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Original Research Article

Varieties of Solanum melongena L. (eggplant) as potential functional ingredients

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Abstract

The heightened knowledge of the advantages of functional food has prompted the food industry to develop a variety of such products utilizing locally sourced, cost-effective agricultural goods. Eggplant (Solanum melongena L) is an agricultural product esteemed for its high fibre content and low caloric value. Four varieties of eggplants, specifically purple (AAA), cream (BBB), green (CCC), and bitter (DDD), were evaluated for their chemical composition (proximate, mineral, and antinutrient composition), antioxidant scavenging capabilities [Nitric oxide (NO), 2,2-diphenyl-1-picrylhydrazyl (DPPH), hydroxyl (*OH)], and iron chelation properties. The components of dietary fibre, glycemic index (GI), and glycemic load (GL) were also analyzed. Moisture content ranged from 4.80% to 8.20%, ash content from 5.10% to 11.95%, crude fibre from 11.86% to 15.68%, fat content from 3.33% to 7.20%, protein from 8.27% to 18.64%, carbohydrate from 45.26% to 62.34%, and energy value from 288.63 to 326.67 kcal. Phosphorus was the primary macronutrient, with levels ranging from 707.50 to 1041.80 mg/100g, but iron was the principal micronutrient; the Ca:P and Na:K ratios were both less than 1. AAA had the highest concentrations of phytochemicals: phytate (12.27 mg/100g), tannin (5.65 mg/100g), oxalate (18.89 mg/100g), saponin (8.34 mg/100g), alkaloid content (0.18 μg/100g), and trypsin inhibitor (3.33 %). AAA had the most significant scavenging capabilities in DPPH, Fe chelation, NO, and OH*. The IDF: SDF of eggplant types varied from 2:1 to 3:1, exhibiting a low glycemic index and medium glycemic load. The findings indicated the potential use of purple aubergine, specifically in the creation of functional food.

Keywords: Eggplant; Chemical compositions; Scavenging abilities; Dietary fibre; Glycemic index

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Introduction

High-fiber diet (HFD) significantly improve blood glucose and reduce plasma cholesterol (Ndife *et al*., 2019). It could improves serum lipoprotein, lowers blood pressure, and improve blood glucose for diabetic individuals. HFD also lowers glucose response, thereby reducing the insulin stimulation (Onwuka *et al*., 2017). Eggplant is an integral part of the African tradition and diet. It is consumed almost on a daily basis in both rural and urban families (Ndife *et al*., 2019). They possess various nutritional and pharmacological properties that make them valuable addition to diets. This is because they have appreciable reserve of nutrients and loads of phytochemical substances, such as anthocyanin, fiber, phenols, ascorbic acid, glycoalkaloids and α-chaconine (Horbowicz et al., 2018). The eggplant is ranked among the top 10 vegetables in terms of oxygen radical absorbance capacity. Thus, eggplant has the capacity to serve as a medicinal plant in maintaining a healthy gut, reduce blood glucose, cure ailments and prevent diseases. There is an indication from previous studies (Lakshman, 2012) that a correlation exists between the increasing consumption of eggplant and a reduction in the risk of overall mortality, overweight, high blood glucose level and cardiovascular conditions. Currently eggplants are utilized in the preparation of garden egg stews, soups, and sauces, or as dessert when consumed in its raw form (Agoreyo *et al*., 2012). It is a good source of minerals and vitamins and amide proteins. Therefore, the study aimed at evaluate the quality characteristics of the eggplant varieties such as (chemical, antioxidant, glycemic index/load and dietary fiber).

Material and Methods

Source of Raw Material

The four kinds of aubergine utilised in this study—purple aubergine (*Solanum macrocarpon*), cream aubergine (*Solanum gilo*), green aubergine (*Solanum aethiopicum*) and bitter aubergine (*Solanum torvum*) **-** were procured at Orange Market, Nasarawa. The identification and authentication of the samples were conducted in the Department of Crop Production at Kogi State University, Anyigba, Kogi State, Nigeria. All reagents utilised are of analytical grade.

Sample Preparation

The technique employed by Uthumporn et al. (2016) was utilised with minor adjustments to produce the aubergine flour.

