Nutritional Profile and Factors Influencing Local Cowpea (Vigna unguiculata L. Walp.) Variety Selection in Dedza and Ntcheu Districts, Central Malawi

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Abstract

This study examined the nutritional composition and factors influencing the selection of local cowpea varieties among smallholder farmers in Dedza and Ntcheu Districts, Central Malawi. Data were collected from 205 respondents through structured questionnaires, laboratory nutritional analysis, and statistical tests, including ANOVA and Principal Component Analysis (PCA). Results indicated significant variation in protein, fiber, and mineral contents across varieties. Demographic and socio-economic characteristics particularly education level, income, and farming experience were key determinants of varietal preference. Findings underscore the need for improved market access, farmer education, and promotion of nutritionally superior varieties to enhance food security and livelihoods in Malawi.

Keywords: Cowpea, Variety Selection, Nutrition, Socioeconomic Factors, Malawi

Introduction

Cowpea (Vigna unguiculata L. Walp.) is a vital legume crop in Malawi, serving as a major source of protein, minerals, and income for smallholder farmers. Despite its agronomic and nutritional importance, limited research has focused on the combined influence of socio-economic factors and nutritional profiles on varietal preferences among farmers. Understanding these relationships is essential to guide breeding programs, extension services, and policy interventions that support food and nutrition security.

Materials and Methods

A mixed-methods approach was employed. Data were collected from 205 smallholder farmers across Dedza and Ntcheu Districts using structured questionnaires and field surveys. Laboratory analyses were conducted to determine the nutritional composition (protein, fiber, fat, carbohydrates, and minerals) of four local cowpea varieties; Kamanyazi, Kamzama, Kachitedze, and Sewula. ANOVA was applied to test for significant differences among varieties, while PCA was used to identify key variables influencing farmers' selection preferences.

Results

Nutrient	Kamanyazi	Kamzama	Kachitedze	Sewula	p-value
Protein (%)	22.1 ± 0.6[b]	23.0 ± 0.5[b]	25.2 ± 0.4[a]	21.9 ± 0.3[b]	0.002
Fiber (%)	4.5 ± 0.3[a]	4.0 ± 0.2[b]	4.7 ± 0.2[a]	4.3 ± 0.2[a]	0.015
Fat (%)	1.8 ± 0.2[b]	2.1 ± 0.1[a]	1.9 ± 0.1[ab]	1.7 ± 0.2[b]	0.041
Carbohydrates (%)	62.4 ± 0.8[b]	61.8 ± 0.7[b]	59.2 ± 0.9[a]	63.1 ± 0.6[b]	0.006

Table 1: ANOVA results showing mean ± SD values for nutritional composition of local cowpea varieties (superscripts denote significant differences at $p < 0.05$).

Mineral	Kamanyazi	Kamzama	Kachitedze	Sewula	p-value
Iron (Fe)	6.8 ± 0.3[b]	7.1 ± 0.4[b]	8.2 ± 0.3[a]	6.5 ± 0.2[b]	0.004
Zinc (Zn)	4.3 ± 0.2[b]	4.7 ± 0.3[a]	4.9 ± 0.2[a]	4.2 ± 0.2[b]	0.012
Calcium (Ca)	42.5 ± 1.5[b]	45.3 ± 1.2[b]	48.8 ± 1.4[a]	43.2 ± 1.3[b]	0.021
Magnesium (Mg)	130.6 ± 2.1[b]	132.4 ± 2.0[b]	138.1 ± 2.2[a]	129.9 ± 1.9[b]	0.007
Phosphorus (P)	240.3 ± 3.8[b]	245.2 ± 3.1[ab]	250.8 ± 3.5[a]	238.7 ± 3.2[b]	0.034

Table 2: Mineral Composition of Local Cowpea Varieties (mg/100g)

Vitamin	Kamanyazi	Kamzama	Kachitedze	Sewula	p-value
Vitamin A	0.43 ± 0.02[b]	0.48 ± 0.03[a]	0.51 ± 0.02[a]	0.42 ± 0.03[b]	0.025
Vitamin B1 (Thiamine)	0.28 ± 0.01[ab]	0.30 ± 0.02[a]	0.29 ± 0.01[a]	0.27 ± 0.01[b]	0.041
Vitamin B2 (Riboflavin)	0.21 ± 0.01[b]	0.24 ± 0.02[a]	0.26 ± 0.01[a]	0.22 ± 0.01[b]	0.032
Vitamin C	1.8 ± 0.1[b]	2.0 ± 0.1[a]	2.3 ± 0.1[a]	1.9 ± 0.1[b]	0.008
Vitamin E	0.92 ± 0.05[b]	1.00 ± 0.04[a]	1.08 ± 0.03[a]	0.89 ± 0.04[b]	0.014

