



Using graphics to promote the health values of indigenous vegetables in anemia, metabolic syndrome, and wound management

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ABSTRACT

Vegetables are any plant whose fruit, seeds, roots, tubers, bulbs, stems, leaves, or flower parts are used as food. However, this study captures leafy vegetables which are affordable and quick to cook; rich in several macro and micronutrients including vitamins, minerals and fibers which are essential for anemic, metabolic syndrome and wound management. Though the nutritive contents of these vegetables

abound, this study aims at advancing the education on the relevant contents of indigenous vegetables based on established data of the synonymous vegetables. This Case Series article was intended to be pictorial



representation of functional leafy vegetables that are available in the research site. Unique graphic designs of the seven indigenous vegetables, which have been previously reviewed, were made to portray their potential micronutrient values and relevance as functional foods in health and disease. Although the seven graphical images indicated similarities, various add-on health values are highlighted. The pictograms depict medical nutrition therapy potentials. . Each pictogram represents an educational tool for health promotion about a vegetable. Bitter leaf had an added value for kidney functions management, Amaranthus for bone maintenance, Lemon grass for insomnia management and general detox, Mint leaf for stomach upset management, Moringa for cancer and malnutrition management, Fluted pumpkin, and Water leaf for constipation management. The health values of these indigenous vegetables include management of common ailments such as anemia, metabolic syndrome and wound management is relatively scarce. This Case Series provides a compendium of seven pictorials to be used as graphical health educational resource to promote consumption of indigenous vegetables in Delta State Nigeria. The significance is to advance health promotion on food matters among a populations where the people may be more inclined to visual prompts. Implications for the COVID19 pandemic is briefly addressed.

Keywords: antioxidants, haematinics, health promotion, immunomodulation, infections, metabolic syndrome, micronutrients, wound management

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INTRODUCTION

Vegetable is often referred to as leafy or soft edible fruits which may be cooked in stew or eaten raw as a salad in Sub-Saharan Africa. Vegetables play an important role in human diet and nutrition as they contain both macro and micronutrients including food fibers, various vitamins such as A, C and K; as well as minerals such as iron, potassium, and zinc to human health development. In the published narrative review, evidence-based research used to support the claims in the pictorials have been articulated that:

“So much have been written on leafy vegetables including the African indigenous varieties, but optimum consumption is yet to be achieved. In the previous papers on food choices, it was recommended that some indigenous foods need to be incorporated as alternatives into food menu plans for the intended local population. This paper provides a narrative mini-review of the literature on some leafy vegetables ... to be promoted for their contribution to healthy dietary habit. The nutritional values and traditional medicine usage forms are also briefly highlighted” [1].

Thus, the nutritive contents of these vegetables abound, educational graphics on the relevant contents of indigenous vegetables are lacking. Yet, such graphics are essential, especially for displays at community centers and health facilities and billboards. This would contribute as educational tool for health promotion

Objective of study: Broadly, the objective is to advance health education on the relevant contents of indigenous vegetables based on established data of synonymous species. That is, to provide a delineation of unsupported claims about the indigenous vegetables based on similar species that have been studied. Specific objectives are to develop graphics of the potential health values of indigenous vegetables for

1. Anti-anemic minerals
2. Metabolic syndrome: diabetes, hypertension, obesity
3. Wound management
4. Infections – with implication for the ongoing COVID19 pandemic

LIMITATIONS AND SCOPE

The scope of this piece of work is specifically to develop graphics that depict the potential health values of the series of vegetables. Hence it is a Case Series report. Focused effort is made to provide references to the sources of the claims. This report is limited to potential values with intent to communicate credible information in memorable ways and portray verbal cues; without argumentation semantics or too much scientific jargon that could put off non-scientific audience. There is no speculation of

dosing, toxicities, or physiologic mechanisms. However, this is work in progress and as such, comments and suggestions are welcomed on how to add more information without making the pictograph too verbose.

