Microbiological and proximate compositionof African star apple (Chrysophyllumalbidum) fruit sold in Osogbo metropolis, Osun state, Nigeria

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Abstract
Microorganisms associated with African star apple fruit (Chrysophy lumalbidum) consumed in Osogbo metropolis were determined.The microorganisms wereisolated and identified using convectional microbiological and biochemical techniques. The microorganisms isolated from the peel of the fruit were Bacillus cereus, B. polymyxa, Proteus mirabilis, Pseudomonasaeruginosa Staphylococcus aureus, Rhizopusstolonifer, Mucormucedo while Leuconostocmesenteroides, Lactobacilli plantarum, Aspergillus flavus, A. fumigatus and A. niger were isolated from the pulp. The proximate compositions were also determined using standard chemical methods. The results of the proximate analysis showed that the pulp and the peel contained 73.5% and 69.7%moisture, 7.8% and 6.1% of crude protein, 5.5% and 3.7%of fat, 35.0 and 64.4%of crude fibre, 2.7% and 2.7% of ash, 8.56% 9.21% of carbohydrate respectively. As with most fruits, it has low calorie because of its little fat content so it is definitely a healthy food. It is also a superb snack because its high fibre and moisture content which provides food bulk which both increases satiety and aids digestion therefore, making it very ideal for weight watchers. It is advised however to be consumed in moderation due to the acidic nature in the mouth, this quality will not qualify it as acid, since it is actually alkalizing when it gets into the body except on contact with our mouth and delicate stomach lining.

Keywords: Microbiological, Chrysophy llumalbidum, proximate, seasonal

1. Introduction

African Star Apple also known as Agbalumo(Yoruba), Udara(Igbo) Eastern Nigeria, is associated with the dry season and has been enjoyed over the years by Nigerians as a fruit. It belongs to the Sapotaceae family. The *Chrysophyllumalbidium* (*Sapotaceae*) tree is common throughout the tropical Central, East and West Africa regions for its sweet edible fruits and various ethno-medical uses (Amusa*et al*.,2003). *Chrysophyllumalbidum* fruit is common in both urban and rural centers especially during the months of December to April.

The fruits are not usually harvested from the trees, but left to drop naturally to the ground where they are picked.The fruit is seasonal, when ripe,it is ovoid to sub-globose, pointed at the apex, and up to 6 cm long and 5 cm in diameter. The skin or peel, is orange to golden yellow when ripe and the pulp within the peel may be orange, pinkish, or light yellow, within the pulp are three to five seeds which are not usually eaten. The seed-coats are hard, bony, shiny, and dark brown, and when broken reveal white-coloured cotyledons.

The fruit has immense economic potential, especially following the report that jams that could compete with raspberry jams and jellies could be made from it (Okafor, 1981). The fleshy fruit pulp is suitable for jams and is eaten especially as snack by both young and old (Okafor, 1981, Amusa*et.al*., 2003).It has been found to have the highest content of ascorbic acid per 100g of edible fruit or about 100 times that of oranges and 10 times of that of guava or cashew (Pearson, 1976) It is reported as an excellent source of vitamins, irons, flavours to diets (Nwadinigwe, 1982; Adisa, 2000).

In addition, its seeds are a source of oil, which is used for diverse purposes. The fruits also contain 90% anarcardic acid, which is used industrially in protecting wood and as source of resin, while several other components of the tree including the roots and leaves are used for medicinal purposes (Adewusi, 1997). The Bark of the tree is used as a remedy for yellow fever and malaria, while the leaves are used as emollients and for the treatment of skin eruptions, diarrhea and stomach-ache, which are as a result of infections and inflammatory reactions (Adewusi, 1997).

The leaf extract also contains hypoglycemic (to treat diabetes) and anti—platelet activities, although it also had toxic effects on some organs. It is a rich source of natural antioxidants booster which removes free radicals from oxidative stress related disease such infections as; diabetics, cancer and coronary heart diseases (Burits andBucar, 2000). Studies have shown a diminished risk of chronic diseases in populations consuming diets high in fruits and vegetables and it has been suggested that antioxidants found in large quantities in

fruits and vegetables may be responsible for this protective effect (Halliwell, 1994). Generally, food antioxidants act as reducing agents, reversing oxidation by donating electrons and hydrogen ions.A recent study by researchers showed that the local cherry fruit, African star apple (Agbalumo, Udara) lowered blood sugar and cholesterol, and could be useful in preventing and treating heart diseases.

