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Health Benefits of Fruits and Vegetables: Review from Sub-Saharan Africa

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Abstract

A fruit is defined as the edible part of a plant that consists of the seeds and surrounding tissues, while vegetables are plants cultivated for their edible parts. Fruits and vegetables are important sources of micronutrients and dietary fibres and are components of a healthy diet, which help in preventing major diseases. Due to the fact that fruits and vegetables have health promoting properties, they contribute to dietary guidance. This chapter defines the basic concepts related to health benefits of fruits and vegetables, reviews the previous literature on health benefits of fruits and vegetables and enumerates the health benefits of some common fruits and vegetables. It also examined the dietary recommendation of fruits and vegetables in less developed countries as well as present situation of fruits and vegetables consumption with particular reference to sub-Saharan Africa.

Keywords: health, consumption, dietary guidance, fruits, vegetables

1. Introduction

A fruit is the mature ovary of a plant or the succulent edible part of woody plants, while vegetables are the edible portions of a plant that can be eaten such as the leaves, stem, tubers, roots and bulbs, the sweet and fleshy product of a tree or other plant that contains seed and can be eaten as food [1]. Nutritionally, fruits and vegetables are energy-dense foods containing vitamins, minerals, fibre and other bioactive compounds [2–5].

According to Mintah et al. [6], a fruit is the edible and fleshy seed-associated structures of certain plants, which could be sweet (such as apples, oranges, grapes, strawberries, juniper berries and bananas) or non-sweet (such as lemon and olives) in their raw forms [7, 8].

Moreover, FAO [9] revealed that “increasing fruit and vegetable consumption is a major public health challenge at the moment”. The statement was made due to the micronutrient deficiencies being experienced worldwide which lead to nutritional disorders such as weakened immune systems, birth defects, mental and physical retardation, among others. These nutritional deficiencies occur as a result of low consumption of fruits and vegetables and also probably because of low knowledge of the nutritional values of fruits and vegetables [10, 11]. Thus, the relevance of this chapter is on the health benefits of fruits and vegetables.

2. Basic concepts related to health benefits of fruits and vegetables

There are several implications of the colours of fruits and vegetables, as observed during the Pacific Regional Workshop on Promotion of Fruits and Vegetables for health in 2014. The purple/blue colour of fruits and vegetables signifies their antioxidant properties and their ability to reduce the risks of cancer, stroke and heart disease. Beetroot and eggplant are good examples. Red colour in fruits and vegetables reduces the risk of cancer and improves heart health (as observed in tomato, watermelon, radish and red grapes). Orange/yellow-coloured ones contain carotenoids that help in maintaining healthy eyes (e.g. carrot, lemon, pineapple). Phytochemicals having antiviral and antibacterial properties as well as potassium are found in brown/white fruits and vegetables such as banana, garlic, onion and ginger, among others. In addition, the green-coloured fruits and vegetables have phytochemicals having anticancer properties such as broccoli, green apples, spinach, green pepper, lettuce and cucumber [12].

2.1. Health benefits of fruits and vegetables

Benefits obtainable from consumption of fruits and vegetables are greater life span [13], improved mental health [14], better cardiovascular health [15], reduced risks of some cancers [16] and weight management [17], among others.

In a study conducted in the USA, lower risk of obesity was observed among healthy middle-aged women who consume fruits and vegetables [18].

Specifically, fruits contain sufficient potassium, which are needed to reduce the effect of bone loss and occurrence of kidney stones [19]. Fruits assist in proper functioning of the brain as it stimulates the memory recall [6] and supplies the human body with fibre needed for a healthy digestive system [19, 20]. Fruits are also rich in dietary nutrients such as potassium, antioxidants and folic acid [21–23]; consumption of fruits guarantees optimum health, gives instant energy to the body and provides vitamins and minerals that are beneficial to body functioning [24].

In addition, vegetables are important as they help improve overall health, protect the vital organs of the body, assist in weight control, and promote healthy skin and hair. They also give abundant antioxidants that help keep diseases away from the body and aid in digestion by preventing constipation, haemorrhoids and diarrhoea [25].

2.2. Health benefits of some common fruits in sub-Saharan Africa

Citrus: Some of the fruits in this category are lime, lemon, orange, tangerine, pomelo and grape. They contain flavonoids, which are thought to contain some anticancer properties [24]. Flavonoids are antioxidants that could neutralise free radicals, protect from heart diseases and improve blood flow through the coronary arteries [26]. Citrus fruits are high in vitamin C and contain folate as well as thiamin. Vitamin C protects the body from free radicals that could destroy the body and helps in wound healing and holding blood vessels, tendons, ligaments and bone together. Thiamin is an important component of metabolism, while folate is required for cell division [27].

