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Proximate, Amino Acid and Fatty Acid Composition of *Eremomastax polysperma*, *Brillantaisia owariensis* Leaves and *Sorghum vulgare* Leaf-Sheath

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Abstract

Proximate, amino acid and fatty acid composition of *Eremomastax polysperma*, *Brillantaisia owariensis* and *Sorghum vulgare* leaf-sheath was studied. The amino acid content was assayed using High performance liquid chromatograpy while the fatty acid content was assayed using gas chromatograpy. The results from this research, showed that the ash and protein content of *Eremomastax polysperma* (3.91 ± 0.01%; 3.80 ± 0.05%) was significantly higher than *Sorghum vulgare* (1.74 ± 0.03%; 1.21 ± 0.05%), and *B. owariensis* (3.39 ± 0.01%; 1.61 ± 0.01%) respectively. The total essential amino acid composition of *Eremomastax polysperma* (43.18g/100g) was higher than *Brillantaisia owariensis* (39.41g/100g) and *S. vulgare* (31.40g/100g), with lysine and cysteine concentration of *B. owariensis* (9.72; 9.45) been higher than *E. polysperma* (9.48;6.59g/100g) and *S. vulgare* (4.11 and 7.19g/100g). The total non-essential amino acid composition of *Sorghum vulgare* leaf-sheath (59.49g/100g) was higher than *Eremomastax polysperma* (53.09g/100g) and *Brillantaisia owariensis* (53.82g/100g), with glutamate (14.69, 20.08 and 14.46g/100g) and aspartate (12.21, 13.22 and 10.64g/100g) having a higher concentration for *E. polysperma*, *S. vulgare* and *B. owareinsis* respectively. For the fatty acid composition, *Sorghum vulgare* leaf-sheath (17.51%) had a higher oleic acid concentration than *Eremomastax polysperma* (1.50%) and *Brillantaisia owariensis* (5.96%). *Brillantaisia owariensis* had a higher palmitic acid (35.30%) and behenic acid (14.17%) than *Eremomastax polysperma* (0.00% and 13.13%) and *Sorghum vulgare* leaf-sheath(25.96% and 12.21%) . Whereas *Eremomastax polysperma* had a higher myristic, magaric and linolenic acid concentration (45.91%; 20.27% and 10.45%) than *Brillantaisia owariensis* (37.23%; 0.36% and 0.00%) and *Sorghum vulgare* leaf-sheath (37.24%; 0.11% and 0.03%) respectively. The results obtained from this research implies that *Eremomastax polysperma*, *Brillantaisia owariensis* leaves and *Sorghum vulgare* leaf-sheath have nutritional benefits.

Keywords: Proximate; Amino acid; Fatty acid

Introduction

Plant derived foods are associated with reducing disease risks, particularly cardiovascular disease and some cancer. Plants are sources of a number of nutrients that may have beneficial effect on health, such as vitamin C, dietary fibre and minerals [1]. Proximate analysis gives a partitioning of food into six fraction: moisture, ash, crude protein, crude fibre, lipid and carbohydrate. The ash content of a food is used to measure the inorganic residue of the food [2]. Dietary fibre helps in lowering blood glucose concentration and reduces the chance of gastro-intestinal problems such as constipation and diarrhoea [3]. Carbohydrate functions as a source of energy; required for the biosynthesis of glycogenic amino acids and inco-operated in RNA and many nucleotides (ribose sugar). Whereas proteins are necessary for growth and tissue maintenance; appropriate pH maintenance; defence and detoxification of harmful substance; formation of essential body components such as hormones and transport of nutrients.

Proteins are the basis for the major structural components of animal and human tissue. Amino acids are the building blocks of proteins which contain a carboxylic acid group and an amino group. Amino acids are essential in the synthesis of proteins and precursors in the formation of secondary metabolism molecules that participate in cell signaling, gene expression and homeostasis regulation, protein phosphorylation, synthesis of hormones and antioxidant capacity. Also, amino acids participate in various physiological processes such as skeletal muscle function, atrophic conditions, sarcopenia and cancer [4].

Fatty acids on the other hand, are carbon chains with a methyl group at one end of the molecule (designated omega, w) and a carboxyl group at the other end. Fatty acids have high energy level, are components of cell membrane (phospholipids), used for insulation and are also involved in gene regulation (transcription) [5]. There are essential [linoleic acid (C18:2n-6, n-6) and α-linolenic acid (C18:3n-3), an n-3] and non-essential fatty acids. The essential fatty acid helps in reducing cardiovascular diseases [6,7]. Hence the objective of this study is to determine the proximate, amino acids and fatty acids composition of *Eremomastax polysperma*, *Brillantaisia owariensis* leaves and *Sorghum vulgare* leaf-sheath.

