# Micronutrient profiles of pigeon peas and dark green leafy vegetables from Lindi Region, Tanzania

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Vegi-Leg

**Introduction** Micronutrient deficiency is a global challenge to nutrition wellbeing, health, and economic development. Pigeonpeas (*Cajanus cajan* L.) are legumes with a high nutritional value acting as major source of protein of many tropical and subtropical regions of the world. Dark green leafy vegetables (DGLV) on the other hand are important sources of micronutrients and other phytochemicals and making them a part of rural household diets in Tanzania. Despite their importance, micronutrient profiles of many traditional vegetables and some pigeon peas is still unknown .

**Objective** To examine the micronutrient profiles of pigeon peas and commonly consumed DGLVs from rural areas of Lindi regions in Tanzania.

**Materials and Methods**

A total of (4) 'undehulled'dried pigeon peas (PPs) and fourteen (14) samples of DGLVs from various varieties were collected and analysed for micronutrient content. Fresh samples were freeze dried before analysis. Amino acid analyser and ICP-OES and HPLC techniques were used to determine amino acids (AAs) in pigeon peas (PPs) and minerals, carotenoids and phytates in PPs and DGLVs.

**Table 1:** Micronutrients of dark green leafy vegetables in mg/ per 100g of fresh weight

| Local name | Botanical name | Lutein | α-Carotene | ß-Carotene | Iron | Zinc | Calcium | Magnesium | Total Phytate |
|---|---|---|---|---|---|---|---|---|---|
| Mkokobwado | *Ipomea aquatica* | 5.4 (5.0,6.0) | 0.1 (0.0, 0.1) | 2.8 (2.4,4.4) | 3.6 (3.1, 4.2) | 0.3 (0.2, 0.5) | 115.3 (104.6, 129.62 | 37.43 (33.85,41.58) | 10.60 (8.25, 11.55) |
| Tindi pori | *Amaranthus graecizans* | 10.63 (10.40, 11.18) | 0.50 (0.43, 0.58) | 6.38 (4.97, 7.40) | 6.28 (6.19, 6.32) | 1.15 (1.14, 1.17) | 393.1 (379.3, 402.5) | **370.7 (370.7, 378.9)** | 5.64 (5.27,6.02) |
| Mchicha wa nyumbani | *Amaranthus spp* | 6.67 (6.12, 6.94) | 0.38 (0.23, 0.42) | 4.66 (3.05, 5.53) | 1.70 (1.71,1.81) | 0.55 (0.54,0.57) | 295.6 (283.2, 314.8) | 114.7 (104.7, 116.5) | 4.69 (4.38, 5.01) |
| Lilende (jute mallow) | *Corchorus olitorius* | 8.73 (8.20,9.26) | 0.03 (0.02,0.05) | 2.82 (2.17,5.23) | 4.69 (1.71, 7.70) | 0.50 (0.49,0.50) | 234.9 (150.7, 320.9) | 54.93 (44.49, 64.81) | 12.73 (4.73, 21.91) |
| Mgagani (African spider plant) | *Cleome gynandra* | 11.78 (11.45,11.95) | 0.12 (0.11, 0.13) | **6.89 (5.54, 9.78)** | **11.13 (10.63, 11.7**) | 0.65 (0.65,0.66) | 236.9 (235.9, 237.4) | 54.03 (53.87,54.23) | 22.98 (21.64,24.33) |
| Mtimba mwisi | *Gisekia pharnaceoides* L. | 5.92 (5.70,6.34) | 0.02 (0.01,0.02) | 1.53 (1.45, 2.07) | 5.14 (5.08,5.25) | 0.51 (0.51,0.52) | 76.88 (75.28, 78.04) | 61.22 (59.61, 62.01) | 1.66 (1.55, 1.77) |
| Tembele (sweet potato leaves) | *Ipomea batatas* L. | 7.91 (7.74,8.07) | 0.29 (0.24,0.34) | 4.50 (2.88, 6.92) | 3.79 (3.55, 4.02) | 0.34 (0.29, 0.40) | 127.12 (118.3, 136.2) | 67.70 (61.05, 73.47) | 4.86 (4.39, 5.40) |
| Majani ya kunde (Cowpea leaves) | *Vigna unguiculata* L. | **12.87 (10.86, 14.92)** | **0.13 (0.05, 0.31)** | 4.28 (3.07, 10.96) | 2.93 (2.23, 3.87) | 0.58 (0.54, 0.63) | 207.96 (158.6, 257.9) | 57.62 (56.83, 59.48) | 6.42 (5.84, 7.08) |
| Majani ya maboga (Pumpkin leaves) | *Curcubita maxima* | 11.99 (9.58, 14.77) | 0.21 (0.08, 0.29) | 2.84 (2.26, 3.54) | 4.20 (3.10, 5.31) | 0.71 (0.70, 0.71) | 232.3 (215.9, 248.7) | 115.5 (105.9, 125.7) | 8.99 (6.69, 12.82) |
| Kisamvu | *Manihot esculenta* | 20.28 (17.80, 21.35) | 0.07 (0.05, 0.11) | 6.74 (4.45, 7.73) | 2.21 (2.11,2.34) | **1.41 (1.37, 1.43)** | 212.2 (189.9, 236.6) | 94.54 (94.04, 94.92) | 9.56 (8.76, 10.45 |
| Tindi ya nyumbani | *Amaranthus viridis* | 8.01 (6.53, 9.29) | 0.38 (0.19, 0.77) | 2.75 (2.18, 4.76) | 5.31 (5.24, 5.38) | 0.72 (0.71,0.75) | **469.1 (405.2, 546.9)** | 217.4 (213.9, 218.1) | 6.24 (5.68, 6.87) |
| Nandelele | *Dioscorea* spp | 5.02 (4.74, 5.20) | 0.01 (0.01,0.02) | 1.01 (0.92, 1.41) | 8.74 (8.66,8.79) | 0.44 (0.44,0.44) | 235.2 (234.9, 38.07) | 277.9 (276.3, 278.5) | 1.82 (1.70, 1.94) |
| Mchicha bangi | *Amaranth maadira* | 5.14 (4.81, 5.47) | 0.07 (0.05, 0.07) | 1.08 (0.84, 1.26) | 2.55 (2.52,2.56) | 0.41 (0.41,0.4) | 380.7 (376.5, 393.3) | 309.5 (309.4, 314.5) | 6.08 (5.68, 6.49) |
| Mchicha pori | *Amaranthus spinosus* | 4.97 (4.90, 5.07) | 0.96 (0.90, 0.10) | 1.47 (1.31,1.54) | 3.50 (3.45, 3.56) | 0.39 (0.39,0.39) | 435.0 (408.4, 456.0) | 164.9 (164.5, 165.9) | 5.14 (4.80, 5.48) |

