

UNIVERSITY OF CAPE COAST

FRUIT EATING KNOWLEDGE AND PRACTICES OF STUDENT-TEACHERS OF
FOSO COLLEGE OF EDUCATION IN THE CENTRAL REGION OF GHANA

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BY

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Thesis submitted to the Department of Health, Physical Education and Recreation of the Faculty of Education, University of Cape Coast, in partial fulfillment of the requirements for award of Master of Philosophy Degree in Health Education

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DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this University or elsewhere

Candidate's Signature: Date:

Name: Emmanuel Armah Enniful

Supervisors' Declaration

We hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Principal Supervisor's Signature: Date:

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Name: Mr. Frank S. Bediako

ABSTRACT

The purpose of the study was to investigate various reasons why student-teachers eat fruit. The study sought to find out whether student-teachers eat fruits for its medical purpose, nutritional value or any other reason other than these, and to find out student-teachers' fruits eating pattern and mode. The study centred on teacher trainees of Assin Foso College of Education. Out of 945 trainees, 150 were used for the study – 75 males and 75 females. The selection of respondents was randomly done by lot. In each class, 10 trainees were selected – five men and five women from all the fifteen classes. Closed-ended form of validated questionnaire was used to collect data for the study. The questionnaire comprised both blank-mode and a checklist mode. Data was presented using percentages.

It was noted that, a greater number of respondents eat fruit for health reasons. About the type and nature of fruit, people eat most, it was realised that, raw fruits and oranges are mostly eaten. The number of those who eat fruit daily was largest. Health factor determines the choice of most fruit. About the quantity of fruits eaten by student-teachers, those who said they eat two mangoes were more than all, those who said they eat four bananas also had the largest number, about guava, those who selected two were more than all. About pawpaw, watermelon, pineapple, student-teachers who selected medium size were the largest. Orange/tangerine, had those who selected two being more than the rest and lime and lemon had those who selected less than 1 having the greatest number. The conclusion drawn was that, even though most respondents eat fruit for health and nutritional reasons, the difference between the number of these and those who eat fruit for other reasons were not large. So the researcher suggested that much education must be done to improve upon the eating habit of fruit by student-teachers.

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DEDICATION

This work is dedicated to my family; Mrs. Cecilia Enniful, Evelyn Donkoh Enniful, Ekuah Ansah Enniful, Kwamena Ehun Enniful and Joojo Ackon Enniful.

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CHAPTER 1

INTRODUCTION

Background to the Study

The human body is like a factory that needs raw materials to build new products, repair old parts and produce the energy that keeps the factory going. These raw materials are provided by the nutrients that are in food. Nutrients are the usable portion of food. Nutrients include proteins, carbohydrates, fats, vitamins and mineral salts.

From parental period throughout life people must have adequate nutrition to prevent malnourishment and minimize the development of illnesses that may be worsened by poor dietary practices. Food supports growth and development by providing the body with the nutrients needed for the production of energy, repair of damaged tissue, growth of new tissue and regulation of physiological processes, all of which undergird full participation in the activities that constitute our days, weeks, months and years of living. But our diets are more than that. Our food selections reflect personal, familial, and cultural traditions. The preparation and serving of food at regular mealtimes and during holiday gatherings and other special occasions enhances all of the dimensions of health.

Ghanaian society is such that some communities will rely on some type of food available at their area which may not provide the body with the required nutrients needed for proper functioning. Others also eat more than certain type of food which provides the body with only one or two different types of nutrients at over and above the required quantity at an expense of other nutrients equally needed by the body.

Some people don't see fruit as a type of food which does a lot to the proper functioning of the body. In Ghana, we are blessed with varieties of fruits both foreign

and local, but most people are not aware of what fruit is capable of doing for the body. People have different reasons for eating fruits. When you go to the rural areas, fruits available at the area are eaten when other food types are not available and as such eaten in large quantity. Others also eat fruits to supplement other food. Even though some people use other parts of fruit to treat sickness, most people don't know that eating fruits do a lot for the body's development.

In cities and urban areas where literates reside, only few people add fruit eaten to their normal diet with the correct intentions. Even at restaurants, where qualified nutritionists are supposed to handle at most time serve only food without fruit being added. It is only conferences, workshops and other official functions that fruits are normally served together with other food due to one or two reasons; the quantity served is very small.

In our schools and colleges, the situation is worse. When one compares the way food was served in the olden days to the present days, one will notice a serious difference. In our boarding schools about twenty or more years ago, fruits were part of the menu but for the past ten or more years ago, the situation is different. Most schools or colleges do not add fruit to the menu for students. So students depend on the little fruits hawkers sell around the campus. In this regard, they depend on only one or two types of fruits. The quantity and period of eating fruit depend on their financial strength. They also eat these fruit ignorantly not considering the benefit of fruit to the human body. So before they leave school, that habit has been formed and this will extend to their families they will raise.

But according to Payne and Hahn (2002), the number of servings that are right for a person depends on age, sex, size and levels of activities. They say the Food Guide Pyramid recommends 2 to 4 servings of fruits each day. One serving includes a medium

apple, one banana or orange, ½ cup of chopped, cooked or canned fruits. Nowadays, fruit juices are all over the place and people do patronize but how many of these consumers use them correctly or have the right intentions to consume them?

Payne and Hahn (2002) suggested that fruit should be served whole; in the case of large fruit like pawpaw and pineapple, you cut when about to serve to prevent the escape of vitamin C. considering the way people eat fruit, it is obvious that knowledge about fruit preventing or curing diseases is absent. William (2005), said that, over the years, epidemiologists in America have attempted to determine the relationship between diet and the development of chronic diseases. In early research, the focus was simply on the overall diet and its relationship to diseases, such as comparing the typical American diet to the Mediterranean (Greece, Italy and Spain) or Japanese diet. If a significant relationship was found between the diets of two nations, say more heart diseases among Americans compared to those consuming the Mediterranean diet, scientists then attempted to determine what specific foods particularly which macronutrients in these foods, may have been related to either an increased or decreased risk for heart diseases.

There are periods that one can say that, Ghanaians directly or indirectly consume better fruit and at regular periods too. These are the seasons where some fruits are fresh, abundant and cheap at the market. Fruit that is in season is likely to be cheaper and of good quality. Fruit bought from the market should be sound, with no bruises and should be free of maggots and insects. It should generally be firm to the touch and should not be over ripe or have patches of decay or mould on it. Even though canned, bottled or frozen fruit can also be used, but this is more expensive and lacks some nutrient of fresh fruit.

Ghanaians also have the habit of presenting to the sick person fruits as gift and other organisations and religious groups also occasionally visit hospitals with numerous

gifts, among these gifts are fruits. This presupposes that, the idea of fruit doing some magic for the sick is there but do we have to wait to be sick before eating fruit or is it because sick person cannot eat heavy food that is why the person must be forced to eat fruit? During my course work, I realized that my knowledge on the benefit of fruits to human health was limited. I found out from colleague students about their knowledge on the benefits of fruit. Responses given were just like what I knew. So I decided to investigate into fruit eating knowledge and practices.