METHODS

This was designed to be a pictorial representation tool and first stage of the project. Second stage shall be assessment of quality of the tool. In this first stage being reported, graphic designs of indigenous vegetables, which had been previously reviewed, were made. Focus was to show in pictures the potential micronutrient values of the vegetables and health relevance of the micronutrients. This study did not involve humans hence neither consent nor ethics was required. However, this work was adoption and advancement of ongoing diabetes research in the Delta State Nigeria [2, 3].

RESULTS AND DISCUSSIONS

Results—graphics designs of the 7 sampled vegetables: All seven images indicate similarities or known values of the various vegetables. Add-on health values are highlighted. Figure 1 shows bitter leaf, which is a shrub and commonly domestic vegetable plant that regenerates naturally. It grows well under full humid and sunlight environmental conditions especially in the African tropical areas such as Nigeria. The leaves are used in Nigeria's famous cuisine, the bitter-leaf soup. Extracts are rich in various phenolic and phytochemical compounds and are exceptionally the richest in folic acids and vitamin C relative to all other vegetables. The bitterness is

attributed to be symbolic of its medicinal properties
it is widely used traditionally as a quinine-substitute
in Africa [4].

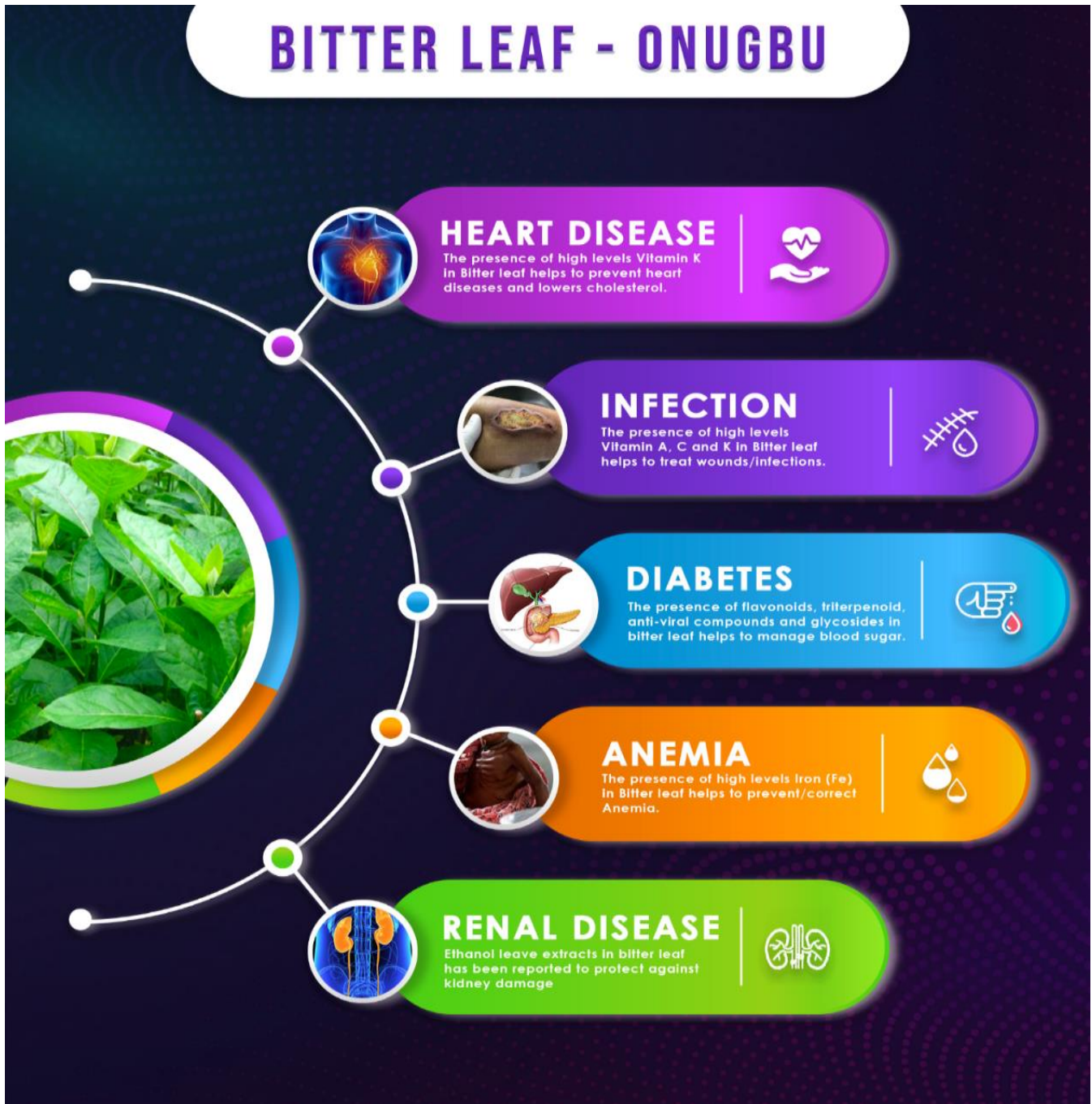


Figure 1. bitter leaf – added value for kidney functions management

Figure 2 shows green amaranth. It grows naturally wild in the farms, though can also be cultivated. Being highly nutritious with high content of antioxidant

vitamins A, C and E; it has been rated as healthiest in fat content and comparable to bitter leaf, mint leaf and waterleaf in fibers [5]. Due to lack of knowledge,

this traditionally consumed vegetable is almost now extinct because people don't value it. Yet, the zinc

content is valuable in fertility and immunomodulation [6].

