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Comparative Study of Effect of Sprouting on Amino Acid in White *Sorghum Bicolor* and *Pennisetum Glaucum*

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ABSTRACT

The utilization of plant-derived foods as functional ingredients in food system continues to be of research interest as a purpose of achieving good health and well-being, target 3 of sustainable development goals (SDGs). Standard methods involving combined classical protein hydrolysis and derivatization with fast separation by Ultra High Performance Liquid chromatography (UHPLC) and detection by a single quadrupole (QDa) mass spectrometer were used to analyze *Sorghum bicolor* and *Pennisetum glaucum* for amino acid profile before and after sprouting. The data showed that eighteen amino acids were determined in all, which includes the essential for the growth of the infants, semi-essential amino acids and the non-essential amino acids (Harper, 1989). The levels in the sample were ranged as follows; unsprouted raw white *sorghum bicolor* seed flour (1.86±0.07-17.6±0.15), sprouted white *Sorghum bicolor* seed flour (1.93±0.06-17.7±0.08) unsprouted *Pennisetum glaucum* (1.86±0.07-17.7±0.09) sprouted *Pennisetum glaucum* (2.07±0.02-17.8±0.07)

The CV% for the values ranged between 0.26-74.2%. The cereals are very rich in ceucine and deficient in methionine and Tryptophan. TAA, TEAA with his, TEA without his, TNEAA, TArAA, TAAA, TBAA, TNAA, TSAA, %TEAA with his in the amino acid profile for white *Sorghum bicolor*decreased in level after sprouting while TNEAA increased after sprouting. All the quality parameters level increased in *Pennisetum glaucum* after sprouting. The result of the research showed that *Sorghum bicolor* and *Pennisetum glaucum* seeds flours, especially the sprouted ones contains appreciable amount of essential amino acid which made them to be a good source of quality parameter of amino acid. This could be relied upon as a good cheap for supplement of essential amino acid in food in order to solve the problems of protein energy malnutrition which could be very useful in infant food production and also for the production of cookies for diabetic patients. From the current research work, *Sorghum bicolor* and *Pennisetum glaucum* seeds flours are good source of quality parameter of amino acid especially the sprouted ones which could be relied upon as a good cheap for supplement of essential amino acid in food in order to solve the problems of protein energy malnutrition
Key words: *Sprouting, Amino acid, White Sorghum bicolor and Pennisetum glaucum*

INTRODUCTION

A cereal is any grass cultivated (grown) for the edible components of its grain (botanically, a type of fruit called caryopsis), composed of the endosperm, germ, and bran. Cereals are the most important stable food for many people in the developed and developing countries FAO, (1995).

In the developed countries, 70% of the cereal production is used as animal food while in the developing countries, like Nigeria, about 68-98% of the cereal production is used for human consumption. The principal cereal crops are millet sorghum, maize, wheat, barley, oats, and rice, Adeyeye and Ajewole (1992). *Sorghum bicolor*, commonly called sorghum and also known as great millet, durra, jowari, or milo, is a grass species cultivated for its grain, which is used for food for humans, animal feed, and ethanol production. Sorghum originated in Africa, and is now cultivated widely in tropical and subtropical regions. 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. *Sorghum bicolor* is considered as one of the most important food crops in the world, which provide the stable food of large population in AfricaWHO/FAO (2003) and semi-arid part of the topics.

Pennisetum glaucum (pearl millet) is also known as spiked millet, bajra (in India). Pearl millet may be considered as a single species but it includes a number of cultivated races. It almost certainly originated in tropical western Africa, where the greatest number of both wild and cultivated forms occurs. About 2000 years ago, the crop was carried to eastern and central Africa and India, where because of its excellent tolerance to drought it became established in drier environments.

Millets are a group of highly variable small seeded grasses widely grown around the word as cereal crops or grains for fodder and human food. Millets do not form a taxonomy group, but rather a functional or agronomic one which are important crops in the semi and tropies of Asia, and Africa (especially in India and Nigeria) with 97% of millet production in developing countries. The most widely grown millet and sorghum are pearl millet and *Sorghum bicolor*. The crops are favored due to its product and short growing season under dry, high temperature conditions. Sorghum and millets are commonly eaten with the hull which retains the majority of the nutrient, which made them highly nutritious but has inferior organoleptic quality due to the presence of anti-nutritional factors such as tannins and phylates. Tannins and phytates. Tannins and phytates complexes with protein and irons, thereby inhibiting protein digestibity and absorption of iron, but it can be overcome by adequate process and techniques. Such as sprouting and fermentation Singleton *et al.*, (1973).