Statement of the Problem

Driven by hunger, our ancestors ate whatever fruits available; some were acid, or even mildly toxic until very ripe. But the vitamin C content were often high, and sometimes extremely high. There would have been times of the year when fruit was either not available at all or scarce. Today we have good variety of fruits, and fruits that are better than just edible. On the other hand, fruit consumption has to compete well. Fruits are full of antioxidants and cancer suppressing chemicals, they are a valuable energy source, and have fibres, which health qualities are only just beginning to be discovered. Most fruits have proven medicinal qualities. For a few individuals, where times, space and inclination allow, home growing selected fruits can provide valuable adjuncts to the modern industrial diet. By selecting fruit particularly rich in vitamins plus enjoying the particular health qualities of other fruit, we can at least match and perhaps even surpass the variety, quality and quantity of fruit that was available to our ancestors.

Many people today have so many perceptions about fruits and these determine their consumption or likeness for a type of fruit. Most people never know any of the

benefits of fruit to the human health and this seriously affects the demand for them even if they are cheaply sold around them.

Purpose of the Study

The purpose of the study was to investigate reasons why student-teachers eat fruits. It is to identify whether people eat fruits for its medicinal purpose, nutritional value, or any other reason other than these and to find out people's fruit eating pattern and mode, that is whether people destroy most of the nutrients before eating or eat it in excess to create problems for their body. Also, to find out what type of fruit student-teachers eat, how frequency they eat fruit and factors that determine their choice of fruit, and the quantity of fruit they eat whenever they eat fruit and finally to find out their knowledge about the benefits of fruits to human health.

Research Questions

1. What reasons do student-teachers give for eating fruits?
2. What types of fruit do student-teachers eat?
3. How often do student-teachers eat fruits?
4. What factors determine student-teachers' choice of fruits?
5. How much fruits do student-teachers eat?
6. What knowledge do student-teachers have about the benefits of fruits to human health?

Significance of the Study

The study may help these institutions (the Colleges of Education) that have the nutrition and dietary departments to gain insight into the fruit eating behaviour of some members of the public so as to know how to plan well on diet education.

Also, the Ministry of Health may know how to handle their crusade on diet and good health, NGOs and stakeholders will also acquire knowledge on the fruit eating habit of some Ghanaians and help to improve it. Finally, the health education and promotion sections of the health sectors will also have a picture of the eating habit and pattern of fruit eating of the public so as to plan well to improve upon it and to improve the health of the public.

Delimitation

1. The study was delimited to teacher trainees in Assin Foso College of Education.
2. The study was further delimited to 12 selected local fruits available in Ghana.
3. It was further delimited to 150 teacher-trainees of Foso Training College, 75 females and 75 males because of resources.

Limitations

Because of resources, only 150 students out of 945 were used for the study which may have an effect on the validity of the result. Observation could have been used along side questionnaire for better information, but due to the scattered nature of the respondents, it was not possible to use this design. Since the first and second year students answered their questionnaire in classrooms, even though the researcher prevented this occurrence, some members of the class who were not selected sat by those selected and assisted them answer the questionnaire and some students selected

responses that they felt suitable other than the actual practices they put up.

Definition of Terms

Prep: This is a period usually in the evening after supper when students go the classroom to study and prepare for the next day's classroom work or to do assignment.

Teacher-trainees: Students who are being trained to become professional teachers.

CHAPTER 2

REVIEW OF RELATED LITERATURE

This chapter reviewed literature related to the reasons for eating fruits. The following areas which were related to the research questions asked in the study were given prominence, they are: meaning of fruit, functions of fruit, implications of lack of fruit, medicinal value, nutritional value, and use as food substitute or supplement

Also the following reasons were also taken care of to give clear picture about the study apart from the above which will help to identify: factors that determine student trainee's choice of fruit, quantity of fruit eaten by fruits eaters whenever they eat fruit, historical background of some fruits.

Meaning of Fruit

According to Oxford Advanced Learner's Dictionary, fruit is the part of a plant that consists of one or more seeds and flesh, can be eaten as food and usually tastes sweet. Also, the Cambridge International Dictionary of English also defines fruit as the usually sweet tasting part of a tree or bush which holds seeds and which can be eaten. Again, the Longman Dictionary of Contemporary English also defines fruit as something that grows on a plant, tree, or bush, can be eaten as a food, contains seeds or a stone and is usually sweet.

Spanish dietary code or "CAE," defines fruit as "fruit, infructescences or the fleshy portions of floral organs that have achieved an appropriate degree of maturity and are fit for human consumption." Empidemiol (2004) stated that, fruits are really an evolutionary adaptation of flowering plants that helps in the reproduction of the species. Technically a fruit is a mature, ripened ovary and may be fleshy or dry.

William and Monach (2005) group fruit into simple, aggregate and multiple. They said simple fruits are defined as having developed from a single ovary of a single pistil and are often classified as being fleshy or dry. Fleshy fruits are juicy. Examples are tomatoes, orange, apple, watermelon and peach. Dry fruits may be indehiscent or dehiscent. Indehiscent fruits are those that do not split open at maturity and usually contain one or two seeds, example are; nuts and samara. Dehiscent fruits are fruits that split open upon maturation, examples are legumes, okra and cotton fruits. Aggregate fruits are fruits that develop from a single flower that has many pistils. Examples are raspberries and strawberries. Multiple fruits consist of a number of flowers that fuse to form a mass. Examples are pineapples.

Importance of Fruit

Fruits play a significant role in human nutrition, especially as sources of vitamin, minerals and dietary fibre. (Quebedeaux & Bliss (1988), Quebedeaux & Eisa, (1990); Wargovich, (2000)). Fruits and vegetables are estimated at 91% of vitamin C, 48% of vitamins A, 27% of vitamin B, 17% of thiamin and 15% of niacin in the U.S. diet. Fruits and vegetables also supply 16% of magnesium, 19% of iron, and 9% of the calories. Some fruits like almond and walnut contribute about 5% of the per capita availability of proteins in the U.S. diet, and their proteins are of high quality.

Prior and Cao, (2000), Produce for Better Health Foundation (1999) said fruit in the daily diet have been strongly associated with reduced risk for some forms of cancer, heart disease, stroke and other chronic diseases. Some components of fruits are strongly antioxidants and function to modify the metabolic activation and detoxification/disposition of carcinogens, or even influence processes that alter the course of the tumor cell. (Wargovich, 2000). Prior and Cao (2000) also say although

antioxidant capacity varies greatly among fruits, it is better to consume a variety of commodities rather than limiting consumption to a few with the highest antioxidant capacity. The USDA 2000 Dietary Guidelines (USDA, 2000) encourages consumers to: (1) enjoy five a day, that is, eat at least 2 servings of fruit and at least 3 servings of vegetables each day, (2) choose fresh, frozen, dried, or canned forms of a variety of colours and kinds, and (3) choose dark-green leafy vegetables, orange, fruits and cooked dry beans and peas often.

