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Comparative Study of Effect of Sprouting On Antinutritional Factors in White *Sorghum Bicolor* and *Pennisetum Glaucum*

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Abstract: *The use of plant-derived foods (cereals) in the prevention, treatment and management of metabolic diseases especially diabetes has gained prominence; this has been associated with their physicochemical properties. This study was conducted to compare the antinutrient composition of the white Sorghum bicolor and Pennisetum glaucum (sprouted and unsprouted). The result showed that the level of antinutritional factors in sprouted white Sorghum bicolor and Pennisetum glaucum were reduced after sprouting as follows: Tannin-UWSB(4.14), SWSB (3.61), UPG (4.00), SPG (3.90) Saponnin- UWSB (2.50) SWSB (0.80) UPG (2.30) SPG (1.82) Flavonoids- UWSB (0.80) SWSB (0.35), UPG (2.30) SPG (1.82), Phenolies- UUWSB (1.50) SWSB (2.0), UPG (1.20) SPG (1.30) Alkanoids-UWSB (1.90) SWSB (0.60) UPG (1.80) SPG (1.30) Glycoside-UWSB(2.30) SWSB(2.10) UPG (2.00) SPG (1.30) Oxylate- UWSB (3.00) SWSB (1.60) UPG (2.70) SPG (2.65) Phylate-UWSB (17.5) SWSB (8.9) UPG (16.5) SPG (15.5*

The overall data results of the antinutrients showed that most of the antinutritional factors were concentrated in testa and even the low levels recorded for all other anatomical part were further reduced by sprouting except alkaloids which increased in the sprouted seed flour. This research study shows that sprouting processes is a means to address myriad interactions through activation of endogenous enzymes such as α-amylase, pollunase, phytase and other glucosidase. These enzymes degrade antinutritional factors and break complex macronutrients to their simple and more digestible forms. Which are particularly beneficial for diabetics and reducing chances of developing type two diabetes because of the high hypoglycemic effect and hypolipidemic property.

Keyword: *White Sorghum bicolor, Pennisetum glaucum, Sprouting, Antinutritional factors*

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I. Introduction

The most important crop species which supply the majority of the world populations nutritional needs are graminaceous cereals such as rice, maize, wheat, barley and Sorghum (Zagrobelny *et al.,* 2004). Seeds of grains from cereals are a main resource for human nutrition and animal feed throughout the world. (Okereke *et al.*, 2015). The nutritional relevance of cereals, particularly of wheat, has been widely recognized as a cymbol of the Mediterranean diet, and diets including enriched cereal products are encouraged by nutritionists in Western Europe in order to improve cereal nutritional contribution (Salah *et al.,* 2002).

The principal cereal crops are millet, Sorghum, maize, wheat, barley, oats, and rice, FAO (1995). *Sorghum bicolor* is considered as one of the most important food crops in the world, which provide the staple food of large population in Africa (FAO, 2006) and semi-arid part of the tropics. The most widely grown millet and Sorghum are pearl millet and Sorghum bicolor respectively. The crops are favored due to its product and short growing season under dry, high temperature conditions. Sorghum is commonly consumed by the poor masses of many countries and it forms a major source of vitamins, minerals protein and calories in the diet of large segment of the population of India and Africa, as well as for the poultry and livestock. Millets are a group of highly variable small seeded grasses widely grown around the world as cereal crops or grains for fodder and human food.

Sorghum and millets are commonly eaten with the hull which retains the majority of the nutrient, which made them to be highly nutritious but has inferior organoleptic quality due to the presence of anti-nutritional factors such as tannins and phytates. Tannins and phytates complexes with protein and irons, thereby inhibiting protein digestibility and absorption of iron, but it can be overcome by adequate process by techniques. Such as sprouting and fermentation.

Sprouting process is known as a way to promote changes in biochemical, sensual and nutritional characteristics of cereal grains (Okereke *et al.,* 2015). This has been reported to improve digestibility, bioavailability of vitamins, minerals, amino acids, proteins, phytochemicals and decrease anti-nutrients and starch of some cereals (Raihanatu *et al*., 2011) and thereby improve protein and iron absorption.

Consequently, considerable interest has been directed toward exploring White Sorghum bicolor and *Pennisetum glaucum* in the prevention, treatment and management of a number of metabolic diseases among which is diabetes milletus. Diabetes mellitus is a multifactorial disease connected with numerous complications, and consequently requires multiple therapeutic approaches (Ward *et al*., 1982). As part of exploration into the protective and antidiabetic mechanisms of white *Sorghum bicolor* and *Pennisetum glaucum* , this study was carried out to compare the antinutrient composition of white *Sorghum bicolor* and *Pennisetum glaucum* (sprouted and unsprouted).