Proximate Analysis

The moisture, ash, fat, crude fibre, and crude protein analyses were conducted according to AOAC (2005), whereas carbohydrate content was determined by difference: 100 − (%moisture + %crude protein + %crude fibre + %fat + %ash). The energy values were derived using the Atwater factors. (9 x crude fat) + (4 × crude protein) + (4 × carbohydrate).

Mineral Analysis

The level of magnesium, calcium, manganese, copper, and iron was determined using an atomic absorption spectrophotometer (AAS Model SP9). Potassium and sodium were quantified using a flame photometer (Sherwood), employing NaCl and KCl as standards. The AOAC (2005) method was employed to quantify phosphorus utilizing the vanadomolyb date colorimetric technique.

Quantitative determination of phytochemical constituents of four varieties of eggplant flour

Phytate (Latta & Eskin, 1980), oxalate (Day & Underwood, 1986), tannin (Burns, 1971), saponin (Brunner, 1984), and trypsin inhibitor activity (Coscueta et al., 2017).

Dietary Fiber Analysis

The analysis of soluble dietary fibre (SDF) and insoluble dietary fibre was conducted according to the AOAC (2005) method.

The *In-vitro* Antioxidant Assay of the Aqueous Extracts of the Eggplant Varieties Flour

The DPPH free radical scavenging activity of aubergine was assessed according to the methodology outlined by Aluko and Monu (2003). The metal chelation capacity of aubergine extract was assessed utilising the methodology of Xie et al. (2008). The ferric-reducing antioxidant activity (FRAP) was assessed using the method of Zhang and Lin (2008). The hydroxyl radical scavenging activity of aubergine extract was assessed using the method described by Girgih et al. (2011).

Determination of *in vivo glycemic* index analysis

Twenty (20) Wistar albino rats, weighing between 145 and 155 g, were utilized for the determination of the glycaemic index. The rats were segregated into four groups (n = 5) and housed in individual metabolic cages within a climate-controlled setting, with unrestricted access to both food and clean water. Animals underwent a 12-hour fasting period (overnight fast) before evaluation. The fasting blood glucose level was measured from the tail vein at time zero. Subsequently, the rats were administered an aubergine sample (equal to 2 g), while the control group received 2 g of glucose. During the initial 30 minutes, random blood glucose measurements were obtained every 15 minutes utilizing a glucometer (Accu-Chek® Performa, Roche Diagnostic, UK), followed by measurements every 30 minutes until the 120-minute mark. The glycaemic index was calculated from blood glucose concentration-time graphs using the incremental area under the curve (IAUC) of the food sample compared to glucose (Wolever et al., 1991).

The glycaemic load (GL) was determined by multiplying the carbohydrate content of aubergine in a standard serving by its glycaemic index (GI) value (Salmeron et al., 1997), as seen below:

GL = Net carbohydrates (g) × Glycaemic Index. Net carbohydrate equals total carbohydrates in the food sample.

Statistical Analysis

Determinations were conducted in triplicate, and the resulting data were analyzed using analysis of variance with SPSS (version 21, USA). Means were distinguished with the New Duncan Multiple Range Test (NDMRT), with significance accepted at a 5% confidence level.

Result and Discussion

Proximate Composition of Eggplant Varieties, Flours on a Dry Weight Basis

Table 1 shows the proximate composition of several eggplant types. The moisture content of eggplant cultivars ranged from 4.12% to 8.20%. AAA (purple aubergine) exhibited the lowest moisture level at 4.12%, whilst BBB (cream aubergine) demonstrated the highest moisture content at 8.20%. The moisture content of the flour samples exhibited a significant difference ($P \leq 0.05$). The moisture content falls within the permitted range of 1–15% as suggested by the USDA (2017) for food storage. The low moisture level detected in the flour samples suggests that, with appropriate packaging, the flour will have an extended shelf life.

