Determination of Post Harvest Fungi and Proximate Composition of *Amarantus hybridus* Sold in Different Markets in Port Harcourt

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DOI: 10.56201/rjfsqc.v8.no1.2022.pg32.39

ABSTRACT

Study on the determination of post harvest fungi and proximate composition of Amaranthus hybridus sold in different markets of Port Harcourt was carried out in the Department of Plant Science and Biotechnology, Rivers State University. Six markets were selected for the study Viz: Rumuokoro, Rumuokwuta, Choba, Mile 1, Slaughter and mile 3. It control experiment conducted in the departmental Screen house, the method of Association of AnalyticalCchemist (AOAC, 2005) was used to assess the proximate composition of all the samples while the cultural laboratory technique was adopted for the Isolation and Characterization of associated post harvest fungi. Investigation of proximate composition shows the presence of moisture, ash, lipid, fibre, carbohydrate, protein and energy in all tested samples. However highest values of lipid (5.65 ± 0.65 %) and carbohydrate (4.2 ± 0.10%) were recorded for samples obtained from mile 1 market. Samples from Slaughter market recorded highest value of ash (2.45± 0.05%) and protein (12.55 ± 0.05%). Highest value of moisture (82.75 ± 0.25%), fibre (3.40 ± 0.00%) and energy (338.6 ± 0.8 kcal/kg) were recorded for Rumuokwuta, Mile 3 and control samples respectively. Five fungal organism (Candida sp, Mucor sp, Trichophytom sp, Penicillum sp, and Rhizopus sp) were Isolated in the present study. Although Mile 3 sample recorded the highest contamination Viz (Candida, Mucor, Trichophytom and Penicillum). Lowest contamination was recorded for Mile 1 sample as it indicated only the presence of Rhizopus. Generally all samples of A. hybridus assessed were rich in nutrient elements and had post harvest fungi. Notwithstanding, samples from Mile 1 had highest proximate composition nutrient and lowest post harvest fungal incidence.

Key words: *Amaranthus hybridus, Post harvest fungi, proximate composition*

INTRODUCTION

Green leaf (*Amaranthus hybridus*), regularly called green amaranth, thin amaranth, smooth amaranth, smooth pigweed, or red amaranth, is a types of yearly blossom, mint plant. It is a weedy animal variety of plant found in North America and brought into Europe. *Amaranthus hybridus* develops from a short taproot and can be up to 2.5 m in tallness (Taylor., M.B, 2007)

It is a glabrous or glabrecent plant. *Amaranthus hybridus* was initially a trailblazer plant in eastern North America. It has been accounted for to have been found in each state with the exception of Utah, and Alaska. It is likewise found in numerous areas of Canada, Mexico, the West Indies, Central America, and South America. It has naturalized in various spots, including upsetting environments (Dhalla Rosa, 1993).

Numerous other *Amarathus species* are accepted to be regular hybridizations or got from *A.hybrids*. It is perceived as a destructive weed of North American harvests. The plant was utilized for food and medication by a few Native American gatherings and in conventional African medication. It is among the species eaten as Quelitequinto, nilli in Mexican food markets (Agros., 2005)

Amaranthus hybridus is a nutritious, without gluten grain that gives a lot of fibre, protein and micronutrients. It has additionally been related with various medical advantages, including decreased aggravation, lower cholesterol levels and expanded weight reduction. *Amaranthus hybridus* is exceptionally restorative with both the seed; oil and leaf are utilized as food. The whole plant is utilized for ulcers, looseness of the bowels, expanding of the mouth or throat and elevated Cholesterol. (Dhalla Rosa., 1993)

In food, *Amaranthus hybridus* is utilized as a pseudocereal. The leaves are plentiful in vitamin A and a cup can meet 97% of your day by day need for this antioxidative nutrient. They are likewise loaded with flavonoid, polyphenolic, cell reinforcements like beta-carotene, zeaxanthin, and lutein which give a defensive layer against oxidative pressure brought about by free extremists. It is additionally wealthy in folate and iron as pregnant women can likewise consume and it assumes a part in mental health of child and backing the placenta (Patel., 2012)

Hence this study was designed to evaluate the nutrients and fungal flora of A. hybridus bought from different markets in Port Harcourt as well the cultivated sample within the department.