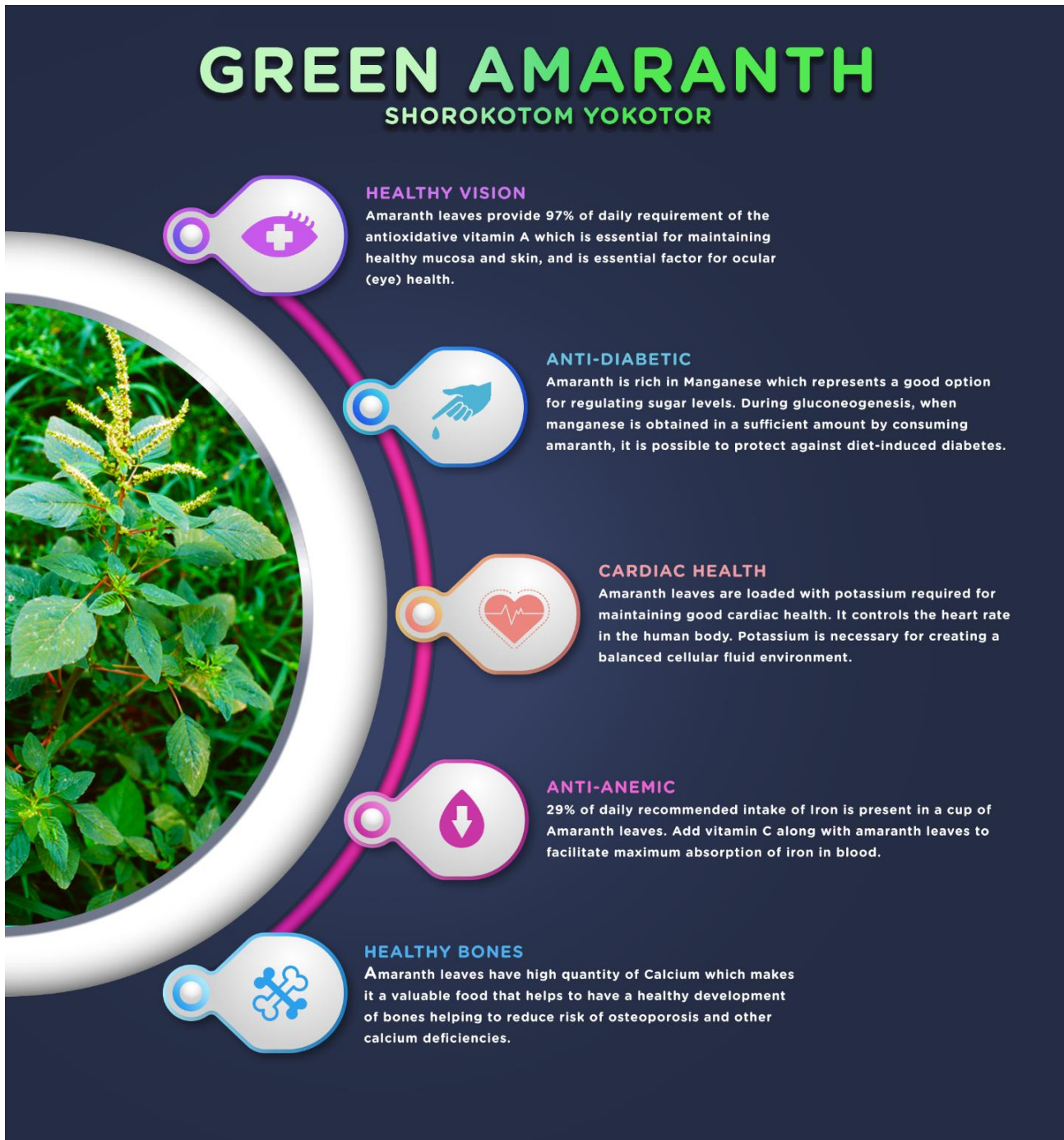


Figure 2. Amaranthus – added value for bone maintenance

Figure 3 is on lemon grass. The vegetable plant can grow naturally, but can also be cultivated e.g. as a cash-crop sold in grocery supermarkets in developed countries. It is indicated to contain more haematinic iron, antioxidant manganese and anti-hypertensive

potassium than chives. It is also better than pumpkin leaf in terms of fat/fibre and carbohydrate/fibre ratios [1]. Lemon grass is (i) well appreciated but grossly under-consumed, (ii) used as spices, and (iii) can be consumed in form of herbal infusion tea.

