Research Article

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# Nutritional Impact of Sprouted *Pennisetum Glaucum,* Functional Ingredients on Covid-19

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**Abstract**

*Public health recommendations encourage the selection of a balanced diet to foster health and well-being through research in achieving good health and well being target 3 of sustainable Development Goals (SDGs). Since over two years that the pandemic was declared and the world struggle with corona virus diseases (Covid-19) pandemic, there is lack of clinically effective therapies, and attention is shifting to different ways in order to strengthen the immune system. Previous studies in assessment of plants properties for combating covid-19 were generally focused on fruits and vegetables functional ingredients. Recently from research, cereals are gaining importance as a health promoting nutritious crop. It was discovered that pearl millet grains have a high potential for therapeutic purpose because of their gluten free, highest in dietary fibre contents, essential amino acid contents, as well as essential minerals and vitamins. This research work was designed and conducted to determine the effect of processing (sprouting) on the mineral and vitamin contents of Pennisetum glaucum.Data were subjected to descriptive evaluation andcomputation.The results showed that there were enhancements in mineral and vitamincontents of Pennisetum glaucum after sprouting. Zn (42.90±0.08), Fe (48.20±0.06) and some other minerals have over 10% level of enhancement while vitamin B9 (-21.0), vitamin C (-13.7) and other vitamins also experienced over 20% level of enhancement.This information about sprouted Pennisetum glaucum could be useful in the formulation and production of adult and infant food supplements in respect of minerals and vitamins to improve health, combat covid-19 and optimize cereal potential generally.*

**Keywords:** Nutritional impact, sprouted *pennisetum glaucum*, functional ingredients, covid-19.

## Introduction

The increasing rate of population coupled with high cost and dwindling availability of plant foods and animal feeds have resulted in malnourishment and ill health [1]. Malnourished people need to consume adequate calories for growth and maintenance in order to overcome the problem of economic crisis leading to under nutrition or Protein-Energy Malnutrition (PEM) [2]. Availability of plant food which could serve as cheap protein and energy sources, of which could be useful in the achievement of Sustainable Development Goals (SDGs) which are good health (Goal 1), zero hunger (Goal 2) and no poverty (Goal 3). The quest to source for nutrient rich plant food that can adequately supply the nutrient needed and therapeutic purpose for adult and children calls for a continuous research into cereals. Cereals belong to the family Poaceae or Gramineae which are monocotyledonous flowering plants known as grasses [3]. Millets have been important staples in the semi-arid tropic of Africa countries which are still the principal sources of energy, protein, vitamin and minerals for millions of the people in these regions. Poaceae includes the cereal grasses, bamboos and the grasses of natural grassland and cultivated lawns and pasture [4]. The nutritional, therapeutic and medicinal benefits of cereal (pearl millet) can be attributed to the presence of essential minerals and vitamins constituents in them. Enhancement through processing (sprouting) and characterization of essential minerals and vitamins from herbal product or medicinal plants (Pearl millet) have led to the discovery of recent distinguished pharmaceutical, health care products as well as preservatives.

## Materials and Method

The samples used for this research work were purchased from major markets located in Ado Ekiti and Ikere Ekiti. The bulk samples after sorting were divided into two sets: the first set was soaked in a clean plastic bowl with distilled water and covered with muslin bag and kept on the bench for five days allow sprouting to occur. The second set was air-dried and milled and kept in the refrigerator for further analysis. The sprouted samples were collected, drained of any water and then air- dried and milled. The milled samples were kept in the refrigerator for further analysis.Mineral and vitamins compositions were determined according to method described by Association of Official Analytical Chemists [5].