II. Results And Discussion

Antinutritional factors (ANFS), by definition are those biological compounds in human or animal foods that reduces the nutrient inhalation or food intake, thereby contributing to impaired gastrointestinal and metabolic performance (Fassasi, 2009). Several antinutritional factors have found in quinoa, such as saponnins, tahins protease inhibitors and phytic acid, which can exert a negative effect on the performance and survival of mongastric animals when it is used as the primary dietary energy source (Mubarak, 2005). However, the phytate content of quinoa grain does not differ from that of the other cereals such as wheat, rice, rye, oats, millet (Zagobelny *et al.,* 2004). The major ANFs in cereals include: Saponnin and Tannin. In this research work, eight antinutritional factors (ANFs) were detected namely: Tannin, Saponnin, Flavonoids, Phenolies, Alkanoids, Gycosides, Oxalate and Phytate.

Levels of antinutritional factors in *sorghum bicolor* and *pennisetum glaucum* (unsprouted and sprouted) are shown in Table 4.24. The results (mg/100g) are as follows: Tannin-UWSB(4.14), SWSB (3.61), UPG (4.00), SPG (3.90) Saponnin- UWSB (2.50) SWSB (0.80) UPG (2.30) SPG (1.82) Flavonoids- UWSB (0.80) SWSB (0.35), UPG (2.30) SPG (1.82), Phenolies- UUWSB (1.50) SWSB (2.0), UPG (1.20) SPG (1.30) Alkanoids- UWSB (1.90) SWSB (0.60) UPG (1.80) SPG (1.30) Glycoside-UWSB(2.30) SWSB(2.10) UPG (2.00) SPG (1.30) Oxylate- UWSB (3.00) SWSB (1.60) UPG (2.70) SPG (2.65) Phylate- UWSB (17.5) SWSB (8.9) UPG (16.5) SPG (15.5).

The CV% for the values among the unsprouted and sprouted samples ranged as follows: UWSB(0.33-27.5%) SWSB (0.48-78.5%) UPG (0.50-32.8%) and SPG (0.076-22.4%) respectively.

The polyphenols present in cereals are not eliminated by simple soaking and heating but through germinating or sprouting and fermentation. Nowadays, some of the ANFs (e.g. tannins) are of much interest due to its antioxidant activity as a potential health benefit (Sridhar ad Seena, 2006). The level of phytate obtained in the present report were favourably compared with what has been reported for sprouted and unsprouted five different varieties or sorghum (Rainhantu *et al.,* 2011) and higher than the levels reported for sprouted pearl millet by Fasasi (2009).

The levels of the phytate and phenol obtained in the present report for the samples were fairly compared with the level reported for content of pea cultivar (*pisum sativum*) in a research carried out on the effect of domestic processing and cooking method on the phytate, phytic acid and polyphenol contents (Okereke *et al.,* 2015). Oxalate content in this research work

reduced significantly with sprouting. The level of oxalate in the present report agree well with the report of effect of germination on oxalate content in sorghum (Massey*et al.,* 2001). The alkanoids, phenols, saponnins and flavonoids values agreed fairly with the report. However, the values obtained in this work are lower than values reported in some cereals (NRC, 1989). It also agrees well with the result of malting and fermentation effect on antinutritional components and functional characteristics of sorghum flour (Osman, 2004).

The anti-nutritional activities of oxalates and phytates lie in their ability to form complexes with metals like Ca, Zn and Fe. However, the risk of calcium deficiency due to the consumption of

oxalate-rich plants have been reported to be very minor (fasasi et al., 2004). This is because humans are able to efficiently use very low amounts of calcium in food (Salah *et al.,* 2002). The low values obtained for phytate in the roasted and cooked samples may be due to its thermo-labile nature.

Phytate act as strong chelator, forming protein and mineral phytic acid complexes thereby reducing protein and mineral bioavailability (Salah *et al.,* 2002). It chelates metal ions such as Ca, Zn, Cu and Fe to form insoluble complexes that are not readily adsorbed from the gastrointestinal tract. Phytin renders many essential minerals unavailable (especially Ca), leading to a prevalenceof Osteomalacia and Osteoporosis in test animals (Salah *et al.,* 2002).