This sprouting method was reported to be more superior to any of the processing method, which confirmed to be used in other to achieve the set goal of this research. Sprouting process is known as way to promote changes in the biochemical, sensual and nutritional characteristics of cereal grains (Masood *et al.*, 2014). Sprouting has been reported to have digestibility, bioavailability of vitamins, minerals, amino acids, proteins, phytochemicals and decrease anti-nutrients and starch of some cereals (Iayang*et al.*, 2008) and thereby improve protein and iron absorption.

There is an increasing rate of population growth, economic crisis and inflation in prices of some commonly consumed imported cereal food items coupled with increase rate of metabolic diseases especially diabetics which has gained prominence in the society which calls for an in-depth research into local whole cereal grains (*Pennisetum glaucum*) reported to

be one of the major source of nutrient vital for human health in Nigeria, especially in Ekiti and Ondo state where this cereal is used now by the populace to produce a popular nutritious locally prepared drink items (Kunu) commonly consumed by the populace.

The various data on previous studies on the effect of sprouting of cereal grains in Nigeria, especially in southern Nigeria focused mostly on maize varieties and the brownish red *Sorghum bicolor* with sparse information available on white *Sorghum bicolor* and *Pennisetum glaucum*. There are no research done on comparative study of the raw sprouted and unsprouted *Pennisetum glaucum* popularly used as major ingredients for kunu(local beverage) commonly consumed recently in an aggressive manner as a substitute to the expensive soft drinks or imported drinks due to financial economic crisis now Ekiti and Ondo states. Most of the research previously done were on the finished product (kunu). Hence the aim of this study is to compare the effect of sprouting on the amino acid for modification of food nutrient for human consumption since sprouting process is known from Mashair *et al* (2008) to cause important changes in the biochemical, nutritional and sensory characteristics of cereal plants .

MATERIALS AND METHODS

In the present research work, the seed of white *S. bicolor* and *P. glaucum* were purchased from the market in Ado Ekiti, Ekiti State, Nigeria and identified in the herbarium of Department of Agronomy, Federal University of Technology, Akure, Ondo State. *White Sorghum bicolor* and *Pennisetum glaucum* seeds were properly sorted to remove the defected ones and each were divided into two portions making four samples in all. The first portion were soaked for 24 hours, after which it was spread on trays lined with cloth and kept wet by frequent spraying of water in the morning and evening for four days.

The sprouted grains were sundried for four days and oven-dried at 60°C to constant weight and milled into flour using electric blender (VTCL Model). The second portion was processed into flour without sprouting using the same method.

The seed flours were labeled as follows: Unsprouted *Sorghum bicolor* (USb) Sprouted *Sorghum bicolor* (SSb), Unsprouted *Pennisetum glaueum* (UPg), Sprouted *Pennisetum glaucum* (SPg) following the methods described by Adeyeye (2010) in the treatment of samples.

Amino acid quality parameters were determined as follows:

Amino acid scores: Determination of the amino acid scores was first based on whole hen's egg (Paul *et al.*, 1976). In this method, both essential and nonessential amino acids were scored. Secondly, amino acid score was calculated using the following formula (FAO/WHO 2003):

Amino acid score = (amount of amino acid per test protein (mg/g)) / (amount of amino acid per protein in reference pattern (mg/g)).

In this method, methionine (Met) + cystein (Cys) and phenylalanine (Phe) + tyrosine (Tyr) were each taken as a unit. Also, only essential amino acids determined were scored. Amino acid score was also calculated based on the composition of the amino acids obtained in the samples compared with the suggested pattern of requirements for pre-school children (2-5 years). Here, Met + Cys and Phe + Tyr were each taken as a unit. Also, only essential ammo acids including histidine (His) were scored. (FAO/WHO/UNU 1985).

Essential amino acid index: The essential amino acid index (EAAl) was calculated by the

S/N	UWSB	SWSB	UPG	SPG

method of Oser (1959).