Table 3: Vitamin Composition of Local Cowpea Varieties (mg/100g)

Variable	PC1 (Nutritional)	PC2 (Socio-economic)	PC3 (Agronomic)	Communality
Protein content	0.87	0.22	0.05	0.80
Mineral richness	0.82	0.31	0.10	0.77
Education level	0.20	0.85	0.15	0.79
Income level	0.25	0.81	0.20	0.75
Farming experience	0.18	0.76	0.25	0.71
Seed color preference	0.05	0.28	0.83	0.75
Drought tolerance	0.10	0.15	0.86	0.78
Total Variance Explained: PC1 = 41.2%, PC2 = 23.6%, PC3 = 13.6% (Cumulative = 78.4%)				

Table 4: Principal Component Analysis (PCA) of Factors Influencing Cowpea Variety Selection

Discussion

The observed nutritional variation among cowpea varieties supports recent findings that both genetic and environmental factors significantly influence legume composition. Notably, the superior protein and mineral concentrations identified in the Kachitedze landrace underscore its potential as a nutritionally valuable genotype for biofortification and dietary diversification. This aligns with Uba et al. (2021), who emphasized the nutritional superiority of indigenous cowpea accessions due to localized adaptation and farmer-driven selection [1]. Similarly, Mwale and Kabambe (2022) demonstrated that local cowpea varieties in Central Malawi exhibit enhanced yield and adaptability, reinforcing their relevance for breeding programs targeting food and nutrition security [2]. Recent evaluations by Biama et al. (2020) and Shevkani et al. (2025) further confirm that cowpea lines bred for semi-arid regions possess high protein content (20–30%), complex carbohydrates, and essential micronutrients, making them ideal for addressing malnutrition in vulnerable populations [3,4].

Such landraces are increasingly recognized as reservoirs of desirable traits for breeding initiatives across sub-Saharan Africa [5]. The Food and Agriculture Organization highlights cowpea's strategic role in improving dietary quality and resilience in low income settings, particularly where micronutrient deficiencies are prevalent [6]. Breeding efforts focused on nutritional enhancement and climate resilience are gaining traction, with recent frameworks emphasizing drought adaptation and resistance to abiotic stress [7,8].

The socio-economic analysis revealed that farmers' education level and income were positively associated with varietal selection decisions. These findings are consistent with recent evidence from Malawi, where Kampanje-Phiri et al. (2025) and IFPRI (2020) reported that socio-economic status significantly influences legume adoption [9,10]. Farmers with higher education and income are more likely to access extension services, evaluate varietal traits, and engage with markets. This dynamic reflects broader patterns of technology uptake and varietal preference shaped by awareness, risk tolerance, and economic opportunity [5].

Principal Component Analysis (PCA) further elucidated the multidimensional nature of varietal preference, with drought tolerance, seed color, and taste emerging as key determinants. These traits reflect both agronomic performance and cultural acceptability, consistent with participatory breeding approaches that prioritize farmer knowledge and local utility. Recent studies emphasize that drought tolerance remains a critical trait in semi-arid regions of Malawi, where climate variability increasingly threatens crop productivity and household food security [2,6,8]. Moreover, preferences for seed color and taste are closely tied to culinary traditions and market demand, reinforcing the need for breeding programs to integrate both functional and cultural traits [7,9].

Collectively, these findings underscore the importance of integrating nutritional profiling, socio-economic dynamics, and farmer-preferred traits into cowpea improvement strategies. A holistic approach that combines genomic tools, participatory breeding, and context-specific socio-economic insights is essential to enhance adoption and ensure that improved varieties meet the needs of diverse farming communities. Such integration is particularly vital for targeting vulnerable populations in resource-constrained environments, where cowpea serves as a strategic crop for food security, income generation, and climate resilience [4-7].

Conclusion and Recommendations

The study concludes that cowpea varietal preferences among farmers in Dedza and Ntcheu are shaped by both nutritional qualities and socio-economic factors. Education, income, and farming experience emerged as critical drivers of varietal choice. It is recommended that policymakers and agricultural extension agents promote varieties like Kachitedze and Kamzama that combine high nutritional value with farmer-preferred agronomic traits. Further research should integrate molecular characterization to strengthen variety improvement programs.

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