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Animals We Love to Hate: The Science and the Myth

"Ghana is endowed with a diversity of wild and domestic animal species which are important as important components of the earth's natural ecosystems and sources of food, medicinal products, recreation and scientific experimentation."



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Ghana Science Association (GSA)

Ghana Science Association

Introduction

The Ghana Science Association (GSA), a voluntary, non-profit making and multidisciplinary organisation of scientists, technologists and mathematicians was formed in 1959. The Association traces its origin to the West African Science Association (WASA) which was formed in 1953 at the University College of the Gold Coast. WASA was formed to provide West African scientists the forum to advocate the importance of Science and Technology as a necessity and bedrock for national development. The formation of GSA broadened the scope of activities from reading of scientific papers to involvement in national and international affairs. The Association was placed on government subvention under the Ministry of Education as far back as 1961 by a Presidential Fiat. Hence the Association is supported through budgetary allocation from the Ghana Government. Other sources of income include membership dues and proceeds from workshops and conferences. The GSA was mandated to promote, popularize and demystify science and create a scientific culture in the country. The Association has made tremendous contributions to National Development, Health and Economic Growth through scientific interventions. The Secretariat is a point where scientific and technological information and research findings are obtained by individuals and corporate bodies.

Membership of the Association is drawn from the Universities, Research Institutes, Industry, Government and Persons interested in the promotion of Science and Technology.

Vision and Mission

Vision

To become a dominant voice in Science and Technology advocacy by promoting and popularizing Science and Technology to meet national developmental needs.

Mission

Advancing Science, Technology, Engineering and Mathematics (STEM) through interaction and cross-fertilization of ideas of all interested people to: -

1. Popularize, promote and disseminate scientific information and technology transfer for national development.
2. Contribute to the development of national Science and Technology policy.
3. Collaborate with industry to set national research agenda.
4. Establish linkages with industry to promote the transfer and application of Science.
5. Seek affiliation and foster cooperative links with other national and international organizations.

Activities

1. Organization and participation in scientific conferences, workshops, seminars, symposia, public lectures, quizzes and science fairs.
2. Promotion of career development of scientists in Universities and Research Institutes in Ghana and elsewhere.

3. Publication of the scientific journal, magazines and books (e.g. Journal of the Ghana Science Association and Everyday Science for Schools magazine).
4. Training programmes for mathematics and science teachers to improve the teaching and learning of these subjects in schools and colleges of Education

Contribution to National Development

Issues of national importance have been regularly and consistently highlighted at biennial workshops, conferences etc. Communiqués had been submitted to Government and other stakeholders on very topical themes to help shape national policies.

What is Agroforestry and its Significance?

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Agroforestry is a land use management practices whereby trees and shrubs are developed nearby or between crops or pastureland. This deliberate arrangement of agriculture and forestry has a diverse remunerations plus increased biodiversity and reduced erosion. Agroforestry practices have been efficacious in the sub-Saharan Africa in part of the world.

Agroforestry as a science: The hypothetical base for agroforestry comes from ecology via agro ecology. From this viewpoint, agroforestry is one of the three key agricultural land use science. The other two are agriculture and forestry. Agroforestry parts principles with intercropping. Mutually are two or more plant species (such as nitrogen-fixing plant) in close propinquity and both afford several outputs.



Plate 1: Alley Cropping in Ghana



Plate 2: Live Fencing in Ghana

Benefits of Agroforestry

Agroforestry system can be beneficial above conventional agricultural and forest products approaches. They can provide increase in productivity, economic profits and additional diversity in the ecological goods and services. Reliant on the applications, positive influences of agroforestry embrace diverse topics.

Biodiversity: Biodiversity in agroforestry systems is characteristically higher than in conventional agricultural systems. There are two or more plant species interacting plant in a given locality build a more complex locale that can maintain a broader diversity of fauna. Agroforestry is dynamic for biodiversity for different reasons;

- It provides more diverse habitat than conventional agricultural system.
- Provision of food and nesting possibilities.
- Provision of germplasm of sensitive species for preservation purposes.
- Helps conserve biodiversity by influencing other ecosystem positively.

Soil and plants growth: Dwindling soils are secured from soil erosion by ground cover plants such as naturally growing grasses in agroforestry system. These help stabilize the soil as they increase cover compared short-cycle cropping system. Soil cover is crucial factor in preventing erosion. Clean water through reduced nutrients and soil surface run-off is an advantage of agroforestry. The run-off can be reduced by decreasing its velocity and increasing infiltration into the soil.

Additional advantages concerning plant growth:

- Bioremediation
- Drought resistance
- Increased crop stability

Contribution to Sustainable Agricultural System

- Reduced poverty through increased production of wood and other products.
- Increased food security by restored soil fertility for food crops.
- Multifunctional site use e.g. crop production and animal graze.

- Reduced global warming and hunger risk by increasing the number of drought-resistant trees and the subsequent production of fruits, nuts and edible oils.
- Reduced deforestation and pressure on woodlands by providing farm grown fuelwood.
- Reduced needs for toxic chemicals.
- Improved human nutrition through more diverse farm inputs.
- Growing space for medicinal plants e.g. in situations where people have limited access to mainstream medicines.

Additional Environmental Objectives

Carbon sequestration is an important ecosystem service. Trees in agroforestry system, like in new forest, can recapture some of the carbon that was lost by cutting existing forests. They also provide additional food as products. The rotation age and the use of the resulting products are important factor controlling the amount of carbon sequestered. Agroforestry can reduce pressure on primary forests by providing forest products.

Agroforestry practices may realize a number of associated environmental goals such as;

- Odour, dust and noise reduction.
- Green space and visual aesthetics.
- Enhancement or maintenance of wildlife habitat.

Adaptation to Climate Change

Small scale farmers have bowed to agroforestry as a means to adapt to climate change. Numerous studies conducted on climate change shows that about 700 households in east Africa, that at least 50% of those households

has begun planting trees in a change from earlier practice (Bojo, 1996)

The trees were planted with fruits, tea, coffee, oil, fodder and medicinal products in addition to their usual harvest.

Agroforestry is one of the most widespread adaptation strategies, along with the use of improved crop varieties and intercropping.

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The Where and When of Cholera in the Greater Accra Metropolitan Area (GAMA)

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Cholera has taken many lives and continues to be a global threat throughout the world. Although, the disease has disappeared from most developed countries, it remains a major public health problem in many developing countries, especially in SSA countries. Africa accounted for about 90% of the one (1) million reported cases between 1999 and 2005 in the world and in Ghana between the same period, over 27,000 cases were officially reported by the Ghana Ministry of Health (WHO, 2006; Osei & Duker, 2008). In the epidemiological history of Ghana, cholera remains one of the deadliest infectious diseases the country has ever known (Oteng-Ababio, 2014). The number of cholera cases in Ghana have been fluctuating since 1982 where 15,032 cases were recorded (Gershon et al., 2014).

Within the last five years in the Greater Accra Metropolitan Area (GAMA) the Accra Metropolis has recorded the highest number of cases with 22,333 (refer to Table 1). Taking Greater Accra Region as a whole, Ada West has the least with just a single case. In the five year period, 2013 recorded the least with 22 Cholera cases and these were all coming from the GAMA. From Table 1, it is evident that cholera incidences are predominant in urban and overcrowded communities as noted in other works (see for instance Osei & Duker, 2008). Results from previous studies (Songsore et al. 2001; 2005) show that the AMA always tops the list of most deprived communities. This possibly explains why it always records the highest number of cholera cases.

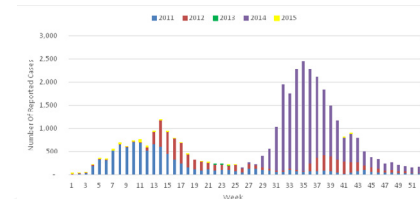
Reported Cholera cases in the GAMA region shows a fluctuating trend (refer to Table 1). For instance, in 2011 a

total number of 19,165 cases were recorded and this reduced to 6,871 in the subsequent year which further reduced to 22 in 2013. Subsequently, there was sharp rise of cholera cases in 2014 with 19,748 cases and as at November, 2015 a total number of 307 cases had been reported. The year 2014 recorded the highest number of deaths within the Greater Accra Region with 121 deaths and 119 deaths in the GAMA. However, in the year 2013, out of the 22 cholera cases reported no death occurred. Overall, it can be emphasized that deaths increase with increasing number of cholera cases.

To address the situation, this study recommends strict enforcement of byelaws, improvement in infrastructure and social provisions, resourcing of Assemblies and a bottom up approach in household and community education through families and clan heads

On monthly basis, cholera occurs throughout the year. However, it is most severe during week 6 to week 22 (February to June) and week 27 to week 47 (July to November) and these months fall within the two main rainy seasons in Ghana (refer to Figure 1). This therefore implies that, cholera incidence has a significant relationship with climatic conditions as asserted by de Magny et al. (2008), that the causative factor of vibrio cholerae has a significant relationship with climatic factors.