Materials and Methods

Collection of plant sample

The plants; Sorghum vulgare leaf sheath was bought from mile 3 market while *Eremomastax polysperma* and *Brillantaisia owariensis* were gotten from a farm at Rumokoro (Lat 4.88999; long 6.96922) all in Port Harcourt, Nigeria. The plants were identified with voucher numbers: UPH/V/1325 (*Brillantaisia owariensis*) and UPH/V/1326 (*Sorghum vulgare*, synomyms sorghum bicolr) and UPH/V/1346 (*Erempmastax polysperma*) . They were dried and ground into fine powder with a blender and stored in an air tight container.

Proximate determination

The moisture, ash, lipid, proteins, crude fibre and carbohydrate content were determined according to AOAC (2011) method [8]. The energy value of the plants was calculated using % protein X4+% Lipid X9+% carbohydrate X4 (atwater factor) [9].

Amino acid and fatty acid determination

Amino acid contents were determined using HPLC and fatty acid composition was determined using gas chromatography.

Statistical analysis

Datas obtained were expressed as mean ± sem and subjected to one way-ANOVA using SPSS, with value p ≤ 0.05 is significantly different.

Results

Table 1: Proximate composition of *Sorghum vulgare* leaf sheath, *B. owariensis* and *E. polysperma*.

Parameters	Composition(%)		
	S. vulgare	*B. owariensis*	*E. polysperma*
Moisture	91.03±0.22a	75.79±0.24b	75.55±0.06b
Carbohydrate	2.11±0.15a	4.47±0.21b	13.17±0.01c
Protein	1.21±0.05a	1.61±0.01b	3.80±0.05c
Ash	1.74±0.03a	3.39±0.01b	3.91±0.01c
Fibre	3.75±0.01a	14.41±0.01b	3.23±0.01c
Lipids	0.16±0.01a	0.33±0.01b	0.30±0.01c
Energy value (kCal /100g)	14.72	27.29	70.58

Values are expressed as Mean±SEM. Values in a row with similar alphabetical superscript do not differ significantly p≤0.05.

Table 2: Non-essential amino acids composition of *Eremomastax polysperma*, *Sorghum vulgare* leaf sheath and *Brillantaisia owariensis*.

Components	E. polysperma (g/100g)	S. vulgare (g/100g)	B. owariensis (g/100g)
Glycine	3.29	2.64	3.84
Alanine	4.07	5.43	2.97
Serine	3.84	2.27	4.78
Proline	3.91	3.42	3.02
Valine	2.47	1.33	4.64
Aspartate	12.21	13.22	10.64
Glutamate	14.69	20.08	14.46
Arginine	5.65	8.71	6.55
Tyrosine	2.96	2.39	2.92
Total	53.09	59.49	53.82

Table 3: Essential amino acids composition of Eremomastax polysperma, Sorghum vulgare leaf sheath and Brillantaisia owariensi.

Components	*E. polysperm* (g/100g)	*S. vulgare* (g/100g)	*B. owariensis* (g/100g)
Threonine	4.28	3.55	4.27
Isoleucine	4.48	4.44	4.6
Leucine	6.59	7.19	9.45
Lysine	9.48	4.11	9.72
Methionine	1.54	3.23	1.49
Phenylalanine	6.86	3.91	3.99
Histidine	5.34	2.27	3.36
Tryptophan	1.23	1.21	1.11
Cysteine	3.38	1.49	1.42
Total	43.18	31.4	39.41

Table 4: Fatty acid content of *Sorghum vulgare*, *B. owariensis* and *E. polysperma*.

Components	Name	Percentage composition (%)		
		Sorghum vulgare	*B. owariensis*	*E. polysperma*
C18:1	Oleic acid	17.51	5.96	1.5
C17	Magaric acid	0.11	0.36	20.27

C12	Lauric acid	6.9	6.97	7.97
C14	Myristic acid	37.24	37.22	45.91
C16	Palmitic acid	25.96	35.3	-
C20	Behenic acid	12.24	14.17	13.13
C18:2	Linoleic acid	0.03	-	10.44
C20	Behenic acid	12.24	14.17	13.13

Discussion

Proximate analysis is the process by which the major components or constituents of food material are determined to establish whether the food is normal or contaminated [2]. The Proximate composition of *Sorghum vulgare* leaf-sheath, *Brillantaisia owarensis* and *Eremomastax polysperma* is shown in **Table 1**. The moisture content of each was 91.03 ± 0.22%, 75.79 ± 0.24% and 75.55 ± 0.06% for *Sorghum vulgare* leaf-sheath, *Brillantaisia owarensis* and *Eremomastax polysperma* respectively. The fat content of *Sorghum vulgare* leaf-sheath, *Brillantaisia owariensis* and *Eremomastax polysperma* was 0.16 ± 0.01%, 0.33 ± 0.01% and 0.30±0.01% respectively. The dietary fibre of *Brillantaisia owariensis* (14.46 ± 0.01%) was significantly higher than ($p \leq 0.05$) and *Eremomastax polysperma* (3.23 ± 0.01%) and *Sorghum vulgare* leaf-sheath (3.75 ± 0.01%). The protein and ash content of *Eremomastax polysperma* (3.80 ± 0.05%;3.91 ± 0.01%) was significantly higher than ($p \leq 0.05$) *Brillantaisia owariensis* (1.61 ± 0.01% ;3.39 ± 0.01%) and *Sorghum vulgare* leaf-sheath(1.21 ± 0.05%; 1.74 ± 0.03%).