According to Produce for Better Health Foundation (1999) and USDA (2000) some fruits supply the body with some antioxidants. Fruits like guava, citrus fruits, kiwi fruit, pineapple and strawberry supply the body with vitamin C. Mango, orange, papaya, pineapple also obtain flavonoids from apple, blackberry, blueberry, grape, peach and others. Most fruits also provide the body with fibre. Potassium too can be obtained from banana, orange, apricots and lemon.

Perkins-Veazie and Collins (2001) said citrus fruits have long been valued as part of a nutritious and tasty diet. The flavours provided by citrus are among the most preferred in the world, and it is increasingly evident that citrus not only tastes good, but is also good for people. It is well established that, citrus and citrus products are a rich source of vitamins, minerals and dietary fibre (no-starch polysaccharides) that are essential for normal growth and development and overall nutritional well-being.

However, it is now beginning to be appreciated that these and other biologically active, non-nutrient compounds found in citrus and other plants (phytochemicals) can also help to reduce the risk of many chronic diseases.

Whitney and Rolfes (1999) also say that, citrus is most commonly thought of as a good source of vitamin C. However, like most other whole foods, citrus fruits also contain an impressive list of other essential nutrients, including glycaemic and non-

glycaemic carbohydrate (sugars and fibre), potassium, folate, calcium, thiamin, niacin, vitamin B₆, phosphorus, magnesium, copper, riboflavin, pantothenic acid and a variety of phytochemical. In addition, citrus contains no fat or sodium and, being a plant food, no cholesterol. The average energy value of fresh citrus is also low, which can be very important for consumers concerned about putting on excess body weight. For example a medium orange contains 60 to 80 kcal, a grapefruit 90 kcal and a tablespoon (15 ml) of lemon juice only 4 kcal.

The main energy-yielding nutrient in citrus is carbohydrate; citrus contains the simple carbohydrates (sugars) fructose, glucose and sucrose, as well as citric acid which can also provide a small amount of energy. Citrus fruit also contains non-starch polysaccharides (NSP), commonly known as dietary fibre, which is a complex carbohydrate with important health benefits. The predominant type of fibre in citrus is pectin, making up 65 to 70 percent of the total fibre. The remaining fibre is in the form of cellulose, hemicellulose and trace amount of gums. Citrus also contains lignin, a fibre-like component. In the body NSP hold water-soluble nutrients in a gel matrix which delays gastric emptying and slow digestion and absorption. This tends to promote satiety, and may reduce the rate of glucose uptake following consumption of glycaemic (available) carbohydrate thus helping to prevent a surge in blood glucose levels. Improper regulation of blood glucose results in either hyperglycaemia (high blood glucose) or hypoglycaemia (low blood glucose). NSP can also interfere with the re-absorption of bile acids which may help in lowering plasma cholesterol levels. Vitamin C (ascorbic acid), an essential water-soluble vitamin, plays a key role in the formation of collagen, a primary component of much of the connective tissue in the body. Adequate collagen synthesis is essential for strong ligaments, tendons, dentin, skin, blood vessels and bones and for wound healing and tissue repair. The weakening of

these tissues is a symptom of vitamin C deficiency. Vitamin C is an important aid in the absorption of inorganic iron; it has also been shown to aid in the treatment of anaemia and stress. Contrary to popular belief, vitamin C does not seem to prevent the onset of the common cold, but in some studies it has been reported to reduce the length and severity of the symptoms.

Contemporary interest in vitamin C centres on its ability to perform antioxidant functions. As an antioxidant, it can help prevent the cell damage done by “free radical” molecules as they oxidize protein, fatty acids and deoxyribonucleic acid (DNA) in the body. Free radical damage has been implicated in the progression of several diverse and important disease states including cancer, cardiovascular disease and cataract formation (Geshoff, 1993; Harats et al., 1998; Jacques et al., 1997). Being a good source of antioxidants, if regularly consumed, can be an important part of a diet aimed at reducing the risk of such chronic disease.

Whitney and Rolfes, (1999) say, potassium is an essential mineral that works to maintain the body’s water and acid balance. As an important electrolyte, it plays a role in transmitting nerve impulses to muscles, in muscle contraction and in the maintenance of normal blood pressure. The daily requirement of potassium is approximately 2000 mg and, while deficiency of potassium is rare, there is some concern that a high sodium-to-potassium intake ratio may be risk factor for chronic disease. Increased consumption of citrus fruits and juice is a good means of increasing potassium intake. One medium orange and one 225 ml glass of orange juice provide approximately 235 mg and 500 mg of potassium respectively.

Steinmetz and Potter, (1991) also say that, naturally occurring compounds found in plants have a wide range of physiological effects and may help to protect against various chronic diseases, including cancer and heart diseases. The wide variety and

number of known phytochemicals continue to grow, as does understanding of their role and importance in the diet.

USDA, (1996) and USDA, (1997) report public health workers and nutritionists generally encourage the consumption of citrus fruits and juices. The nutrient and non-nutrient factors in citrus promote health and may provide protection against a number of illnesses. Citrus fruits contain carbohydrate, fibre, vitamin C, potassium, folate, calcium, thiamin, niacin, vitamin B₆, phosphorus, magnesium, copper, riboflavin, pantothenic acid and a variety of phytochemicals.

There is scientific evidence that citrus consumption may help to reduce the risk of cancer, cardiovascular disease, anaemia, birth defects and cataracts. Citrus fruits are equally valuable among populations who need to overcome and prevent micronutrient deficiencies as well as those concerned with problems of over nutrition, obesity and diet-related chronic diseases. Surveys in many countries show that citrus intake is often low. Food preferences, learning history, cultural values, perceptions, attitudes and societal factors such as the media and advertising, as well as availability and variety, all play a role in determining food choice. Among the barriers to consumption of citrus are high cost, fear of harmful pesticides and quick spoilage. The elderly, the poor and the critically ill may have inadequate access to fresh food and often consume very little citrus fruits and juices. In the past 20 years, greater health-consciousness, the desire for convenient foods and rising incomes has increased the demand for citrus. The potential for citrus consumption to increase as part of the overall recommended increase in fruit and vegetable consumption is considerable.

Goldberg (2003), Hyson (2002), Prior and Cao (2000), Produce for Better Health Foundation (1999), Quebedeaux and Bliss (1988), Quebedeaux and Eisa (1990), Southon (2000), Tomas-Barberan and Espin (2001) and Wargovich (2000) all

confirmed that, some components of fruits (Phytochemicals) are strong antioxidants and function to modify the metabolic activation and detoxification/disposition of carcinogens or even influence processes that alter the course of the tumor cell. Fruits in the daily diet have been strongly associated with reduced risk for some forms of cancer, heart disease, stroke, and other chronic disease.

In another study, adding antioxidant (vitamin A, C and E) dietary supplements into the diet of cancer treatment patients, who were eating a balanced diet of fruits and vegetables, negatively impacted their radio and chemotherapies (Seifried, McDonald, Anderson, Greenwald & Milner, 2003).