Figure 1: Cumulative Weekly Cholera Epidemiological Graph in the Greater Accra Region (2011-2015)



Source: GARHD, 2015

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| | 2011 | | | 2012 | | | 2013 | | | 2014 | | | 2015 | | |
|--------------------|-------------|-----------|------------|-------------|-----------|------------|-----------|----------|----------|--------------|------------|------------|------------|----------|------------|
| | Cases | Deaths | CFR | Cases | Deaths | CFR | Cases | Deaths | CFR | Cases | Deaths | CFR | Cases | Deaths | CFR |
| Accra Metropolis | 6960 | 62 | 0.9 | 4623 | 39 | 0.8 | 14 | 0 | 0 | 10504 | 65 | 0.6 | 232 | 5 | 2.2 |
| Ada East* | 1 | 0 | 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 103 | 1 | 1.0 | 0 | 0 | 0 |
| Ada West * ** | | | | | | | 0 | 0 | 0 | 1 | 0 | 0.0 | 0 | 0 | 0 |
| Adenta Municipal | 42 | 0 | 0.0 | 84 | 0 | 0 | 0 | 0 | 0 | 19 | 0 | 0.0 | 0 | 0 | 0 |
| Ashiaman Municipal | 17 | 0 | 0.0 | 7 | 0 | 0 | 0 | 0 | 0 | 68 | 1 | 1.5 | 1 | 0 | 0 |
| Ga Central ** | | | | | | | 7 | 0 | 0 | 152 | 1 | 0.7 | 0 | 0 | 0 |
| Ga East | 758 | 1 | 0.1 | 754 | 3 | 0.4 | 0 | 0 | 0 | 190 | 0 | 0.0 | 5 | 0 | 0 |
| Ga South | 420 | 3 | 0.7 | 765 | 2 | 0.3 | 1 | 0 | 0 | 2082 | 5 | 0.2 | 19 | 0 | 0 |
| Ga West | 621 | 3 | 0.5 | 356 | 3 | 0.8 | 0 | 0 | 0 | 1286 | 2 | 0.2 | 5 | 0 | 0 |
| Kopne Katamanso ** | | | | | | | 0 | 0 | 0 | 280 | 0 | 0.0 | 9 | 0 | 0 |
| La Dadekotopon ** | | | | | | | 0 | 0 | 0 | 1907 | 15 | 0.8 | 7 | 0 | 0 |
| la Nkwantanang ** | | | | | | | 0 | 0 | 0 | 770 | 6 | 0.8 | 8 | 0 | 0 |
| Ledzokuku Krowor | 276 | 0 | 0 | 269 | 0 | 0 | 0 | 0 | 0 | 1398 | 14 | 1.0 | 18 | 0 | 0 |
| Ningo prampram *** | | | | | | | 0 | 0 | 0 | 32 | 0 | 0.0 | 0 | 0 | 0 |
| Shai Osudoku * | 8 | 1 | 12.5 | 11 | 0 | 0 | 0 | 0 | 0 | 315 | 1 | 0.3 | 5 | 0 | 0 |
| Tema Metropolis | 71 | 2 | 2.8 | 13 | 1 | 7.7 | 0 | 0 | 0 | 1092 | 10 | 0.9 | 3 | 0 | 0 |
| Total | 9174 | 72 | 0.8 | 6882 | 48 | 0.7 | 22 | 0 | 0 | 20199 | 121 | 0.6 | 312 | 5 | 1.6 |

Table 2: Cholera Reported and Investigated Cases by Districts in the Greater Accra Region (2011-2015)

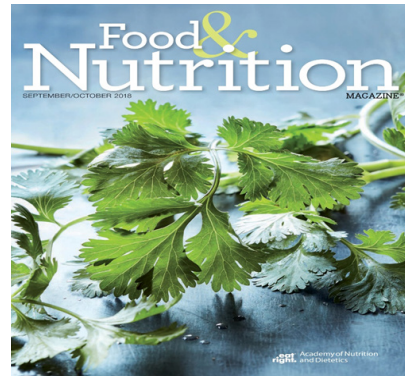
* Areas outside GAMA

** Until 2012 were part of other Metropolis and Districts

Source: GARHD, 2015

Food and Nutrition

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Good nutrition can help prevent disease and maintain human health. There are six categories of nutrient that the body needs to acquire from food, which is protein, carbohydrate, fat, fibers, vitamins and minerals, and water. This basically form the body by supplying most necessary requirement for growth and development. With this there is adequate need for a field that will take correct needs for this necessities, which the study in foods and nutrition plays key role in this.

Food: is the material consisting essentially of protein, carbohydrate and fat used in the body of an organism to sustain growth, repair and vitalize processes and to furnish development.

Nutrition: the study of the food and liquids requirement of human beings or animals for normal physiologic function including energy, maintenance, growth activity, reproduction and lactation. It basically the science or study that deals with food and nourishment, especially in humans.

Concept of Foods and Nutrition

This field of study aim much more at promoting proper nutritional status of individual, families and the communities.

- Prevention of the nutritional deficiency disorders.

- Maintenance of the health of the individuals and supplementation of essential nutrients to all the vulnerable groups.



Career Opportunities in Studying Foods and Nutrition

Clinical dietetics- is a specialist who aid in developing creating and supervising nutritional plans as part of individual overall treatment plan. They most work with health centers and other private organizations. At least a degree in foods and nutrition is needed.

Food industry professional- They aid in developing recipes and analyzing product for nutritional labeling to promote and educate consumers about the nutritional value of specific foods.

Food writer- Someone with a background in foods and nutrition can often find writing opportunity across the spectrum, from reporting on food ness and trends for magazines and many more in the field of food exhibition.

Public health worker- with much knowledge in food and nutrition, one can help in the designing of programs, policies and systems that support and maintain good health for specific population.

Relation Between Nutrition and Health

Nutrition play vital role in the health of humans that helps in the following;

1. Achievement of optimal growth and development reflecting the full expression of one's genetic potential.
2. Maintenance of the structural integrity and functional efficiency of body tissues necessary for an active and productive use.
3. Mental well-being.
4. Ability to combat diseases such as;
 - Resisting infections
 - Preventing the onset of degenerative diseases.
 - Resisting the effect of environmental toxins/pollutants

Precautions

Individuals should not change their diets without the advice of nutritional expert or health care professionals. Certain individuals, especially children, pregnant and lactating women and chronically ill patients only should change their diets under professional supervision.

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Bureau of Labor Statistics Occupational Outlook Handbook: Dietitians and Nutritionist

Why Ants Rule the World

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Introduction

There are over 12,000 named species of ants across the world and at least about double of that remain to be discovered. Ants are classified in the phylum Arthropoda, class Insecta, order Hymenoptera, family Formicidae. Ants have a very slender waist. The head has two bent antennae. In most species there are two compound eyes. The jaws are of the biting type and in some species are used for defense. Most ants are black, brown, red, or yellow. And while we may not like them inside our house, ants serve a number of useful functions.

Communication is the key

Adding to the success story of the ants is the communication mechanism that they have developed that aid them to rapidly disseminate information among themselves. It is due to this social behavior of the ants that account for massive number of them we see around a source of food that appeals to them, just a minute after only one of them has discovered the food. They have various ways of transmitting information.

One key feature that helps the ants in transmitting information is their ability to produce a scented chemical substance called pheromones. The pheromones are used to communicate with their family. Pheromones are detected at the tips of their antennae, the left and right

antennae tell the ant which way to turn with the varying pheromone strength. Ants that have missing or damaged antennae become much disorientated.

There are about ten to twenty different pheromone perfumes, each represents information that the entire colony understands. Pheromones can be used to summon a few ants to thousands of ants, depending on what is required. This may be the attacking of prey, the defending of the colony, the location of a sweet food source, or the relocation of the colony, it works very well. When an ant is squashed, it releases a different pheromone that warns the others of potential danger. Pheromones also help ants to distinguish between different family members, nest mates and strangers.

Team work is crucial for achieving set goals



Ants because they are small in size and sometimes smaller than the size of their prey. They always attack in groups. Some ants are better at finding resources, while others are better at defending whatever food resource or prey is hunted and kept at their hideouts.

Smaller ants are better at recovering a large piece of food because they can break it into tiny pieces then work as a team to tow it back home. When the smaller species compete for a smaller piece of food, however, larger ants will tread heavily into the fight and drag the entire piece off before the smaller ones break it down. Ants hate each other but work together. As the saying goes, "where one is weak another is strong". When two ants meet each other head-on, they smell each other thoroughly to make sure that they belong to the same colony. If not, things can get tense.

Conclusion

Ants as a group are beneficial to humans. Many life principles are derived from the ants. These principles include effective communication and teamwork. Also, their tunneling mixes and aerates the soil, allowing water and oxygen to reach plant roots. Many species feed on small insects that are serious crop pests. So unless ants are entering your home, consider allowing them to perform their important ecological functions in your yard or garden.

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So Your Light Bulb's Got Biceps and can Lift Weight?

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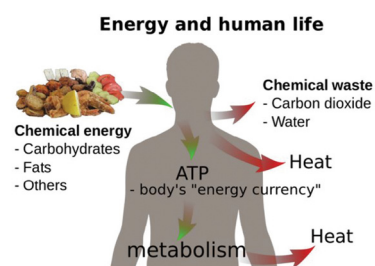
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Whenever I sit across a plate of some sumptuous meal (and I do love doing it), I can't help myself from getting struck by this weird thought that I am actually resorting to those lifeless muscles of matter to stay alive; a couple days without them and I'm as good as humus. Tongue in cheek, I'm tempted to view us humans as some sort of 'chemical appliances', powered by chemicals (calories) in the forms of 'Banku', rice, TZ, etc and converting them into mechanical energy - energy to walk, talk, write, think. Of thinking, is it really a mechanical phenomenon? Well, it does involve neurons in motion.



Interestingly, we humans, like electrical appliances, also have efficiencies – measures of the chemical energies ingested versus the mechanical work we do or are willing to do; we dissipate heat through sweat and urine, and from a socially-biased perspective, there are people that go straight to

bed right after a deluxe meal treat, an arguably unproductive use of Joules of chemical energy. A unit of energy, the Joule sinks better with me when I view it as the energy consumed when an average sized orange is raised through a distance of one meter, do this in a span of a second and you might have exerted a power of 1 Watt. So what exactly does the wattage rating on my bulb (and other electrical appliances) mean?

Just as humans must continue eating in order to keep carrying out mechanical work, a lightbulb requires energy in some existing form in order to produce light. This is the annoying dictate placed on us by energy: it can only be converted from one form to the other, period! So the lightbulb converts – or more accurately put, is designed to convert – electrical energy to light energy. Consequently, for every second that the bulb is lit, an equivalent amount of electrical energy is being consumed.