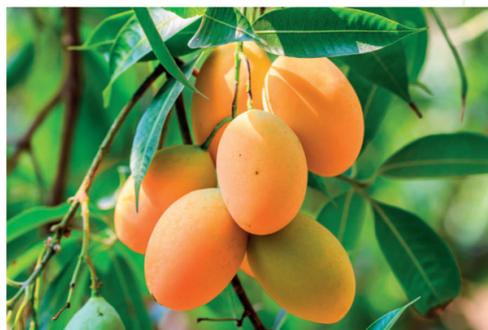


Orange



Lime

Mango: Mangoes are low in calories, high in fibre and can help avoid constipation while the fibre assists in metabolism by aiding the absorption of vitamins. The peels contain enzymes, which aid breaking down of carbohydrates, fats and proteins to form easily absorbable by the body. Mangoes contain magnesium, an electrolyte mineral that helps in regulating blood pressure, and vitamin A, a protective role in eye health, and help to protect the DNA structure. In addition, it helps in reducing age-related cognitive decline as well as damage from dangerous radiations. Consumption of mangoes prevents some forms of cancer due to its component –mangiferin that helps in functioning of the immune system. It also prevents the body from some diseases such as anaemia, asthma and atherosclerosis. Mangoes are good for repairing brain tissues as they reduce the effect of anxiety, depression and insomnia. Furthermore, consumption of mangoes improves the joint and skin; it also strengthens the bone [28].



Mango

Pawpaw: Pawpaws have low calorie content, soluble dietary fibre and do not contain cholesterol. They are high in vitamin C, vitamin A and flavonoids. Vitamin A helps to maintain healthy skin and eyes; folic acid, thiamin (vitamin B1), riboflavin and pyridoxine are all useful in body metabolism. Pawpaw seeds are also used in the treatment of stomach ache and ringworm infections [29].



Pawpaw



Sliced pawpaw

Pineapple: They contain calcium, potassium, carbohydrates, crude fibre and vitamin C (ascorbic acid, an effective antioxidant that aids the body's absorption of iron). It contains copper, which regulates the heart rate and blood pressure [30]. The vitamin C in pineapple also retards the development of urinary tract infections in pregnant women. Pineapples contain malic acid which boosts immunity and assists in maintaining oral health. They have natural anti-inflammatory properties and aids digestion. They are also a good source of manganese, a mineral that is required for building bones and connective tissues in the body [31]. Consumption of pineapple juice helps build healthy bones and restore the immune system. Moreover, consumption of pineapples helps the body to get rid of nausea, constipation, throat infections and intestinal worms.



Pineapple



Banana: It contains vitamins A, B6, C and D as well as potassium (that prevents muscle spasms). Banana helps the body to fight against ulcers; it is also useful in the treatment of anaemia, burns, wounds and arthritis. It aids constipation and presents a good relief for

diarrhoea. Its main benefits include mood improvement, weight loss and promotion of the human muscles and bones [32].



Banana

Avocado: These fruits are creamy with high content of mono-unsaturated fats and are rich in dietary fibre and high in calories. They contain tannins which have anti-inflammatory and anti-ulcer properties. It also contains vitamins (A, E, K, folate, thiamin, niacin), minerals (iron, copper, magnesium, manganese) as well as potassium, which help regulate the heart rate and blood pressure [33].



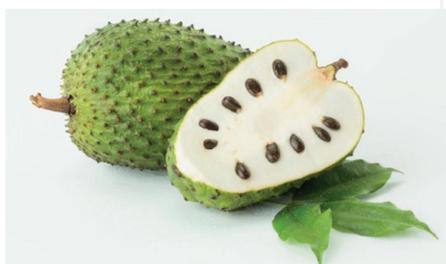
Avocado

African star apple: This fruit helps in lowering the blood sugar and cholesterol; a good treatment for toothache, constipation and sore throat. It is a good source of vitamin C which is a natural antioxidant and helps in weight loss. African star apple is low in carbohydrate, proteins, crude fibre and fat [34].



