 ± 1.15^{ab}
Spinach	31.33 ± 1.15^{ab}	25.33 ± 1.15^{a}
Coriander	21.33 ± 1.15^{ab}	15.67 ± 0.58^{ab}
Mint	28.33 ± 0.58^{a}	23.33 ± 1.15^{a}
Fenugreek	31.33 ± 1.15^{ab}	25.33 ± 1.15^{ab}

Values were expressed Mean; n=3; $^{a-c}$different letters in same column are significantly different ($p<0.05$, Turkey's test)

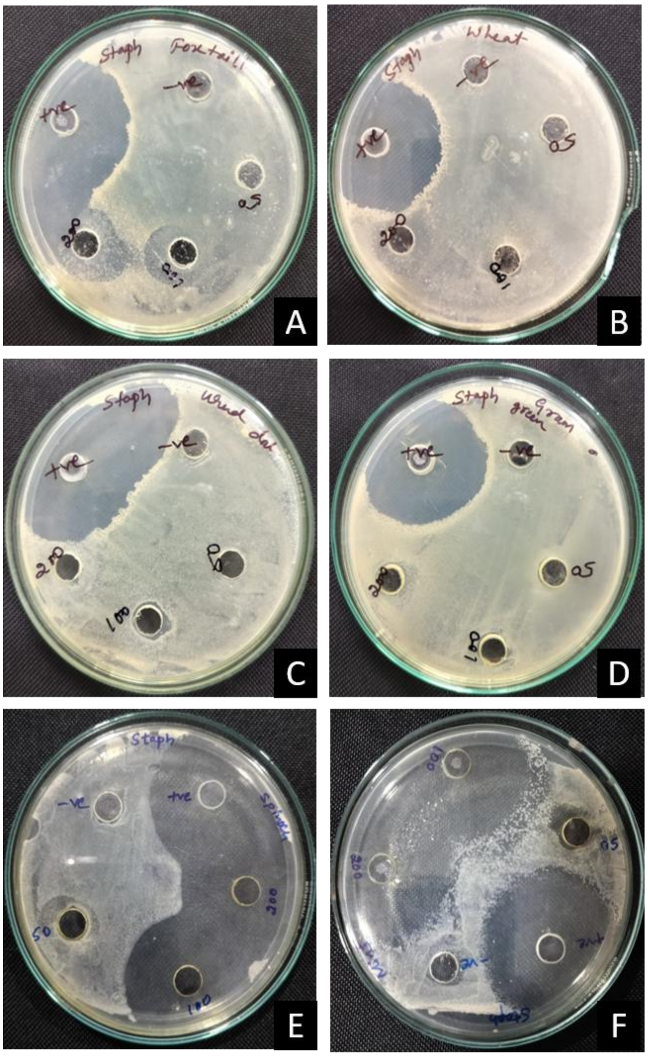

Figure 1. Antimicrobial activities of millets, pulses, and green leaves extracts against Gram +ve bacterial (*Staphylococcus aureus*)

A. Foxtail millets; B. Wheat; C. Urad dal; D. Green gram; E. Spinach leaves; F. Mint leaves

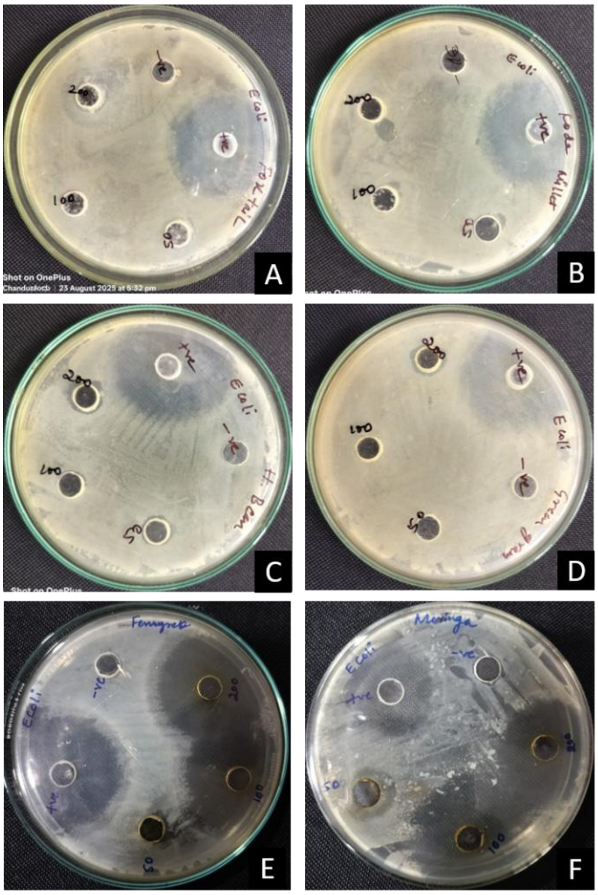

Figure 2. Antimicrobial activities of millets, pulses, and green leaves extracts against Gram -ve bacterial (*E. coli*)

A. Foxtail millets; B. Kudo millet; C. Hyacinth bean; D. Green gram; E. Fenugreek leaves; F. Moringa leaves