And over its lifecycle, the bulb would continuously produce light energy once, and only if, it is continuously being fed with some other source of energy, mostly electrical energy. But exactly how much electrical energy must I feed my light bulb each second

to keep it lit? There! You'd have to read the wattage rating.

The wattage of your bulb is a kind indication and reminder of how much electrical energy in Joules it would need every second in order to keep your room lit; hence a 100 W bulb consumes 100 Joules of electrical energy per second. So given that we typically switch our light on at about 6pm and put it out at 6am, a 100 W bulb would draw 100 Joules of energy every second for 12 hours, daily. This is enough energy to lift 72 bags of cement through a distance of hundred meters, by day break; it would do more (unnecessary) work, and dig deeper into your purse, if you leave it lit after 6 pm. Do not let it!



So does more energy consumption – thus bigger power ratings – of bulbs mean brighter lighting? Not entirely. Brightness is largely dependent on the luminous efficacy of the bulb, information on which is usually provided on the labels of any new bulb. The luminous efficacy – given in lumens per watts – tells how much of the electrical energy consumed by your bulb is actually being converted into light energy and not heat or some other undesired energy. So for optimum brightening, lesser energy consumption and a lower life-cycle cost, choose a bulb with lower wattage and higher luminous efficacy; that way, you would also be contributing towards climate change mitigation.

Functional Foods and Nutrient-Deficiency-Related Diseases

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Abstract

Nutrient-deficiency-related Diseases are those disease conditions caused by not having adequate amounts of key nutrients in human diets. The development of these ailments can be controlled through the consumption of functional foods rich in bioactive compounds that improve the health and well – being of humans. Epidemiological (in vivo and in vitro) studies have shown that consumption of functional foods have the potential of reducing the risk of various chronic diseases. In this opinion, a description of nutritional disorders and diseases; and how they can be controlled by the consumption of functional foods is presented.

Keywords: Functional food; Diseases; health; Undernutrition; Overnutrition; bioactive compounds; deficiency; potentially – active components

Introduction



Nutritional Disease is the disease caused by an insufficient intake of food or of certain nutrient. These diseases can also be caused by undernutrition, overnutrition and or imbalance of nutrients ^[1]. This health problem is experienced in both underdeveloped and developing countries of which Ghana is no exception. Nutrient deficient diseases particularly affect

the young, old, pregnant and immune deficient individuals (YOPI) and impedes their growth and development, thus leading to severe health problems. There are still children and adults that do not get enough to eat, do not eat the right amounts, or eat in an unbalanced way. In other cases, people may suffer nutrient deficiency disorders due to their body's inability to properly digest and absorb food; even if they get plenty to eat and a proper diet, they still develop diseases due to nutrient deficiencies. Furthermore, some diseases may be caused by an excessive amount of one nutrient (such as the development of diabetes conditions from overconsumption of sugar). According to the World Bank, from 2000 to 2016, the prevalence of undernutrition (% population) in Ghana averaged 12.50 % ^[2]. Moreover, United Nation Children's fund (UNICEF), have also indicated that approximately 45% of all death in children (under 5 years of age) can be attributed to malnutrition ^[3]. Based on recent most recent estimates from United states Agency for international Development (USAID), the prevalence of underweight, weight for age (% of children under 5) in Ghana is 11% as of 2018; and the prevalence of stunting, height for age (% of children under 5) in Ghana is 19% as of 2018^[4]. The prevalence of nutrient deficiency diseases in Ghana should therefore be of concern.

There are hundreds of different nutrient - deficiency-related diseases. These are dependent on the deficiencies or excesses of various nutrients. Moreover, each nutrient has its purpose and function so that the absence of each nutrient in food leads to its own specific illness. Some examples of these nutrient-deficiency-related-diseases include metabolic diseases such as obesity ^[1], skin disorders, digestive

and gut health issues, pernicious anaemia, polygenic disorder and chronic diseases such as cardiovascular diseases, hypertension, diabetes, marasmus, mental retardation, rickets, osteoporosis, goitre, kwashiorkor, beriberi, scurvy etc.^[1].



One of the most promising avenues to address these aforementioned maladies are functional foods. Functional foods are modified foods or food ingredient that improve upon the health and well-being of individuals by providing benefits beyond that of the traditional nutrients it contains ^[5,6]. Functional foods include whole, fortified, enriched foods which have a potentially beneficial effect on health when consumed as part of a varied diet on a regular basis at effective levels ^[6,7]. These functional foods possess certain bioactive compounds which impart desirable effect on body systems when consumed in adequate amounts. In recent times, interest in functional foods have escalated due to key factors such as growing self-care movement, increasing healthcare costs, changes in food regulations, strong scientific



evidence highlighting the critical relationship between diet and health [7]. Functional foods are among the leading trends in the food industry. They are also active area of research in the nutritional sciences [5,9].

Examples of functional foods found in Ghana include flaxseed, fruits, tomatoes, onions, ginger, garlic, green leafy vegetables, citrus fruits, tea, beverages, fish, dairy products, eggs and beef.

These aforementioned foods are classified as functional foods because they possess potentially beneficial bioactive compounds that deliver enhanced benefits and play important roles in achieving optimal human health [11]. Functional foods can therefore help control the prevalence of nutrient-deficiency health complications. For example, plant based functional foods are able to reduce the risk of different chronic problems such as heart disease, stroke, diabetes, Alzheimer's disease, cataracts, and age-related

function decline [6,9]. These bioactive compounds include phytochemicals (phenolics, flavonoids, phytosterols, nitrogen containing compounds), vitamins (vitamin C, folate, pro – vitamins A), minerals (potassium, calcium, magnesium), dietary fibres, and proteins [10]. In this regard, some key bioactive phytochemicals are lycopene in tomatoes and watermelon; alliacins in onions and garlic, beta-carotene in carrots, sweet potato, red pepper and mangoes; flavonoids (hesperetin and naringenin) phenolics in green pepper, cucumber, cabbage, banana, watermelon, lemon, orange, mango, pear, pineapple, lettuce, carrot, mushroom, avocado, potatoes; and zeaxanthin and lutein in potatoes [13].

Although, plant sources consist of enormous amount of naturally occurring health enhancing compounds, there are a number of physiologically-active components in animal products that deserve attention for their potential role in optimal human health promotion [5, 12]. Examples include: calcium, probiotics (especially found in yoghurts), whey

proteins and whey peptides, from dairy products; omega-3 and omega-6 fatty acids from fish; conjugated linoleic acid from beef and lamb meat; sphingolipids from eggs; and the conditionally-essential nutrients L-carnitine, coenzyme Q10, alpha-lipoic acid, choline and taurine, widely abundant in animal products [14].

In conclusion, the health-conscious Ghanaian consumer should increasingly consume diet well-supplied with fruits and vegetables; and have a balanced nutrition to avoid been nutrient deficient. Balanced nutrition and diet helps one to maintain a healthy weight, reduce body fat, provide the body with energy, promote good sleep and generally makes one feel better.

These aforementioned foods are readily available in the average markets in Ghana. In addition, the average Ghanaian finds it easy to grow all these foods since our climatic conditions support the growing of these tropical crops. Thus, Ghanaian consumers find a steady supply of these foods all year round.

Over the years, there have been substantial postharvest loss of these food sources (fruits and vegetables) due to physical damage during handling and transport, physiological decay and water loss or sometimes simply because there is a surplus in the marketplace and no buyer can be found. This postharvest loss affects the potentially – active components in the foods. Thus, there is the need for further research in identifying local technologies to preserve these foods, as well as avenues for the minimal processing that ensures these nutrients and bioactive compounds are preserved.

Figure 1: Some functional foods available in Ghana.

Table 1: Functional food sources, their bioactive compounds and health functions

| | Functional Food Source | Key Bioactive Compound | Health Functions |
|---------------------|-----------------------------|--|---|
| Plant foods | Tomato | Lycopene | Antioxidant; Reduce the risk of prostate cancer |
| | Carrots, Fruits, Vegetables | Carotenoids, Alpha-carotene/beta-carotene, Anthocyanidins, Flavonones, flavones, Phenolics | Neutralize free radicals which may cause damage to cells; Reduce risk of cancer |
| | Onion | Prebiotics and Probiotics, Fructo-oligosaccharides (FOS); | Improve quality of intestinal microflora; gastrointestinal health |
| | Flaxseed | Lignans | Prevention of cancer; renal failure |
| | Green vegetables | Lutein | Reduce the risk of muscular degeneration |
| Animal foods | Salmon and Fish oil | Fatty Acids, Long chain omega-3 Fatty Acids-DHA/EPA | Reduce risk of cardiovascular disease; improve mental and visual functions |
| | Beef and meat | Conjugated Linoleic Acid (CLA) | Improve body composition; decrease risk of certain cancers |
| | Yoghurt, dairy products | Probiotics, Lactobacillus, Biofidobacterium | Improve quality of intestinal microflora; gastrointestinal health |
| Fungal foods | Mushrooms | Secondary metabolite (polyphenols, sterols, vitamins, terpenoids, lactones, alkaloids, Sesquiterpenes) | Antioxidant, Antitumoral, antimicrobial, immunomodulatory and Antiviral agent. |

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Drug Abuse: Causes, Effects and the Way Forward

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You may first ask, “what are drugs?”

Drugs are chemical substances usually obtained from organic or inorganic materials which may alter mood, perception, or consciousness when taken or introduced into the body.

Drug Abuse to the layman is the deliberate use of chemical substances for non-medical purposes. In other words, it can be defined as the wrong use of drugs or using drugs without medical prescription.

What are the types of drug abuse?

Basically they have been divided into two;

1. Abuse of legal drugs

These include the misuse of legally selling drugs, eg. Tramol, cough

mixtures, alcoholic drinks like gin bitters, “akpeteshie” cigarettes, pethidine, etc. Also, it includes wrong use of over the counter medications and commonly prescribed analgesics such as acetaminophen (paracetamol).