African star apple

Soursop: Soursop is used in the treatment of several ailments such as worms and parasites and as astringent for diarrhoea and dysentery. It is also used to cure cancer, improve the body's immune system, liver problems, kidney disease, urinary tract infections and prevents bacterial infections. Its consumption increases the milk production after childbirth in lactating mothers; its high vitamin C content is useful in slowing down the ageing process. It is rich in dietary fibre and contains calcium and magnesium needed for strong bones; contains vitamin B1 which aids in body metabolism and prevents nerve damage. It also has vitamin B2 which is needed for proper functioning of the nervous system and the body's energy production [35].



Soursop

Sweetsop/sugar apple: Consumption of this fruit facilitates milk production in lactating mothers, contains high amounts of folate required by pregnant women. It reduces the risk of heart attack and stroke as a result of the presence of high amount of magnesium. Vitamins A, B and C found in sweetsop makes it a good antioxidant and are needed for healthy skin. It regulates blood pressure level due to the presence of potassium in the fruits. Thiamin in sweetsop helps fight fatigue and weakness of the body. Its high content of calcium and magnesium assists in the promotion of healthy and strong bones; the niacin in sweetsop also controls body cholesterol level. The fruit also has anticancer properties, treats toothache and infections, prevents anaemia, promotes digestion and detoxifies the body [36].



Sweetsop/Sugar apple

African Bush mango: It is good for weight management, regulates cholesterol level and prevents constipation. This fruit is a rich source of potassium, iron, energy, protein, carbohydrates, ascorbic acid, sodium, dietary fibre, magnesium, calcium and phosphorus [37].



Africa bush mango seeds

Breadfruit: Consumption of breadfruits improves eye and bone health, immune system and physical cognitive condition [38]. It is high in carbohydrates, minerals, vitamins [39] and carotenoids [40]. Its consumption also protects the body against cancer, vitamin A deficiency, diabetes and heart disease. It is low in fat and cholesterol; a ready source of omega-3 and omega-6 fatty acids that regulate sebum production in the scalp and prevents hair loss. Consumption of breadfruit juice also improves the glowing of the skin, and the dietary fibre content of the fruit prevents heartburn, acidity, ulcer and gastritis as it eliminates toxic compounds from the gut [41].



Breadfruit

Guava: It is a super fruit rich in vitamins and minerals due to the bioactive compounds present in it. It has anti-allergenic, antimicrobial, anti-thrombotic and anti-atherogenic effects [42]. It also has antioxidants that help protect the body cells from damage.



Guava

Cashew: These nuts have high fat and calorie content and contain copper, which is useful for bone growth, nerve function and glucose metabolism. Most of the fat in cashew is in unsaturated form (oleic acid), which reduces triglycerides that could raise the risk of heart disease. Magnesium found in cashews is essential for energy generation, while zinc is important for reproduction and the immune system [43]. Consuming the nuts also prevents cancer and gall stones, strengthens the bones and promotes weight loss [44].



Cashew

Passion fruit: Its health benefits include promotion of intestinal health due to its high dietary fibre content; also it treats insomnia, helps during asthma attacks, kills cancer and reduces anxiety. It also aids weight loss and helps unwind the nerves. One serving of passion fruit provides the human body with the entire daily vitamin C requirement [45].



Passion fruit

Apples: Apples are rich in vitamins and minerals. Consuming these fruits aid weight loss, enhances brain health, provides antioxidants, reduces the risk of metabolic syndrome and prevents some forms of cancers [46].



Apples

Dates: Dates have high caloric content, low protein and fat content, moderate sources of vitamin A, adequate amounts of pyridoxine, niacin, pantothenic acid, riboflavin and vitamin K. They are also rich in minerals such as magnesium, manganese, selenium, potassium, copper, iron and calcium. The fruit cures anaemia, treats sexual weaknesses, night blindness, constipation and diarrhoea, prevents abdominal cancer and strengthens the human bones. It also helps maintain a healthy nervous system owing to the presence of potassium found in the cells and body fluids needed for the control of the body's heart rate and blood pressure level. Its iron content makes it suitable for pregnant women as it prevents haemorrhage after birth; it has anti-ageing benefits due to the presence of antioxidants that deals with harmful free radicals in the body [47].



Dates

2.3. Health benefits of some common vegetables in sub-Saharan Africa

Tomatoes: They contain the highest level of lycopene among all fruits and vegetables; lycopene is an antioxidant, which helps the body to get rid of free radicals that are harmful to it. Consumption of tomatoes helps in preventing various forms of cancers, reduces cholesterol level and thus reduces blood pressure due to the presence of vitamin B and potassium. Vitamin D in tomatoes keeps the hair shiny and strong, and it also helps improve vision. Chromium in tomatoes helps diabetic patients to keep the blood sugar level under control [48].



