Bio-Science Research Bulletin
Volume 41, Number 2
July-December 2025: P.92-97
Original Article

Print version ISSN 0970 0889
Online version ISSN 2320 3161
http://www.bpasjournals.com

Proximate and Mineral Content of Fruits of Some Cucumber Varieties Cultivated Under NPK Fertilizer in Ado-Ekiti

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ABSTRACT
Cucumber (*Cucumis sativus* L.) is consumed all over the world and in all parts of Nigeria for its nutritional and medicinal benefits. This research involved the assessment of the nutritional contents of fruits of five cultivars of *Cucumis sativus* (Monalisa, Greengo, Saira, Nandini and Lily) grown under NPK fertilizer application in Ado-Ekiti. The proximate and mineral analyses of the harvested fruits were investigated using conventional analytical technics. The results of proximate analysis indicated that marked variations ($P \leq 0.05$) existed in the moisture content of all the five varieties. Nandini had the highest moisture content of 93.25 %. Interestingly, no significant differences were discovered in the Ash, Fat, and Crude Fibre composition among all the varieties evaluated. However, Monalisa recorded the highest crude protein composition (2.81 %) among the varieties investigated. Meanwhile, Saira had the highest carbohydrate composition (3.14 %), while Monalisa and Nandini recorded the lowest significant carbohydrate composition of 1.80 and 1.66% respectively. The results of mineral analysis also showed that significant variations exist in the micronutrients. The concentration of Sodium and Calcium were found to be the highest in Nandini with values of 17.25 and 206.50 ppm respectively, while Lily (13.73 ppm) and Monalisa (158.40 ppm) recorded the lowest Sodium and Calcium composition. Monalisa recorded the highest potassium content (462.55 ppm). The results also revealed that Saira had the highest magnesium composition (21.36 ppm) and Lily had the lowest value (15.81 ppm). All the five varieties had appreciable proximate and mineral contents. However, Greengo, Nandini and Monalisa varieties could be preferred due to their comparatively higher proximate and mineral composition in most cases.

KEYWORDS: Cucumber, NPK 15-15-15 fertilizer, Proximate, Mineral composition, Ado-Ekiti

Received on 13.08.2025, Revised on 27.10.2025, Accepted on 29.11.2025

How to cite this article: Arowosegbe S., Kayode E.O. and Fakorede H. (2025). Proximate and Mineral Content of Fruits of Some Cucumber Varieties Cultivated Under NPK Fertilizer in Ado-Ekiti. *Bio-Science Research Bulletin,* 41(2), 92-97.

INTRODUCTION

Cucumber (*Cucumis sativus* L.) is a plant with crawling vines that produce cylindrical succulent fruits consumed as green vegetable (Ejaz and Bahadur, 2024). The plant is classified within the Cucurbitaceae family, made up of 117 genera and 825 species, usually planted where temperature is not too cold (Nagamani *et al*., 2019). Genetically, cucumber is a diploid self-pollinated species, having chromosome number 2n=2x=14. Data of the global production of cucumber indicated that the plant is a major vegetable crop in the world. The world production figure of cucumber is over 91 million kilograms on 2.26 million hectares (FAOSTAT, 2020). Unfortunately in Nigeria, cucumber seems to remain a minor or under-documented crop with production seen as mostly on small-scale farms. However, its production and consumption in Nigeria keep on increasing from year to year as a result of its exceptional nutritional and economic values (Nweke, 2013).

Cucumber fruit (Figure 1.) is well cherished as a fruit delicacy because it is power-packed with many essential nutrients necessary for growth and nourishment. According to Wang and Li (2014), it is used in salad preparation and processed into pickles, juices, and other food items. The fruit could also be eaten raw and fresh, with crispy and refreshing qualities.

Nutritional properties are crucial, as they help counter human malnutrition on a large scale.
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Furthermore, cucumber production supports rural livelihoods and boosts the national economy, especially in areas where horticulture is majorly practiced (Razmjoo and Modarres, 2020). The use of fertilizer remained very important factor in sustaining increasing food production especially, in demand against pressures of increasing population and disappearing farmland (Lai, 2018). Among fertilizers, NPK (nitrogen, phosphorus, and potassium) is the most widely used and recognized for their ability to enhance growth and yield of crops (Fageria and Baligar, 2005).

It is worth noting that yield is more emphasized in agriculture in most cases than nutritional quality. With respect to cucumber, it has been reported that when fertilizers are applied in different modes and dosage, they have a significant influence on the proximate and mineral composition (Razmjoo and Modarres, 2020). However, information on the responses of different varieties to fertilizer application in terms of nutritional quality is scanty. The demand for high-quality and nutrient-dense crops has surged with the increase in population and the demand for food security. The mineral level and proximate composition variations in different varieties of cucumber are poorly documented. Hence, the research presented here attempts to find the differential nutritional and mineral qualities of fruits of five common varieties of cucumber under NPK fertilizer treatment.

Figure 1: Cucumber fruits

MATERIALS AND METHODS

The research took place on the experimental farm of the Faculty of Agricultural Science, Ekiti State University, Ado-Ekiti (7° 40′N, 5° 15′E). The town is situated in the South-West of Nigeria. The town experiences a dual rainfall pattern (April to July and September to November) with yearly average of 1400 mm (Arowosegbe, 2016).