2. Abuse of illegal drugs

These are the forbidden drugs of the land, also called illicit drugs. Examples are cannabis (also known as ‘wee’, marijuana, Indian hemp, ‘Taaba’), Cocaine, heroin, etc.

Why do people abuse drugs?

Drug abusers do drugs for many reasons without thinking much of the negative risks. Some of the reasons people abuse drug are:

Curiosity: The desire to “test and see” has made lot of people become drug addicts. Most youth intend to

experiment and consequently became drug abusers and addicts in the long run.

Peer pressure: Mostly, people abuse drugs because their peers use drugs hence are lured into the gang or ring of drug abusers. Most ‘wee’ smokers and cocaine sniffers were influenced by their mate(s) who already have used the drug before.

Relief of stress/Boredom: Some people misuse drugs because of very stressful life experiences like death of dear one, disappointment, diagnosis of a life threatening ailment, etc. Some people drink alcohol and smoke cigarettes or cannabis to ward off sorrow, stress and other hurtful emotional experiences.

Media advertisements: There are lots of new brands of drugs advertised in the print media, on TV, radio, and on the various social media networks which carry very catchy messages. Most often, those drugs are easily accessible and readily available.

Rebellion against authority: Finally there are some people who use drugs to feel high; it boosts their confidence to rise against authority. Usually, they misuse wee, cocaine or heroin to make them feel bold and ruthless to go against authority.



What are the consequences of drug abuse?

There are many consequences or effects of drug abuse, below are some of them as briefly explained.



Poor health: Wrong use of drugs causes a lot of danger to the natural human anatomy. For instance excessive use of alcohol causes liver disease, hepatitis, an alteration of brain function and heart problems. Excessive use of tobacco, alcohol and other stimulants by pregnant women causes severe deformities of the fetus such as mental retardation. Also many studies have shown that drinking of alcohol and smoking have tendencies of causing cancer.

Engagement in criminal acts: Secondly, addiction results in compulsive behavior. Drug abusers resort to all sorts of acts to sustain and maintain themselves to prevent the unwanted feeling of withdrawal. Some even resort to robbery, stealing, prostitution and other vices to make a living which in the end lead to infractions of the law.

The risk of infection: Since many drug abusers share injectables, ie. syringes and needles, it becomes a major route of the spread of HIV/AIDS, Hepatitis B, and other blood borne diseases. Moreover, as their sexual libido rises, promiscuous sex life becomes common. The smokers may contract pulmonary tuberculosis in their life time too.

Effect on the nation: The resources used in rehabilitating drug abusers in prison and psychiatric hospitals, could be used to provide social amenities to the various deprived communities.

Yearly, the state loses a large portion of its productivity to drugs since absenteeism, poor work performance, high accident rate and loss of life of the youth renders the nation impoverished.

What measures can help control drug abuse?

The fight against drug abuse does not rest on the shoulders of only one person. Ideally consultation of different stakeholders is paramount as the effects lead to mental health problems, loss of life, waste of resources, accidents, etc.

Regular health education on drug abuse: To begin with, regular health education on drug abuse in print media, TV, fm radio, and on social media networks like Facebook, WhatsApp platforms, Twitter and Instagram can greatly help sensitize people, particularly the youth. Regular education in schools, churches, mosques, markets and other public places by various organizational leaders can also be of great help in curbing the drug abuse menace. National Commission for Civic Education (NCCE) and other non-governmental organizations (NGOs) can do their part in the fight against drug abuse.

Setting up treatment centres: provision of correctional centers, rehabilitation centres, psychiatric and counseling units by the government and private investors will help the fight against drug abuse greatly.

Every health worker has the charge to continue the education in every corner he or she find his or herself and educate their clients on the need to abstain from drugs.

Government policy: In addition to the above, government needs to make national policies to end the production, importation, purchase and supply illegal drugs in Ghana. Government should tighten the surveillance on its borders, and all laws on illegal drug dealings should be rigorously enforced. Also, government should equip the Pharmacy Council so they can help curb misuse

of legal prescription drugs.

International collaboration: Added to the aforementioned, government fighting drugs should be a collective collaboration between neighboring countries and other international communities to check and track trafficking rings to stop illegal drug trade and misuse of illegal drugs internationally. For instance, Narcotics Drug Control Board and the Ghana Police Anti-drug Trafficking unit should collaborate with their neighboring country counterparts to prevent the production and sales of illegal drugs in the respective countries.

Conclusion

In Ghana, drug abuse is now a national canker, with the latest abuse of legal prescription drugs; Tramadol and cough mixtures by the youth trending. Most of the time, young people intend to boost their spirit, want more energy, and feel high. Unfortunately they are not well informed on the risks associated with the drugs, that is the numerous withdrawal symptoms, ranging from vomiting, headache, hallucinations, nightmares, light headedness, excessive sweating, fainting attacks, tremors, high blood pressure, delirium, physical aggressiveness, restlessness and fits.

Abstaining from drug abuse is the best choice for complete healthy living and good life. Live well, Say No To Drug Abuse !!!

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The Microorganism

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It was the 17th century and there was a revolution in science. Antonio Van Leeuwenhoek has developed a new curiosity, one that has led to the development of new lenses leading to the discovery of our world. He named us Animalcules. It is now the 21st century and we have developed a much cooler name; the microorganism. Microorganisms have developed a bad press. We are known as the cause of disease and have been blamed through time. Do you remember the Miasma theory; it was believed that diseases such as Cholera, Chlamydia, Black Death were caused by a bad gas called Miasma; what a ridiculous theory. My folks and I laughed when we first heard the theory only to our surprise that this theory was polished into the germ theory, to blame us as the sole cause of diseases. Dear friends, I agree that some folks of mine have caused some diseases but our importance are much greater than causing diseases. Our bad press has made a lot of pharmaceutical companies rich with their fancy perfumed sanitizers and lotions to get rid of us. Dear friends, before you use that expensive sanitizer

you have just bought that is capable of killing all microorganisms on your skin, kindly spend a few minutes with me and I will show you our essence.

Microorganisms have existed naturally with other higher forms of organisms. Skin flora are microorganisms which reside on the skin. Benefits obtained from this association are both mutualistic and commensal. Skin flora, protect the host from other pathogenic organisms. Gut microorganisms possess a range of enzymes capable of breaking down complex carbohydrates, aiding digestion.

Similarly, microorganisms are used in the production of antibiotics. Also, weakened forms of viruses or viral particles such as their protein coat or nuclei material are used as vaccines to cure or prevent viral infections. Further, humans have developed more sophisticated technologies for harnessing more benefits from us. The recombinant DNA technology has made it possible to insert a human gene into microorganisms so that we can produce protein encoded by the gene. This technology has been used

to create a lot of useful materials such as insulin for diabetic patients. Also, genetically modified organisms are produced using microorganisms such as Agrobacterium. Due to genetically modified organisms, we can produce food products with higher yield and quality, and crops resistant to diseases as well as a range of medical products.

Microorganisms are decomposers responsible for getting rid of pollutants from the environment. Some of the by-products of decomposition are beneficial and may be used in the production of biogas, electricity and inorganic chemicals and even food. In aquatic environments, microorganisms are responsible for breaking down pollutants and providing clean water. Microorganisms can also convert greenhouse gasses into other forms reducing global warming. Microbial association with plant roots such as mycorrhizae and rhizosphere protect plants and makes them more resistant to diseases, provide nutrients such as nitrogen by fixing atmospheric nitrate and nitrite for plant use (Azotobacter, Nitrosomonas). Mycorrhizae roots also have large surface area to absorb more nutrients and water.

Industrially, the benefits of microorganisms are far beyond comprehension. Microorganisms are used in the production of yoghurt and beer, microorganisms are used in the production of acetic acid, microorganisms are used in treatment plants, microorganisms are used as agents of bioremediation in composting for agricultural activities, in mining activities, as indicators of water and food quality, etc.

Now that you know my essence, you can tell that I am more of a friend than a foe.

Food Processing – An Overview

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Introduction

Fruit juices, soft drinks, chocolate, bread, *kenkey*, *gari* are popular foods eaten in many parts of the world. These products are made from different raw materials, using many different procedures. The methods and procedures needed to change food from its raw state into a finished product, which can be eaten readily is termed food processing. Food processing involves a combination of procedures such as raw material handling, cutting, mixing, steaming, drying, heating,



Fig 1: An illustration of food processing

packaging, etc. These procedures are done with different machines, including mixers, dryers, rollers, boilers and fillers. A combination of these machines may be used to manufacture a food product which is liked by consumers, and also has a longer expiry date. Raw materials used in food processing may come from animal or plant sources. Examples of those from animal sources are eggs, meat and milk while those from plants include vegetables, fruits and grains. These raw materials have different properties. After processing, a food product which is entirely different from the raw materials is made.

Why is food processed?

Food is perishable, and therefore if certain control measures are not adopted, it will simply go to waste. This is one of the main reasons for processing food. Processing reduce losses and ensure that food is available throughout the year. Additionally, food is processed to prevent spoilage, improve nutritional value, add value and to inactivate/eliminate microorganism, make food convenient and presentable.

Food processing methods

Generally, there are 3 main levels of food processing: minimal, moderate and high, and these may be grouped into heat and non-heat processing methods. Some food processing methods that involve the use of heat are cooking, drying and canning. Non-heat methods do not involve any form of heating, and these may include refrigeration, freezing, fermentation and curing. The method used depends on the raw materials and equipment available, the final product, properties

of the final product, availability, cost, etc. Food processing methods which use heat have been criticized for destroying nutrient and color. Non-heat processing, on the other hand, is praised for its preservation of nutrients and freshness. However non-heat processing cannot be used for all raw materials and products.