*Values are medians of four determinations (extraction /analysis) for carotenoids , triplicate determinations of minerals and two determinations of phytate; values in parenthesis represent minimum and maximum values of medians subgroup with the highest values; bold print indicates the homogenous subgroup with the highest values.

*Ipomea aquatica*

*Cleome gynandra*

*Ipomea batatas* L.

*Komboa (ICPL 87091)*

**Table 2:** Micronutrients of "undehulled" dry pigeon peas per 100g of 'fresh weight'

| Local name | Glutamic acid (g) | Phenylalanine (g) | Lysine (g) | Total AAs (g) | Iron (mg) | Zinc (mg) | Calcium (mg) | Magnesium (mg) | Total Phytate (mg) |
|---|---|---|---|---|---|---|---|---|---|
| **Mbaazi ya kienyeji (Local variety)** | 3.0 (2.9,3.1) | 2.0 (1.9,1.9) | 1.28 (1.27, 1.28) | 18.93 (18.69, 19.04) | **2.61 (2.59, 2.63)** | **2.39 (2.23, 2.54)** | 89.38 (77.96, 100.15) | 122.24 (120.8,123.4) | 702.3 (693.1,736.2) |
| **ICEA** | 2.85 (2.77,2.93) | 1.84 (1.82,1.88) | **1.32 (1.32, 1.35**) | 19.17 (18.97, 19.36) | 1.87 (1.83, 1.90) | 2.00 (19.7,2.06) | 50.36 (48.49, 54.03) | 124.4 (122.4, 128.9) | 422.5 (409.5, 435.5) |
| **Komboa** Genotype *ICPL 87091* | **2.90 (2.83, 3.01)** | 1.95 (1.92,19.8) | 1.28 (1.24, 1.33) | 18.60 (18.13, 19.25) | 2.58 (2.23, 2.93) | 2.23 (19.7, 2.49) | **90.40 (86.98, 92.58)** | **125.27 (110.9, 143.4**) | 666.4 (654.1, 713.2) |
| **Serena** | 2.86 (2.73,2.98) | **2.00 (2.00, 2.01)** | 1.23 (1.23, 1.24) | 18.17 (17.98, 18.37) | 1.66 (1.64,1.67) | 2.00 (1.97,2.01) | 58.01 (54.48, 59.54) | 142.1 (138.2, 145.2) | 366.7 (346.4, 370.6) |

*Values are medians of four determinations (extraction /analysis) for carotenoids, triplicate determinations of minerals and two determinations of phytate; values in parenthesis represent minimum and maximum values of medians subgroup with the highest values; bold print indicates the homogenous subgroup with the highest values.

**Results** The analyses of 'undehulled' local and improved genotypes of PPs revealed an excellent AA profile with 18 AAs and a (median) total of 19 gram/100 grams. Glutamatic acid and phenylalanineshowedconcentrations2gram/100gram,andimprovedPPsshowedhigher lysine concentrations compared to local genotypes. The mineral analysis revealed high median concentrations of iron (2.4 mg/100g), zinc (2.1 mg/100g), calcium (80 mg/100g) and magnesium(123mg/100g),but also a very high total phytate(IP5plusIP6) concentration of 701 mg/100g. DGLV such as Amaranth spp but also 'leaves' from conventional agriculture such as cassava and sweet potato represented very good sources of provitamin A (> 4 mg beta-carotene/100 g fresh weight (FW), other carotenoids (lutein), iron (3.8 mg/100g FW), calcium (236 mg/100g FW) and magnesium (94 mg/100g FW). In general, the median phytate content of the leafy vegetables was very low (6.3 mg/100g FW), contrary to expectations and regarding previous publications.

**Conclusion** This study shows that PPs and DGLVs have the potential to improve dietary intake of specific macro and micronutrients and therefore promoting these foods can have a positive impact on food and nutrition security.

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