Determination of the predicted protein efficiency ratio: The predicted protein efficiency ratio (P-PER) was determined using one of the equations derived by Alsmeyer (1974), i.e.

$$P\text{-}PER_1 = -0.468 + 0.454\ (Leu) - 0.105\ (Tyr).$$

$$P\text{-}PER_2 = -0.684 + 0.456\ (Lue) - 0.047\ (Pro)$$

Other determinations: Determination of the total essential amino acid (TEAA) to the total amino acid (TAA), i.e. (TEAA/TAA); total sulphur amino acid (TSAA); percentage cystine in TSAA (% Cys/TSAA); total aromatic amino acid (TArAA), etc Computation of lysine (Lys) / tryptophan (Trp) and methionine (Met) / tryptophan (Trp): The ratios of lysine (Lys) / tryptophan (Trp) and methionine (Met) / tryptophan (Trp) were computed.

RESULT AND DISCUSSIONS

Amino Acid Profile

Table 1 showed the amino Acids profile of the samples. Eighteen amino acids were determined in all, which includes the essential for the growth of the infants (Harper, 1989). Semi-essential amino acids and the non-essential amino acids. The levels in the sample were ranged as follows; unsprouted raw white *sorghum bicolor* seed flour (1.86±0.07-17.6±0.15), sprouted white *sorghum bicolor* seed flour (1.93±0.06-17.7±0.08) unsprouted *Pennisetum glaucum* (1.86±0.07-17.7±0.09) sprouted *Pennisetum glaucum* (2.07±0.02-17.8±0.07)

The CV% for the values ranged between 0.26-74.2%. The amino acids ranged compared well the values of range of amino acids reported for sorghum and pearl millets by Bachl and Munck (1985), and Serna*et al.*, (1996) which is (1.00+14.2g/100g) rice (1.20-15.2g/100g) and Soyabean (1.2-17.0g/100g) by Liu et al., (2008). Glutamic acid was the major amino acid in the sprouted and unsprouted sample ranged (17.66-17.74g/100g). Similar reports have also been made for rice (Sridhar and Seena, 2006) and raw steeped and germinated wheat (9.10-14.2g/100g) (Adeyeye, 2010) the cereals are very rich in ceucine and deficient in methionine and Tryptopha

Table 1 Amino Acid Profile for White *Sorghum bicolor* and *Pennisetum glaucum* (Sprouted and unsprouted)

		ME AN	SD	CV %	ME AN	SD	CV %	ME AN	SD	CV %	ME AN	SD	CV %
1	glycine	4.46	0.10 74	2.4 0	4.45	0.1 22	2.7 4	3.74	0.2 77	7.4 2	4.12	0.0 66	1.6 2
2	Alanine	5.26	0.15 72	2.9 8	5.25	0.1 06	2.0 2	4.66	0.0 32	0.8 2	4.68	0.0 93	1.9 8
3	serine	5.25	0.07 40	1.4 0	5.25	0.1 1	2.2 3	5.49	0.1 30	2.3 6	5.64	0.0 79	1.4 0
4	proline	4.56	0.11 55	2.5 2	4.54	0.0 87	1.9 3	5.34	0.0 90	1.6 9	5.47	0.0 94	1.7 2
5	valine	5.63	0.08 37	1.4 8	5.64	0.0 89	1.5 8	5.11	0.1 12	2.2 0	5.13	0.0 54	1.0 5
6	threonine	3.67	0.08 91	2.4 2	3.41	0.0 89	2.6 3	3.35	0.0 85	2.5 4	3.41	0.0 87	2.5 4
7	isoleucine	4.05	0.01 05	0.2 6	3.86	0.0 78	2.0 1	3.04	0.0 53	1.7 6	3.03	0.0 17	0.5 6
8	leucine	7.65	0.09 70	1.2 6	7.26	0.0 99	1.3 6	7.75	0.0 96	1.2 4	7.83	0.0 50	0.6 3
9	Aspartate	9.74	0.12 49	1.2 8	9.76	0.1 02	1.0 5	10.4 4	0.0 78	0.7 5	10.5	0.0 78	0.7 4
10	lysine	3.74	0.11 61	3.1 0	3.37	0.1 03	3.0 6	3.65	0.1 29	3.5 5	3.66	0.0 85	2.3 4
11	methionine	2.76	0.09 03	3.2 7	2.35	0.1 03	4.4 0	2.54	0.1 02	4.0 2	2.54	0.0 61	2.4 2
12	glutamate	17.6 1	0.14 7	0.8 3	17.7 4	0.0 84	0.4 7	17.6 6	0.0 97	0.5 5	17.7	0.0 75	0.4 2
13	phenylalanine	4.46	0.12 41	2.7 8	4.45	0.0 95	2.1 4	4.56	0.1 33	2.9 3	4.71	0.0 90	1.9 2
14	Histidine	2.32	0.10 17	4.3 6	2.14	0.0 96	4.4 7	2.07	0.0 25	1.2 1	2.20	0.0 27	1.2 5
15	arginine	8.34	0.10 7	1.2 8	8.50	0.1 48	1.7 4	8.53	0.0 92	1.0 8	8.78	0.0 47	0.5 4
16	tyrosine	4.42	0.09 81	2.2 1	4.32	0.0 82	1.9 1	4.25	0.0 87	2.0 4	4.44	0.0 85	1.9 3
17	tryptophan	1.85	0.06 95	3.7 4	1.93	0.0 60	3.1 2	1.85	0.0 76	4.1 2	2.07	0.0 20	0.9 6
18	cystine	2.24	0.10 43	4.6 4	2.55	0.0 94	3.7 1	2.16	0.0 81	3.7 4	2.42	0.0 86	3.5 6