## Results and Discussion

The highest level for the minerals in the samples were observed in sprouted *pennisetum glaucum* and recorded as follows: Co (0.93±0.20), Cr (32.50±0.10), Mn (18.90±0.00), Cu (6.26±0.06), Ca (46.80±0.66), Zn (42.90±0.08), Fe (48.20±0.06), Na (-9.30±0.06), and K (2355.70±0.11) all in mg/100g. Table 1a and table 1b showed the coefficient of variation for all the mineral elements. It was revealed that the entire CV% of all the sample groups were very low as follows: UPG (0.002-7.83), and SPG (0.004-8.72).The value for Zn in sprouted pearl millet is a little bit higher (42mg/100g) and compare well with the tolerable upper intake level (40mg/day) as set by. The level of Cu in the unsprouted (0.94mg/100g) and sprouted (6.26mg/100g) were higher than the level of Cu (0.60, gg/100g) millet and compares well than that of maize in a research carried out by [3]. In the unsprouted *pennisetum glaucum* flour, Co, Cr, Mn, Ca, Fe, Na and K were less concentrated than the sprouted one. There was an enhancement in the level of Co, Cr, Mn, Cu, Ca, Zn, Fe, Na and K by 1.5%, -190.70%, -18.90%, 563.6-%, -28.70%, -23.60%, -25.30%, -122.00% and -8.30% respectively. Level of mineral enhancement was found at the highest level in copper. They all follow the same trend. This work is in agreement with previous studies which reported that processing cereals depletes their mineral and tannin content. The increase in the calcium content of the sprouted grain flour compared favourably with the result of a research study on sprouting characteristics and associated changes in nutritional composition of co-operating. Also, the increase in calcium content of cowpea after sprouting may be attributed to presence of calcium salt in water used during sprouting process. All rxy were significant at r=0.05 and n=2 degree of freedom. The coefficient of alienation (CA) ranged from 0.82-14.1%.The standard mineral safety index (MSI) for the minerals are Na (4.8), Mg (15), P(10), Ca (10), Fe (6.7), Zn (33) and Cu (33). Table 2a and table 2b showed the mineral safety index of Na, Ca, Fe, Cu, and Zn for the unsprouted and sprouted flour sample *Pennisetum glaucum*.In all, the unsprouted and sprouted flour sample *Pennisetum glaucum*, Fe MSI values are -10.50 and 14.80 for UPG and SPG respectively.This value of Fe indicates that there is abnormally high level of Fe in all the samples.For the Zn mineral safety index values, differences between the MSI and the samples MSI with respective values of -43.30, and -61.40 for UPG, and SPG were observed respectively.Positive difference between the standard MSI and the sample MSI were observed for sodium, calcium, and Cu values in all the flour samples. This result indicates that the *Pennisetum glaucum* both unsprouted and sprouted samples were okay in terms of calcium, sodium, and copper intake.Overloading of sodium in the body can even lead to secondary hypertension.Among the computed minerals ratios in Table 3, K/Na, Na/K, Ca/Na, Fe/Cu, Ca/K, Zn/Cu were all better in unsprouted *Pennisetum glaucum* than in the sprouted sample. This is an indication that both sprouted do not elevate any of these ratios. The levels (mg/100g) of vitamin A in this present report as shown on Table 4a and table 4b were lower than those reported for raw and processed in a research carried out by [6]. Similarly. The levels recorded in this present study for the raw and processed cereals flour samples were seriously lower than those reported for raw and processed red pepper. The levels in the samples were comparably lower than the recommended daily allowance (RDA). In any case, to meet up with the RDA foods rich in vitamin B1 needs to be consumed alongside with the *pennisetum glaucum*. The present reports on the other hand were comparably higher than the levels reported for cosmas variety seeds (0.022-0.021mg/100g) and sassako variety seeds (0.016-0.017) both for raw and processed samples [7]. It was so evident that sprouting enhanced the levels of water soluble and fat soluble vitamins when compared the unsprouted whole flour sample of *pennisetum glaucum*. However, in the fat—soluble vitamin group, the highest level of enhancement was observed among the samples as follows; vitamin K (-10.1) while the least enhancement was found in vitamin E (-5.10). For *pennisetum glaucum* sample among the water-soluble vitamins, the highest enhancement was observed in B9 (-21.0) while other enhanced vitamins were observed as B5 (-11.8); B12 (-140); B3 (-13.6) and C (-13.7), B6 (-0.7), B1 (-1.0) and B2 (-7.4). The least enhanced vitamins were vitamin K (-3.50) and E (-7.40). In table 6, the rxy levels were positively high (0.99961-0.99922) whereas the Rxy ranged from 0.88164 to 0.94550 as the rxy were significant at r=0.05 and n-2 degree of freedom. The coefficient of alienation (CA) ranged from 0.01-0.06% whereas the corresponding index of forecasting efficiency (IFE) ranged from 94.4 to 98.7%. In this research work, all the water- soluble vitamins were enhanced at various degrees and percentage by sprouting while in all the fat soluble vitamins for all the samples, there were enhancements. In this research work, eight anti-nutritional factors (ANFs) were detected namely: Tannin, Saponnin, Flavonoids, Phenolies, Alkanoids, Gycosides, Oxalate and phytate.