Table 1: Proximate Composition (%) of Some Selected Eggplant Varieties Flour (Dry Basis)

Samples	Moisture	Crude Ash	Crude fibre	Crude Fat	Crude Protein	Carbohydrate	Energy value (kcal)
AAA	4.80 ± 0.01^{d}	11.95 ± 0.05^{a}	15.68 ± 0.03^{a}	3.67 ± 0.02^{c}	18.64 ± 0.01^{a}	45.26 ± 0.04^{d}	288.63^{d}
BBB	8.20 ± 0.04^{a}	5.10 ± 0.04^{d}	13.32 ± 0.08^{b}	6.67 ± 0.01^{b}	10.97 ± 0.05^{c}	55.69 ± 0.02^{b}	326.67^{a}
CCC	5.00 ± 0.05^{c}	9.20 ± 0.01^{c}	11.86 ± 0.06^{d}	3.33 ± 0.05^{c}	8.27 ± 0.03^{d}	62.34 ± 0.02^{a}	312.41^{c}
DDD	7.00 ± 0.01^{b}	10.30 ± 0.02^{b}	12.90 ± 0.01^{c}	7.20 ± 0.03^{a}	11.29 ± 0.02^{b}	51.31 ± 0.03^{c}	315.20^{b}

Mean ± standard deviation of three replicate; with the same superscript letter within the same column do not differ significantly ($p < 0.05$). **Key:** AAA: Purple Eggplant (*Solanum macrocarpon*), BBB: Cream Eggplant (*Solanum gilo*), CCC: Green Eggplant (*Solanum aethiopicum*), DDD: Bitter Eggplant (*Solanum torvum*)

The crude ash level of the flours varied from 5.10% to 11.95%. The ash concentration of the flour samples exhibited a significant difference ($P \leq 0.05$). This aligns with Ruperez's (2020) finding that a high ash content in plants indicates the provision of significant quantities of necessary minerals for the body. The crude fibre content of flour samples varied between 11.86% and 15.68%. The elevated value (15.68%) noted in AAA (purple aubergine) would facilitate digestion and maintain gastrointestinal health. Likewise, the elevated fibre content aids in maintaining stable blood sugar levels by decelerating glucose release after digestion, hence necessitating reduced insulin for cellular glucose absorption.

The crude fat content of the flour samples ranged from 3.33% to 7.20%. A notable difference ($P \leq 0.05$) is observed among all samples, with DDD (bitter aubergine) flour demonstrating a higher crude fat content. The results obtained align with the findings of Muthamilarasan et al. (2016) about numerous eggplant cultivars, which demonstrated values ranging from 1.3 to 1.8%. Also, the crude protein content of the flour samples ranged from 8.27% to 18.64%. AAA flour demonstrated a higher protein content compared to other varieties of aubergine. Proteins function as a source of amino acids (Gupta and Prakash, 2011).

The carbohydrate concentration of the samples ranged from 45.26% to 62.34%. AAA demonstrated the lowest mean value at 45.26%, while CCC registered the highest value at 62.34%. The carbohydrate values demonstrate considerable variance ($P \leq 0.05$), with the carbohydrate content of the aubergine cultivars inversely associated with the protein content.

Energy levels ranged from 288.63 to 326.67 Kcal. Sample AAA displayed the minimum energy value at 288.63 Kcal, whilst sample BBB revealed the maximum energy content at 326.67 Kcal. The proportion of fat, protein, and carbohydrates contributed to its heightened energy level.

Table 2 shows the mineral content of raw materials obtained from the eggplant cultivars. The minerals content are more pronounced in the sample B, than other samples, but much lower in sample A, which shows that the sample B are good source of minerals for the body when compare to others. The sodium (62.10mg/100g), potassium (156.30 mg/100g), calcium (134.22 mg/100g),