Similar observations were also made in the present report which also corroborates the results of earlier studies on sorghum and pearl millet sp. (Bach and Munck (1985) and Rooney *et al.*, (1986).

All the essential amino acids were present in varing amounts. The most concentrated essential amino acids in the samples were UWSB (Leucine, 7.65g/100g and arginine, 8.35g/100g), SWSB (Leusine, 7.75g/100g and Arginine, 8.50g/100g) UPG (Leusine, 7.75g/100g and arginine 8.53g/100g), SPG (arginine 8.78g/100g and leusine, 7.83). Generally, arginine had the highest concentration in the samples. Critical observation shows that in all the EAA leusine and Arginine consistently occurred with high concentration. The research work compared well with the research carried out by Adeyeye&Oyarekua, (2014a) on Amino acid concentration in co-fermented maize/cowpea and sorghum/cowpea ogi. The level of leucine in the research work which ranged between (7.26g/100g-7.83g/100g) compares favourably with the level of leucine which ranged between (7.16g/100g to 12.8g/100g) in a research carried out on amino acid composition of raw, roasted and cooked samples of Trecula Africana seed parts by (Adesina, 2015).

Table 1 shows the differences in the amino acid profiles between unsprouted and sprouted white *Sorghum bicolor* and *Pennisetum glaucum* samples. The sprouted whole whihte Sorghum bicolor floor were better concentrated than the unsprouted floor. They experienced an enhancement .Valine (Va), Aspartate (Asp), Glutamate (glu), Argiine (Arg) trptophan (Trp) and Cystine (Cys) making a total of 33.3% of the total amino acids whereas the Glycine (gly) Alanine (Ala) Serine (Se) Proline (Pro) threonine (thr) Isoleucine (Iso) Leucine (Leu) Lysine (lys) Methionine (Methio) Phenylalanine (Phen) Histidine (Hist) and Tryosine (tyr) does not experience enhancement, making a total amount of 66.7% of the total amino acids.

Similar observations have also been made in the processed groundnut seed flowers (Adeyeye 2010) and also the research carried out on processed and unprocessed *Treccullia africa* seeds floor (Adesina 2015).

Table 2: Summary of the Differences in Amino Composition of White *Sorghum bicolor* and *Pennisetum glaucum* (sprouted and unsprouted) from Table 1