| S/N | Minerals | UPG/SPG MEAN±SD | CV% |
|---|---|---|---|
| i. | Co | 0.93±0.08 | 8.20 |
| ii. | Cr | 21.86±0.08 | 0.46 |
| iii. | Mn | 17.38±0.08 | 0.45 |
| iv. | Cu | 3.6±0.05 | 2.36 |
| v. | Ca | 41.61±0.43 | 0.98 |
| vi. | Zn | 38.82±0.44 | 0.22 |
| vii. | Fe | 43.32±0.09 | 0.22 |
| viii. | Na | 21.23±0.07 | 0.37 |
| ix. | K | 2265.94±0.08 | 0.003 |

**Table 1a: coefficient of variation of elements**

| | Correlation (rxy) | Coefficient of determination rxy$^2$ | Regression (Rxy) | Coefficient of Alienation (CA) | Index of forecasting efficiency (IFE) | Critical Table vale (TV) | remark |
|---|---|---|---|---|---|---|---|
| UPG/SPG | 0.99999 | 0.99999 | 0.92677 | 0.82 | 98.2 | 0.4680 | S |

**Table 1b: represents statistical analysis of mineral composition (linear correlation and regression data from Table ia).**

| Fe | | | Na | | | Ca | | | Zn | | | Cu | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TV | CV | D | TV | CV | D | TV | CV | D | TV | CV | D | TV | CV | D | |
| 6.7 | 17.2 | -10.5 | 4.8 | 1.27 | 3.53 | 10 | 0.30 | 9.70 | 33 | 76.3 | -43.3 | 33 | 1.40 | 31.6 | UPG |
| 6.7 | 21.5 | -14.8 | 4.8 | 0.28 | 4.52 | 10 | 0.39 | 9.61 | 33 | 94.4 | -61.4 | 33 | 9.40 | 23.6 | SPG |

**Table 2a: represents Mineral Safety Index**

| Fe | | | Na | | | Ca | | | Zn | | | Cu | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MEAN | SD | CV% | MEAN | SD | CV% | MEAN | SD | CV% | MEAN | SD | CV% | MEAN | SD | CV% | |
| 11.47 | 4.34 | 37 | 3.21 | 1.46 | 45 | 5.60 | 4.63 | 92.68 | 20.73 | 14.97 | 29.45 | 22.07 | 14.62 | 56.24 | UPG |
| 14.30 | 6.05 | 42 | 3.20 | 2.06 | 64 | 6.67 | 4.45 | 36.37 | 50.87 | 18.50 | 36.37 | 22.00 | 9.70 | 44.09 | SPG |

**Table 2b: represents Mineral Safety Index**

| UPG/SPG | | | |
|---|---|---|---|
| S/NO | MINERALS | MEAN±SD | CV% |
| i. | Co | 0.5±3.81 | 4.85 |
| ii. | Cr | 16.50±0.33 | 16.43 |
| iii. | Mn | 9.44±0.39 | 9.65 |
| iv. | Cu | 3.15±1.42 | 3.64 |
| v. | Ca | 23.52±0.66 | 23.74 |
| vi. | N | 14.33±0.31 | 21.56 |
| vii. | Fe | 24.16±0.25 | 24.14 |
| viii. | Na | 14.69±0.16 | 14.77 |
| ix. | K | 1177.93±0.07 | 177.88 |
| x. | K/Na | 41.14±1.05 | 40.19 |
| xi. | Na/K | 0.27±14.47 | 19.52 |
| xii. | Ca/Na | 2.24±1.71 | 4.17 |
| xiii. | Fe/Cu | 5.64±0.55 | 3.89 |
| xiv. | Ca/K | 0.775.64±0.5514.19 | 132.39 |
| xv. | Zn/Cu | 4.725.64±0.550.72 | 3.55 |