Tomatoes

Okra: Okra is a vegetable that contains vitamins (A, B1, B2, B3, B5, B6, B9 and C) and minerals (calcium, iron, phosphorus, potassium, magnesium, sodium and zinc). They also contain amino acids that are beneficial to health; lower cholesterol level; aid free bowel movement and reduce the risk of gastrointestinal problems. Consuming okra also contributes to active lifestyle. Okra contains antioxidants that remove free radicals from the body and potassium which helps reduce clotting and atherosclerosis. It has vitamin A that protects skin health, and high vitamin C content that induces the creation of white blood cells, which assists the immune system [49].



Okra

Eggplant: They have low carbohydrate and high fibre content, which helps the body manage blood sugar level. Its magnesium, calcium, phosphorus and potassium content helps to maintain the body's electrolyte balance. It helps to prevent birth defects in pregnant women due to its rich source of folic acid. It also contains iron and calcium that are both essential for bone health and aids in weight loss due to its low cholesterol content. Furthermore, it aids digestion because of its high dietary fibre content; iron and copper in eggplant also make it good in combating anaemia [50].



Eggplant

Cucumber: They contain sterols that can reduce cholesterol levels and as such, it is good in the treatment of both low and high blood pressure. Its consumption relieves arthritis pains and gout as well as promotes joint health. They are a good source of silica, which strengthens the connective tissues. Moreover, consuming cucumbers relieves bad breath, helps in weight loss, aids digestion, fights some forms of cancer and helps rehydrate the body [51].



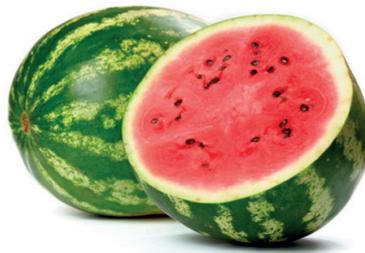
Cucumber

Pepper: They are appetite stimulants beneficial to people with starvation disorders. It also has antibacterial and anti-carcinogenic effects as well as good anti-inflammatory properties when applied topically [52].



Chili pepper

Watermelon: It has low calorie and a good source of vitamins and minerals. It provides lycopene, a powerful antioxidant along with vitamins A and C that have antioxidant and anti-ageing properties. It is an anti-inflammatory food that helps in limiting body stress, relieves pain, detoxifies the body and keeps skin healthy. It boosts immunity, manages high blood pressure, helps preventing kidney stones, boosts eye health, relieves acid reflux and helps fighting cancer [53].



Watermelon

Beets: Consumption of beets promotes cardiovascular well-being; it has high fibre content and improves exercise performance. The presence of antioxidants in beets is helpful in diabetic management, and it also boosts sex drive in men and women [54].



Beets

Garlic: Consumption of garlic helps reduce the risk of cancer and cardiovascular diseases, stimulates the immune function, restores physical strength and enhances detoxification [55].



Garlic

Onion: Onions protect the body from cardiovascular diseases, some infections and stomach cancer; it also improves lung function. It contains quercetin, which thins the blood, lowers cholesterol level, fights asthma, prevents blood clot, and acts as a sedative and an anti-inflammatory and anti-viral vegetable. Consumption of vegetables helps to detoxify the body, cures insomnia, improves the digestive system and memory and enhances strong nervous system [56].



Onion

Ginger: It is used to treat nausea and vomiting, lowers blood pressure, regulates blood glucose levels and also alleviates rheumatoid arthritis. It has antioxidant, antimicrobial and anticancer properties [57].



Ginger

2.4. Dietary recommendations of fruits and vegetables

Vegetables in particular are divided into food groups; the recommended daily intake is based on these groupings. The United States Department of Agriculture made it known that for these food groups, recommended daily intake should depend on the age, gender and level of activity of an individual. Vegetables have five subgroups which are as follows:

- Dark green vegetables, for example, broccoli
- Dark leafy green vegetables, for example, spinach
- Starchy vegetables, for example, green peas
- Beans and peas, for example, lentils
- Red and orange vegetables, for example, tomato, red pepper, carrot
- Other vegetables, for example, cabbage, beets, avocado, mushrooms

On the other hand, fruits are not divided into specific subgroups, but they also have recommended daily intake.

Recommended daily intake of vegetables for women of aged 50 and below is two and a half cup of vegetables, while men of the same age group require three cups of same vegetables. Once above 50 years, both men and women should reduce their daily intake by half a cup.