MATERIALS AND METHODS

Collection of Samples

Amaranthus hybridus was Purchase from six distinct markets in Port Harcourt city, Slaughter market, Choba market, Mile 1 market, Mile 3 market, Rumuokoro market and Rukpokwu market and brought to the Department of Plant Science and Biotechnology. A control was planted at the screen house of the department for proper comparison.

Cultivation of control sample

Seeds of *Amaranthus hybridus* were obtain from mile 3 Diobu market. The seeds were planted into polyethene bags of 10cm containing 2kg of gardensoil. The bags were monitored and watered till *A. hybridus* was ready for harvest.

Nutrient analysis

The method of AOAC, (1990) was adopted for the assessment of proximate composition of *A. hybridus* collected from the various markets and the cultivated sample for the determination of moisture, ash, fibre, lipid, carbohydrate, protein and energy.

Mycological Studies

Preparation of Mycological Medium

Sterilization of conical flask, slides, Petri dishes and all the equipment needed for the experiment was carried out in the laboratory. The glass waves were sterilized in the oven at 120^0C for an hour after washing with soaps while other equipment were surface sterilized with 70% ethanol to reduce microbial contamination (Chuku, 2009). Inoculating loops and scapels were sterilized by dipping for 20 seconds in 70% ethanol and heated to red hot. The mycological medium used was Sabouraud Dextrose Agar prepared in a conical flask using the standard method. The mouth of the flask was plugged with non-absorbent cotton wood and wrapped with aluminum foil. The conical flask containing the mycological medium was autoclaved at 121^0C and pressure of 101kg cm^{-3} for 15 minutes. The molten afar was allowed to cool to about 40^0C and dispensed into Petri dishes at 15mls per plate and allowed to further cool and solidify.

Isolation of Fungi

The direct plating method of Mehrotra and Aggarwal (2003) was adopted where samples of spoilt leaves were inoculated into Sabouraud dextrose agar in Petri dishes containing Ampicillin to hinder the growth of bacteria and this was done in triplicate. The inoculated plates were incubated for 5 days at ambient temperature of 25^0C ± 3^0C. The entire set up was observed for 7 days to ensure full grown organisms Pure culture of isolates were obtained after a series of isolations.

Identification of Fungal Organisms

Microscopic examination of fungal isolates was carried out by the needle mount method (Cheesebrough, 2000). The fungal spores were stained with cotton blue in lacto phenol and examined microscopically using both the low and high power objective. The fungi were identified based on their spore and colonial morphology, mycelia structure and other associated structurse using the keys of (Barnett and Hunter, 1998).

Determination of Percentage Incidence

The percentage incidence of fungal occurrence was determined by the formular stated below (Chuku *et al,* 2019).

$$\frac{X}{Y} \times \frac{100}{1} = \% \text{ Incidence}$$

Where;

X – Total number of each organism

Y – Total number of all identified organism

Data Analysis

Data obtained from the above studies were subjected to analysis of variance (ANOVA). Duncan multiple range test was also used for mean separation with the aid of SPSS version 25.

RESULTS

Table 1: Proximate Composition of *Amaranthus hybridus* from different market (%)

