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EVALUATION OF PROXIMATE, MINERAL AND PROTEIN DIGESTIBILITY OF GERMINATED PEARL MILLET (*Pennisetum glaucum*) AND AMARANTH GRAIN (*Amaranthus cruentus*) FLOUR BLENDS

Samuel Olufemi Owolade , Olaide Ruth Aderibigbe

[1] National Horticultural Research Institute, Product Development Programme, P.M.B. 5432, Idi- Ishin, Jericho GRA, Ibadan, Oyo State, Nigeria.

INTRODUCTION & AIM

The major cause of widespread malnutrition among children in low-income communities in developing countries of Africa has been attributed to the use of unsupplemented cereal-based foods off millet, maize and sorghum which are characterized by low energy and quality protein(Adepoju and Ayenitaju, 2021).

The commercial infant foods are often too expensive for families, especially the rural and poor urban ones. Thus, the study was aimed to evaluate the proximate, mineral an digestibility score of germinated millet flour incorporated with germinated amaranth grain flour to form blend as possible alternative to unsupplemented millet used as traditional infant food by rural nursing mothers. Millet, though a popular staple food but low in quality protein, being limited in essential amino acids, particularly lysine and tryptophan (Jacob et al., 2024).

Amaranths are ancient crops gaining lots of interest in recent time due to its high-quality protein(13%–19% dry wt) with a remarkable essential amino acid balance (Akin-Idowu et al., 2013; Aderibigbe et al., 2020). They are excellent source of minerals and vitamins (Toimbayeva et al., 2025

METHOD

Germination of millet and amaranth grains was performed by wrapping soaked grains in cheesecloth and kept for 24 hours, washed, dried and milled. Design expert was used to achieve ten runs of millet and amaranth flour blends, analyzing proximate, mineral and protein digestibility.

In vitro protein digestibility was determined with the common method of using a pepsin–pancreatin enzyme system with other chemicals such as NaoH and HCl.

Table 3: Mineral composition of millet and amaranth blends

	Millet	Amaranth	Fe(mg/100g)	Ca (mg/100g)	Zn (mg/100g)	Mg (mg/100g)	Mn (mg/100g)
Control	100	0	6.19^{g}	13.72^{e}	14.39^{f}	22.20^{f}	0.24^{b}
1	90	10	6.751±0.03^{f}	18.791±0.40^{d}	26.958±0.54^{e}	30.745±0.11^{g}	0.38±0.02^{ab}
2	67.5	32.5	8.26±0.15^{e}	26.07±0.25^{b}	31.75±0.15^{b}	40.98±1.09^{d}	0.53±0.02^{a}
3	90	10	6.751±0.01^{f}	19.11±0.66^{d}	27.74±0.49^{e}	30.74±0.12^{g}	0.26±0.18^{ab}
4	80	20	8.27±0.01^{e}	20.81±1.21^{c}	28.42±0.26^{d}	38.35±1.74^{e}	0.48±0.00^{ab}
5	70	30	9.96±0.04^{a}	25.51±0.52^{b}	29.07±0.23^{c}	47.54±1.15^{f}	0.66±0.04^{a}
6	60	40	9.13±0.001^{b}	38.11±0.78^{a}	33.41±0.20^{a}	67.31±0.16^{a}	0.46±0.34^{ab}
7	90	10	6.751±0.03^{f}	18.79±0.40^{d}	26.95±0.54^{e}	30.74±0.11^{g}	0.38±0.02^{b}
8	82.5	17.5	6.06±4.51^{d}	25.59±0.50^{b}	29.15±0.06^{c}	35.17±0.05^{f}	0.40±0.30^{ab}
9	60	40	9.15±0.00^{b}	38.11±0.78^{a}	33.41±0.20^{a}	67.81±0.52^{a}	0.46±0.34^{ab}
10	75	25	8.26±0.15^{e}	21.47±0.11^{c}	28.27±0.15^{d}	43.21±0.00^{e}	0.42±0.01^{ab}

RESULTS & DISCUSSION

Table 1: blend of millet and amaranth

sample	millet	amaranth
control	100	0
1	90	10
2	67.5	25.5
3	90	10
4	80	20
5	70	30
6	60	40
8	90	10
9	82.5	25.5
10	60	40
10	70	30

Table2: **Proximate composition of millet and amaranth flour blends**

	Millet	Amaranth	Moisture%	Protein%	Fat%	Ash%	Fibre%	CHO %	EnergyKcal/ 100g	E.D(kcal/g)
control	100	0	12.03±0.1	8.7± 0.1	3.21 ±0.1g	1.7± 0.2	1.5± 00.1g	73.70±0.2	358± 0.12	3.58 ±0.1
1	90	10	11.08±0.08^{b}	9.20±0.02^{f}	3.64±0.02^{f}	2.13±0.02^{e}	1.20±0.02^{e}	72.01±0.02^{a}	357.65±0.02^{c}	3.57±0.01^{c}
2	67.5	32.5	10.73±0.02^{g}	2.35±0.02^{h}	3.93±0.02^{d}	2.54±0.02^{c}	1.60±0.02^{a}	68.84±0.02^{d}	359.2±0.02^{d}	3.59±0.01^{d}
3	90	10	10.70±0.02^{g}	9.156±0.02^{f}	3.30±0.02^{f}	2.12±0.02^{e}	1.19±0.02^{e}	73.73±0.02^{a}	361.33±0.02^{bc}	3.613±0.01^{bc}
4	80	20	11.01±0.02^{e}	11.43±0.02^{c}	3.77±0.02^{e}	2.38±0.02^{d}	1.35±0.02^{d}	70.050.02^{b}	359.89±0.02^{d}	3.59±0.01^{d}
5	70	30	10.86±0.02^{f}	12.22±0.02^{a}	3.98±0.02^{c}	2.52±0.02^{c}	1.46±0.02^{c}	69.16±0.02^{c}	361.39±0.02^{b}	3.61±0.01^{b}
6										
7	90	10	10.70±0.01^{g}	9.17±0.01^{f}	3.31±0.01^{f}	2.13±0.01^{e}	1.19±0.01^{e}	73.51±0.03^{a}	360.53±0.02^{bc}	3.60±0.01^{bc}
8	82.5	17.5	11.30±0.01^{c}	11.48±0.01^{c}	3.97±0.01^{c}	2.39±0.01^{d}	0.93±0.01^{f}	69.94±0.01^{b}	361.52±0.02^{b}	3.61±0.01^{b}
9	60	40	10.80±0.01^{f}	13.13±0.05^{a}	4.43±0.02^{a}	2.92±0.02^{a}	1.61±0.01^{b}	67.37±0.04^{e}	361.82±0.21^{b}	3.61±0.002^{b}
10	75	25	10.30± 0.01b	11.92±0.01^{d}	4.02±0.01^{b}	2.62±0.02^{b}	1.26±0.01^{d}	69.86±0.03^{b}	363.43±0.05^{a}	3.63±0.00^{a}

Table 4: protein digestibility of millet and amaranth blends

control	Millet x	Amaranth y	PROTEIN DIGESTIBILITY (I-F)/I X100)
1	100	0	65%c
2	67.5	32.5	80%^{b}
3	90	10	70%^{d}
4	80	20	75%c
5	70	30	80%b
6	60	40	85%^{a}
7	90	10	70%d
8	82.5	17.5	75%^{c}