The cotyledons from the seeds of *Chrysophyllumalbidum* are used as ointments in the treatment of vaginal and dermatological infections in Western Nigeria.It is also an excellent source of raw material for industries. Tannins, flavonoids, terpenoids, proteins, carbohydrates and resins are the phytochemicals that have been reported in *Chrysophyllumalbidum*. Therefore, the objectives of this work are to determine the associated microorganisms of African star fruits sold in Osogbo, the proximate compositions of the peel and the pulp of the fruit since it is the peel and the pulp that are usually consumed.

Plate1: Shows the African star apple sold in Osogbo

2. Materials and Methods

Sampling method

Ten fresh and healthy African star fruit were bought in Ota Efun marketfrom five different sellers, another ten were bought in Igbona market on the market day from 5 different sellers also another 10 from 5 different sellers in Olu-ode market, and 10 from another 5 sellers from Sabo market In February, making 40 fruits. Each fruit wasplaced separately in sterile plastic bags and transported tothe laboratory for processing within 1 h of purchase.

Agar used

The agar used were plate count, Sabouraud dextrose, Lactose and EMB agar, for determining total plate count, fungal count and the last two for coliform count respectively. They were prepared according to manufacturer's instruction.

Determination of microbial load

Each of the fruit was washed separately inside sterile distilled water and then, the water was serially diluted and pour plated. Aliquots of 0.2 mL of the dilutions (10^{-4})was plated induplicate onto different media plates. All the mediawere prepared according to the manufacturer'sinstruction. Plates were incubated for 24 h at 37ºC.Sabouraud Dextrose agar plates were however, left at roomtemperature. Colonieswere counted after the incubation time using Colonycounter (Stuart Scientific, UK).

Purification of Isolates

Inoculation of each of the different colonies on the different agar medium was made onto Nutrient agar plates. All inoculated plates wereallowed to solidify, inverted and incubated at 37ºC for 24 h.

Sabouraud Dextrose agar plates was however, incubatedat 28ºC for 72 h.Distinct discrete colonies on the two differentmedia were isolated and purified on nutrient agar and sabouraud dextrose agar respectively byrepeated sub-culturing and stored on agar slants at 4^{o}C.

Characterization of isolates:

Coliform organisms: Five mL of each water sample were inoculated into lactose broth with Durham's tubes. Te presence of gas after 24-48 h of incubation constitute positive presumptive test.From the original water sampled, the positive ones were serially diluted and pour plated on EMB agar plates for confirmed test.

Fungal isolates:

Identification was based on theirmacroscopic and microscopic characteristics as seen inculture morphological characteristics. Reference was made to standard identification keys and atlas (Fawole and Oso, 1986;Tsuneo, 2010).

Bacterial isolates:

Typical colonies stored on nutrient agar slants at 4ºC wereresucitated, Gram stained.Further characterization of pure cultures stored on agar slants at 4ºC was by the methods ofOlutiola*et a*l., (2000) using cultural characteristics and biochemicaltests-IMVIC test, carbohydrate utilization, reaction onTSI, gelatin liquefaction, nitrate reduction, motility,Oxidase and Urease production IMViC test was also done to characterise the coliforms.

Determination of proximate composition

The moisture, fat, fibre content were determined according to AOAC(1990).

3. Research Results

Mean results of the total plate, coliform and fungal counts are shown in figures 1-4 below. The total plate counts were highest in Ota-efun market followed by Olu-ode, Igbona and Sabo market . The moisture and fibre contents were highest among other compositions, while the ash contentwas the least as seen in figure 5.