High consumption of tomatoes and tomato products has been linked to reduced carcinogenesis, particularly prostate cancer and has been thought to be due to the presence of lycopene, which gives red tomatoes their colour. (Giovannucci, 2002).

Southon (2000) continue by saying, there is increasing evidence that consumption of whole foods is better than isolated food component (such as dietary supplements and nutraceutical). For example, increased consumption of carotenoid-rich fruits and vegetables was more effective than carotenoid supplements in increasing LDL oxidation resistance, lowering DNA damage, and inducing higher repair activity in human volunteers who participated in a study conducted in France, Italy, Netherlands, and Spain. Similar comparative studies are needed on other constituents of fruits and vegetables and on the bio-availability of nutrients taken as dietary supplement or as foods that contain these nutrients. Dieticians and nutritionists around the globe emphasize the need to make fruits and vegetables an important part of our diets. There are numerous reasons they give in favour of their suggestion. Southon quotes ten good reasons that the American Institute for Cancer Research has assembled:

1. The first in the list is cancer prevention. There are abundant supplies of antioxidant substances in fruits and vegetables that are proven to be helpful in preventing cancer. These give protection against reactive substances that harm human cells and offset cancer. They are also rich in phytochemicals that main function of which is to detoxify substances leading to cancer.
2. Number 2 on the list is staying slim. It's proven that most vegetables contain a very low caloric count as compared to junk food, such as a bag of potato chips or a small cookie. This leaves a person feeling fuller and wards off his hunger. In this way you will consume lesser quantities of high-calorie meats and desserts.
3. Including more fruits and vegetables in your diet as compared to meat and dairy products can help in limiting the use of saturated fat and cholesterol which are found guilty to damaging the heart. They protect blood vessels from getting clogged with fatty deposits, provide fibre that helps lower cholesterol and generally lower the risk factors for heart diseases.
4. Veggies and fruits lower blood pressure. Studies have shown that people using high fruit and vegetable diets controlled their BP levels. This is probably due to presence of potassium and magnesium in them.
5. Studies carried out recently show that high vegetable and fruit diets can lower the risk of stroke by an amazing 25%. The high potassium content as well as antioxidants and phytochemicals contained in these may be responsible.
6. Including plenty of fruits and veggies in the diet lowers the risk of contracting cataracts and macular degeneration which are the two main causes of adult blindness.
7. Diverticulosis, an intestinal disorder where the intestine creates small pouches in its wall that leads to inflammation causing pain, may be prevented by an intake

8. Fruits and vegetables help in preventing diabetes. They raise blood sugar less than other carbohydrate containing food. Fibre found in there can also slow down the process of sugar absorption in the blood.
9. Fruit and vegetables are of immense benefit to people watching their weight. The natural sugar found in them satisfies a sweet tooth. They provide instant boost of energy and nutrition as opposed to the empty calories, you may be consuming from other sweet stuffs like candies and fizzy drinks.
10. Lastly, the research focused on the pure pleasure fruits and vegetables provide to a table. The rainbow colour of fruits and veggies like greens, reds, yellows and purples have the power to make any dish more visually tantalizing. The variety of taste and texture adds an interesting dimension to foods as well as flavour.

Cleveland, Goldman, Borrud (1996) said that on a diet that is so predominated by fat, blood levels of this nutrient tend to run extremely high. High blood fat results in high blood sugar, as sugars cannot exit the blood well when blood-fat levels are elevated. Under this scenario, the pancreas and the adrenal glands are forced to work harder to lower blood sugar levels down towards normal. This causes them to become fatigued and eventually fail. This will lead to great swings in blood sugar levels known as hyper and hypoglycemia and, eventually, to diabetes and chronic fatigue. The hypoglycemia develops as a result of excessive insulin production. The thyroid gland soon follows suit, for it is stimulated by the adrenals and will often become hypo-functional as the adrenal glands weaken. Other hormonal issues, cancer, heart disease, and most digestive disorders are also known to be caused by the overconsumption of fat. So how does fruit take the blame? Many of the above-mentioned symptoms and

conditions do not become apparent unless fruit is consumed. Unstable blood sugar levels are often seen immediately following the consumption of even small quantities of fruit when the consumer is on a high-fat diet.

However, almost every condition for which fruit is named the culprit is actually caused by the high-fat diet. While raw food movement leaders continue to blame fruit for a wide assortment of health problems, I must agree with them that these effects will occur as long as the consumer is on a high-fat diet.

Avoiding fruit is not the answer, as fruit is not the guilty party. In fact, it is insufficient fruit consumption that leads raw fooders to consumer higher-than-healthy levels of fat. The simple sugars in fruit, namely glucose and fructose, are essential – they are the exact fuel used by all of our body's cells.

Fruits, nuts and vegetables play a significant role in human nutrition, especially as sources of vitamins [C (ascorbic acid), A, thiamine (B₁), niacin (B₃), pyridoxine (B₆), folacin (also known as folic acid or folate) (B₉), E], minerals, and dietary fiber (Craig and Beck, 1999), Quebedeaux and Bliss (1998), Quebedeaux and Eisa (1990) and Wargovich (2000). Their contribution as a group is estimated at 92% of vitamin C, 48% of vitamin A, 30% of folacin, 27% of vitamin B₆, 17% of thiamine, and 15% of niacin in the U.S. diet. Fruits and vegetables also supply 16% of magnesium, 19% of iron, and 9% of the calories. Legume vegetables, potatoes, and tree nuts (such as almond, filbert, pecan, pistachio, and walnut) contributes about 5% of the per capita availability of proteins in the U.S. diet, and their proteins are of high quality as to their content of essential amino acids. Nuts are a good source of essential fatty acids, fiber, vitamin E, and minerals. Other important nutrients supplied by fruits and vegetables include riboflavin (B₂), zinc, calcium, potassium, and phosphorus. Fruits and vegetables remain

an important source of nutrients in many parts of the world, and offer advantages over dietary supplements because of low cost and wide availability.

Dietary supplements, while advantageous for conditions where specific nutrients are needed in abundance such as with iron deficiency, may be poorly absorbed, and many are derived chemically rather than from natural sources. Climatic conditions, particularly temperature and light intensity, have an especially strong effect on the nutritional quality of fruits and vegetables oxidation (Mozafar, 1994). Low temperatures favour synthesis of sugars and vitamin C (glucose being the precursor to ascorbic acid) and the same time decrease the rate of ascorbic acid oxidation. Maximum β -carotene (vitamin A) content in tomatoes occurs at a temperature range of 15 to 20 °C, (59 to 70 °F) but β -carotene content is reduced if temperatures are higher or lower than this range, principally due to the temperature sensitivity of lycopene, the precursor to β -carotene and lutein.