AMINO ACID	UWSB-SWSB (%)	UPG-SPG(%)	UWSB-UPG(%)	SWSB-SPG(%)
glycine	0.006(0.1%)	-0.4(-10.2%)	0.7(16.1%)	0.3(7.5%)
Alanine	0.01(0.3%)	-0.02(-0.3%)	0.6(11.4%)	0.6(10.9%)
serine	0.002(0.04%)	-0.2(-2.8%)	-0.2(-4.5%)	-0.4(-7.5%)
proline	0.03(0.6%)	-0.1(-2.4%)	-0.8(-17.2%)	-0.9(-20.7%)
valine	-0.01(-0.2%)	-0.02(-0.3%)	0.5(9.2%)	0.5(9.1%)
threonine	0.3(7.2%)	-0.06(-1.9%)	0.3(8.8%)	-0.005(-0.1%)
isoleucine	0.2(4.8%)	0.007(0.2%)	1.0(25.0%)	0.8(21.5%)
leucine	0.4(5.1%)	-0.1(-1.2%)	-0.1(-1.3%)	-0.6(-7.9%)
Aspartate	-0.02(-0.2%)	-0.07(-0.7%)	-0.7(-7.2%)	-0.8(-7.7%)
lysine	0.4(10.0%)	-0.01(-0.4%)	0.09(2.5%)	-0.3(-8.7%)
methionine	0.4(14.8%)	0.002(0.1%)	0.2(7.7%)	-0.2(-8.2%)
glutamate	-0.1(-0.7%)	-0.1(-0.5%)	-0.04(-0.3%)	0.003(0.02%)
phenylalanine	0.005(0.1%)	-0.1(-3.2%)	-0.1(-2.4%)	-0.3(-5.8%)
Histidine	0.2(7.7%)	-0.1(-6.4%)	0.3(11.1%)	-0.05(-2.5%)
arginine	-0.2(-1.9%)	-0.3(-3.0%)	-0.2(-2.2%)	-0.3(-3.3%)
tyrosine	0.1(2.3%)	-0.2(-4.5%)	0.2(3.8%)	-0.1(-2.
tryptophan	-0.08(-4.1%)	-0.2(-11.6%)	0.002(0.1%)	-0.1(-7.2%)
cystine	-0.3(-13.7%)	-0.3(-12.3%)	0.1(3.9%)	0.1(5.1%)

UWSB-Unsprouted White *Sorghum bicolor*

SWSB-Sprouted White *Sorghum bicolor*

UPG-Unsprouted *Pennisetum glaucum*

SPG-Sprouted *Pennisetum glaucum*

In Pennisetum glaucum, the sprouted samples were better concentrated also because they experienced good enhancement except for methionine and isoleucine, all other essential and non-essential types of amino acid experienced enhancement 33.3% of the essential were enhanced while 66.7 of the non-essential amino acid were enhanced.

Nutritionally, sprouting enhanced some essential and non-essential amino acid constituents. From the present result, sprouting reduced amino acid mentioned above as follows: (values on Percentage); glycine (0.1%), alanine (0.3%), serine (0.04%), proline (0.6%), threonine (7.2%), isoleucine (4.8%), leucine (5.1%), lysine (10.0%), methionine (14.8%), phenylanine (0.1%), histidine (7.7%) and tyrosine (2.3%) respectively. While the increase in amino acid were observed in percentage as follows: valine (-0.20%), Aspartate (-0.2%), glutamate (-0.7%), arginine (-1.9%), trptophan (-4.1%) and cysteine (-13.7%) in white *Sorghum bicolor*.

In *Pennisetum glaucum*, reduction in amino acid were observed in percentage as follows; isoleucine (0.2%) and methionine (0.1%) respectively. While the enhancement in amino acid by percentage were observed as follows; glycine (-10.2%), alanine (-0.3%), serine (-2.8%0, proline (-2.4%), valine (-0.3%), threonine (-1.9%), isoleucine (-1.2%), aspartate (-0.7%), lysine (-0.4%) glutamate (-0.5%), phenylalanine (-3.2%), histidine (-6.4%), arginine (-3.0%), tryptophan (-11.6%), tyrosine (-4.5%) and cysteine (-12.3%).

There was an increase in the level of arginine in both white sorghum bicolor and *pennisetum glaucum* after the sprouting processing which indicates that the sprouted samples are good for infant formular. Histidine and arginine are regarded as essential for the growth of infants formular (Harper, 1989 and Adeyeye*et al.*, 2014a).

After sprouting, there was reduction in glycine level (non-essential amino acid) in white sorghum bicolor similar to the result observed by Oyarekua and Adeyeye (2009) while *Pennisetum glaucum* showed an increase in glycine level after sprouting process.

For both white sorghum bicolor and *Pennisetum glaucum*, a significant reduction was observed in the alanine levels after the sprouting processing as shown in Table 2. Alanine and Glycine are good examples of non-essential amino acid.