Recommended daily intake for fruits includes two cups of fruits for women up to 30 years of age and men of all ages, while beyond 30 years, women should reduce their daily intake to one and a half cup [58].

In less developed countries, minimum intake of 400 g of fruits and vegetables is required per day to prevent diseases and alleviate micronutrient deficiencies [2].

A study by [59] noted that recommended dietary guidelines should consider the consumer's age, sex as well as their physical activity level. The study showed a slight reduction in the percentage of adults in the United States who eat fruits and vegetables as opposed to the previous situation. According to the study, increased awareness on the benefits of fruits and vegetables consumption and educating people to change their eating behaviour are measures that could be put in place to ensure that people follow the recommended dietary guidelines. Other approaches could be employed such as farm-to-school programme, school gardening project and community projects.

2.5. Fruits and vegetables consumption in sub-Saharan Africa

There have been studies which examined fruits and vegetables consumption among different segments of the population in various parts of sub-Saharan Africa.

Fruits and vegetables consumption among younger population (adolescents in school) was examined by [60] in Cotonou, the Republic of Benin. It had earlier been observed in the area

that most urban adults aged 35–64 years consume less than the recommended daily intake, while among school going adolescents, a mean daily intake of 97 g was observed for fruits and vegetables. This prompted a focus group discussion on the factors that determine fruits and vegetables in selected public and private schools in Cotonou. The choice of schools considered the parental income, class of the school children; as such, the schools were sampled from the most-disadvantaged and better-off neighbourhoods. From the discussion with the school students, they had not received information on consumption of fruits and vegetables (nutrition education) in school. They felt that unhealthy foods (sweets and biscuits) were as nutritious as fruits and vegetables. Two-thirds of students in the private schools opined that their parents purchased fruits and vegetables for them at home; on the other hand, only few of those in public schools attested to this. Moreover, parental influence was a major determinant of adolescent students' consumption of fruits and vegetables. Personal factors that influenced their consumption were preferences, their nutritional and health knowledge of the fruits and vegetables as well as cultural beliefs. Most of the students did not consume fruits and vegetables on a daily basis except for tomato and onions, which are mostly used in daily meals. Other factors such as food safety, cost of fruits and vegetables, medical prescription and media influence determine the adolescent students' consumption. The study concluded that to increase fruits and vegetables consumption among adolescents while in school, food vendors selling these products should be in and around the school. Also, parents play a major role, while adolescents from poor families should be targeted.

Another study by [61] also assessed the knowledge and consumption of fruits and vegetables among secondary school students in Lagos state, Nigeria. Most of the students have a good knowledge of the nutritional and health benefits of fruits and vegetables. However, only 5.45% of the students consumed the recommended daily intake of 400 g or five servings per day. As observed by the students, factors that could ensure adequate consumption of fruits and vegetables are parental intake, encouragement and supervision, availability and accessibility of fruits and vegetables at home. Therefore, the study opined that the school children should be encouraged to maintain healthy eating habits as they grow older.

In South Africa, Peltzer and Phaswana-Mafuya [62] conducted a study on fruits and vegetables consumption among older adults aged 50 years and above. It was a nationally conducted survey involving 3840 participants. The results of the survey showed that 68.5% of the older adults experienced insufficient fruits and vegetables intake as observed in their mean daily intake of four servings per day. Predictors of insufficient fruits and vegetables consumption included being a male, having low educational level, being overweight, lack of religious involvement, lower quality of life, daily tobacco use and being a black African/coloured participant. The study thus recommended public education and campaigns for increased fruits and vegetables consumption among older adults in South Africa.

In Ghana, Kpodo et al. [63] examined the consumption pattern and preferences of polytechnic students for fruits and vegetables. The study was conducted among 449 students with most of them (59.6%) consuming vegetables at least thrice a day, while only one-third of them consumed fruits 1–3 times daily. The most frequently consumed fruits among the polytechnic

students were banana, mango and watermelon; while the least consumed were apples and pawpaw. For vegetables, tomato and onion were most frequently consumed; availability, convenience and cost were the three factors that mostly influenced the choice of vegetables consumed. Most of them purchase fruits (38.6%) and vegetables (45.8%) just sufficient for one serving, and they consumed these fruits and vegetables mostly for their known health benefits. Most preferred fruits included bananas, apples and watermelons, while vegetables such as carrots, tomatoes and onions were mostly preferred by the students for consumption. In essence, the study recommended that the fruits and vegetables mostly preferred by the students should be made available and accessible to them so as to change their eating habits. This is to ensure that they improve their consumption of fruits and vegetables.