Changes that occur when food is processed

A number of changes occur in food during processing. These changes may be physical or chemical. They are usually related to the kind of raw materials and processing methods used. For instance beef becomes soft and its flavor becomes nicer after it has been processed into corned beef. The taste of milk changes when it is processed into yogurt. While many of these changes are beneficial, some are also undesirable and must be minimized or eliminated during processing. Nutrient loss is one of the major concerns linked with food processing. For example, some essential nutrients such as vitamins are lost when vegetables are cooked.

The key point in food processing, therefore, is to reduce the nutrient losses and other changes that may occur. To achieve this, a good understanding of the properties of ingredient to be used, properties of the final product as well as the methods and equipment available, is required. The background knowledge and skill of the processor will ensure that the methods of food processing chosen will preserve the basic functions of food, i.e., to provide quality nutrition and keep the body alive.

Acknowledgement

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Weaponization of Acids

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Introduction

Acid throwing has been on the increase in recent memory. Most tabloids have a reported case of acid throwing for a multitude of reasons. Jealous partners, jilted lovers, revenge are just but a few of such reasons people commit such barbarism. A simple internet search on acid attack in Ghana reveals a worrying trend which must be contained. Acid attack (or acid throwing) is loosely defined as the deliberate throwing of acid [mostly sulphuric acid (H_2SO_4), nitric acid (HNO_3) and sometimes rarely hydrochloric acid (HCl)] on individuals solely to disfigure, maim or kill. Most acid attack victims do not survive (because of extensive physiological damage) or are seriously disfigured (FIGURE 1) leading to life-long traumatization and dejection.

Control of Toxic Acids

The acid involved are controlled chemicals but the ease of access and possession is seeing a continuous weaponization of these chemicals which are otherwise needed for production of fertilizers, car batteries; gold treatment and very useful everyday products.



Figure 1: Acid Attack Victim

According to article Ia of the Organization for the Prohibition of Chemical Weapons (OPCW), a chemical weapon refers to any toxic chemicals and their precursors except where

intended for purposes not prohibited under the chemical weapons convention as long as the types and quantities are consistent with such purposes. Article II (subsection 2) further defines toxic chemicals as any chemical which through its action on life processes can cause death, temporary incapacitation or permanent harm to humans and animals.

This includes as such chemicals regardless of their origin or of the method of production and regardless of whether they are produced in facilities, munitions or elsewhere. From this definition, it can be inferred that the unintended use of these acids' places them in a category worth strict controlling. This is also true for many harmless products on the Ghanaian market but which contains chemical precursors that may be used for chemical weapons.

It is important to notice the coincidence between the crackdown on galamsey (illegal gold mining) and the acid throwing incidence in recent months. Since HNO_3 is used heavily in gold treatment, it tells of the effect of galamsey on the ease of access to such toxic chemicals. Admittedly, there seem to be stricter control on importation and production of such chemicals in Ghana. However, proprietary control after distribution becomes a challenge. Open market access and seemingly lack of buyer accountability has exposed our identification deficiencies. Regardless, the devastating nature of acid attacks warrant serious attention both in law and penalties.

The Way Forward

Though, the Ghanaian ministry of Environment, Science, Technology and Innovation (MESTI) has finished a draft legislation on the acquisition

and use of toxic chemicals, it is yet to be given approval. This implies punitive measures cannot be applied on non-compliant persons. This notwithstanding, educational drive is needed to sensitize the public on the proprietorship and use of chemicals. This includes strengthening the capacity of chemical industries and distributors to develop robust know-your-customer KYC regimes. This is possible after reviewing the national chemical safety and security protocols through stakeholder engagements and state willingness to pursue its desired interests. Finally, the penalty regimes for acid throwing should be revisited and made harsher to all engaged in its unauthorized chain of custody.

Conclusion

In conclusion, people tend to think chemical weapons come in Rambo-style movies like grenades and tanks. However, chemicals for such weapons may be in your deodorant or dye you have in your room. You bitter enemy might be planning to walk into that shop at the roadside to buy HNO_3 to harm-it is that easy to get here. Acid attack effects are devastating, barbaric and inhumane-it needs urgent attention.

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The Biodiversity of Coastal Upwelling Sandy Beach System

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Coastal upwelling sandy beaches

The most prominent upwelling areas of world are located at the western coasts of continents where an equatorward wind (Fig.1A), due to the subtropical high, forces an offshore Ekman drift (Fig. 1B) of the surface water. Coastal upwelling is a dramatic event during which warm nearshore water is replaced from below by cold nutrient-rich water (Fig.1C). Surface waters are usually depleted of nutrients such as phosphates and nitrates which are critical for plant growth while deep waters normally have higher nutrient concentrations (Fig.1C). Upwelling of cold and nutrient rich water towards the ocean surface replenishes (Fig.1C) the surface layer with nutritional components necessary for the biological productivity and thus upwelling regions are among the richest coastal marine areas of the world. Coastal upwelling also fuels the high productivity of sandy beaches (Laudien, 2002). During upwelling maximum biological production is very high (Mensah and Anang, 1998). Off the Ivoir-Ghanaian coast, intense seasonal upwelling of cold, high saline water significantly influences the rich fish distribution (Mensah and Anang, 1998).

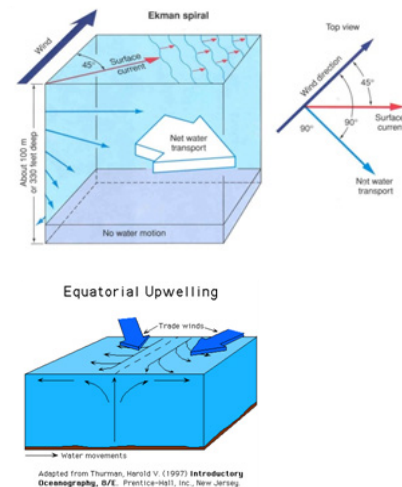
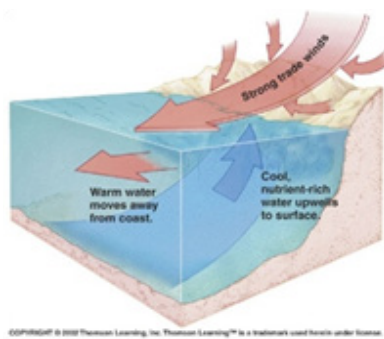


Figure 1 Coastal upwelling mechanisms; (A) Equatorial Upwelling (B) Ekman Transport (C) Upwelling of cold rich-nutrients from deep waters to warm nutrients-poor surface waters via Ekman transport

Sandy beaches are most extensive intertidal systems worldwide (Short, 1999). Sandy beaches dominate temperate and tropical coastlines, serving as recreational and buffer zones against the sea (Davies, 1972). Sandy beaches are one of the most highly productive systems (McLachlan, 1983). Most sandy beaches originate from glacial erosion (Fig.2A). Sand can be made of small particles originating from erosion of rocks through water, chemicals, and temperature (Fig.2B). Quartz sand is the most common on the East Coast, a result of the breakdown of granite and sandstone (Fig.2B). Shallow marine sands that appear to consist of clean mineral grains only harbour a microscopic community of microorganisms (e.g., bacteria, fungi and protozoa), meio- and macrofauna organisms that in its diversity rivals that of terrestrial ecosystems. Human activities (e.g., tourism, sewage disposal, pollution and among many) threatens water quality and biodiversity in sandy beach ecosystem.



Types of beaches

The interaction of waves and tides with the available sediment results in a series of morphological beach types (Short, 1996). The most common beach types are dissipative reflective beaches, although there are few intermediate beaches. For wave-dominated beaches the extremes are characterized by the dissipative condition, where the wave energy is largely dissipated in a broad surf zone before reaching the intertidal sand, resulting in a gentle beach slope and non-turbulent swash. While reflective beaches, there is no true surf zone, so the waves break on the beach front and much of the wave energy is reflected back towards the sea (Defeo and McLachlan, 2005). Dissipative and reflective beaches can be found in Ghana, these include La beach and Chorkor beach respectively (Table 1).

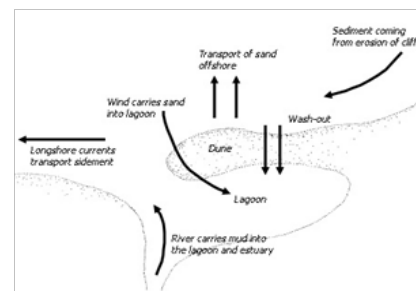


Figure 2 (A) Processes on sandy beaches

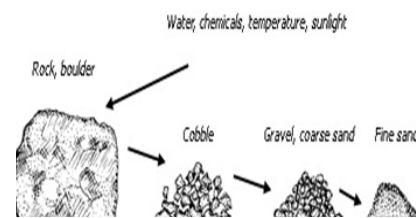


Figure 2 (B) components of sand particles



Figure 3 Types of sandy beach; dissipative and reflective beache; (A) La Beach



Figure 3 Types of sandy beach; dissipative and reflective beache; (B) Chorkor Beach

Table 1 Types of sandy beaches in Ghana

| Beach characteristics | Type 1 | Type 2 |
|-----------------------|----------------------------------|--------------------------------------|
| Beach Name | La Beach | Chorkor beach |
| Latitude | 5°33'30.88" N | 5°31'3.99"N |
| Longitude | 0°9'34.74" W | 0°14'38.16"W |
| Beach type | Dissipative | Reflective |
| Slope | 1:6.28 | 1:11.23 |
| Grain size (Φ) | 2.37 ± 0.18 (fine) | 0.99 + 0.66 (course) |
| Sorting (Φ) | 0.72 ± 0.11 (moderately sorted) | 0.79 ± 0.18 (sorting coefficient) |
| Skewness (Φ) | 0.02 ± 0.14 (near symmetrical) | 0.27 ± 0.46 (moderately well sorted) |
| Kurtosis (Φ) | 1.09 ± 0.17 (mesokurtic) | 1.07 ± 0.15 (leptokurtic) |
| Donax species | Donax pulchellus | Donax rugosus |

Biodiversity of sandy beaches

Most invertebrate fauna (Fig.4A) on sandy beaches are interstitial animals and macrofauna (Short, 1999). Some of the macrofauna are typical of intertidal sands and the surf zone. While others inhabit sheltered sandbanks, sandy mud and estuaries (Short, 1999). Macrofauna (e.g., molluscs, crustaceans and polychaetes, Fig.4B-D) are most abundant fauna in sandy beach system and vary from a few mm to 20 cm in length. The upper sandy beach (transitional from land to sea) is occupied by ghost crabs and sand fleas, animals more terrestrial than marine. True marine life appears at the intertidal zone. Two common inhabitants, active at high tide, are the lugworm, which burrows through the sand and feeds on organic matter; and the surf clam *Donax*, which advances up the beach and retreats with the tides. Among the sand grains live small copepods (minute crustaceans) and nematodes (worms) that feed on microscopic algae, bacteria, and organic matter. On the lower beach, which remains uncovered for only a short period of time, live clams, crabs, starfish, and sand dollars, whose calcareous skeletons lie partially buried in the sand (Brown and McLachlan, 2006) (Fig.4A-D). Physical factors (e.g., wave action and particle size) of the sand largely determine the distribution and diversity of the invertebrate macrofauna of sandy beaches (McLachlan, 1996). Food input and surf-zone productivity may determine the abundance population. Water movement is an important parameter controlling macrofaunal distribution on beaches (Brown and McLachlan 1990).