The B vitamins are crop specific when it comes to temperature sensitivity. Warm season crops (beans, tomatoes, peppers, melons, etc) produce more B vitamins at high (27 to 30 °C; 81 to 86 °F) versus low (10 to 15 °C; 59 to 70°F) temperatures. Conversely, cool season crops (broccoli, cabbage, spinach, peas, etc) produce more vitamins at low versus high temperatures. Light intensity has little effect on the B vitamins, but as light intensity increases, vitamin C increases and total carotenoids (vitamin A precursors) and chlorophyll decrease (Gross, 1991). Higher light intensities produce more sugars, leading to more vitamin C, and also increase plant temperatures, inhibiting beta carotene (vitamin A) production, which protects chlorophyll from photo bleaching. Soil type, the rootstock used for fruit trees, mulching, irrigation, fertilization, and other cultural practices influence the water and nutrient supply to the plant, which can affect the composition and quality attributes (appearance, texture, taste and aroma)

of the harvested plant parts (Goldman, 1999). Other environmental factors that impact fruit and vegetable nutritional quality are altitude, soil pH and salinity, production practice (organic versus conventional, and greenhouse versus field), ozone, insect injury, and plant diseases.

Maturity at harvest, fruit size and harvesting method influence the commodity's quality and extent of physical injuries. Delays between harvest and consumption or processing can result in losses of flavour and nutritional quality. The magnitude of these losses increases with the exposure to temperatures, relative humidities, and/or concentrations of O₂, CO₂, and C₂H₄ outside the ranges that are optimum for each commodity during the entire postharvest handling system (Lee and Kader, 2000). Furthermore, processing and cooking methods can greatly affect the nutritional value of fruits and vegetables. For instance, water-soluble vitamins such as vitamin C and folate are lost at high rates when cooking water is discarded, while fat-soluble compounds such as lycopene may be stabilized or enhanced by cooking.

Fruits, nuts and vegetables in the daily diet have been strongly associated with reduced risk for some forms of cancer, heart disease, stroke, and other chronic diseases (Goldber, 2003; Hyson, 2002; Prior and Cao, 2000; Produce for Better Health Foundation, 1999; Quebedeaux and Bliss, 1988; Quebedeaux and Eisa, 1990; Southon, 2000; Tomas-Barberan and Espin, 2001; Wargovich, 2000). Some components of fruits and vegetables (phytochemicals) are strong antioxidants and function to modify the metabolic activation and detoxification/disposition of carcinogens, or even influence processes that alter the course of the tumor cell (Wargovich, 2000). Although antioxidant capacity varies greatly among fruits and vegetables (Prior and Cao, 2000; Perkin-Veazie and Collins, 2001; Kalt, 2002) it is better to consume a variety of commodities rather than limiting consumption to a few with the highest antioxidant

capacity. The USDA 2000 Dietary Guidelines (USDA, 2000) encourage consumers to: (1) enjoy five a day, i.e., eat at least 2 servings of fruits and at least 3 servings of vegetables each day, (2) choose fresh, froze, dried, or canned forms of a variety of colours and kinds, and (3) choose dark-green leafy vegetables, orange fruits and vegetables, and cooked dry beans and peas often. In some countries, consumers are encouraged to eat up to 10 servings of fruits and vegetables per day.

There is increasing evidence that consumption of whole foods is better than isolated food components such as dietary supplements and nutraceuticals. For example, increased consumption of carotenoid-rich fruits and vegetables was more effective than carotenoid dietary supplements in increasing LDL oxidation resistance, lowering DNA damage, and including higher repair activity in human volunteers who participated in a study conducted in France, Italy, Netherlands, and Spain (Southern, 2000). In another study, adding antioxidant (vitamins A, C and E) dietary supplements into the diet of cancer treatment patients, who were eating a balanced diet of fruits and vegetables, negatively impacted their radio- and chemotherapies (Seifried, 2003). High consumption of tomatoes and tomato products has been linked to reduced carcinogenesis, particularly prostate cancer, and has been thought to be due to the presence of lycopene, which give red tomatoes their colour (Giovannucci, 2002). Similar comparative studies are needed on other constituents of fruits and vegetables and on the bioavailability of nutrients taken as dietary supplements or as foods that contain these nutrients.

Citrus fruits have long been valued as part of a nutritious and tasty diet. The flavours provided by citrus are among the most preferred in the world, and it is increasingly evident that citrus not only tastes good, but is also good for people. It is well established that citrus and citrus products are a rich source of vitamins, minerals

and dietary fibre (non-starch polysaccharides) that are essential for normal growth and development and overall nutritional well-being. However, it is now beginning to be appreciated that these and other biologically active, non-nutrient compounds found in citrus and other plants (phytochemicals) can also help to reduce the risk of many chronic diseases. Where appropriate, dietary guidelines and recommendations that encourage the consumption of citrus fruit and their products can lead to widespread nutritional benefits across the population.

Citrus is most commonly thought of as a good source of vitamin C. however, like most other whole foods, citrus fruits also contain an impressive list of other essential nutrients, including both glycaemic and non-glycaemic carbohydrate (sugars and fibre), potassium, folate, calcium, thiamin, niacin, vitamin B₆, phosphorus, magnesium, copper, riboflavin, pantothenic acid and a variety of phytochemical. In addition, citrus contains no fat or sodium and, being a plant food, no cholesterol. The average energy values of fresh citrus is also low, which can be very important for consumers concerned about putting on excess body weight. For example a medium orange contains 60 to 80 kcal, a grapefruit 90 kcal and a tablespoon (15 ml) of lemon juice only 4 kcal (Whitney and Rolfer, 1999).

Putnam and Allshouse (1997) said the health benefits associated with citrus consumption are clear. Citrus fruits are nutrient-dense foods that can be good sources of carbohydrates, including dietary fibre, and many vitamins and minerals. Citrus fruits are equally valuable among populations who need to overcome and prevent micronutrient deficiencies as well as those concerned with problems of overnutrition, obesity and diet-related chronic diseases. For example, citrus is an ideal component of low-fat, sodium-restricted diets. As nutritionists and public health specialists learn more about the relationship between diet and health, the importance of balanced and varied dietary

intakes becomes ever more evident. Accordingly, there is an increasing emphasis on promoting high levels of fruit and vegetable intakes among most population. Citrus consumption has a considerable potential to expand as part of this overall recommended increase in fruit and vegetable consumption. While the supply of citrus is a problem in some areas, a greater obstacle is often the lack of effective demand for citrus. Addressing both the supply and demand problems, as appropriate, will require that a range of issues, such as agriculture and trade policies, food and nutrition policies, dietary guidance and nutrition education, and marketing, are addressed effectively and in a comprehensive manner. In many countries, a multifaceted approach that brings together, as appropriate, representatives of producers, processors, importers, retailers and consumers with nutritionists and public health specialists can have a significant impact on citrus consumption. Given that increasing the consumption of citrus benefits both producers and consumers, building effective partnerships to that end should not be difficult and would be an invaluable investment in the nutritional well-being and health of the population.

Implications of Lack of Fruits

Carpenter, (1986), says, scurvy, a serious deficiency of vitamin C that has caused tremendous human suffering throughout history, was first described by ancient Egyptians and then by the Greeks and Romans. For hundred years, scurvy was a scourge of long-distance sailors, soldiers, explorers and the poor in many countries where there was a lack of access to fresh fruits and vegetables. However, it was not recognized scurvy could be prevented and cured by consuming citrus fruit until the eighteenth century.