**Table 3: represents Quality Parameter and Ratio in Mineral Composition of *Pennisetum glaucum* (sprouted and unsprouted).**

| S/N | NAME | UPG | | | SPG | | |
|---|---|---|---|---|---|---|---|
| | | MEAN | ±SD | CV% | MEAN | ±SD | CV% |
| i. | Vitamin B3 | 4.16 | ±0.14336 | 3.444877 | 4.72 | ±0.103685 | 2.19349335 |
| ii. | Vitamin B6 | 0.76 | ±0.01099 | 1.446273 | 0.75 | ±0.016215 | 2.14785742 |
| iii. | Vitamin c | 4.75E-05 | ±1.8E-06 | 3.835603 | 5.40E-05 | ±1.15E-06 | 2.11901901953 |
| iv. | Vitamin A | 2.35E-06 | ±2.6E-07 | 11.12812 | 2.80E-06 | ±1.31E-07 | 4.6568996 |
| v. | Vitamin B1 | 0.27 | ±0.01436 | 5.278039 | 0.27 | ±0.007358 | 2.67679546 |
| vi. | Vitamin B2 | 0.05 | ±0.00187 | 3.742744 | 0.05 | ±0.001834 | 3.41445145 |
| vii. | Vitamin D | 7.92E-06 | ±7E-08 | 0.886579 | 8.90E-06 | ±1.29E-07 | 1.46137722 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| viii. | Vitamin E | 1.54 | ±0.12017 | 7.781329 | 1.65 | ±0,107253 | 6.46706635 |
| ix. | Vitamin B9 | 0.004 | ±0.00026 | 5.719452 | 0.005 | ±0.000155 | 2.82541539 |
| x. | Vitamin K | 5.70E-06 | ±5.3E-07 | 9.387849 | 5.90E-06 | ±1.38E-07 | 2.3510424 |
| xi. | Vitamin B5 | 1.23 | ±0.08788 | 7.114714 | 1.38 | ±0.19004 | 13.7597129 |
| xii. | VitaminB12 | 1.14E-05 | ±1.1E-06 | 9.765681 | 1.30E-05 | ±1.63E-06 | 12.6261896 |

**Table 4a: represents Vitamins Composition of *Pennisetum glaucum* (sprouted and unsprouted).**

| S/N | NAME | UPG/SPG | |
|---|---|---|---|
| | | MEAN±SD | CV% |
| i. | Vitamin B3 | 4.44±0.12 | 2.81 |
| ii. | Vitamin B6 | 0.76±0.01 | 1.80 |
| iii. | Vitamin C | 5.08±1.48 | 2.98 |
| iv. | Vitamin A | 2.58±1.95 | 7.89 |
| v. | Vitamin B1 | 0.27±0.01 | 3.97 |
| vi. | Vitamin B2 | 0.05±0.00 | 3.57 |
| vii. | Vitamin D | 8.41±4.15 | 1.17 |
| viii. | Vitamin E | 1,.59±0.10 | 7.12 |
| ix. | Vitamin B9 | 0.0003±0.00 | 4.27 |
| x. | Vitamin K | 5.80±3.34 | 5.87 |
| xi. | Vitamin B5 | 1.31±0.14 | 10.44 |
| xii. | Vitamin B12 | 1.22±1.37 | 11.17 |

**Table 4b: represents Vitamins Composition of *Pennisetum glaucum*(sprouted and unsprouted).**

| S/No | Vitamins | UPG-SPG (%) | MEAN±SD | CV% |
|---|---|---|---|---|
| i. | Vitamin B3 | -0.6(-13.6%) | 0.4± 0.23 | 54.5 |
| ii. | Vitamin B6 | 0.005(0.70%) | 0.31±0.25 | 79.65 |
| iii. | Vitamin C | -0.000007(-13.7%) | 0.000015±0.0362 | 0.01 |
| iv. | Vitamin A | -0.0000005(-19.1%) | 0.0000058±0.0103 | 0.02 |
| v. | Vitamin B1 | -0.003(-1.00%) | 0.040.31±0.043 | 107.5 |
| vi. | Vitamin B2 | -0.004(-7.40%) | 0.00530.31±0.00000675 | 0.04 |
| vii. | Vitamin D | -0.000001(-12.4%) | 0.0000230.31±0.05 | 0.02 |
| viii. | Vitamin E | -0.1(-7.40%) | 0.12±0.105 | 87.5 |
| ix. | Vitamin B9 | -0.001(-21.4%) | 0.0011±0.011 | 1.00 |
| x. | Vitamin K | -0.0000002(-3.5%) | 0.000000016±0.00000102 | 0.02 |
| xi. | Vitamin B5 | -0.1(-11.8%) | 0.0975±0.000076 | 0.02 |
| xii. | Vitamin B12 | -0.000002(-14.0%) | 0.000055±0.0000000073 | 0.01 |