Furthermore, a study by Layade and Adeoye [64] carried out an assessment of fruits and vegetables consumption among students of tertiary institutions in Oyo state, Nigeria. The study showed that the most preferred fruits by the students were banana and watermelon, while the least preferred were pawpaw and cashew. For vegetables, pumpkin leaves were the most preferred, while *Celosia argentea* was the least preferred vegetable. Health benefits, taste and availability were the major reasons for the students' preferences. Few of the students consumed the recommended daily intake of fruits and vegetables. Factors that affected the consumption of fruits and vegetables among the respondents were students' allowance, sex, parents allowance, availability and access. The study, therefore, recommended awareness creation to promote adequate consumption of fruits and vegetables among the study population.

Fruit intake level and its adequacy as well as determinants were examined by Ilesanmi et al. [65] among in-school adolescents in Nigeria. Fruit consumption among the female adolescents is lower than recommended. Adolescents with parents having high socioeconomic status had adequate fruit intake. The students' most preferred fruit was apple; while the study also showed that level of awareness of the benefits of fruits consumption for ensuring good health should be increased. Fruits should also be made available and affordable among adolescents to increase their consumption.

Also, a study was conducted by Mintah et al. [6], which examined the factors hindering fruits consumption among students in a public university in Ghana. Findings showed that high price and satiety were the most hindering factors for fruits and vegetables consumption. The low fruit intake was adjured to the fact that the consumption of fruits did not yield satisfaction for the students, that is, they could not eat fruits to alleviate hunger. Sixty five percent of the students did not consume up to the recommended daily intake of fruits and vegetables of 2–4 servings per day according to USDA 1992. Fruits such as oranges, apples, pineapple, pawpaw, banana, mango, pear, tangerine and watermelon were available to the students. The most preferred fruits were in descending order: pear, tangerine, apple, banana, guava, watermelon and pineapple. This study prescribed awareness creation and education on fruits consumption to improve public health, specifically among the university students and the general public as well.

In addition, Banwat et al. [66] assessed the consumption of fruits and vegetables among adults in an urban-slum in Jos Nigeria. Most of the respondents have fair knowledge of nutritional values; their knowledge of the nutritional values of fruits and vegetables was significantly

determined by their sex and educational status. Most of them (69.2%) consumed adequate quantity of fruits and vegetables. Respondents gave the cost of food items and seasonal availability of fruits and vegetables as reasons for the low consumption. Thus, to improve the intake of fruits and vegetables in the study area, the mass media and health talks by health workers could be used to educate respondents on the need for them to increase their consumption. Moreover, to reduce the expenses on fruits and vegetables purchase, households were encouraged to have home gardens where they can produce the crops, which will ensure their availability and all year round consumption of fruits and vegetables.

The reviewed studies have shown the various factors affecting consumption of fruits and vegetables across different subpopulations within sub-Saharan Africa. Studies that were conducted among students (adolescents and tertiary institution students) revealed that consumption of fruits and vegetables was due to the knowledge of health benefits derived from them [60, 61, 63, 64]. Moreover, the reviewed studies recommended awareness creation [6, 64], public education campaign [62] and encouraging households to have home gardens where they can have access to fresh fruits and vegetables at reduced costs [66]. Most of the studies revealed that consumption of fruits and vegetables in the region is still below the recommended daily intake of five servings per day.

3. Conclusion

This chapter discussed the definition of fruits and vegetables, the concept of colour in fruits and vegetables and recommended daily intake of fruits and vegetables across the globe (which is the same world over). It also outlined the benefits of some common fruits and vegetables in the sub-Saharan region. In the same vein, the situation of fruits and vegetables consumption within the region was reviewed. The chapter thus concludes that, there is still more to be done in order for households in the region to meet the recommended daily intake of fruits and vegetables. As studies have highlighted, awareness creation and public campaigns in the form of health talks concerning the health benefits of consuming fruits and vegetables are important for the entire population to realise their benefits. In addition, a review of the health benefits of these fruits and vegetables shows that increasing their consumption will keep the entire household healthy. This is because consuming fruits and vegetables has been seen to prevent and cure several diseases which could be noticed among all the different population strata. This could be highlighted during awareness campaigns and health talks so as to encourage the public to consume more fruits and vegetables.

Conflict of interest

There is no conflict of interest on this document.

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