A Review of the Educational Implications of the Causes, Effects and Benefits of Allium Cepa (Onion Bulbs) in Okene Metropolis, Okene, Nigeria

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ABSTRACT
This review was carried out to determine the educational implications of the major causes, effects and benefits of Allium cepa (onion bulbs). The study revealed that most people in the area of the study were not knowledgeable about the causes, effects and benefits of consuming onion bulbs. From this review, microorganisms like Mucor spp, Aspergillus spp, Staphylococcus aureus, and Bacillus spp. were major microorganisms incriminated for spoilage of onion bulbs. Other causes included climate condition, nutrient requirement and temperature. On the basis of the findings of this study, recommendations were made which included: adequate control of humidity, storage and temperature, proper sanitation, maintaining dry environmental condition during harvesting. All these would reduce the growth of microorganisms which are associated with onions spoilage.

Keywords: Allium cepa, micro-organisms, harvest, spoilage

INTRODUCTION
Onion (Allium cepa) is a vegetable crop which belongs to the family Alliaceous, (Brewster, 2018). It is a biennial plant but usually grown as an annual. This is because the onion bulb and stem mature within one year while it takes the onion plant two years to fully grow and mature. For this reason, the onions that are commonly eaten are harvested during the first year, and the plant is killed rather than being allowed to go to its second year. The onion plant consists of yellowish to bluish-green leaves which grow alternatively in a flattened, fan-shaped swathe. The stem of the onion plant from which the roots arise is very short while the bulb consists of fleshy connective scales, which are enclosed in paper like wrapping leaves. According to Aliyu, Dikko, Magaji, & Singh, (2008), the bulb, from which the crop is grown is formed differently and as the onion matures, food reserves begin to accumulate in the leaf bases and the onion bulb swells.

Onion is one of the most commonly consumed vegetable crops in the world with China being the number one producer of onions while Japan and India are the second highest producers of green onions and dry onions respectively. Nigeria, ranks sixth amongst the top ten producers of green onion, and eleventh in terms of dry onion production. In Nigeria, onion is grown mostly in Kano, Kaduna, Jigawa, Sokoto, Plateau, Bauchi and Kebbi states. According to statistics and data research, Nigeria had a world share of 5.5% out of a total of 4,339,925 tons of green onions produced in 2012 and a 1.6% share of a total of 82,815,92 tons of dry onions produced around the world. In most cases the crops is grown from its bulbs which are harvested in most countries once a year and are used daily in every home for seasoning and flavouring of foods. Onion is a valuable ingredient in the diet due to its content of sugars, vitamins, minerals, electrolytes, proteins and dietary fibre.

Different varieties of onions are grown in Nigeria some of which is the Red creole a brilliant red short daily variety with medium-sized flattened bulbs. It is a popular standard variety in high demand because of its good keeping quality. It produces mainly single onions from transplants and has a pungent taste.
White Cerole is a short day onion variety it produces onions with an exceptional great keeping quality. The bulbs are firm, small to medium in size with a thick flat shape. They also have a pungent smell with dehydration. Red Tropicana FI Hybrid is a high yielding large, red, thick-flat onion with firm pungent flesh. It is a highly productive and widely adaptable hybrid that needs good management. It is resistant to common fungal diseases. It should be kept in dry well aerated conditions. “Bombay Red” is a variety for dry and warmer conditions. It is small to medium sized, globe shaped, purplish red and pungent. This is a popular short-day variety in India. It is suitable for dry and warm conditions with wide acceptance in home gardens. Bulbs are medium-large, semi round in shape and red in color-flesh, it is firm and pungent. Medium-late maturity. Green bunching is a non-bulbing spring onion.

Numerous benefits have been attributed to onions including prevention of cancer and cardio-muscular disorders, reduction in the blood levels of cholesterol, reduction in osteoporosis, reduction in stomach ulcers, inhibition of the proliferation of cultured ovarian, breast and colon cancer cells, inhibition of platelets mediated thrombosis, prevention of inflammatory processes associated with asthma, treatment of fever, common cold, cough, sore throat and its use as an antimicrobial pigment.

In the tropic most onions are grown with irrigation during the relatively cool dry season in semi arid region, they are not good crop for hot wet tropic. Onion can be grown under a wide range of climatic condition but they succeed best in a mild climate without excessive rainfall or great extremes of heat and cold. They are not suitable to regions with heavy rainfall in the lowland humid tropics. Cool condition for maturation, harvesting and curing. They can be grown on a variety of soil, but the soil should be retentive of water, non-racking and rich in nutrient, a good fertile loam usually gives the best result. They may be grown successfully on peat soils. The soil optimum PH is about 6.0 – 7.0 (Abdelrazzag, 2002) In storage a specific environment must be provided for the onions, if a high quality product is to result. Storage losses are a function of storage environment as well as the condition and cultural practices used during the growing season. Proper control of significantly extend the storage season from that which would result from storage environment that were not matched to the condition of the onions when placed in storage.