Table 2: mineral composition (mg/100g) of some selected eggplant varieties flour

Samples	AAA	BBB	CCC	DDD
Sodium (Na)	45.65±0.05^{d}	62.10±0.60^{a}	60.15±0.05^{b}	53.55±0.95^{c}
Potassium (K)	126.80±1.15^{d}	156.30±0.60^{a}	149.70±0.75^{b}	135.20±1.55^{c}
Calcium (Ca)	78.23±1.15^{d}	134.22±4.95^{a}	109.06±0.55^{b}	91.08±1.05^{c}
Magnesium (Mg)	283.23±0.15^{d}	536.25±0.45^{a}	511.15±0.25^{b}	365.40±1.20^{c}
Phosphorus (P)	707.50±1.25^{d}	1041.80±0.6^{a}	870.10±0.10^{b}	852.00±1.75^{c}
Iron (Fe)	38.62±0.45^{d}	58.32±0.45^{a}	51.52±0.65^{b}	46.82±0.95^{c}
Manganese (Mn)	12.20±0.04^{d}	20.35±0.05^{a}	17.85±0.55^{b}	16.25±0.25^{c}
Zinc (Zn)	3.07±0.00^{c}	4.02±0.01^{a}	3.72±0.15^{b}	3.28±0.24^{c}
Ca/P ratio	0.11	0.13	0.13	0.11
Na/K ratio	0.36	0.40	0.40	0.40
Phytate (mg/100g)	12.27±0.05^{a}	8.77±0.06^{b}	5.95±0.03^{c}	4.22±0.04^{d}
Tannin (mg/100g)	5.65±0.01^{a}	4.16±0.01^{b}	2.46±0.02^{d}	3.36±0.12^{c}
Oxalate (mg/100g)	18.89±0.05^{a}	14.44±0.05^{b}	10.59±0.00^{c}	8.45±0.04^{d}
Saponin (mg/100g)	8.34±0.02^{a}	7.53±0.01^{b}	2.34±0.02^{d}	5.43±0.02^{c}
Alkaloid (%)	0.18±0.00^{a}	0.15±0.10^{b}	0.10±0.00^{d}	0.13±0.03^{c}
Trypsin inhibitor (%)	3.33±0.00^{a}	2.22±0.00^{b}	1.11±0.00^{c}	1.22±0.02^{c}
Phytate/Calcium	0.16	0.07	0.06	0.05
Phytate/zinc	3.99	2.18	1.60	1.29
Phytate/Iron	0.32	0.15	0.12	0.09

Mean ± standard deviation of three replicate; with the same superscript letter within the same row do not differ significantly (p< 0.05)

magnesium (536.25mg/100g), phosphorus (1041.80 mg/100g), iron (58.32mg/100g), Manganese (20.35 mg/100g) and zinc content (4.02 mg/100g). The mineral richness of BBB is superior to that of other garden egg kinds, particularly AAA, which has the lowest mineral content. This indicates that BBB (cream aubergine) is a superior supplier of minerals for the body relative to others. The elevated mineral content in BBB (cream aubergine) indicates its capacity to sustain normal cellular homeostasis and manage fluid, electrolyte, and blood pressure balance in the body (Olagunju, 2022). BBB may also serve as an excellent source of calcium for developing children, pregnant women, and elderly individuals.

The anti-nutrient levels were elevated in AAA compared to other eggplant types. The phytate concentration of 12.27 mg/100g in AAA is significantly lower than the advised daily consumption of 0.18 to 4.57g/day (Schlemmer et al., 2009). Elevated levels of anti-nutrients, including oxalate, saponin, and phytate, can chelate calcium, magnesium, iron, and zinc, rendering them inaccessible by creating complexes (Ndife et al., 2019; Onwuka, 2018). The low level of anti-nutrients in food is significant for health, as these compounds can bind to nutrients (proteins, minerals), so impeding their absorption and utilization, ultimately diminishing the nutritional value of the meal (Olagunju, 2022).

The molar ratios of phytate to minerals are utilized to forecast the inhibitory impact of phytate on mineral bioavailability. A phytate: calcium molar ratio over 0.24 will hinder calcium absorption (Morris and Ellis, 1985). A phytate: iron molar ratio beyond 1 markedly reduces iron absorption (Hallberg et al., 1989), but a phytate: zinc molar ratio below 5 is advised for optimal zinc bioavailability. All eggplant samples demonstrated a phytate to mineral molar ratio below the acceptable limits, indicating elevated mineral bioavailability for all specimens. Nevertheless, sample AAA, despite exhibiting elevated phytate/calcium, phytate/zinc, and phytate/iron ratios, still demonstrates significant bioavailability of the minerals (calcium, zinc, and iron) upon consumption.