Markets	Moisture	Ash	Lipid	Fibre	CHO	Protein	Energy (Kcal/Kg)
Rumuokoro	80.25 ± 0.25^{cd}	1.45 ± 0.05^{a}	2.45 ± 0.05^{b}	1.55 ± 0.05^{b}	3.35 ± 0.05^{d}	11.55 ± 0.05^{b}	198.5 ± 1.0^{c}
Rumuokwuta	82.75 ± 0.25^{e}	1.62 ± 0.02^{b}	1.65 ± 0.05^{a}	1.62 ± 0.005^{b}	3 ± 0.10^{c}	10.55 ± 0.05^{a}	123.4 ± 0.90^{b}
Choba	80.75 ± 0.25^{d}	1.45 ± 0.05^{a}	3.55 ± 0.05^{c}	3.15 ± 0.05^{d}	2.75 ± 0.05^{b}	10.55 ± 0.05^{a}	224.45 ± 4.75^{d}
Mile 3	78.25 ± 0.15^{b}	1.55 ± 0.05^{b}	3.60 ± 0.10^{c}	3.40 ± 0.10^{e}	1.5 ± 0.10^{a}	11.5 ± 0.10^{b}	109.2 ± 1.90^{a}
Slaughter	74.1 ± 0.10^{a}	2.45 ± 0.05^{d}	5.55 ± 0.05^{d}	2.35 ± 0.05^{c}	3.05 ± 0.05^{c}	12.55 ± 0.05^{c}	292.5 ± 1.0^{e}
Mile 1	74.15 ± 0.15^{a}	2.35 ± 0.05^{c}	5.65 ± 0.05^{d}	2.35 ± 0.05^{c}	4.2 ± 0.10^{e}	12.4 ± 0.10^{c}	295 ± 3.50^{e}
Control	79.95 ± 0.05^{c}	1.55 ± 0.05^{b}	2.45 ± 0.05^{b}	1.45 ± 0.05^{a}	3.3 ± 0.10^{d}	11.45 ± 0.15^{b}	338.6 ± 0.80^{f}

N.B. Means within the same column with different super script (^{a,b,c,d}) are significantly different ($P<0.05$). CHO=Carbohydrate

TABLE 2: FUNGAL PERCENTAGE INCIDENCE

MARKETS	*Candida* sp.	*Mucor* sp.	*Trichophyton* sp.	*Penicillium* sp.	*Rhizopus* sp.
RUKPOKWU	70	-	-	-	20
CHOBA	100	-	-	-	-
RUMUOKORO	60	20	-	20	-
SLAUGHTER	60	40	-	-	-
MILE 1	-	-	-	-	100
MILE 3	20	10	50	20	-
CONTROL	-	-	60	40	-

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The result of proximate composition of *Amaranthus hybridus* has shown the presence of Moisture, Ash, Lipid, Fiber, CHO, Protein and Energy. Rumuokwuta market leaf samples had the highest moisture content (82.75±0.25) followed by Choba market samples (80.75±0.25), Rumuokoro market leaf samples (80.25±0.25), control (79.95±0.05), Mile3 market leaf samples (78.25±0.15), Mile1 market samples, (74.15±0.15), and samples from Slaughter Market (74.1±0.10). Ash content of *A. hybridus* from Slaughter market samples recorded the most (2.45±0.05)**,** Followed by Mile1 market samples, (2.35±0.05), Rumuokwuta market samples, (1.65±0.02), leaf samples from control and Mile3 market samples recorded (1.55±0.05) respectively while and Rumuokoro market samples and Choba market samples recorded (1.45±0.05) respectively.

Lipid content from Mile 1 market samples had the highest **(**5.65±0.05**)** followed by Slaughter market leaf samples (5.55±0.05), Mile 3 market samples (3.60±0.10), Choba market leaf, (3.55±0.05), Rumuokoro market leaf and leaf from control (2.45±0.05) and Rumuokwuta market leaf sample (1.65±0.05). Fibre content from Mile 3 market samples gave the highest **(**3.40±0.01**)** followed by Choba market leaf samples (3.15±0.05), Mile1 market leaf and Slaughter market leaf recorded (2.35±0.05), Rumuokwuta market leaf samples (1.62±0.05), Rumuokoro market samples (1.55±0.05) and leaf samples from control recorded (1.45±0.05). Carbohydrate content for leaf samples from Mile 1 market had most elevated value **(**4.2±0.10**)** trailed by leaf sample from Rumuokoro market (3.35±0.05), control, (3.3±0.01), Slaughter market (3.05±0.05), Choba market leaf (2.75±0.05) and Mile 3 market leaf (1.5±0.10).

Protein content for samples gathered from slaughter market had the most elevated, **(**12.55±0.05) followed by Mile1 market, (12.4±0.10), Rumuokoro market (11.55±0.05), control, (11.45±0.15), Mile 3 market, (11.5±0.10) and leaf samples from Rumuokwuta market and Choba market (10.55±0.05) respectively While leaf samples from control had most elevated Energy (338.6±0.80) followed by leaf samples from Mile 1 market (29.5±3.50), leaf samples from Slaughter market recorded (292.5±1.0), leaf samples from Choba Market recorded (224.45±4.75), leaf samples from Rumuokoro market recorded (198.5±1.0), leaf sample from Rumuokwuta market (123.4±0.90) and leaf sample from Mile 3 market recorded (109.2±1.90).