Onions may be stored in bulk or may be placed in bins that are stacked in a storage structure. The use of bins may make handing of onions convenient but it does make ventilation of the onions more difficult. Improved bins design may alleviate the ventilation problems in future.

Onion are packed locally by using basket and jute bags these packaging material come locally from palm; bamboo and fibrous jute trees, also they have different sorts and sizes. These packaging materials have the function for transportation and storability of the onions. Again these packaging materials are locally available and relatively cheap. Apart from these few advantages mentioned they have no barrier to dust, not suitable for measuring weight and can easily be crushed which might lead to damage of the onions. The deterioration of raw onions may result from physical factors, actions of their own enzymes, microbial or combination of these factors. Mechanical damage resulting from action of animals, birds, or insects or from brushing, wounding, brushing, cutting, freezing, desiccation or other mishandling, may predispose towards increased enzymatic action or entrance, and growth of micro organisms. Also previous damage by plant pathogens may make the part of the crop used as food unfit for consumption or may open the way for growth of saprophytes and spoilage by them. Contact with spoilage onions may brings about transfer of organisms causing spoilage and increasing the wastage. Improper environment condition during harvest, transit, storage and marketing may favour spoilage.

Genera of bacteria usually present in onion include Pseudomonas spp, Bacillus spp Chromobacterium, Enterobacterium, Flavobacterium, Lactobacillus serratia Staphylococcus spp, Streptococcus spp and others and perhaps general containing plant pathogens, such as Erwinia and xanthomomes. Growth of some micro-organisms may take place between harvesting and processing or consumption of the vegetable. Adequate control of temperature and humidity will reduce such growth.
FUNCTIONS OF ONION BULBS

Onions have been used for thousands of years as an ingredient in various dishes by many cultures around the world. These vegetables can be eaten raw, cooked, fried, dried or roasted. They are commonly used as flavouring and seasoning agent in many dishes. Apart from added an excellent taste to dishes, onions are also provides many health benefits to its users.

In Chinese medicine, onions have been used to treat angina, coughs, bacterial infections, and respiratory problems. And even the World Health Organization (WHO) also supports the use of onions for the treatment of poor appetite and preventing atherosclerosis. Some health benefits of onions are as given below:

**Fight Cancer**
Onion extract is rich in a variety of sulfides, which provide some protection against tumor growth. Some studies have showed, regular consumption of onions helps to reduce the risk of several cancers such as colorectal cancer, oral cancer, laryngeal cancer, stomach cancer, esophageal cancer, and ovarian cancer. It is suggested to consume one onion serving per day (approximately 1/2 cup).

**Cardiovascular Benefits**
The regular consumption of onion has been shown to lower high blood pressure and high cholesterol levels. This is attributed to the sulfur compounds, chromium, and vitamin B6 in onions, which helps prevent heart disease by lowering high homocysteine levels, another potential risk factor for heart attack and stroke, (Fahs & Faucher, 2002).

**Reduce Blood Sugar Levels**
The regular consumption of onions also have been shown to lower the blood sugar levels. A study found that, onions contain allyl propyl disulfide that helps to reduce the glucose levels by increasing the amount of insulin.

**Promotes Gastrointestinal Health**
Onions packed with enormous flavonoids, these flavonoids help to reduce the risk of colon cancer. It has been shown to inhibit the growth of tumors in animals and to protect colon cells from the damaging effects of certain cancer-causing substances.

**Good for Skin**
The onions help in stimulating the circulation of blood in the mucous membrane. It can be applied as poultice to boils, bruises, wounds, etc. Onion juice mixed with honey also can be the best home remedy for acne.

**Stimulate Hair Growth**
Onion is rich in sulfur which is one of the essential nutrients in promoting hair growth. A study has shown that applying onion juice on scalp twice a week for 2 months will stimulates hair regrowth.

**Treats Cholera**
Onion is an effective remedy for cholera. Grind about 30 grams of onions with 5-7 black peppers. Have 2-3 times of the mixture a day. This is effective treatment for cholera. On the other hand, this also helps to lessens diarrhoea and vomiting.