Source of the Seeds
Seeds belonging to the five cucumber varieties; Greengo, Monalisa, Saira, Lily and Nandini were purchased from an accredited seed firm in Ibadan, Oyo State.

Design and Layout of the Experiment
A land with an area of 364 m^2 was used for this experiment. The land was cleared and ridges were made using hoes and cutlass. The experiment followed a Randomized Complete Block Design (RCBD) replicated three times. Each replication had 10 ridges of 12 m long with the five (5) different varieties.

Planting and Fertilizer Application
The seeds were sown in September, 2024. Two seeds were sown placed 3 - 4 cm deep with 30 cm spacing. The ridges were 75 cm apart. The seedlings were subsequently reduced to one per stand, 2 weeks after emergence (WAE). A rate of 150 Kg ha^{-1} N.P.K 15-15-15 fertilizer was administered once flowering commenced.

Weeding, Staking and Vine Management
Weeds on the plot were handpicked at two weeks interval to keep it weed free. Plants were Staked three weeks after they emerged, using the appropriate materials.

Sample Collection
Marketable fruits of the five cucumber varieties were harvested and placed in labelled airtight containers. They were then taken to the laboratory for proximate and mineral analyses.

Proximate Analyses
The proximate content of the cucumber fruits was estimated as highlighted by AOAC (2000) and Pearson (1976). Each Analysis was carried out in triplicate, with results reported as means of percent values on a dry-weight basis.

Mineral Analyses
Mineral analyses were done by adopting the methods of Martin-Prevel *et al.* (1984) with little modifications. An atomic absorption spectrophotometer and a flame photometer were used to determine the major mineral content of the samples. The Iron content of the samples was estimated by colorimetric methods. Elemental concentrations in the samples were computed based on dry matter.

Data Analysis
All the data gathered were analyzed statistically using Analysis of Variance (ANOVA), and means values separated at 5% level of significance using Duncan Multiple Range Test (DMRT). SPSS software, 2014 version was used in doing these.

RESULTS AND DISCUSSION

The results of the proximate content (%) of fruits of five varieties of cucumber under the application of NPK fertilizer is presented in Table 1. This indicated that all the varieties contained high concentration of moisture. It was also noted that marked differences exist in the moisture content of the fruits of the varieties. Nandini contained greater moisture content with a value of 93.25 %, while Greengo and Monalisa had the least moisture content with values of 91.58 and 91.81 % respectively. This result corroborates the discovery of Abey *et al*. (2017), who reported that fruits of cucumber contain more than 90 % moisture. Adequate water consumption is fundamental for maintaining hydration, which is critical for proper functioning of physiological processes including temperature regulations, nutrients transport and waste removal (Aina *et al*., 2004). However, due to the high moisture content in cucumber fruit, it has a short shelf life, prone to fungal growth and eventual spoilage (Werthera *et al*., 2000).

Interestingly, differences recorded in the ash, fat and crude fibre composition among all the varieties evaluated were not significant. Monalisa recorded the significantly highest crude protein composition (2.81 %), while the

differences in the crude protein composition among other varieties (with values distributed from 1.58 to 2.29 %) were not statistically different. Consumption of dietary fibre aids in lowering the risk of gastrointestinal issues, such as constipation and diarrhea (Aina *et al.,* 2004). Plant fibres consist of long-chain carbohydrates that do not allow digestion by human gastrointestinal enzymes, thereby contributing to dietary bulk and promoting digestive health. (Weickert and Pfeiffer, 2008). The suggested daily fibre requirement for an adult with normal health status is 20-25 g per day (American Dietetic Association, 2005). The results of this study also support the assertion that cucumber consumption is good in fighting constipation (Yohanna, 2013). The observed minimal fat concentration in the fruits implies that its regular intake is appropriate for people adhering to low fat diet. Additionally, the significant ash content observed in this study (Table 1) suggests that cucumber fruit may serve as an effective source of essential mineral nutrients.

Saira had significantly highest carbohydrate composition with a value of 3.14 %, while Monalisa and Nandini recorded the lowest carbohydrate composition with values of 1.80 % and 1.66% respectively. Carbohydrate is made up of a vital class of organic compounds that occur naturally and are necessary for the preservation of life in all living organisms. (Ebun-Oluwa and Alade, 2007). The difference in value of carbohydrate may be due to differences in varieties of plant and method of extraction.