Table 3 presents the antioxidant characteristics of the aubergine types. The DPPH scavenging capacity of aubergine flour varied between 74.50% and 86.63%, with aubergine BBB exhibiting the lowest value (74.50%), and AAA demonstrating the highest value (86.63%). The order of effectiveness is AAA > DDD > CCC > BBB. This aligns with the findings of Mansurat et al. (2023) and Uthumporn et al. (2016), both of which indicated that purple aubergine possesses the highest phenolic content. The remarkable capacity of purple garden egg to scavenge DPPH may be ascribed to delphinidin-3-caffeoylrutinoside-5-glucoside, a significant component of anthocyanin that exhibits the highest radical scavenging activity against DPPH (Sanches-Silva et al., 2014). The consumption of AAA may thereby mitigate oxidative stress that might result in cellular damage within the body

Table 3: *In-vitro* Antioxidant Assay of Aqueous Extract of Eggplants Varieties Flour

Samples	DPPH %	Iron chelation %	No %	OH %
AAA	86.22±0.88[a]	64.33±0.54[a]	35.88±0.33[a]	53.47±0.54[a]
BBB	74.50±0.42[d]	61.21±0.00[d]	23.05±0.33[d]	34.22±0.53[d]
CCC	76.67±0.46[c]	63.15±0.21[b]	30.56±0.43[b]	46.26±0.80[b]
DDD	83.63±0.54[b]	62.28±0.21[c]	26.99±0.66[c]	38.56±1.46[c]

Mean ± standard deviation of three replicate; with the same superscript letter within the same column do not differ significantly ($p< 0.05$). **Key**: AAA: Purple Eggplant (Solanummacrocarpon), BBB: Cream Eggplant (Solanumgilo), CCC: Green Eggplant (Solanumaethiopicum), DDD: Bitter Eggplant (Solanumtorvum)

The iron chelation activities varied from 61.21% to 64.33%, with AAA exhibiting the highest value of 64.33%, and BBB displaying the lowest at 61.21%. The results demonstrate that AAA is more effective than other eggplant cultivars in reducing Fe3+ to Fe2+. The capacity of a material to chelate and neutralize transition metals inhibits these metals from engaging in the onset of lipid peroxidation, protein carboxylation, DNA damage, and oxidative stress via metal-catalyzed processes. The eggplant's capacity to chelate transition metals is attributed to an antioxidant process. Likewise, AAA had the greatest nitric oxide scavenging capacity (35.88%) and the highest hy0? My[],.BBB had the lowest nitric oxide scavenging capacity at 23.05%, whereas DDD demonstrated the minimal hydroxyl scavenging ability at 26.88%.

The dietary fibre content of eggplant cultivars, as presented in Table 4, indicated that the insoluble dietary fibre (IDF) ranged from 58.60% to 74.30%, while the soluble dietary fibre (SDF) ranged from 21.10% to 35.40%. AAA demonstrated the minimal IDF and the maximal SDF. No significant difference (P 0.05) was noted among the IDF of the aubergine types, except for DDD, which was much greater than the others. Nonetheless, the SDF of AAA was markedly ($P \leq 0.05$) elevated compared to others. A substantial consumption of soluble dietary fibre demonstrates additional metabolic benefits, including enhanced glycaemic indices of carbohydrate-dense diets and improved lipid profiles (Landberg 2012; Russel et al., 2016). Soluble fibre decelerates digestion and diminishes the rate of glucose absorption post-consumption. Consumption of a diet rich in insoluble dietary fibre is essential, as it aids digestion, prevents constipation, and may reduce the risk of chronic diseases. The recommended daily intake of total dietary fibre is 25 to 30 grammes (Quagliani & Felt-Gunderson, 2017). The results for IDF and SDF of the eggplant varieties above the acceptable levels, indicating that these kinds are abundant sources of both IDF and SDF.

The ratio of IDF to SDF varied between 2:1 and 3:1. The ratio of IDF to SDF indicates consumer health, as fibre aids digestion, alleviates constipation, and may lower the risk of chronic diseases. AAA and DDD conform to the 2:1 guideline established by the WHO.