**Table 5: represents summary of the vitamin composition of *Pennisetum glaucum* (sprouted and unsprouted).**

| Groups | Correl (rxy) | Determ.(Rxy2) | Regress (Rxy) | CA | IFE | Critical table value (TV) | Remark |
|---|---|---|---|---|---|---|---|
| UPG/SPG | 0.99961 | 0.99922 | 0.88399 | 2.77 | 97.2 | 0.5341 | S |

**Table 6: represents statistical analysis (linear correlation and regression) of data from table iva and table ivb.**

## Conclusion

In this research work, all the minerals, water soluble and fat soluble vitamins were enhanced at various degrees and percentages by sprouting, of which the level in this report compared well with the recommended daily allowance of 3.0mg/day for individual of 7 years old and above which could also be useful in the treatment of covid-19 and other related diseases.

## References

1. Adeyeye, E. I., Akinyeye, R. O., Ogunlade, I., Olaofe, O., & Boluwade, J. O. (2010). Effect of farm and industrial processing on the amino acid profile of cocoa beans. Food

chemistry, 118(2), 357-363.
2. World Health Organization. (2000). Obesity: preventing and managing the global epidemic.
3. Adeyeye, A., & Ajewole, K. (1992). Chemical composition and fatty acid profiles of cereals in Nigeria. Food Chemistry, 44(1), 41-44.
4. F.A.O. Official Agricultural statistics. (18th Ed.). Food and Agricultural Organization, Canada; 2006. pg 1002-1004.
5. Official Methods of Analysis (18th ed). AOAC International, Maryland, U.S.A: A.O.A.C; 2005.
6. Adesina AJ. Effects of processing methods on the chemical composition and functional properties of Africana breadfruit (treculia africana) seeds flour. Ph.D Thesis.2015.
7. Gwana, A. M., Bako, M. M., Bagudu, B. Y., Sadiq, A. B., & Abdullahi, M. M. (2014). Determinations of phytochemical, vitamin, mineral and proximate compositions of varieties of watermelon seeds cultivated in Borno State, North-Eastern Nigeria. International Journal of Nutrition and food sciences, 3(4), 238-245.
8. Agrawal AJ. Processing of pearl millet for its more effective utilization. Ph.D thesis, CCS Haryaua Agricultural University, Hisar, Haryana, India, 1992.183pp.
9. Achana. Development and nutritional evaluation of pearl millet based diabetic food. Ph.D thesis, CCS Haryana Agricultural University Hisar, Haryana, India, 2002. 176pp.
10. Bello, F. A., Enidiok, S. E., & Azubuine, B. C. (2017). Effect of stepping and sprouting on the nutritional, anti-nutritional and functional properties of pearl millet (Pennisetumglaucum) starch. International Journal of Advanced Research in Science, Engineering and Technology, 4(9), 4465-4471.
11. Raihanatu, M. B., Modu, S., Falmata, A. S., Shettima, Y. A., & Heman, M. (2011). Effect of processing (sprouting and fermentation) of five local varieties of sorghum on some biochemical parameters. Biokemistri, 23(2).
12. Serna-Saldivar, S. (1995). Structure and chemistry of sorghum and millets. Sorghum and millets: chemistry and technology, 69-124.
13. Wilkinson, D. L., & Harrison, R. G. (1991). Predicting the solubility of recombinant proteins in Escherichia coli. Bio/technology, 9(5), 443-448.
14. Bello, F. A., Enidiok, S. E., & Azubuine, B. C. (2017). Effect of stepping and sprouting on the nutritional, anti-nutritional and functional properties of pearl millet (Pennisetumglaucum) starch. International Journal of Advanced Research in Science, Engineering and Technology, 4(9), 4465-4471.