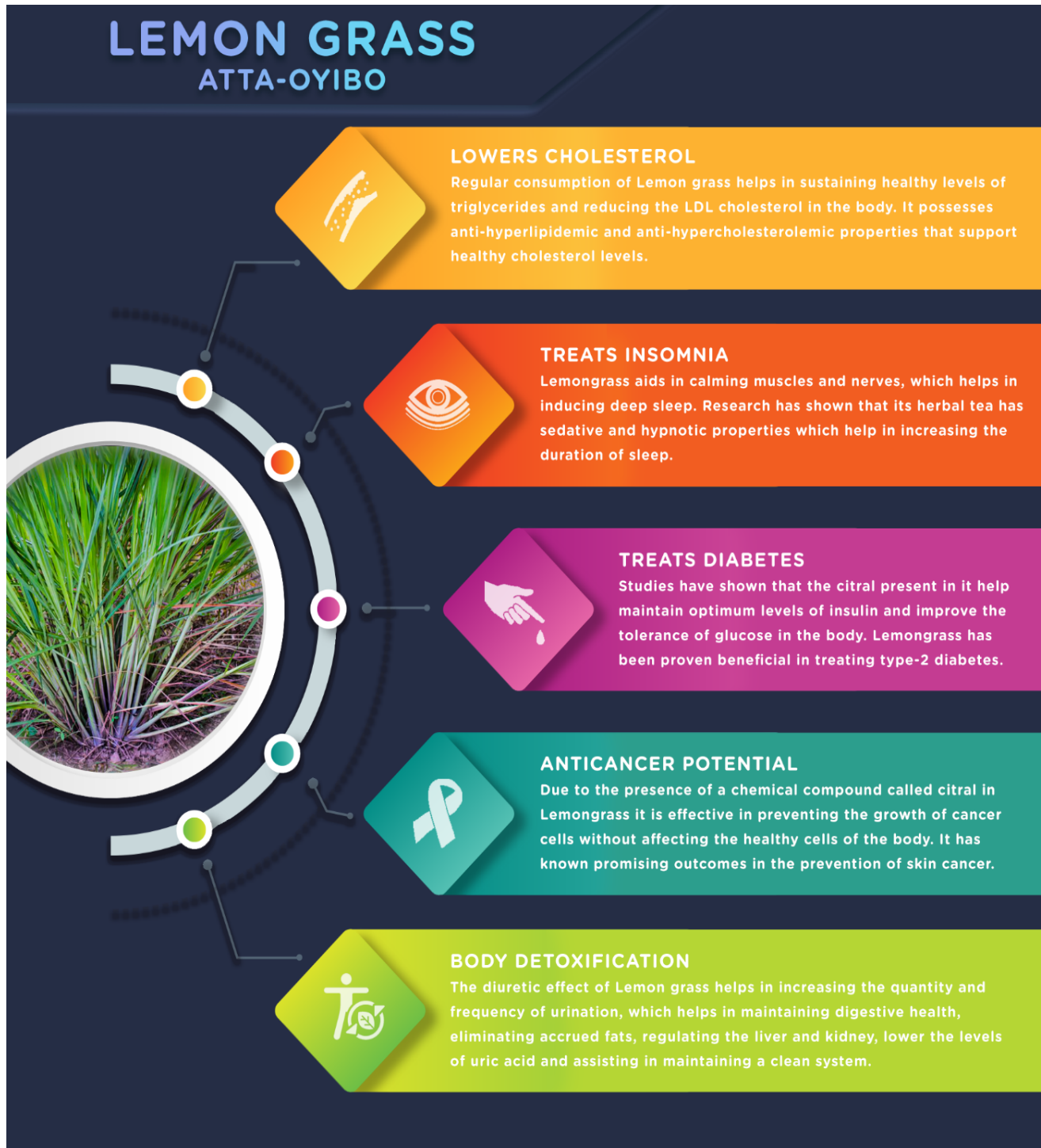


Figure 3. Lemon grass – added value for insomnia management and general detox

Figure 4 is mint leaf. It has the capacity to regenerate, grow wildy and it can be cultivated in domestic vegetable gardens. Mint leaf has a high amount of antioxidant and nutritional values comparable to bitter leaf [7]. Similar to lemon grass, this vegetable is

well appreciated but not routinely consumed in the rural communities, except as spices in occasional social delicacies. It is known that consuming it in form of herbal tea infusion can manage several types of ill-health [8].



Figure 4. Mint leaf – added value for stomach upset management

Figure 5 graphic is Moringa oleifera. This plant is almost extinguished in the living areas, but still grows wildly as a tree at farm lands. M. oleifera is rated to be richer in vitamin C than lemon and orange [9]; and the leaves are equally rich in various bioactive

compounds including antioxidants. Thus, this is one indigenous vegetable that is yet to be fully appreciated [10]; hence not really eaten by the people.