Table 4: Dietary Fibre (%) of the Raw Materials of Some Selected Eggplant Varieties Flours

Sample	insoluble %	Soluble %	IDF:SDF
AAA	58.60±3.80[c]	35.40±1.00[a]	2: 1
BBB	63.90±1.90[b]	22.20±0.60[bc]	3: 1
CCC	61.70±2.90[bc]	23.10±0.10[b]	3: 1
DDD	74.30±0.10[a]	21.10±0.70[c]	4: 2
REF (WHO 2020)	45	30	2: 1

Mean ± standard deviation of three replicate; with the same superscript letter within the same column differ significantly ($p< 0.05$). **Key:** AAA: Purple Eggplant (Solanum macrocarpon), BBB: Cream Eggplant (Solanum gilo), CCC: Green Eggplant (Solanum aethiopicum), DDD: Bitter Eggplant (Solanum torvum)

The glycemic index (GI) and glycemic load (GL) are critical instruments for blood sugar regulation and dietary planning. Table 5 displays the glycemic index (GI) and glycemic load (GL) of various eggplant types. The glycemic index of eggplant cultivars varied from 27.34% to 39.41%. This suggests that eggplant types may have a negligible effect on blood glucose, given they all demonstrate a low glycemic index. The Dietary Glycemic Index (GI) serves as a metric for carbohydrate quality, indicating its impact on blood glucose levels. Foods are categorized into three classifications: high GI (>70%), medium GI (56-69%), and low GI (<55%), based on the rate of blood sugar elevation. Conversely, glycemic load assesses both the quality and quantity of carbohydrates in food (Eleazu, 2016; Wolever et al., 1991). Consumption of eggplant variants may be beneficial for weight control, blood sugar regulation, and other health concerns, making them potentially acceptable for diabetes management. Glycemic load (GL) is a quantitative measure that indicates the quality and quantity of carbohydrates present in diet. It quantifies the quantity of food that influences blood glucose levels.

Table 5 indicates that the GL of the eggplant varieties' spans from 12.37 to 18.25, demonstrating a medium GL. A GL number of 10 or below is classified as low, 11 to 19 as medium, and 20 or above as high. Glycemic load is significant since it aids in blood sugar regulation and diminishes the likelihood of developing type 2 diabetes and cardiovascular disease. The glycemic load of food is affected by its glycemic index and portion size; modifications in glycemic load can be attained by altering any or both of these factors (Eleazu, 2016)

Table 5: *In-vivo*-Glycemic Index/ Load of Some Selected Eggplant Varieties Flour Samples

SAMPLES	GLYCEMIC INDEX	GLYCEMIC LOAD
AAA: Purple Eggplant	27.34	12.37
BBB: Cream Eggplant	32.56	18.13
CCC: Green Eggplant	34.58	21.56
DDD: Bitter Eggplant	35.56	18.25
CONTROL: Glucose	100	-

Key; AAA: Purple Eggplant (*Solanum macrocarpon*), BBB: Cream Eggplant (*Solanum gilo*), CCC: Green Eggplant (*Solanum aethiopicum*), DDD: Bitter Eggplant (*Solanum torvum*)

Conclusion

The research indicated that the four examined eggplant cultivars may be advantageous due to their abundant micro and macronutrients, high mineral bioavailability, distinctive radical scavenging properties, low glycemic index, and medium glycemic load. Nonetheless, purple aubergine (AAA) distinguishes itself across all these characteristics, possessing a substantial quantity of soluble dietary fibre (SDF) and demonstrating superior scavenging capabilities, as evidenced by its chelating properties for Fe, NO, and OH*. This indicates that eggplant cultivars, particularly purple eggplant (AAA), possess the capacity to efficiently neutralize free radicals that contribute to oxidative stress in the body. The notably elevated dietary fibre, particularly soluble dietary fibre, may influence insulin levels necessary for diminishing glucose absorption in the body. Likewise, the low glycemic index and moderate glycemic load demonstrated by eggplants, particularly AAA, indicate their appropriateness as a functional meal for the control of diabetes and associated disorders.

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Author's Contribution

OSO: Conceptualization; supervision; writing – review and editing. AIO: Conceptualization; supervision. LRI: Formal analysis; investigation; methodology; project administration

Conflict of Interest.