Harats, Chevion, Nahir, Norman, Sagee & Berry (1998) say it is well accepted a diet low in saturated fat and cholesterol and rich in fruits and vegetables reduces the risk of heart disease. Epidemiological studies have also shown a significant association between vitamin C intake and protection against cardiovascular mortality, but the precise mechanism of protection is still unclear.

Harats continue to say that, recent study has, shown that high intake of vitamin C (500 mg/day) obtained from the juice of freshly squeezed oranges, prevented rise in the level of oxidized low-density lipoprotein (LDL) even in the presence of a high-saturated fat diet.

Bloom (1998), Tucker, Selhub, Wilson and Rosenberg (1996) also confirm that, a low dietary intake of folate contributes to the decrease of plasma folate and the raising of plasma homocysteine levels. Homocysteine is a toxic agent for the vascular wall and, when plasma levels rise above normal, their response relationship has been identified for fruit and vegetable intake and plasma homocysteine levels. Frequent consumption of folate-rich foods, such as oranges and orange juice, tend to increase plasma folate levels and, thus, lower homocysteine levels.

After numerous studies made by Block, Patterson and Subat, (1992), fruit and vegetable intake and cancer development, there is a consensus that consuming these foods has a protective effect. However, it is unlikely that one anticarcinogen substance in particular is responsible for the benefit. There is reasonable scientific support for vitamin C's protective role in cancer. Many of the animal, cell culture and human studies have suggested it has a positive effect. However, epidemiological studies provide good evidence that protective effects are more closely associated with the consumption of fruits and vegetables rather than with the enormous levels of vitamin C often used in cell culture and animal studies.

Centers for Disease Control and Prevention (1992) also advised that regular consumption of citrus foods can help supply adequate folate and thus reduce the risk of birth defects. The centers say during the first stage of pregnancy, adequate folate intake is critical for reducing the risk of severe birth defect, namely spina bifida and anencephaly. Public health recommendations in the United States include the consumption of 400 mg of folate per day for women of child-bearing age.

Jacques, Taylor, Hankinson, Willet, Mahnken, Lee, Vaid & Lahau (1997) said that oxidation of the eye's lens plays a central role in the formation of age-related cataracts. The role of dietary antioxidants, such as vitamin C, in the aetiology of cataracts has been a recent focus of research. Lower cataract risk has been shown in individuals with high blood concentrations or intakes of vitamin C and carotenoids. There is now evidence to show that a high level of vitamin C intake over the long term decrease the risk of cataract development. Although studies that measures past nutrient intake and status suggest a protective effect from citrus, further studies are needed to examine the long-term benefits of citrus fruit consumption and cataract protection.

Mozafar (1994) said epidemiology data support the association between high intake of fruits and vegetables and low risk of chronic disease. There are several biologically plausible reasons why consumption of vegetables and fruit might slow or prevent the onset of chronic diseases. Fruits and vegetables are rich sources of a variety of nutrients, including vitamins, trace minerals, and dietary fibre, and many other classes of biologically active compounds. Even though other food substance may supply nutrients needed by the body to function well, but lack of some fruits which are rich in these nutrients may result in the following. Calcium eases insomnia and helps regulate the passage of nutrients through cell walls. Without calcium, muscles wouldn't contract correctly, blood wouldn't clot and nerves wouldn't carry messages. If you don't get

enough calcium from the food you eat by supplementing it with fruits, the body automatically takes the calcium needed from the bones. If the body continues to tear down more bones than it replaced over a period of years in order to get sufficient calcium, the bones will become weak and break easily. Deficiency may result in the muscle spasm and cramps in the short term and osteoporosis.

Most fruits contain amount of copper and lack of this may result in improper absorption, storage and metabolism of iron and the formation of red blood cells. Also, the supply of oxygen to the body is also affected. Lack of iodine rich fruits may also retard the regulation of the rate of energy production and body weight and promotes proper growth. It also affects the healthy hair, nails, skin and teeth. In developed countries, however, because iodine is added to table salt, iodine deficiencies are rare. About iron, most at risk of iron deficiency are infants, adolescent girls and pregnant women. Iodine deficiency in infants can result in impaired learning ability and behavioural problems. It can also affect the immune system and cause weakness and fatigue. To aid in the absorption of iron, eat foods rich in vitamin C at the same time you eat the food containing iron. The tanning in non-herbal tea can hinder the absorption of iron. Take iron supplement and your vitamin E at different times of the day, as the iron supplement will turn to neutralize the vitamin E. Magnesium is needed for bone, protein, making new cells, activating B vitamins, relaxing nerves and muscles, clotting blood, and in energy production. Insulin secretion and function also requires magnesium. Magnesium also assists in the absorption of calcium, vitamin C and potassium. Deficiency may result in fatigue, nervousness, insomnia, heart problems, high blood pressure, osteoporosis, muscle weakness and cramps.

Manganese, functions of this mineral are not specific since other mineral can perform in its place. Manganese does function in enzyme reactions concerning blood

sugar, metabolism, and thyroid hormone function. Deficiency is rare in humans. In combination with calcium, phosphorus is necessary for the formation of bones and teeth and of the nerve cells. Phosphorus is second to calcium in abundance in the body. It is very widely distributed in plants and animal food so it is unlikely that deficiency will be a problem. Potassium is essential for the body's growth and maintenance. It is necessary to keep a normal water balance between the cells and body fluids. Potassium plays an essential role in proper heart function. Deficiency may cause muscular cramp, twitching and weakness, irregular heart beat, insomnia, kidney and lung failure. Selenium is a part of several enzymes necessary for the body to properly function. Generally, selenium functions as an antioxidant that works in conjunction with vitamin E. Selenium deficiency is rare in humans. Sodium is required by the body to regulate blood pressure and blood volume. It helps regulate the fluid balance in your body. Sodium also helps in the proper functioning of muscles and nerves. Many people get far more sodium than they need, which tend to cause health problems. Different body types needs different amount of sodium. Zinc is a metal which is important in a number of key activities, ranging from protein and carbohydrate metabolism to the immune system, wound healing, growth and vision. Severe deficiency can contribute to stunted growth. Deficiency can sometimes be seen in white spots on the finger nails.

Boileau, Liao, Kim, Lemshow, Erdman & Clinton (2003) speak of constituent of fruits and proposed effects on human-wellness. Vitamin C, lack of vitamin C is scurvy, delay in wound healing, unhealthy immune system and cardiovascular disease. Lack of vitamin A also may result in night blindness, chronic fatigue, psoriasis, heart disease, stroke, catarats. Lack of fibre, result in diabetes and heart disease. Lack of magnesium result in osteoporosis, nervous system defect, teeth and immune system malfunctioning. Lack of potassium also causes hypertension, stroke, and arteriosclerosis. Lack of

Proanthocyanins causes cancer, Anthocyanidins also causes heart disease, cancer, initiation, diabetes, cataracts, blood pressure allergies. Lack of Flavin-3-ols is insufficient platelet, aggregation and cancer. Lack of flavanones also is cancer, and Phenolic acids also result in cancer and high cholesterol.