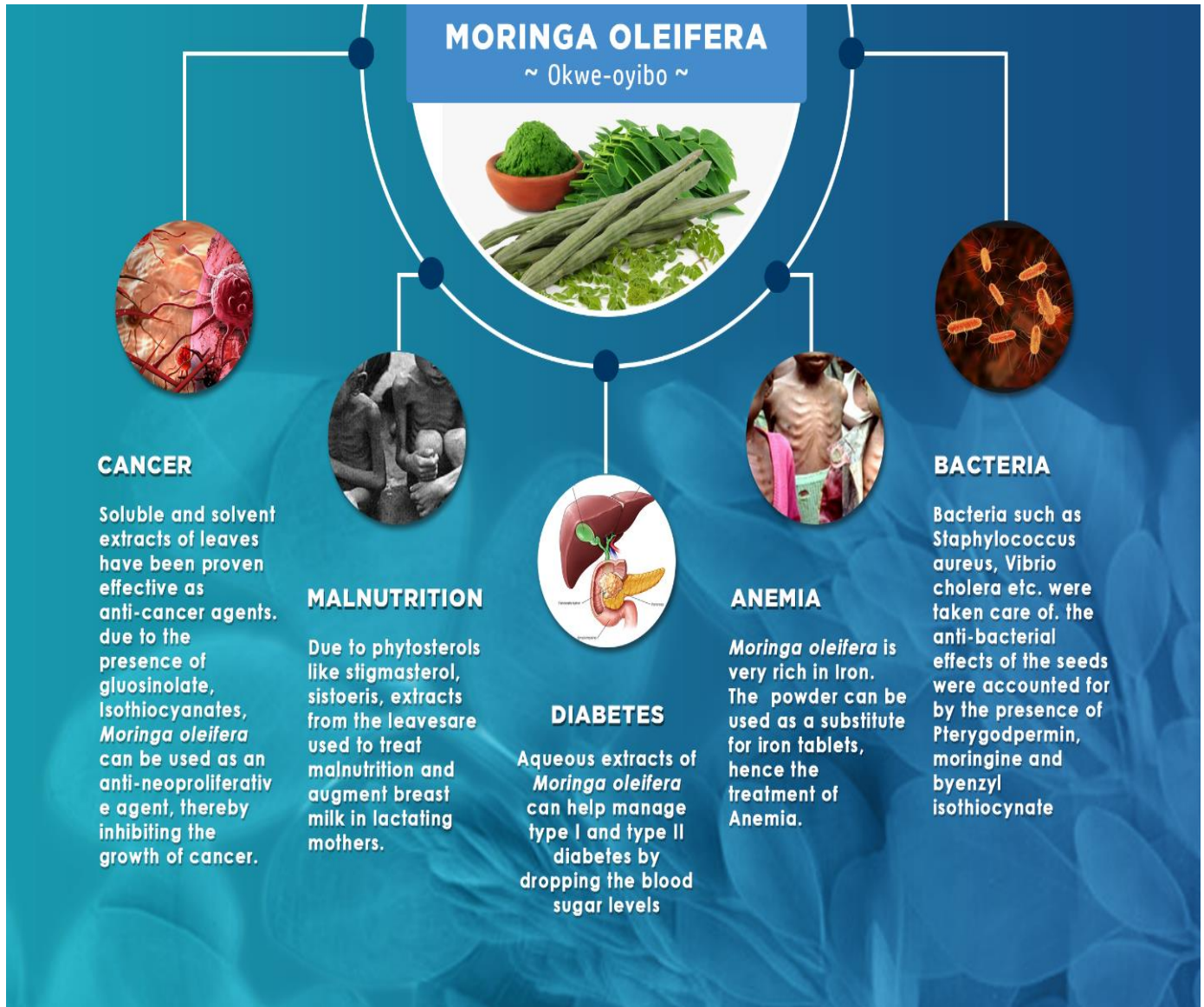


Figure 5. Moringa – added value for cancer and malnutrition management

Figure 6 is the fluted pumpkin (*Telfairia occidentalis*). It is commonly grown as an outdoor domestic food plant and it is widely cultivated for its nutritious and palatable leaves. The fluted pumpkin is rich in

minerals such as Ca, P, and Fe contents but greatest value is probably the higher content of anti-hypertensive potassium relative to other commonly consumed leafy vegetable.

FLUTED PUMPKIN - UGU



Figure 6. Fluted pumpkin

Last but not the least is water leaf i.e. *Talinum triangulare* on (Fig 7). Water leaf is known to grow wild on its own even without cultivation. It is rich in fibre, protein and vitamins; besides its food properties. It is a good source of some important minerals such as magnesium and potassium as well as

antioxidant vitamins. It is credited to be anti-diabetic, anti-dyslipidaemic and anti-hypertensive (i.e. useful in management of metabolic syndrome) due to the potassium content [11]. Water leaf is easily accessible, much appreciated and commonly consumed.



Figure 7. Water leaf – added value for constipation management

Brief note

Though the research works on the health values of indigenous vegetables abounds, [5, 12-15] there is still issue of consumer acceptance that needs to be addressed. It is known that individual’s age as well as vegetable’s familiarity and taste are among factors associated with taste [16, 17].