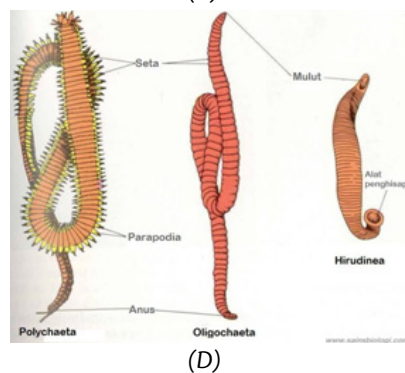
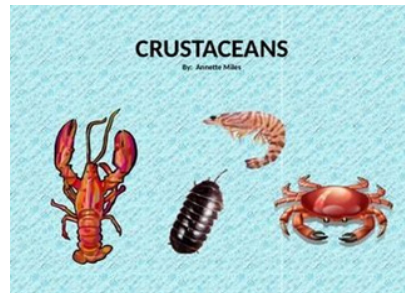
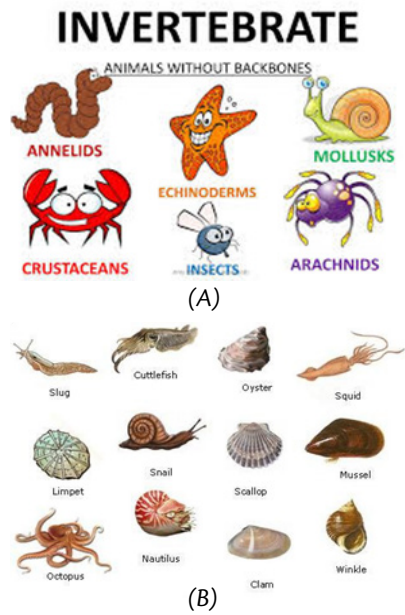


Figure 4 Biodiversity of sandy beaches; (A) Invertebrates (B) Molluscs (C) Crustaceans (D) Polychaetes

Donax species inhabiting in coastal upwelling sandy beaches

Sandy beaches are inhabited by a diverse macrobenthic fauna of sometimes high commercial value. The beaches derive an important link with the adjacent ecosystem and commonly have large socio-economic values. Most of the prominent coastal upwelling areas are located at the

western coasts of the continents (Fig.5A) characterized by strong currents directed to the equator (i.e. the Humboldt and California Current of the Pacific, the Canary, Benguela and Guinea Currents of the Atlantic Ocean (Laudien, 2002).

Donax species (e.g., surf clams, beach clams and wedge clams) are often the primary consumer in intertidal sandy beach-communities of upwelling systems supported by the high levels of phytoplankton production (Fig.5A) (Laudien, 2002). They filter feeding on phytoplankton, small particles such as unicellular algae, detritus and are in turn consumed by fish and shore birds as well as by human beings (Salas et al., 2001). Therefore, Donax species provide an important trophic link in surf food webs. When shelled organisms such as Donax die the remaining skeleton is broken up. These parts consist mainly of calcium carbonate, which may dominate sands (Brown and McLachlan, 2006).

Bivalves of the genus Donax are widely distributed in exposed sandy beaches from tropical to temperate coasts (Ansell, 1983). Seventy seven percent (77 %) of Donax species are found on sandy beaches in tropical waters, 22 % in warm temperatures and only 5 % in cold waters and are believed to have originated in the tropics and migrated to cooler climates (Ansell, 1983). The lowest species diversity of Donax is therefore found on the West Coast of coastal upwelling sandy beaches of Africa (Ansell; 1983). The clam buries itself by extending its foot in a tapered point into the sand (Fig.5B). Then the foot expands and becomes an anchor. The clam pulls the rest of the body downward (Fig.5B). Sixty four (64) species of Donax exist worldwide (Ansell, 1983), two of which are found in Ghana (thus *D. pulchellus* and *D. rugosus*) (Akita et al., 2014). The two beach surf clams (*D. pulchellus* and *D. rugosus*, Figures 4B-C) inhabiting coastal upwelling sandy beaches of Ghana, belongs to super family Tellinacea of family Donacidae and class Bivalvia of the Mollusc Phylum (Akita et al., 2014).

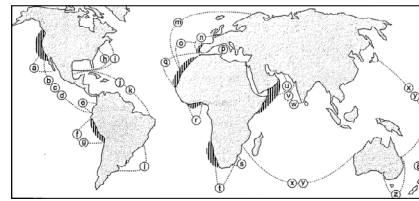


Figure 5A Coastal upwelling areas of the world ocean and the geographical distribution of selected donacids (adapted from Laudien, 2002) a: *D. gouldii*, b: *D. carinatus*, c: *D. panamensis*, d: *D. punctatostratus*, e: *D. dentifer*, f: *D. marincovich*, g: *D. obesulus*, h: *D. foster*, i: *D. variabilis*, j: *D. denticulatus*, k: *D. striatus*, l: *D. hanleyanus*, m: *D. vittatus*, n: *D. variegatus*, o: *D. trunculus*, p: *D. semistriatus*, q: *D. venustus*, r: *D. puchellus* and *D. rugosus* s: *D. sordidus*, t: *D. serra*, u: *D. townsendi*, v: *D. speculum*, x: *D. cuneatus*, y: *D. faba*, z: *D. deltoids*, á *D. pallidus*.

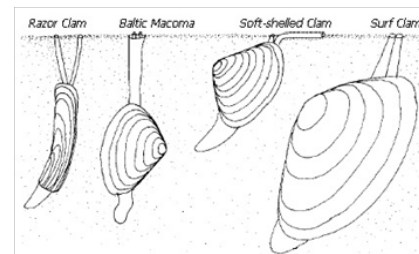


Figure 5B Different types of Donax species feeding via protruding their siphon to surface of sand.



Figure 5C: *Donax pulchellus* -'Adjamo' found in fine sandy of La beach, Gulf of Guinea upwelling coast, Ghana.



Figure 5D: *Donax rugosus* -'Osege' found in coarse sand of Chorkor beach, Gulf of Guinea coastal upwelling, Ghana.

Conclusion

Coastal parallel winds in conjunction with Coriolis force (Ekman transport) induced coastal upwelling (transport of cold nutrient-rich layer into warm surface nutrient-poor layer, euphotic zone). Sandy beaches surround temperate to tropical coastlines across the world. Coastal upwelling sandy beaches are one of the most productive systems (thus restricted to west coast of most continents across the world). Two common types of sandy beaches include dissipative and reflective beaches. A dissipative beach is characterised by flat beach slope, finer sand, non-turbulent and low wave energy (e.g., La beach). Whereas reflective beach is characterised by steeper beach slope, coarse sand, turbulent and high wave energy (e.g., Chorkor beach). The biodiversity (e.g., crabs, clams and polychaetes) of sandy beach helps to regulate the nutrients cycle of coastal ocean front water and maintain the nutrition of trophic food chain. The most common macrofauna in coastal upwelling sandy beaches include surf beach clams, Donax species. Human pressure (e.g., population increase, urbanisation and industrialization) on coastal environments (e.g., sandy beach

ocean fronts, estuaries and lagoons), demands integrated approach to assess the state of coastal water quality and coastal diversity. *Donax pulchellus* and *Donax rugosus* are the two common tropical beach clams found in the Western Coast of the Gulf of Guinea, Ghana. *Donax pulchellus* prefers fine sandy dissipative beach of La. While *D. rugosus* dwells in coarse sandy reflective beach of Chorkor. As in-situ permanent members of coastal upwelling sandy beaches, Donax species can be explored as biological indicators to be integrated in physico-chemical environmental monitoring of coastal waters in Ghana. Integrated assessment of ecosystems offers a broader view of state of the coastal water quality.

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Animals We Love to Hate: The Science and the Myth

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Introduction

Ghana is endowed with a diversity of wild and domestic animal species which are important as important components of the earth's natural ecosystems and sources of food, medicinal products, recreation and scientific experimentation. Unfortunately, due to widespread human superstition, ignorance, and socio-cultural and religious prejudices, some wild and domestic animals in Ghana have suffered persecution and direct hostility. This article scientifically explains some widely- believed myths about five common misunderstood animals in Ghana.

Snakes

Snakes are probably the most feared and hated animals in Ghana, due to their very powerful, potentially-fatal venom, rapid movement without legs, and very sharp reflexes. Two very common snakes myths are that they are all venomous and deadly, and that all snakebites are fatal. In reality, only about a third (30%) of the world's snake species are venomous, and bites by even the most venomous and dangerous snakes can be managed with the proper medical attention.