No conflict of interest

References

A.O.A.C (2005). Official Methods of Analysis, Association of Official Analytical Chemists. Washington, D.C

Agoreyo, R. O., Obansa, E. S. and Obeanor, E. O. (2012). Comparative nutritional and phytochemical analysis of two varieties of Solanum melongena. Science World Journal, 7: 225-230.

Aluko, R. E., & Monu, E. (2003). Functional and bioactive properties of quinoa seed protein hydrolysates. Journal of Food Science, 68(4), 1254– 1258. https://doi.org/10.1111/j.1365-2621.2003.tb09635.

Brunner, J. H. (1984). Direct spectrophotometer determination of saponin. Animal Chemistry, 34, 1324–1326.

Burns, R. E. (1971). Methods for estimation of tannin in grain sorghum. Agronomy Journal, 63, 511–512.

Coscueta, E. R., Pintado, M. E., Picó, G. A., Knobel, G., Boschetti, C. E., Malpiedi, L. P., & Nerli, B. B. (2017). Continuous method to determine the trypsin inhibitor activity in soybean flour. Food Chemistry, 214, 156–161. https://doi.org/10.1016/j.foodc hem.2016.07.056

Day, A. L., & Underwood, R. A., Jr. (1986). Quantitative analysis (5th ed., p. 701). Prentice Hall.

Eleazu, C. O. (2016). The concept of low glycemic index and glycemic load foods as panacea for type 2 diabetes mellitus; prospects, challenges and solutions. *African health sciences*, *16*(2), 468-479.

Girgih, A. T., Udenigwe, C. C., & Aluko, R. E. (2011). In vitro antioxidant properties of hemp seed (Cannabis sativa L.) protein hydrolysate fractions. Journal of the American Oil Chemists' Society, 88(3), 381–389. https: //doi.org/10.1007/s11746-010-1686-7

Gupta, S. and Prakash, J. (2011). Nutritional and sensory quality of micronutrient-rich traditional products incorporated with green leafy vegetables. *International Food Research Journal*; 18:667-675.

Hallberg, L., Brune, M., & Rossander, L. (1989). Iron absorption in man: ascorbic acid and dose-dependent inhibition by phytate. *The American journal of clinical nutrition*, *49*(1), 140-144.

Horbowicz, M., Kosson, R., Grzesiuk, A. and Bski, H. D. (2018). Anthocyanins of Fruits and Vegetables—Their Occurrence Analysis and Role in Human Nutrition, Vegetable Crops Research Bulletin, 68 (1):5-22.

Lakshman R.B., (2012). Phytochemical screening, quantitative estimation total phenolics and total flavonoids, anti-microbial evaluation of Cyamopsistetragonoloba. IJRPBS, 3(3), 1139-1142.

Landberg R. (2012). Dietary fiber and mortality: convincing observations that call for mechanistic investigations. *Am J Clin Nutr*. 96(1):3–4

Latta, M., & Eskin, M. (1980). A simple and rapid colorimetric method for phytate determination. Journal of Agricultural & Food Chemistry, 28, 1313–1315. https://doi.org/10.1021/jf60232a049

Mansurat, A. I., Dandago, M. A., & Diya'udeen, H. B. (2023). Phytochemical Contents and Antioxidant potentials of Eggplants from Kano State, Nigeria: A Review. *Dutse Journal of Pure and Applied Sciences (DUJOPAS)*, (1a), 160-167.

Muthamilarasan, S., Mehra, M., Pasricha, V. and Gupta, R. K. (2016). Estimation of nutritional, phytochemical and antioxidant activity of seeds of musk melon (*Cucumismelo*) and water melon (*Citrulluslanatus*) and nutritional analysis of their respective oils. *J Pharmacogn Phytochem*. 3:98-102.