It is interesting to note that a systematic review of literatures on intervention strategies to improve vegetable consumption indicated there is positive potential for the use of graphics to advance health promotion vis-à-vis intake [17]. However, there is none of such resources on the indigenous vegetables in Ndokwa communities. Therefore, information on the health values of indigenous vegetables in common ailments such as anaemia, metabolic

syndrome and wound management is relatively scarce. Hence, this piece of work.

Evaluation of graphic designs, just like review of other research manuscripts, can be very subjective [18]. However, there are standard questions for critical qualitative and quantitative evaluations of images [19]. The next phase of this work is to welcome volunteer reviewers to use these standard questions to provide feedback.

In addition, quite pertinent is that it will take more efforts to validate the understanding of messages by different users (age, education, gender groups and environment). This will require dedicated validation studies of the different socioeconomic strata. Therefore, this is a crucial step in the project – i.e. to communicate support for the healthy living by consumption of healthy food in a broader setting. Furthermore, there may be cultural or ethical concerns in different populations and places where the designed information is displayed, which may necessitate legal framework (e.g. permission with/without governmental check). One of the agenda in the ongoing work is to investigate these factors that may influence uptake of the educational pictographs. For this, volunteer collaborators are also invited, especially among public health nutritionists and health promotion practitioners.

Implications for the ongoing COVID19 pandemic:

Presently, there is an ongoing COVID19 pandemic and complementary medicine including good nutrition is being advanced in the treatment roadmap [20]. Plants are known for their diverse antioxidant potentials. The antioxidants are hematinic [21-23], by their ability to prevent erythrocyte oxidative stress that would otherwise lead to anaemia [20]. For instance, the bioavailability of the iron from vegetables may be lower relative to meat [24]; but there is also the antioxidant potentials of vegetables. Indeed, the World Health Organisation recommends that “Applied to iron deficiency, efforts should be directed towards promoting the availability of, and access to, iron-rich foods. Examples include ... non-

animal foods such as legumes and green leafy vegetables” [25].

Oxidative stress reduces (while antioxidants improve) haematocrit [21-23].



Vegetables reduce oxidative stress, by their antioxidant potentials [23].



Hence, vegetables indirectly improve haematocrit [25]

Figure 8. Role of vegetables in oxidative stress

Further, antioxidants modulate iron homeostasis [23]. Beyond being haematinics, antioxidants have been identified as having immunomodulatory effects [26]. Also, the ongoing COVID19 pandemic has raised interest on antioxidant potentials copper and zinc [27, 28], which are rarely considerable micronutrients in vegetables. It is pertinent to note that all the vegetables presented here have some levels of copper and zinc (Table 1), as evident from authors [29-32].

Table 1: Copper and zinc contents of the vegetables presented

Source	Vegetable	Copper	Zinc
	Bitter leaf (mg/ kg)	0.2	2.87
Onianwa et al (2001)	Amaranthus (mg/kg)	0.07	2.87
	Pumpkin (mg/kg)	0.07	3.53
	Waterleaf (mg/kg)	0.23	2.92
Prkić et al (2013)	Mint leaf (mg/kg)	3.89	7.97
USDA	Lemon grass (mg/100g)	0.26	0.23
Glover-Amengor (2016)	Moringa (mg/100g)	5.8	21.4

However, several authors acknowledge the significance of balanced diet for a healthy immune status [33-35]; but lack articulation on the immunomodulatory function of the antioxidant content.

Hence, this pictorial may help inform the micronutrient value of the indigenous vegetables

CONCLUSION

This piece of project sets to develop graphical images that would be used as health education resource to promote consumption of indigenous vegetables in Delta State Nigeria. It is first of 2-phased development of the resource. Images of seven vegetables illustrating micronutrient contents that are relevant to anemia, metabolic syndrome and/or wound healing are presented. Voluntary feedback based on objective standard questions are welcomed.

List of abbreviations: COVID19 – coronavirus disease 2019

Competing Interests: There are no conflicts of interest to declare.

Author's Contributions: All the authors contributed to this study. IIC and NEU conceptualized the idea, IIC did the graphics. ES, CH and IEO are supervising the work contributing to the discussion, NEU did the final draft.

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