Table 1: Proximate Contents (%) of the Fruits of Five Cultivars of Cucumber Cultivated in Ado-Ekiti

Cultivar	Moisture	Ash	Fat	Crude Fibre	Crude Protein	Carbohydrate
Greengo	91.58±0.009^{cd}	0.84±0.004^{a}	0.65±0.004^{a}	2.17±0.002^{a}	2.29±0.003^{b}	2.47±0.014^{b}
Lily	92.76±0.008^{b}	0.70±0.001^{a}	0.57±0.003^{a}	1.76±0.004^{a}	1.93±0.003^{b}	2.28±0.003^{b}
Saira	92.17±0.009^{c}	0.73±0.003^{a}	0.51±0.004^{a}	1.87±0.006^{a}	1.58±0.004^{bc}	3.14±0.020^{a}
Monalisa	91.81±0.003^{c}	0.91±0.003^{a}	0.62±0.002^{a}	2.05±0.011^{a}	2.81±0.003^{a}	1.80±0.015^{c}
Nandini	93.25±0.006^{a}	0.66±0.008^{a}	0.49±0.003^{a}	1.97±0.008^{a}	1.79±0.004^{bc}	1.66±0.016^{c}

Means having different alphabet(s) within a column are significantly different ($p \leq 0.05$) using Duncan Multiple Range Test.

Table 2 shows the results of the mineral content of the fruits of the five cultivars analyzed. The results indicated that the macro mineral composition in the varieties differ significantly in most cases. Whereas, there seemed to be no significant differences in the micro mineral composition. The concentration of sodium and calcium were found to be the highest in Nandini with values of 17.25 and 206.50 ppm respectively, while Lily (13.73 ppm) and Monalisa (158.40 ppm) recorded the lowest sodium and calcium composition respectively. Bones are made up of calcium which aids in muscular contraction, clotting of blood and the transfer of information by nerves. The body by itself will get the calcium required from the bones when the calcium supply to the body is not sufficient. However, this is dangerous because if the body keep on depleting more calcium than it is produced over a long period, the bones will become less strong and could eventually break. According to Aliu *et al*. (2008), calcium is also important for disease prevention and control.

The quantity of potassium found in all the five varieties ranged from 396.35 to 462.55 ppm with Monalisa having the significantly highest potassium composition and Lily having the lowest. The results also indicated that Saira recorded the highest magnesium with a value of 21.36 ppm, while Lily had the least (15.81 ppm). Sodium and Potassium play very important role in diet capable of controlling high blood pressure. Lower sodium and higher potassium intake have been shown to lower high blood pressure (Kim *et al*., 2024).

It was also observed that all the fruits contain relatively low concentration of Iron, Copper, Manganese and Zinc. Copper aids the proper

utilization of iron and sugar in the body. It is also important in bone development and proper nerve functioning (Binesh and Venkatachalam, 2024).

Manganese is very crucial in the proper functioning of the connective tissues, bones, nerves, sex hormones and in blood clotting (Oluwagbenle *et al*., 2019).

The levels of zinc in all the cucumber varieties although very low, could also be crucial to the overall development of the body since zinc is actively involved in protein and nucleic acid synthesis of cells (Abitogun *et al*., 2010).

Table 2: Mineral Contents (ppm) of Fruits of Five Varieties of Cucumber Cultivated in Ado-Ekiti
Means having different alphabet(s) within a column are significantly different (p≤0.05) using Duncan Multiple Range Test.

Cultivar	Na	Ca	K	Mg	Fe	Cu	Mn	Zn
Greengo	15.53±0.251^{c}	185.65±0.250^{c}	418.65±0.150^{c}	18.70±0.006^{b}	0.78± 0.004^{c}	0.15± 0.002^{a}	0.48± 0.001^{a}	0.38± 0.003^{a}
Lily	13.73±0.153^{e}	191.40±0.100^{b}	396.35±0.150^{e}	15.81±0.006^{e}	0.92± 0.004^{b}	0.11± 0.004^{a}	0.33± 0.004^{a}	0.22± 0.002^{a}
Saira	16.30±0.100^{b}	177.50±0.300^{d}	435.50±0.100^{b}	21.36±0.008^{a}	0.99± 0.001^{a}	0.21± 0.003^{a}	0.31± 0.002^{a}	0.25± 0.003^{a}
Monalisa	14.40±0.100^{d}	158.40±0.200^{e}	462.55±0.250^{a}	17.60±0.003^{c}	0.66± 0.008^{d}	0.17± 0.003^{a}	0.51± 0.003^{a}	0.21± 0.003^{a}
Nandini	17.25±0.050^{a}	206.50±0.800^{a}	410.50±0.200^{d}	16.83±0.003^{d}	0.59± 0.004^{e}	0.14± 0.002^{a}	0.37± 0.003^{a}	0.31± 0.002^{a}

CONCLUSION

The Cucumber varieties evaluated in this study contain appreciable amount of essential minerals. These minerals are very important in maintaining overall health, enhancing growth, and facilitating the production of vital body components such as bones, teeth, hair, blood, nerves, skin, vitamins, enzymes, and hormones. Furthermore, the cucumbers varieties contain significant proximate constituents, including moisture, ash content, crude protein, crude fat, crude fiber, and carbohydrates. These highlighted their potential in promoting good health and vitality. However, some varieties were found to have more minerals or proximate composition than the other.

RECOMMENDATION

It is therefore recommended that Greengo, Nandini and Monalisa varieties should be cultivated and consumed due to their comparatively higher proximate and mineral composition. Furthermore, plant breeders are to see to the fortification of cucumber with minerals and other important nutrients in order to meet the increasing demand for nutrient-rich cucumbers.

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