Ndife J., Elija I., Onwuzuruike A., Ubbor S., O and jinnaka M. C (2019). Impact of Blanching Pretreatment on the Quality Characteristics of Three Varieties of Oven Dried Eggplant. International Journal of Agriculture and Biological Sciences- Vol 3. (4) pp 2522-6584

Olagunju, A.I (2022). Multigrain porridge possesses superior nutritional quality, its consumption alleviates hyperglycemia, hypercholesterolemia and oxidative stress in obese-diabetic wistar rats. Journal of food Biochestry, 34 pp 1-167

Onwuka, G. I. (2018). Food Analysis and Instrumentation: Theory and Practice (2nd Ed.). Naphtali Prints, Lagos. 179-228.

Quagliani, D., & Felt-Gunderson, P. (2017). Closing America's fiber intake gap: communication strategies from a food and fiber summit. *American journal of lifestyle medicine*, *11*(1), 80-85.

Ruperez, P. (2020). "Mineral content of edible marine seaweeds," Dep. Metab. Nutr. Inst. del FrÃ ´o, Super. Counc. Sci. Res. (CSIC), Ciudad Univ. s / n, 28040-Madrid, Spain, vol. 79, pp. 23–26.

Russell, W.R.; Baka, A.; Bjorck, I.; Delzenne, N.; Gao, D.; Griffiths, H.R.; Hadjilucas, E.; Juvonen, K.; Lahtinen, S.; Lansink, M. (2016) Impact of Diet Composition on Blood Glucose Regulation. Crit. Rev. Food Sci. Nutr. 56, 541–590

Salmeron, J., Manson, J. E., Stampfer, M. J., Colditz, G. A., Wing, A. L., & Willett, W. C. (1997). Dietary fibre, glycaemic load, and risk of non-insulin-dependent diabetes mellitus in women. Journal of American Medical Association, 277, 472. https://doi.org.10.1001/ jama.1997.03540300040031

Sanches-Silva, A., Costa, D., Albuquerque, T. G., Buonocore, G. G., Ramos, F., Castilho, M. C., Machado, A. V., & Costa, H. S. (2014). Trends in the use of natural antioxidants in active food packaging: A review. Food Additives & Contaminants: Part A, 31(3), 374–395. https://doi.org/10.1080/ 19440049.2013.879215

Schlemmer U, Frølich W, Prieto RM, Grases F. (2009). Phytate in foods and significance for humans: food sources, intake, processing, bioavailability, protective role and analysis Mol Nutr Food Res.

;53 Suppl 2:S330-75. doi: 10.1002/mnfr.200900099.

USDA. (2017). "US-Nigeria Commodity Storage Workshop VII-I on Stored grain Management in On-farm Storage and Warehouse Structures." International Institute of Tropical Agriculture (IITA), Ibadan.

Uthumporn U. A. Fazilah, A.Y. Tajul, M. Maizura and A.S. Ruri (2016). Physico-chemical and Antioxidant Properties of Eggplant Flour as a Functional Ingredient. Advance Journal of Food Science and Technology 12(5): 235-243.

WHO, (2020). Global Recommendations on Physical Activity for Health. World Health Organization, Geneva, 2014.

Wolever, T. M., Jenkins, D. J., Jenkins, A. L., & Josse, R. G. (1991). The glycemic index: Methodology and clinical implications. American Journal of Clinical Nutrition, 54, 846–854.

Xie, Z., Huang, J., Xu, X., & Jin, Z. (2008). Antioxidant activity of peptides isolated from alfalfa leaf protein hydrolysate. Food Chemistry, 111(2), 370– 376. https://doi.org/10.1016/j.foodchem.2008.03.078

Yusuff O., Mohd Y. R., Fatai A., Samuel C. C., Monsuru A. S., Bolanle A. O, Ifeoluwa K. Fagbohun and Taoheed K. M. (2021). Genetic Diversity and Utilization of Cultivated Eggplant Germplasm in Varietal Improvement. Journal of Plants, 260:75 pg 1-20

Zhang, L. L., & Lin, Y. M. (2008). Tannins from Canarium album with potent antioxidant activity. Journal of Zhejiang University Science B, 9(5), 407– 415. https://doi.org/10.1631/jzus.B0820002

Cite as: Isah L.R.,Omoba O.S. & Olagunju A.I.. (2025). Varieties of Solanum melongena L. (eggplant) as potential functional ingredients. Funct Food J 6(1):212-219. https://ffnan.org/journals/journal-13