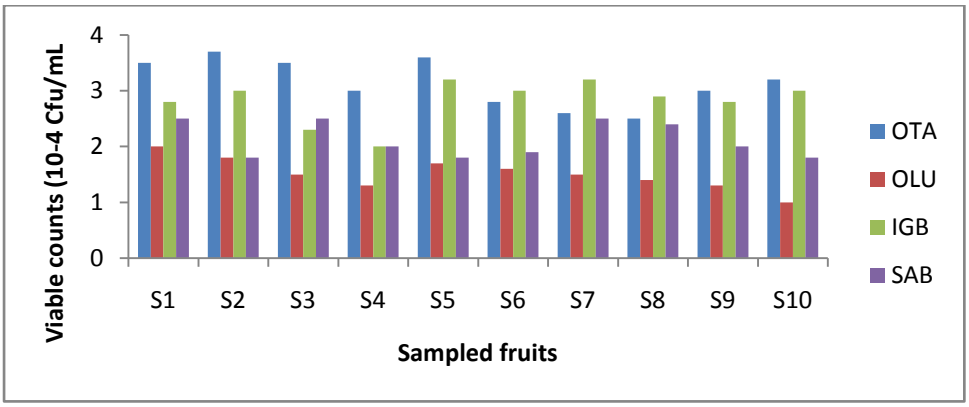

Figure 1: Total plate counts of the sampled fruits in the concerned markets

Key: OTA: Ota efun market, OLU: Olu ode market, IGB: Igbona market
SAB: Sabo market

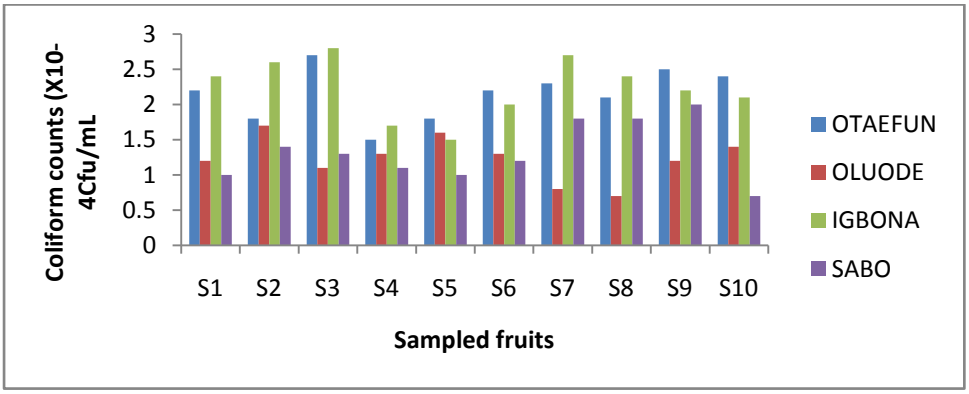

Figure 2: Average coliform counts of the sampled fruits in the concerned markets

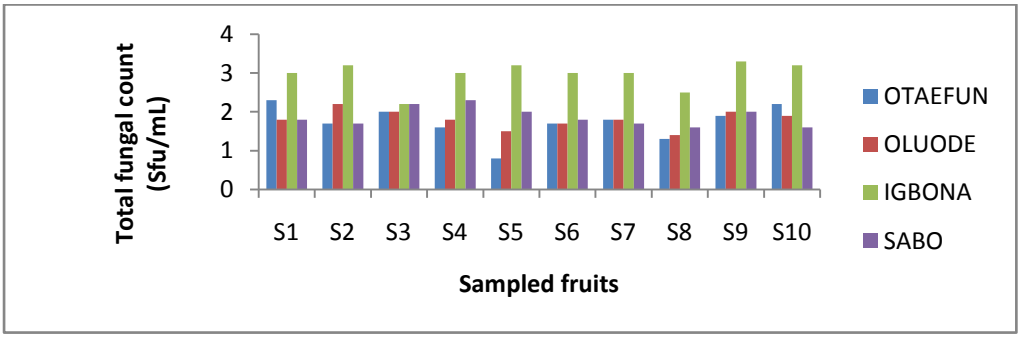

Figure 3: Total fungal counts of the sampled fruits in the concerned markets

Table 1: **Microorganisms isolated from each market**

Market	Isolated microorganisms
Ota efun	*Bacillus subtilis, B. polymyxa, Pseudomonas aureginousa, E. coli,Aspergillus niger, A. fumigates. Penicillium, Rhizopus and Mucormucedo,Staphylococcus aureus, B. cereus, L. plantarum*
Igbona	*Bacillus subtilis, Pseudomonas aureginosa, Rhizopusnigricans, Staphylococcus aureus, N. mesenteroides,*
Oluode	*Staphylococcus aureus, E. coli, Salmonella spp, Shigellaspp, Bacillus subtilis*
Sabo	*Staphylococcus aureus and Bacillus subtilis, Salmonella spp., Enterobacter aerogenes*