Puff Adder (*Bitis arietans*)
Venomous Ghanaian snake



Royal Python (*Python regius*)
Non-venomous Ghanaian snake

Owls

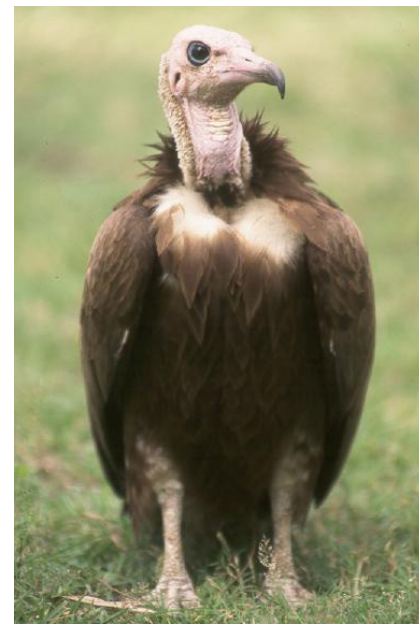
Most humans erroneously believe that owls assume human form and cause havoc through witchcraft. Owl myths largely originate from some peculiar adaptations: (i) flat, wide human-like face with binocular vision, (ii) terrifying hoot, (iii) acute vision in total darkness, (iv) noiseless flight and (v) keen sense of hearing. The reality is that the owl's hoot is a means of creating fear in other animals and make them easy to spot. The combination of efficient vision, hearing and silent flight enhance noiseless, swooping hunting at night. There is no spirituality involved.



Owl

Vultures

Humans consider vultures as filthy, and disease-carrying creatures because of their scavenging lifestyle and perceived association with unsanitary conditions. In reality, The behaviour of vultures does not however portray such negative attributes. They clean themselves in any water bodies close to their feeding sites and also burn off bits of food stuck to their bodies, by basking in the sun after feeding. Vultures are also specially adapted for digesting meat in advanced stages of decay. They actually play an important role as nature's "sanitary workers", cleaning the environment and helping to reduce human infection and disease.



Vulture

Pigs

Pigs are generally considered by humans as dirty, lazy, greedy and unintelligent creatures. On the contrary, however, pigs are very intelligent creatures. Their frequent bathing in muddy water helps to cool their bodies because they lack the major sweat glands found in other mammals. They eat a lot to produce fat under the skin for buoyancy when

swimming, and they would not normally excrete waste near their living places. Most experts consider pigs as more intelligent and easily trainable as pets than dogs or cats.



Pig

Wall Geckos

Wall geckos are common tropical nocturnal and insectivorous lizards which frequent human habitations. This behaviour and their perceived ability to deface the walls of houses, make them particularly revolting to humans. A common gecko myth is that they are poisonous, dangerous, and disease carriers. There is however no scientific evidence indicating that any gecko is poisonous or that they cause human diseases.



Wall Gecko

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Snakes: Facts and Myths

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Introduction

Most people dread an encounter with snakes, because of the erroneous belief that all snakes are venomous and dangerous, and that all snakebites are necessarily accompanied by injection of potent and fatal venom. Such misconceptions about snakes put them constantly under threat of extinction and discourage people from learning about them. This article discusses some aspects of snake biology as an attempt to dispel the above myths and others.

What is a snake?

Snakes are reptiles, a group of crawling vertebrates (animals with backbones) which also includes lizards, tortoises, turtles, and crocodiles. Snakes are closely related to lizards but differ from them in lacking eyelids and external ears (eardrums).

How many types of snakes?

There are about 2,700 different species of snakes worldwide, the smallest being the worm snake (*Leptotyphlops bilineata*) which is 12 cm long. The world's largest snake is the 11.5-metre long anaconda (*Eunectes murinus*) of South America, while the 12 metre long reticulated python (*Python reticulatus*) of Asia is the longest. Africa and Ghana's largest snake is the African python (*Python sebae*) which can grow to a maximum of 24 feet. There are 91 species of snakes in Ghana.



Reticulated Python



African Python



Worm Snake



Anaconda

How do snakes move without legs?

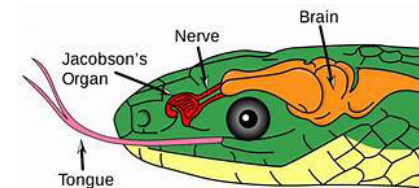
The backbone of snakes is very flexible and composed of 100 to 400 vertebrae. This enables snakes to manoeuvre around obstacles and almost effortlessly slither in and out of the narrowest of nooks and crannies. Specialized rectangular scales on the underside of snakes overlap backwards and enable friction with the ground to propel the snake forward.

How do snakes feed?

All snakes are carnivorous (flesh-eating), feeding on a wide variety of invertebrates (e.g. earthworms, insects, etc.) and vertebrates. Snakes swallow their food whole, with well-developed salivary glands and very strong stomach enzymes enabling quick and efficient digestion.

What are the snake's sense organs?

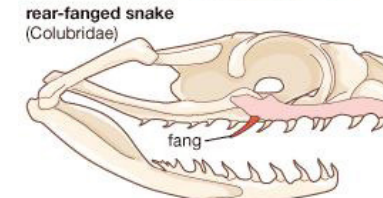
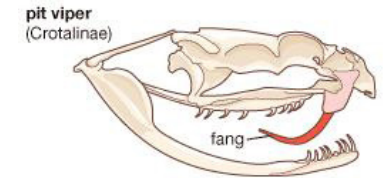
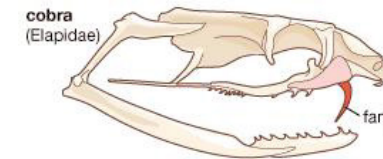
Snakes have very weak senses of hearing and taste, but a fairly good sense of sight. Snakes cannot blink, and are largely deaf to air-borne sound due to the lack of external ears. The forked tongue of snakes is an organ of smell.



Snake Sense Organs

What makes a snake venomous?

For a snake to be venomous, it must possess venom and the means to inject it. The possession of venom by some snakes greatly enhances their feeding and defensive abilities, enabling them to subdue and consume very large animals with a minimum of effort or risk. Snake venom is modified saliva stored in venom glands in the snake's head. Venom is injected using fangs (specialized teeth) connected to the venom glands by venom ducts. Non-venomous snakes lack venom and fangs to inject it. Only 30% of all snakes in the world are venomous.



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Snake Fangs

How many types of venomous snakes?

There are two major types of venomous snakes, based on the location and type of fang. Back-fanged (opisthoglyphous) snakes possess fangs located at the back of the row of teeth in the upper jaw, and belong to the group of snakes referred to as colubrid or "typical" snakes. These make up the majority (60%) of all the world's snakes. Front-fanged snakes have fangs located in front of the row of normal teeth in each half of the upper jaw. Some front-fanged snakes (cobras and mambas) have short and fixed fangs (proteroglyphous) and inject nerve-acting (neurotoxic) venom while others (vipers and adders) have long and movable fangs (solenoglyphous) and inject blood-acting (haemotoxic) venom.

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Hand Hygiene and Food Safety

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On the 15th of October, Ghana joins the world to mark the global handwashing day, aimed at increasing the awareness and basically reinforcing the practice of hand hygiene. Recurrent tv/radio adverts as well as sensitization programs such as the “high five for handwashing” campaign are needful as inadequate hand hygiene has been implicated as a serious contributing factor in the outbreak of several foodborne diseases. The WHO (2010) asserted that proper hand washing practices curtail the transmission of respiratory infections including diarrhea and cholera, thereby reducing the number of food-borne illnesses and deaths.

The reality is that, our hands pick up germs such as *Streptococcus pneumoniae*, pathogenic *Escherichia coli*, *Salmonella spp.*, *Vibrio cholerae* etc. from various points during regular activities such as playing, working, visiting the toilet, handling garbage, wearing your shoe as well as from

objects such as money, tables, door knobs etc. Apparent from the periodic tv/radio adverts, sanitizing the hands after visiting the toilets has been the focal point for these sensitization campaigns. This is because most of these germs that cause infectious diseases such as cholera, typhoid, hepatitis and diarrhoeal diseases are transmitted through the human excreta (Carr, 2001). Regrettably, this public health quandary is further compounded by Ghanaian’s unfortunate culture of open defecation.

Although food service establishments are required to implement hand hygiene programs, the substandard food and personal hygiene exhibited by most, especially Ghanaian street food vendors begs the question of how well these food vendors practice proper hand hygiene. The outbreak of diarrhoeal diseases including cholera are common occurrence in Ghana. According to Ababio and Adi (2012), about 420,000 cases related to foodborne illnesses

are reported per year with an annual death rate of 65,000 people. This hence brings to the fore the need to promote the practice of good food hygiene and in this case, proper hand hygiene especially before preparing or eating foods in order to prevent these germs from infections and sickness.

Some methods of hand hygiene

1. Handwashing

Hand washing with soap and running water is obviously the most common method. It is advised that we use soap made with antimicrobial agents such as chlorhexidine, iodine or hexachlorophene instead of plain soaps as the former not only ensure the physical removal of foreign material or microbes but also destroys them (WHO, 2009).



2. Alcohol-based sanitizers

These sanitizers come in the form of gels or wipes. Gel dispensers are often fixed in washrooms, offices and labs, or you can purchase the mini or pocket one which is sometimes seen attached to the hand bags of ladies. These sanitizers contain 60–80% alcohol (isopropanol, ethanol, n-propanol) which acts as skin disinfectants. Just a small amount of the gels is applied and rubbed on the hands and allowed to dry. The hand wipes on the other hand are small moistened pieces of paper or cloth that remove physical materials as well as reduce microbes’ presence on the hands. Their rapid action, easy to use, less irritation to skin properties coupled with their superior antimicrobial

efficacies compared to handwashing with antimicrobial soap, make them the most recommended measure for routine hygienic hand antiseptics by WHO. Nevertheless, these alcohol-based hand sanitizers are reported as not effective against bacterial spores and certain non-enveloped viruses (WHO, 2009).