**Maintain Bone Health**
A study revealed that onions also possess the ability of building connective tissue and bone health due to a newly identified substance in it called growth plate chondrocytes (GPCs). Hence onions are very beneficial for women who are at a risk for osteoporosis. There is also evidence to suggest that the risk of hip fracture in menopausal women may be lowered through regular consumption of onions.

**Remedy for Cold and Flu**
Onion is also a great remedy for cold and flu. The Native Americans used them to ward off the common cold and flu. The World Health Organization has even recognized the onion for its ability to help relieve flu symptoms such as coughs, bronchitis, congestion, and respiratory infections.

**Relieve Tooth Disorders**
Recent research shows that onions may kill bacteria that cause tooth decay and other dental problems. Chewing a raw onion for two to three minutes could kill all the germs in the mouth. Placing a small piece of onion on the affected tooth or bad tooth can also help in relieving toothache.


Treat Urinary Disorders
Onion has diuretic properties, which are useful in treating urinary disorders. For those suffering from burning sensation during urination, drink water boiled with 6 to 7 gm of onion, this may relieve the symptoms.

Prevents Blood Clot
Onions are considered as natural anti-clotting agents. The sulfur contents in the onions can suppress clumping of platelets thereby help in preventing blood clot.

Improve Digestive Function
Onions are a good source of dietary fibre and pre-biotics that encourage the growth of good bacteria (probiotics) in the digestive system, thereby improving digestive function.

Protect against Allergies
The onions such as red onions are rich in Quercetin, an antioxidant which is known to have anti-inflammatory and anti-allergy properties. Flavonoids contained in them blocks the allergy creating histamine and other substances. According to a recent study, eye symptoms associated with hay fever are greatly reduced by quercetin. Suggested dosage is 200-400 mg thrice a day.

Anti-Inflammatory Benefits
The quercetin found in onions, along with other substance; help promote a healthy immune system. These substances act as anti-inflammatory agents, which reduce the effect of inflammatory diseases such as rheumatoid arthritis.

Onion Spoilage in Nigeria
Onions are associated with micro-organisms which are capable of causing spoilage. This spoilage usually occurs during harvesting, post-harvesting, transportation, marketing and storage. In tropical countries the storage is in ambient temperature (24-32°C) and at a variable relative humidity depending on location and season.

Factors that Causes Onions Spoilage in Nigeria are stated below as follows:
Bulb-rot is a common cause of onion loss or spoilage during storage. They are caused by microorganisms particularly fungi the black mould disease caused by Aspergillus niger is a limiting factor in onion production worldwide. Aspergillus niger has been reported to survive between onion crops as a soil saprophyte in or on bulbs in field or storage and is ubiquitous in nature. Onions are prone to spoilage by fungi during harvesting, handing storing and marketing processes.
Adebayo and Diyaolu,(2003) & Gashua et al. (2014) opined that fungi, especially moulds are important pathogens of fruits and vegetables particularly under tropical and sub-tropical condition.
Gent & Mohan, (2006) estimated that bulb rot account for 10%-15% of storage losses of different varieties during three month storage period under local condition. Five fungal belonging to different genera are found to be responsible for the spoilage of onion bulbs. These genera include Penicilum, spp, Aspergillus flavors, Fusarium spp, Aspergillus niger and Mucor spp. Among the fungi isolated from rotten bulbs, Fusarium species are responsible. Aspergillus spp grow on the surface of onion bulbs but did not cause rotting when inoculated artificially. Generally spoilage fungi are known to toxigenic or pathogenic under favorable conditions (Adebayo et al. 2012). Al-Hindi et al (2011) isolated toxigenic fungi from spoiling fruit, pathogenic fungi are cable of causing infections. Aspergillus spp are known to produce several toxic metabolites.
During refrigeration some moulds may also produce mycotoxins. Bulb rottening by storage losses of onions in Nigeria as well as other countries in the world are well documented by Adamick,(2004). Botrytis Neck rot is also a micro organisms capable of causing spoilage in onion his is cause by botrytis alli, a fugus that over winter on plant debris in soil, on infected bulbs, and as sclerotia in soil. Economic effect on the economy of the onion bulbs farmers in the particular and the economy of the country in general. The control of the fungal spoilage of onion bulbs is therefore inevitable. Proper storage conditions, careful harvesting, protection of the bulbs from sunburn, provision of adequate ventilation and regular examination during storage will minimize the entry and proliferation of these organisms in the
onion bulbs, thereby reducing the incidence of diseases caused by fungi and also improve the economy by reducing waste resulting from spoilage. Bacteria are of only minor importance in the market spoilage of most vegetables e.g. onions because of the acid pH value. The soft rot coliform bacteria, *Erwinia carotovora* and *Pseudomonas* similar to *Pseudomonas marginatia* are responsible for most soft rot of onions during transportation or in storage. These micro-organisms develop on onions in the field before harvesting after heavily rains and when leaves are drying. The main source of inoculums is contaminated soil and crop residues. The bacteria are spread by splashing rain, irrigation water, and insects. Which enter into the bulbs only through wounds such as those caused by transplanting, mechanical injuries or sunscald, it is said that the spoilage of onions occurs during storage because *Pseudomonas aeruginosa* contaminates onion bulbs during harvest by moving through wounds caused by topping, finally causing soft rot. The pathogen can also be seed borne. Botrytis leaf rot is caused by a different pathogen from Botrytis leaf spot. This is seen primarily in onion, the spoilage occur more apparently after harvest, while bulbs are in storage. At first the soft neck tissues looks water soaked, and a yellow discoloration moves down into the scales. Bulbs break down into soft mass. A gray mold develops between the onion scales, later producing small to large black bodies (sclerotia) which develop as solid layer around the neck, (Carisse, Tremblay, Brodeur, Mc Donald, & Mc Roberts, 2015).