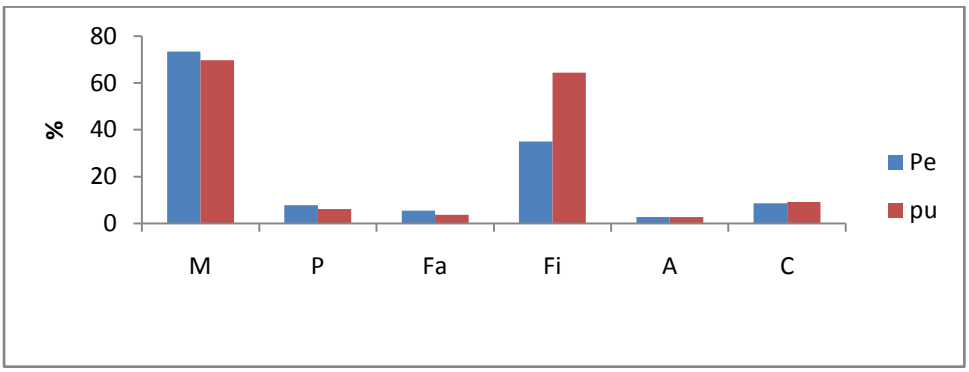

Figure 5: Representative proximate compositions of the peel and pulp of African star apple

Key: M: Moisture content, P:Protein, Fa: Fat, Fi: Fibre,A: Ash, C: Carbohydrate, Pe: Peel and Pu: Pulp

4. Discussion

Microorganisms get into our fruits during cultivation, transportation and the environment in which the food is kept contributes greatly to its contamination (Ray and Bhunia, 2007). The fruits ondisplay for sale are often visited by many hands of thecustomers and by the vendors. These individuals pick anddrop as many fruits as are available, to enable themmake a choice. Poor handling by unhygienic hands is afactor contributing to the high microbial load.

Water of questionablequality which often is used to washthe fruits before taking to the market to are contributing factors that could aid the survivaland possible multiplication of contaminants on fruitsurfaces. Besides Ota efun is a local market in which people go to farm on the market day and bring their products directly to the farm.

The microorganisms reported for this workcorroborate the findings of other studies on fruits andvegetables (Eni*et al*., 2010). Coliformsare indicator organisms and counts of 10^4-10^6Cfu/samplereported in this work are a cause for concern, since thefruits are usually consumed without further processing.Some of the bacterial isolates from the fruits areGram negatives and non pathogenic, however, thepresence *E. coli*, *Salmonella*spp, *Shigella*spp which areoften associated with poor sanitary practices indicate thatthey put a pointer to a potential risk of food borne illnessto consumers (Oranusi*et al*., 2006,2007; Eni *et al*., 2010). *Staphylococcus aureus* and*B. cereus* are common food contaminants from Man andthe environment, their presence in food however, need tobe controlled because they have been reported as cause ofmajor food borne illnesses (Mudgil*et al*., 2004; Oranusi*et al*., 2007).

The fungal isolates of the fruits in this study*Aspergillus*spp; *Penicillium*spp, *Rhizopus*, *Mucor*sppare common environmental contaminants, (Tournas, 2005). The fibre content of the representative sample was relatively higher han some other contents (32%-peel) and (64% -pulp),fiber helps to manage weight, lowers cholesterol, keeps bowel movements regular, and reduces the odds of getting diabetes and heart disease(Burits and Bucar, 2000).

5. Conclusion and Recommendation

The star apple fruits sold in Osogbo metropolis are contaminated, the presence of *Shigella*spp, *S. aureus*, *Salmonella* and *B. cereus* which are known pathogenscalls for concern. Education of fruit vendors on food hygiene, and food safety, public enlightenment for consumers and allconcerned from production to transportation andmarketing would help to prevent possible food borneillness associated with consumption of fruits. Proper washing of fruits before consumption should be emphasized.

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