Amino acids are the building block of proteins. There are essential and non-essential amino acids. The essential amino acids are histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine and tryptophan and valine. The non-essential ones are arginine, cysteine, glycine, glutamine, proline, tyrosine, alanine, asparagine, aspartate, glutamate and serine [10]. Glycine for instance is needed during periods of rapid growth and for biosynthesis of porphyrins of haemoglobin. Glutamate along with cysteine and glycine are components of glutathione (antioxidant). Methionine protects the liver from damage by poisons such as carbon tetrachloride, arsenic and chloroform. Phenylalanine and tyrosine helps in foetal childhood brain development. Tryptophan is used for nicotinic acid synthesis and as a precursor of serotonin (a vasoconstrictor). Proline and hydroxyl-proline are present in haemoglobin and cytochromes and also in collagen of connective tissues [3]. Aspartic acid function is essential for purine, pyrimidine, asparagine and inositol synthesis. Valine maintains the balance of branched chain amino acids, whereas alanine is involved on hepatic autophagy, gluconeogenesis and transamination. Leucine regulates the protein turnover (mTOR signaling) and gene expression. Glycine, lysine, threonine and glutamate help to maintain intestinal integrity and health [4,11]. The results on **Tables 2** and **3** shows the amino acid composition of composition of *Eremomastax polysperma*, *Sorghum vulgare* leaf sheath and *Brillantaisia owariensis*. The total non-essential amino acid composition of *Sorghum vulgare* leaf-sheath (59.49g/100g) was higher than *Eremomastax polysperma* (53.09g/100g) and *Brillantaisia owariensis* (53.82g/100g), with glutamate (14.69,20.08 and 14.46g/100g) and aspartate (12.21,13.22 and 10.64g/100g) having a higher concentration for *E. polysperma*, *S. vulgare* and *B. owariensis* respectively. The total essential amino acid composition of *Eremomastax polysperma* (43.18g/100g) was higher than *Brillantaisia owariensis* (39.41g/100g) and *S. vulgare* (31.40g/100g), with lysine and cysteine concentration of *B. owariensis* (9.72; 9.45) been higher than *E. polysperma* (9.48;6.59g/100g) and *S. vulgare* (4.11 and 7.19g/100g).

The fatty acid content of *Sorghum vulgare*, *Eremomastax polysperma* and *Brillantaisia owariensis* is shown in **Table 4**. Fatty acids are carbon chain with a methyl group at one end and a carboxyl group at the other end of the molecule. Fatty acids can be saturated (straight chain hydrocarbon) or unsaturated (carbon-carbon double bond chains) fatty acids. The unsaturated fatty acids can be monounsaturated or polyunsaturated [5]. Fatty acids can also be essential or non-essential. The essential ones are required in diet, the body can-not synthesize them [examples are linoleic acid omega-6) and α-linolenic acid (omega-3)]. Essential fatty acids (EFA) are important for membrane fluidity and increases the number of receptors and other affinity to the respective hormones or growth factor. EFA has antibacterial, antiviral and antifungal properties; an example is linoleic acid which kills *Staphylococcus aureus*. Decosahexaenoic acid (DHA) a precursor of linoleic acid is a suppressor of pro-inflammatory cytokines(IL-1, IL-2, IL-6 and TNF-α), suggesting its anti-inflammatory properties [12]. For monounsaturated fatty acids such as oleic acid (C18:0), they function in inhibiting Low density lipoproteins (LDL)-cholesterol oxidation and slows down atherosclerosis formation. MUFA are resistant to peroxidation and preserves HDL level [3]. From **Table 4**, the concentration of Oleic acid of *Sorghum vulgare* leaf sheath (17.51%) was higher than *Brillantaisia owarensis* leaf (5.96%) and *Eremomastax polysperma* leaf (1.53%). The linoleic acid concentration of *Eremomastax polysperma* (10.44%) was higher than of *Sorghum vulgare* leaf sheath (0.03%) and absent in *Brillantaisia owariensis* leaf (0.00%).

Conclusion

The results obtained showed that these plants are sources of nutrients.

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