Spoilage microorganism can also cause spoilage by entering plant tissue during development either through the calyx along the stem, or through various specialized water and gas exchange structures of leafy matter. Blue mold of onion spoilage this is caused by several Penicillium species. These fungi, attack a wide range of vegetables, bulbs, and seeds they are common in the soil growing in infected animal and plant debris. These organisms develop on lesions when bulbs are cut open, one or more of the fleshy scales may be discolored and water-soaked. These microorganisms are responsible for poor plant stand in the field and storage delay. The presence of fungi in onions bulbs is also attributed to the environmental conditions, state of handling and processing, state of storage facility and the onions the fungal load of the handlers and the quality of the onion bulbs. These fungi have been known to cause disease of humans and animals.

**STORAGE**

According to the National Onion Association (NOA), onions are best stored in a cool, dry, dark and well-ventilated room, such as a pantry, cellar, basement or garage. This is because they easily absorb moisture. If temperatures or humidity are too high, they may start to sprout or rot. One study found that storing onions at 40–50°F (4–10°C) is ideal. At these temperatures, they best maintain their characteristics. It’s also important to ensure proper ventilation to prevent molding and rotting. An open basket, bamboo steamer, mesh bag, netted bag or even pantyhose will do. Avoid leaving onions in plastic bags, as this may make them spoil quickly due to poor ventilation, (Adamick, 2004). Furthermore, darkness helps them last longer. The lack of sunlight reduces changes in temperature and humidity, two factors that can cause them to go bad faster.

**Educational implications**

1. The relevance of spices such as onion bulbs in human daily nutrition should be emphasized, because of its numerous health benefits. Onion slices rejuvenates the cells and improves body immunity.
2. It can increase life expectancy because of its antioxidants rich bimolecular components and vitamins. These assist in fighting diseases and disorders.

**CONCLUSION**

The review showed that spoilt onion bulb is a reservoir of both fungal and bacterial micro-organisms which have been known to cause spoilage. Some of these organisms of spoilt onions are pathogens and as such spoilt onions are unfit for human consumption. Mechanical damage of onions at harvest or during packing and temperature of storage also affect the spoilage of the commodity. Also improper environmental conditions during harvesting, transit, storage and marketing may favor spoilage.
In order to ensure good keeping of onions that will meet desired quality attributes, attempts should be made at reducing the number of micro-organisms in the post-harvest environment coupled with effective transportation and storage. This will however reduce the risk of mycotoxins associated with fungi contamination which are deleterious to human health. From this study, some of the micro-organisms like fungi have serious public health risk while others fasten spoilage of the vegetables. High numbers of these microorganisms in raw or consumed onion bulbs would lead to the consumers’ illness with attendant symptoms and consequences of the particular or combined microbial presence.

RECOMMENDATIONS
Based on the findings and conclusion of this review, it is recommended that both the farmer who harvested the vegetable (onion) into bags for transportation, the marketers and consumers take necessary and appropriate precautions in preventing contamination and consuming of contaminated onion. Precautionary measures suggested for reducing the level of onion bulb spoilage and contamination includes the following:
1. Brushing during harvesting and storing should be avoided.
2. Proper sanitation should be mentioned during processing, handling and storage.
3. In storage, a specific environment should be provided for the onions, if high quality products are to result.
4. Consumption of raw onions without a prior heat treatment should be discouraged.
5. Maintain dry environmental condition during harvesting; onion bulbs should be handled gently to avoid bruises during irrigation. Avoid use of microbial contaminated water to reduce infestation.

REFERENCES