The current review has shown that *A. hybridus* had considerable measures of moisture, ash, lipid, fibre, carbohydrate, protein and energy; in addition the study also revealed varying concentrations of the above proximate parameters for the different market source as well as the control. Several authors have also reported similar results on proximate composition of *A.hybridus* as well as others edible leafy vegetables (Akindahunsi and Salawu, 2005; Gupta *et al.*, (2005). Akubunate*et al.*, (2007) reported similar results for proximate composition in *A. hybridus* but higher contents for moisture, ash, fibre, carbohydrate and protein. Although he further reported lower contents for lipid and energy.

Ogwu, (2020) additionally assessed the general piece of *A. hybridus* and recorded higher proximate value than those found in the current study. However, Topwal, (2019) detailed lower an incentive for lipid (0.5 - 0.3) and protein (3.5 - 2.5) for *A. hybridus* leaves compared to those detailed in this study. Oluwole *et al.*, (2019) also reported lower values for the proximate composition assessed in the current study for leaves of *Amaranthus*. Akinnibosun and Adeola, (2015) also assessed the proximate composition of *A. hybridus* values. In spite of the fact that they revealed lower moisture and lipid similiar in protein (12.86±0.19) and higher fibre, ash and carbohydrate as compared to the current study. These nutrient conents

play significant roles in when consumes as they do not serve as a source of energy but also amino acid (Soriano-Garcia *et al.*, 2018).

The result of fungi isolates and percentage incidence showed the occurrence of Candida, Mucor, TrichophytomPenicilluim and Rhizopus. Be that as it may, Candida, Mucor, Trichopyton, Penicillium and Rhizopus as isolate from samples. Sample from Rukpokwu market had the most elevated rate occurrence of Candida (70%), Rhizopus (20%) present separately. Sample from Choba market just recorded Candida (100 percent). Sample from Rumuokoro market recorded Candida with percentage incidence of (60%), Mucor (20%) and Penicillium (20%). Sample from Slaughter market has Candida (60%), and Mucor (40%). In Mile 1 Rhizopus recorded (100 percent). Sample from Mile 3 had Trichophyton (50%), Penicilluim (20%) and Mucor (10%). While sample from the Control had Trichophyton (60%) and Rhizopus (40%) separately.

The present studies has shown that *A. hybridus* also faces the challenge of contamination and spoilage by fungal organisms as *Candida sp, Mucor* sp., *Trichophyton rubrum*, *Penicillium italicum* and *Rhizopus* sp. were all isolated in the current study. Prior to studies, different analysts had implicated similar fungal organisms to be responsible for the contamination *A.hybridus* and other leafy vegetables (Chuku & Ugorji, 2012a). Literature has also shown that vegetable mycoflora are mainly sourced from the planting soil, water, animals and improper handling practices (Chuku & Ugorji, 2012b). The isolates of the present study agrees with the findings of Akinnibosun&Adeola, (2015) as they also implicated Rhizopus, Mucor and Penicillium species to be responsible for the contamination of *A.hybridus* leaves. Moreover, Blodgett and Louw, (2004) also revealed the occurrence of several fungal genus including Rhizopus and Penicilium to be associated with cankered and decayed stems of *A. hybridus*. Sun *et al.*, (2013) also reported similar fungal organisms as seen in the present study on *Amaranthus genus*.

The presence of the isolates discourages the consumption of *A.hybridus* as they do not only affect the appearance of the leaves but also the quality of produce and income of farmer and traders. Fungal organisms also pose serious health risk as they are able to produce aflatoxin and cause other disease like candidiasis called by candida sp (Schipper, 1984; Amaike and Keller, 2011).

CONCLUSION

Amaranthus hybridus possesses valuable nutrients such as moisture, ash, fibre, Carbohydrate, Protein and energy, although it still faces the challenge of post harvest fungi such as Rhizopus, Mucor, Trichophyton, Penicillum and Candida. Therefore proper hygienic measures should be adopted by market trader and consumers to protect this valuable vegetable.

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