Glycine level was reduced by 14.1% in white sorghum bicolor after sprouting, while Alanine was reduced in *Pennisetum glaucum*by (0.03%)after sprouting.

As shown in Table 1 the values of CV% obtained for Glycine, senine, valine, threomine, Isoleucine, leucine, methionine, Histidine, arginine increases with sprouting process while that of alamine, proline, aspartate, lysine, glutamate, phenylalamine, tyrosine, tryptophan and cystine decreases in white *sorghum bicolor*, all with very close range while for *pennisetum glaucum*, the values of CV% obtained for glycine, serine, valine. Isoleucine, leucine, aspirate methionine, arginine, tryptophan, tyrosine and cystine decreases with sprouting process while that of histidine, phenylalanine, lysine, threonine and alanine increases the range of increament and reduction in this parameter level is a little bit far from the other which is contracting to that of white *sorghum bicolor*. For example the CV% for glycine in white sorghum bicolor before sprouting was (2.40%) and latter increase to (2.74%) after sprouting, while in *pennisetum glaucum*, the CV% for glycine before sprouting is (7.42%) and after sprouting reduced to (1.62%).

In this floured samples it was observed comparatively that sprouting helped in reducing the (leucine). Essential amino acid level of white sorghum bicolor from 7.65 to 7.35g/100g while increasing a little bit from 8.34 to 8.650g/100g while for *pennisetum glaucum*, the sprouting process helped in the increase level of leucine and arginine from 7.75 and 8.53g/100g to 7.83

and 8.78g/100g respectively. Sprouted *pennisetum glaucum* is best I term of essential amino acid level for the formulation of adult and baby food than that of *Sorghum bicolor*.

Looking at the statistical result critically from table 3, the unsprouted raw white sorghum bicolor/ sprouted white sorghum bicolor (UWSB/SWSB) showed that rxy had a positive value (0.9986957), rx^2 (coefficient of determination) of 0.99739319; Rxy value was 0.98382822 meaning that for every one unit of increase in the unsprouted raw whole seed flour (USWB) the amino acid values; there was a corresponding increase of 0.98382822 in the sprouted raw whole seed flour (SWSB). The coefficient of alienation (CA) is 5.10% was a lit bit low with a corresponding high index forecasting efficiency IFE value of 94.8% meaning that the forecasting relationship was high. The IFE is actually the reduction in the error of forecasting efficiency the high value of IFE obtained for USWB/SWSB indicated that the relationship between the amino acid parameter values could be easily be predicted because the error of prediction was just 5.10% which was averagely low. The high level of IFE showed that the unsprouted whole seeds white sorghum bicolor flour can be replaced by sprouted white sorghum bicolor flour or vice versa in their biochemical activities.

Table 3: Statistical analysis of Amino Acid composition (linear correlation and regression data from table 2)

Groups	Correl (rxy)	Determ. (Rxy^2)	Regress (Rxy)	CA	IFE	Critical Table value (Tv)	REMARK
UWSB/SWSB	0.99869	0.99739	0.98382	5.10	94.8	0.4680	**S**
UPG/SPG	0.99961	0.99922	1.00183	2.78	97.2	0.4680	**S**
UWSB/UPG	0.99364	0.98733	0.95369	11.2	88.7	0.4680	**S**
SWSB/SPG	0.9931	0.98628	0.96974	0.11	0.88	0.4680	**S**

C.A = coefficient of alienation, IFE = index of efficiency

TV = critical table value at r = 0.05, S = significant

Table 4 indicated the level of Total Amino Acid (TAA), Ttotal Essentiial Amino Acid (TEAA), Histogen (His) Total Aromatic Amino Acid (TArAA), Total Neutral Essential Amino Acid (TNEAA), Total Acid Amino Acid (TAAA), Total Basic Amino Acid (TBAA), Total Neutral Amino Acid (TNAA), Total Saturated Amino Acid (TSAA) and % Total Essential Amino Acid (% TEAA). For white sorghum bicolor and *pennisetum glaucum* (sprouted and unsprouted).