3. Hot hand towels

The use of moist hot hand towels (Oshibori) has not yet gained presence in Ghana, however some restaurants abroad especially in Japan are utilizing them for hand sanitizing. From microbial safety stand point, the fact that the used towels are washed and reused again posed a bit of concern, although they are sterilized with sodium hypochlorite. Sano and Anrakub (2018) reported that, the likely survival of microbes on the towels despite the sterilization generates malodors hence the towels have to be disposed-off after some period of use.

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Microorganisms and their Roles in Food

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Cassava Dough Packaged for the Fermentation Process

What is the first thing that comes to your mind when you hear “microorganisms” or “microbes”? *Illness, right? Well!* You might not be alone when that is your first unpleasant impression of microorganisms. Its true microorganisms are the causative agents of many infectious disease of humans and animals, including tuberculosis, cholera, malaria, yellow fever, AIDS, Ebola etc. Nevertheless, food microorganisms are classified into 3 groups, namely beneficial, spoilage and food poisoning microorganisms depending on the role they play in the food.

We tend to forget that microorganisms play crucial roles in our day to day lives. First of all, the intestinal tracts of humans and animals are lined with bacteria that support the digestion of food. And in regard to food, besides their spoilage and illness causing reputations, microbes play beneficial roles in the quality and safety of our food. Kenkey and gari are two of the most common foods in Ghana. The unique acidic flavor which evolves from the 3-5 day fermentation of the corn/cassava dough by lactic acid bacteria, is one of the most

prominent quality properties of these staples. If you have ever eaten bread for breakfast or drunk beer when celebrating or relaxing, then you need to know that both products would not exist without the vital function of the yeast, *Saccharomyces cerevisiae*. Apart from improving the organoleptic properties, enhancing the nutritional quality and digestibility of foods as well as inhibiting the growth of spoilage microbes and pathogens due to the high acidity through fermentation, are few of the valuable functions of microorganisms.



Some Foods Rendered Undesirable due to Microbial Spoilage.

Spoilage microorganisms such as *Pseudomonas*, *Shewanella* on the other hand incite ruinous changes in the sensory characteristics of

the food making it unfit for human consumption. These microbes basically change the colour, texture, smell and taste making the food undesirable to consume. Slime formation or discoloration as well as soft and mushy texture of products mark the physical alterations that occur during spoilage. Have you ever accidentally tasted a spoiled milk? Well, it has a weird sour taste. This is due to the production of lactic acid by bacteria which corrupts the flavor quality of the milk. It is however important to note that, a microorganism that spoils a particular food may be used beneficially to produce desirable organoleptic properties in other products (e.g. Lactic acid bacteria) (Devlieghere, 2013).



Change in the Physical and Sensorial Properties of Milk Caused by Spoilage

Unlike the beneficial and spoilage groups where a microorganism can act as either a beneficial or spoilage depending on the product, the pathogens' group

is quite dissimilar as the microbe including its toxin cause illness. Pathogens are categorized into food intoxicants (eg. *Salmonella* spp., EHEC(*E. Coli* 0157), *Listeria monocytogenes*) or infectants (*Bacillus aureus*, *Clostridium botulinum*, *Staphylococcus aureus*) depending on whether the live microorganism is needed in the food to cause illness or just its toxin. It is important to note that, consuming a spoiled food may not necessarily mean you will suffer from food poisoning. Spoilage microorganisms only change the quality of the food and make it undesirable for consumption. They will not result in illness if pathogens are absent in the food. On the other hand, food that is unsafe for consumption may not be necessarily spoiled or present any warning characteristics but may contain a high number of foodborne illness causing microbes (Devlieghere, 2013).

Preventing the contamination of food by spoilage microbes and pathogens forms the core of food safety. As such, everyone is required to practice good hygiene when handling food and the food industry is also mandated to implement strict food safety principles during food production to ensure only food with high quality and safety reach consumers.

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Okra (*Abelmoschus esculentus*): Beyond the Dining Table

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Abelmoschus esculentus (L.) Moench is an international vegetable which originates from Ethiopia, Sudan and West Africa, cultivated in many countries but widely in Africa and distributed to Asia, Southern Europe and America. It is commonly known as okra (in the U.K and the USA), okro (in Ghana), ladies' finger (English), gumbo (in French) and many more. Botanically, okra is also known as *Hibiscus esculentus* (Kumar et al., 2013) and is a member of the Malvaceae family. Another known edible species is *Abelmoschus caillei* (Chev. A). Okra grows best in the tropical, subtropical and warm temperate regions. The okra pod/fruit is rich in carbohydrates in the form of a mucilage, protein, and vitamin C whilst the seed is rich in oil and fatty acids comparable to soybean oil. It contains minerals mainly calcium and potassium as well as trace amounts of zinc, magnesium and iron.

Worldwide production of okra is estimated at 7 million Metric Tonnes per year whereas over 60,000 Metric Tonnes (worth 38 million dollars) is

produced in Ghana annually (FAOSTAT, 2012) as cited in Agbenorhevi et al. (2015). Okra is cultivated in almost all the ten regions, where it is cultivated either via the mono-cropping system or mixed cropping system. Horticulturally mature okra fruits are harvested manually by hand-picking into baskets, bowls, and so on. The harvesting frequency is usually between every five to seven days. Farmers usually suffer from blisters on the fingers especially after a day harvest of large quantities of okra. Majority of harvested okra



fruits in Ghana are either used fresh or dry in food. Processing methods of fresh okra pods for use in foods include slicing, grating and crushing whilst dry pods are usually ground or crushed into powder prior to usage. Okra in

Ghana is mainly preserved by cutting into pieces, sun drying and storing in baskets, pots or bags.

Utilization of Okra

In domestic food applications, the fresh leaves, flowers and green pods okra are commonly used whereas its mucilaginous polysaccharide extract called pectin and its decoctions as well as infusions are applied in medicine (including herbal medicine), the pharmaceutical industry, the paper and textiles industry, and so on (Kumar et al., 2010; Kumar et al., 2013).

Medicinal/Pharmaceutical applications

Blood Volume Expander/Plasma Replacement: The mucilaginous substance (pectin) in okra functions as a plasma replacement or blood volume expander. Blood volume usually decreases after surgical operations, serious injuries and anaemic diseases. There is the need therefore to retain the blood volume to fully restore the functions of blood. Okra mucilage as well as other substances can be used to achieve this.

Natural Prophylactic: Okra mucilage also functions as a prophylactic, where it removes toxic substances especially poisoning cations from the body. Okra pectin is applied in treating diarrhea since it has the ability to increase the viscosity of stool. The fibrous nature of okra pectin makes it useful in preventing constipation and effective in reducing cholesterol as well as other lipids and glucose absorption in the digestive system. Okra is therefore important for controlling diabetes, obesity and cardiovascular diseases.

Treatment of ulcers, haemorrhoids, gastric irritations, dental diseases, wounds and cuts: Okra pectin shortens the coagulation time of blood and is therefore useful in arresting bleeding

during cuts and wounds whereas its ability to counteract acids is applicable in treating peptic ulcers (Srivastava and Malviya, 2011; Kumar et al., 2013).

Tablet Binder: In the pharmaceutical industry, pectin and its salts are applied to coat tablets and also as binding agents. Okra pectin could be used to achieve this same purpose in tablet formulations. This is further applied in specific target drug delivery. For example drugs for treating diseases of the colon are coated with pectin and calcium pectinate to render them insoluble in the upper part of the gastrointestinal and increase their effectivity in the colon where pectinolytic enzymes breakdown the pectin and calcium pectinate to release the drugs (Srivastava and Malviya, 2011).

Treatment of Overeating: Pectin as a dietary fiber immobilizes food components and reduces their exposure to digestive enzymes. Eventually, digestion rate is reduced and food remains in the digestive system for a longer time. Pectin molecules also bind water molecules and provide a feeling of satiety. Okra pectin could be applied for this purpose.

Others: The significant amount of dietary fibre and bioactive compounds in okra makes it useful in the treatment of diabetes and several other ailments. In a study that collected data from 1560 Ghanaians on the utilization of okra in Ghana, the various parts of okra including its leaves, flowers, fruits, seeds and roots are useful in traditional treatment several ailments. Respondents from some parts of Northern Ghana explained that the okra plant is useful in treating dislocations, fractures, cold, ringworm, 'ananse', diabetes and also in ameliorating difficulties during childbirth.

Food Applications

The okra fruit functions as an emulsifier, a thickener, a stabilizer and a gelling agent in foods. Its mucilage (pectin) content causes thickening of stews and soups, stabilizes emulsions and causes gelation in foods through binding

of water molecules. Okra pectin also functions as egg white and fat substitutes in cookies, confectioneries such as chocolate bars and so on. It also increases the firmness of bread loaf and improves the texture of fried yam snacks (Abgenorhevi et al., 2015). According to Farinde et al. (2007), the fresh flowers as well as the green pods are consumed in Nigeria as food either in a cooked, boiled or fried state. The dried okra seed are also roasted, ground and used as coffee additives or substitutes. Due to their health benefits, okra flowers are consumed as health tea in China (Geng et al., 2015)

Non-Food Industry Applications

Okra polysaccharides are applied as brightening agents in electro-deposition of metals, deflocculant in paper making and fabric production. Due to their slimy nature, they are also applied as protectants to reduce friction in pipe flow. Biodegradable polymeric materials are also produced from a combination of okra polysaccharides and acrylamide. Okra polysaccharides are also applied in the treatment of textile waste water.

Conclusion

Okra is very useful in the medicinal industry, food and non-food industrial applications. It has the potential to serve as low cost raw material for these industries and its commercial production will eventually create employment for people.

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