According to Lampe (1999), extensive study of phytochemicals in cell-culture systems and animals' models has provided a wealth of information on the mechanisms by which a diet high in fruit and vegetables may lower the risk of chronic disease in humans. However, it is not always clear whether the effect in animals, often observed with high doses of single compounds can be readily extrapolated to humans. It is not clear whether the biology that appears to influence disease risk in some degree or in the same manner in humans consuming realistic doses as part of a habitual diet. Furthermore, studies in cell culture are often conducted before it is known how the phytochemicals are processed in vivo, how they are absorbed and metabolized in the body, or whether they are even available to tissues of interest. For example, some phytochemicals are fermented by chronic bacteria so that the compound absorbed from the gut and circulating in the blood is different from what was consumed and the original phytochemical may not even be detectable in the blood.

Experimental dietary studies in humans serve as important links between nutritional epidemiology studies and studies conducted in cell-culture systems and animal models. They rely on intermediate endpoints related to disease risk by using biological markers that also help provide insight into the action of fruit and vegetable constituents in human. At the same time, they are limited by the sensitivity and specificity of the biological markers, access to biological samples, and the logistics of conducting studies in humans.

Considering the mechanisms of action, antioxidant activity, oxidative damage can result when balance between free radical generation to play a key role in cardiovascular disease, cancer initiation, cataract formation, the aging process, inflammatory diseases, and a variety of neurological disorders. Free radical molecules that carry one or more unpaired electrons are formed endogenously as a result of normal oxidative metabolic reactions, exogenously s components of tobacco, smoke, diet drugs, and other environmental pollutants; and indirectly through metabolism of certain solvents and by radiation. If not quenched by antioxidants these highly reactive compounds will react with and potentially alter the structure and function of several cellular components, such as lipid-containing cell membranes, lipoproteins, proteins, carbohydrates, RNA and DNA. The antioxidant defence system has both enzymatic and non enzymatic components that prevent radical formation, remove radicals before damage can occur, repair oxidative damage, eliminate damage molecules, and prevent mutations. Several of the antioxidant enzymes are metalloenzymes, which contain trace minerals for which vegetables and fruit are significant source.

New, Bolton-Smith, Grubb & Reid (1997) said the influence of nutrient intake on bone density is an area of current research with many unanswered questions. Long-term intake of various foods may be important to bone health, possibly because of their beneficial effect on the acid base balance. Vitamin C intake has been associated with bone mineral density, but work in this area is necessary to understand the mechanism of interaction.

They say that a kidney stone is formed by excessive salts in the urine. The most common type of stone is the calcium stone. A stone will increase in size until it is not passable and becomes lodged in the ureter. Stone symptoms include severe back pain, blood in the urine and fever. Stones strike men three to four times more often than

women. Some people prone to stone have been found with insufficient levels of citrate in the urine and it has been suggested that eating citrus fruits and drinking orange juice may help prevent kidney stones by increasing urinary citrate.

Ortega, Requejo, Andres, Lopez-Sobaler, Quintas, Redondo, Navia, & Rivas (1997) talked about cognitive function. They say that elevated homocysteine levels are associated with cognitive dysfunction in the elderly. Older subjects with greater intake of fruits and vegetables and the corresponding nutrients vitamin C and folate, have been shown to perform better on cognitive tests. The consumption of a satisfactory diet, containing nutrient-dense foods, appears to be associated with better cognitive function in the elderly. More research is needed to determine the effect of long-term citrus consumption on cognition.

Hatch (1995) also said, some studies suggest that a diet low in vitamin C is a risk factor for asthma. Vitamin C is the major antioxidant substance present in the airway surface liquid of the lungs, which could be important in protecting against oxidants. More research is needed to understand whether vitamin C and citrus consumption is protective in the causation and progression of asthma.

Lampe (1999) again said that the human immune system has a central role in protecting against various external disease-promoting factors and perhaps against malignant cells. It is a complex and highly interactive network of cells and their products. A subset of immune cells recognizes and response external stimuli and another component is capable of mounting a more vigorous and effective response the next time it receives a particular stimulus. The immune system regulates itself by means of helper and suppresser cells and soluble products. Nutrients and other constituents of fruit and vegetables have the potential to affect almost all aspects of the immune system.

The relation of single nutrients to immune function as well as the effect of nutrient-nutrient interactions in humans and in animal models has been reviewed comprehensively. Several of the vitamins associated with diets high in fruit and vegetable have been shown to improve immune status, particularly in older individuals. In a placebo-controlled, double-blind trial, 12 mo of supplementation with an over-the-counter multivitamin and mineral supplement improved delayed-type hypersensitivity skin responses in subjects aged 59-85 years, an effect that was associated with significant increases in serum concentrations of ascorbate, β -carotene, folate, vitamin B-6 and α -tocopherol at 6 mo, 12 molybdenum (mo), or both. Vitamin E supplementation alone also improves response to delayed-type hypersensitivity tests in healthy individuals greater than 65 years of age.

Lampe continues to say that, human dietary intervention studies using disease endpoints provide the strongest evidence for an effect of vegetables and fruit on disease risk. The disadvantages are that dietary intervention studies typically need to be large to have adequate statistical power, and consequently they are very expensive. Because such studies run only for a limited time and disease is the end result, typically they only give information about late-stage events. In addition, issues such as time of intervention, dose of intervention, compliance with the intervention, and choice of study populations influence interpretation of the results.

Lampe speaks about daily dose of food agent, duration of treatment and outcome of treatment. Daily dose of food agent of fruit and vegetables providing 325 mg vitamin C, 95 g fat; 225 ml wine and 2 cups coffee caused urinary N-nitrosoproline excretion to reduce; high fat diet, wine, and coffee had no effect. This was a single test meal. When 300 mg vitamin C, 300 mg α -tocopherol, and 15 mg zinc acetate was given as daily

dose, micronutrient treatments reduced urinary N-nitrosoproline excretion and other N-nitrosamine result in Ex vivo lipoprotein oxidation decreased by 34%.

Daily dose for two days of 60 ml fruit juices, 75 mg vitamin C, and 300 ml heat-processed vegetable juice had outcome of N-nitrosoproline excretion increased with heat processed juice. Daily dose for four weeks of 20 mg β -carotene resulted to breath pentane and ethane was reduced in smokers.

Ten weeks daily dosage of 280 mg *all-rac- α -tocopherol* gave an outcome result of Ex vivo erythrocyte lipid peroxidation, plasma lipid peroxides, TBARS, and conjugated dienes were reduced. Six days of 300 mg vitamin C and 30 mg β -carotene gave outcome result of reduced lymphocytic micronuclei with β -carotene but not with vitamin C and 100 mg vitamin C, 280 mg *all-rac- α -tocopherol* and 25 mg β -carotene daily dosage for twenty weeks resulted in lymphocytic DNA base oxidative damage decreased ; resistance to ex vivo oxidative damage was increased.