Table 4: Quality Parameter and Ratio in Amino acid Composition of White *Sorghum bicolor* and *Pennisetum glaucum* (sprouted and unsprouted)

GROUP NAME			UWSB				SWSB					
				Mean	SD	C.V				Mean	SD	C.V
TAA	98.22	98.23	97.88	98.11	0.20	0.21	100.43	95.86	97.68	97.99	2.30	2.35
TEAAwith His	44.58	44.59	44.40	44.52	0.10	0.23	43.00	42.22	43.70	42.98	0.74	1.72
TEAA WITHOUT HIS	42.24	42.16	42.18	42.19	0.04	0.10	40.84	39.98	41.66	40.83	0.84	2.05
TNEAA	46.88	46.79	46.65	46.78	0.12	0.25	51.44	51.06	51.52	51.34	0.25	0.49
TArAA	13.17	13.39	12.66	13.07	0.37	2.86	12.89	12.70	12.99	12.86	0.15	1.13
TAAA	27.49	27.08	27.52	27.36	0.24	0.89	27.52	27.33	27.69	27.51	0.18	0.66
TBAA	14.40	14.53	14.34	14.42	0.10	0.69	14.06	13.85	14.16	14.03	0.16	1.13
TNAA	14.40	14.53	14.34	14.42	0.10	0.69	14.06	13.85	14.16	14.03	0.16	1.13
TSAA	12.90	13.04	12.83	12.92	0.11	0.83	13.25	13.24	13.15	13.21	0.05	0.38
%TEAA WITH HIS	45.38	45.39	45.36	45.38	0.01	0.03	42.82	44.04	44.74	43.87	0.97	2.22
%TEAA WITHOUT HIS	43.01	42.92	43.09	43.01	0.09	0.20	40.67	41.71	42.65	41.67	0.99	2.38
%TNEAA	47.73	47.63	47.66	47.68	0.05	0.10	51.22	53.26	52.75	52.41	1.06	2.02
%TArAA	13.41	13.63	12.93	13.32	0.35	2.66	12.84	13.25	13.30	13.13	0.25	1.93
%TAAA	27.98	27.57	28.12	27.89	0.28	1.02	27.41	28.51	28.35	28.09	0.60	2.12
%TBAA	14.66	14.79	14.65	14.70	0.08	0.55	14.00	14.45	14.50	14.32	0.27	1.90
%TNAA	14.66	14.79	14.65	14.70	0.08	0.55	14.00	14.45	14.50	14.32	0.27	1.90
%TSAA	13.13	13.27	13.10	13.17	0.09	0.68	13.19	13.81	13.47	13.49	0.31	2.29
Cys in TSAA	2.21	2.17	2.37	2.25	0.10	4.65	2.57	2.64	2.45	2.56	0.09	3.71
%Cys in TSAA	17.15	16.61	18.44	17.40	0.94	5.40	19.42	19.96	18.66	19.35	0.65	3.38
P-PSER1	-0.57	-0.58	-0.56	-0.57	0.01	-1.57	-0.56	-0.54	-0.57	-0.56	0.01	-1.81
P-PER2	-1.96	-1.94	-1.98	-1.96	0.02	-0.85	-1.87	-1.84	-1.89	-1.87	0.03	-1.43
LEU/ILE	1.89	1.86	1.91	1.89	0.03	1.53	1.89	1.89	1.86	1.88	0.01	0.72
LEU-ILE	3.60	3.48	3.70	3.59	0.11	2.99	3.42	3.37	3.41	3.40	0.03	0.80
%LEU-ILE	3.67	3.55	3.78	3.66	0.12	3.17	3.40	3.51	3.49	3.47	0.06	1.66
Lys/Trp	1.93	1.95	1.95	1.94	0.01	0.74	1.75	1.74	1.73	1.74	0.01	0.55
Met/Trp	1.42	1.44	1.44	1.43	0.01	0.73	1.22	1.20	1.23	1.22	0.02	1.29
Phenylalanine	4.49	4.57	4.33	4.46	0.12	2.78	4.47	4.35	4.55	4.46	0.10	2.15