Table 1: Levels of anti-nutritional factors in White *Sorghum bicolor* and *Pennisetum glaucum* `(unsprouted and sprouted samples)

UWSB-Unsprouted White *Sorghum bicolor*
SWSB-Sprouted White *Sorghum bicolor*
UPG-Unsprouted *Pennisetum glaucum*
SPG-Sprouted *Pennisetum glaucum*

S/N		UWSB			SWSB			UPG			SPG		
		MEAN	SD	CV%	MEAN	SD	CV%	MEAN	SD	CV%	MEAN	SD	CV%
1	Tannin	4.14	0.07	1.69	3.61	0.031	0.86	4.00	0.05	1.25	3.90	0.03	
2	saponin	2.50	0.45	18	0.80	0.231	28.88	2.30	0.33	14.35	1.82	0.21	11.54
3	Flavonoids	0.80	0.22	27.5	0.35	0.11	31.43	0.67	0.22	32.84	0.5	0.112	22.4
4	Phenolics	1.50	0.01	0.33	2.0	0.01	0.55	1.2	0.12	9.23	1.30	0.014	1.17
5	Alkanoids	1.90	0.32	16.84	0.60	0.471	78.5	1.80	0.21	11.67	1.30	0.114	8.76
6	Glycosides	2.31	0.02	0.87	2.1	0.01	0.48	2.00	0.01	0.5	1.3	0.001	0.076
7	Oxalate	3.00	0.202	6.73	1.60	0.43	26.56	2.70	0.212	7.85	2.65	0.11	4.19
8	Phytate	17.5	0.547	3.13	8.9	0.670	7.53	16.5	0.454	2.75	15.5	0.342	2.21

Table 2 shows the summary of the differences in the anti-nutrional factors between the unsprouted and sprouted samples. Except the phenlic content in unsprouted flowered samples which were not affected by sprouting, virtually all other factors were drastically reduced by sprouting. This further confirms previous reports on the effect of heat on antinutritional factors (Balogun and Fetuga, 1986).

Table 2: Summary of the differences in anti-nutritional levels of *Sorghum bicolor* and *Pennisetum glaucum* (unsprouted and sprouted samples)

Antinutrients	UWSB-SWSB (%)	UPG-SPG(%)	UWSB-UPG(%)	SWSB-SPG(%)
Tannin	12.8%	2.5%	3.38%	-8.03%
Saponin	68%	20.87%	8%	-127.5%
Flavonoids	56.25%	25.37%	16.25%	-85.7%
Phenolics	-33.3%	-7.69%	20%	-35%
Alkanoids	68.42%	27.78%	5.26%	-116.7%
Glycosides	8.69%	35%	13.04%	38.95%
Oxalate	46.67%	1.85%	0.1%	-65%
Phytate	49.14%	6.06%	5.71%	-74.2%

-ve – Enhancement
+ve – Reduction

Table 3: Statistical analysis (Linear correlation and regression)

Groups	Correl (rxy)	Determ. (Rxy^2)	Regress (Rxy)	CA	IFE	Critical Table value (Tv)	REMARK
UWSB/SWSB	0.99997	0.99995	1.01927	0.72	99.3	0.7540	S
UPG/SPG	0.99843	0.99687	1.04746	5.60	94.4	0.7540	S
UWSB/UPG	0.99865	0.99829	1.04800	4.13	95.9	0.7540	S
SWSB/SPG	0.99652	0.99306	1.07581	8.33	91.7	0.7540	S

C_A= coefficient of alienation,
IFE = index of forecasting efficiency,
TV = critical (table) value at r =0.05,
S = significant.

The results of statistical analysis of data from table are shown in table 3 above: Taking UWSB/SWSB (row 1) as example, a high IFE (99.3%) and a corresponding low C_A (0.72%) indicate that there is a reduction of 99.3% in the error of prediction of relationship between the unsprouted samples (UWSB) and sprouted samples (SWSB) anti-nutritional contents. Furthermore, it shows that unsprouted flowered seeds could easily replace sprouted seeds in its biochemical roles and vice versa. In Table 3, all the r_{xy} anti-nutrional factors levels were positively high (0.99652-0.99997) whereas the R_{xy} ranged from 1.01927-1.07581. All the r_{xy} were significant at $r=_{0.05}$ and n-2 degrees of freedom. The coefficient of alienation (C_A) ranged from 0.7241-8.3333 whereas the corresponding index of forecasting efficiency (IFE) ranged from 94.4-99.3.

III. Conclussion And Recommendation

The results of the antinutrients showed that most of the antinutritional factors were concentrated in testa and even the low levels were recorded for all in the unsprouted samples, which were further reduced by sprouting. Comparatively, it could be inferred from the results that *Pennisetum glaucum* nutritional parameters were enhanced than that of white Sorghum bicolor; therefore it could therefore be recommended that *Pennisetum glaucum* should be sprouted when it is being used as food supplements especially for infants .This is because most of nutrients were concentrated in sprouted sample while level antinutrients and fiber were concentrated in the testa. The alimentary system of infant cannot easily digest fiber white bicolor in his own course having high value to adult. It could be usefulin production of adult food.

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