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

The levels of the quality parameters mentioned above the white sorghum bicolor ranged as follows: TAA-SWSB (97.9)-UWSB (98.1), TEAA with his- SWSB (42.9)-UWSB (44.5), TEAA without his- SWSB (40.8)-UWSB (42.1), TNEAA- UWSB(46.7)-SWSB (51.3), TArAA-SWSB (12.8)-UWSB (13.0), TAAA-UWSB (27.5)-SWSB (27.5), TBAA-SWSB (14.0)-UWSB (14.4), TNAA-SWSB (14.0)- UWSB (14.4), TSAA-UWSB (12.90-SWSB (13.2), % TEAA with his-SWSB (43.8)-UWSB 48.3) while that of *pennisetum glaucum* is as follows:- TAA-UPG (96.2)-SPG (98.5), TEAA with his- UPG (42.4)-SPG (43.4), TEAA without his- UPG (40.4)-SPG (41. 2), TNEAA- UPG (51.7)-SPG (52.3), TArAA-UPG (12.5)-SPG (13.4), TAAA-UPG (28.1)-SPG (28.3), TBAA-UPG (14.2)-SPG (14.6), TNAA-UPG (14.2)-SPG (14.6), TSAA- UPG (12.7)-SPG (13.4), % TEAA with his-UPG (44.1)-SPG (44.3).

The results in the research is similar to the result observed by Oyarekua and Adeyeye (2009). The percentage level of TEAA to TAA as observed in the presenet samples of this research work were strongly comparable for the one reported for the percentage (43.6%) for pigeon flour (Oshodi*et al.,* 1999) and 43.8-44.4% reported for beach pea protein isolate (Chavan*et al.,* 2001). The ArAA suggested for ideal infant protein (6.8-11.8g100g cp). (FAO/WHO/UNU, 1985) has the current value for the unsprouted (12.6-13.0) and sprouted (12.8-13.4). They are better than the minimum and maximum value for that of epinephrine and thyroxine. The unsprouted seed were better in all the quality parameters except for that of TNEAA in white *sorghum bicolor* while in *pennisetum glaucum* all the sprouted samples were better in all the quality parameters than the unsprouted ones. The highest level of the quality parameter are observed as follows: Cys in TSAA-SWSB(2.56), % Cys in TSAA-SWSB (19.35), P-PER_1 –SWSB and USPG (-0.56), P-PER_2 –SWSB (-1.87), LEU/ILE SPG-(2.58), LEU-ILE –SPG (4.81), %LEU-ILE –USPG (4.89), Lys/Trp-USPG(1.97), Met/Trp-USWB (1.43) and Phenylalanine-SPG(4.71).

A critical observation from Table 4 actually showed that statically the analysis result for unsprouted *Pennesetum glaucum* (upg) and sprouted *Pennesetum glaucum* (spg) whole seed flour followed the same trend as that of sprouted and unsprouted white sorghum bicolor as earlier discussed.

Actually the result of the comparative analysis for unsprouted white sorghum bicolor and unsprouted *Pennesetum glaucum* from table 4.3b shows that the rxy, Rxy CA and IFE values for uswb/upg are 0.9936476, 0.9536985, 1121882% and 88.74872% respectively, while the values for the same parameters for the swsb/spg are 0.993117, 0.96974302, 0.11712663 and 0.882133%.

The result showed that higher value of IFE was obtained for UWSB/UPG (88.7) while that of swsb/spg was 0.88%. The error of prediction was higher in the unsprouted for the amino acid parameters. (11.2%) and lower in the sprouted samples (0.11%).

This results indicated that the sprouted white sorghum bicolor and *Pennesetum glaucum* can replace one another vice versa in the food formulation. But for that of unsprouted samples one cent of the samples may be a little bit preferred to another in food production.

Generally, it was observed that rxy value were all highly positive (0.98628135-0.99922857) and Rxy and Rxy values ranged between (0.95369851-1.00183564). all the rxy amino acid values were different at r=0.05. The co-efficient of alienation (CA) ranged from 0.11%-11.2% whereas the corresponding index of forecasting efficiency (IFE) values ranged between 0.88-97.2%.

CONCLUSION AND RECOMMENDATIONS

Generally on the quality parameters considered like TAA, TEAA with his, TEA without his, TNEAA, TArAA, TAAA, TBAA, TNAA, TSAA, %TEAA with his in the amino acid profile for white *Sorghum bicolor*, there was decrease in the level of all the parameters after sprouting except for that of TNEAA which increased after sprouting. While in *Pennisetum glaucum* all the quality parameters level increases after sprouting.

From the current research work, *Sorghum bicolor* and *Pennisetum glaucum* seeds flours are good source of quality parameter of amino acid especially the sprouted ones which could be relied upon as a good cheap for supplement of essential amino acid in food in order to solve the problems of protein energy malnutrition.

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