Daily dosage for 4 weeks of 4 capsules vegetables and fruit extract gave a result of plasma lipid peroxide concentration decreased. Three grammes of raw garlic for eight days resulted in decrease in the number of benzo[*a*]pyrene DNA adducts. Daily dosage for 3 months of 0.2 mg selenium resulted in decrease of plasma peroxides and TBARS; RBC glutathione peroxidase and glutathione reductase activities increased, 330 ml tomato juice and 10 g of spinach powder resulted in lymphocyte DNA strand breaks decreased; DNA base oxidation was reduced with carrot juice. Daily dosage for 4 weeks of 1 g vitamin C, 294 mg *all-rac- α -tocopherol acetate*, and 60 mg ubiquinone brought about LDL and serum antioxidant potential raised, there was no effect on diene conjugation in urinary 8-oxodeoxyguanosine in 6 participants.

A hundred and fifty grammes Brussels sprout and 100 grammes cabbage daily for one week resulted in metabolism of antipyrine and conjugation of phenacetin

metabolite increased. The same food agent for the same period also brought about acetaminophen glucuronidation, but not sulfation increased.

Only single dose of 250 ml grapefruit juice, double strength; 250 ml orange juice, double strength; and water resulted in metabolism of felodipine and nifedipine resulting in higher heart rates and lower diastolic blood pressure. Five hundred grammes of broccoli for ten days brought about increase in Cytochrome P450 (CYP) 1A2 metabolism of caffeine.

One thousand two hundred ml grapefruit juice single dose also decrease CYP1A2 metabolism of caffeine. Twelve weeks single dose of 10 ml aged garlic extract resulted in no effect on oxidative metabolism of acetaminophen or glucuronidation of CYP2D6 metabolism of debrisoquine. Single dose 100 ml grapefruit produced no effect of CYP1A2 metabolism of theophylline.

Daily dose for three days of 171 watercress converted 4-(methylnitrosamino)-1-(3-pyridyl)-1-butanone (NNK) to 4-(methyl-nitrosamino)-1-(3-pyridyl)-1-butano (NNL); GST, glutathione *S*-transferase and glucuronidation of NNL increased. Three hundred grammes of Brussels sprouts for one week resulted into Rectal mucosal glutathione *S*-transferase (GST) increased by 30% and 15%, respectively. Three hundred grammes broccoli for twelve days increased salivary GST and aldehyde dehydrogenase, and DT-diaphorase activities and 50 g watercress single dose decreased acetaminophen oxidation and increased glucuronidation. Three grammes raw garlic for 8 days increased N-acetyl transferase activity and no change in CYP1A2 and CYP2A6. conversion of NNK to NNL decreased, the NNL-glucuronide; NNL ration increased as a result of 5 days single dosage of 400 mg indole-3-carbinol. Natural killer (NK) cell activity was enhanced when 0.5 g raw garlic/kg body weight; 1800 mg garlic powder

was taken for 3 weeks. Daily dosage of multivitamin and mineral supplement for 12 months delayed-type hypersensitivity skin response improved.

Sixty milligrammes of β -carotene for 44 weeks increased CD4: CD8 ratio and no change in NK cells or virgin, memory, or cytotoxic T cells. Daily Dosage of 1 g vitamin C; 400 mg *all-rac- α -tocopherol*; vitamins C and E increased cytokine production by peripheral blood mononuclear cells. Fifty mg β -carotene every other day for 10 to 12 years enhanced natural killer cell activity in the older men; and no effect on IL-2 and PGE₂ production. Delayed-type-hypersensitivity skin response and antibody titer to hepatitis B improved with 200 mg dose; and no effect on immunoglobulin or T and B cell concentrations when 0, 60, 200 and 800 mg *all-rac- α -tocopherol* was daily taken for 235 days. Ten grammes garlic single dose resulted in platelet aggregation inhibited in a short term. Eighteen milligrammes cold pressed garlic from 9 grammes fresh garlic for 4 weeks decreased platelet aggregation by 16.4%. Control diet plus 290 grammes carrots and 20 grammes spinach, 390 g broccoli and 300 g cauliflower or 100 g tofu and 45 g textured soy protein was taken daily for 9 days increased serum PDGE-AB with soy and carotenoid diet; there was no effect on mitogenic activity. Daily dosage of 350 ml red wine, 375 ml white wine for 4 weeks resulted that the main platelet antaggregatory effect was with wines; the ratio of cyclooxygenase to lipoxygenase product formation decreased with resveratol-enriched juice compared with commercial grape juice.

Total cholesterol was reduced with carrot fibre, guar gum and pectin; HDL was reduced with carrot fibre as result of 20 g dietary fibre from carrot, cabbage, apple, wheat bran or guar gum, and 31 g pectin taken for 3 weeks. Daily dosage of 200 g raw carrot for 3 weeks reduced serum cholesterol, fecal bile acid and fat excretion increased.

Serum total cholesterol was reduced by 4% to 7% with vegetable and fruit and pectin diets, respectively due to wheat bran daily dosage for 5 weeks.

Mean plasma cholesterol concentrations were reduced by >10% when 350-400 g raw apple was taken daily for one month. Plasma LDL-cholesterol and fecal lithocholic acid concentrations decreased when 100 g prunes daily dosage for 4 weeks was administered. Serum total cholesterol and triglycerides decreased when 0.5-1.0 kg guava was eaten for four weeks. When 15 g dietary fibre as carrots was daily eaten for 3 weeks, there was no effect on serum cholesterol concentrations or fecal bile acid excretion.

Total cholesterol was reduced by 12% with garlic; triglycerides were lowered with garlic powder; there was no change in HDL-cholesterol as result of 600-900 mg garlic powder or 10-20 garlic daily taken for 1-3 months. Total and LDL-cholesterol concentration were reduced with garlic when 900 mg garlic powder, 12 g fish oil was eaten daily for 12 weeks. There was an increase in estradiol 2-gydxylation when 500 mg indole-3-carbinol was eaten daily for 7 days. Four hundred milligrammes indole-3-carbinol and 20 g cellulose was eaten daily for 3 months and 946 ml grapefruit juice for 7 days resulted in 2-hydroxyestrone; estriol ration increased with indole-3-carbinol. Urinary cortisone ratio decreased in only 2 of 6 men. Six-seven milligrammes per kilogramme indole-3-carbinol for one week, resulted in C2-hydroxylated estrogens increased; for men and 2 months for women, brought other estrogen metabolites in urine of men and women were decreased.

Vegetable and fruit diet or vegetable and fruit juice diet taken daily for 26 days resulted in blood pressure reduction in men with diastolic pressure > 80 mm Hg, and 0.5-1.0 kg guava for 4 weeks also decreased systolic and diastolic pressures. Systolic and diastolic pressures were lowered with 8.5 servings. Particularly in hypertensive

patients when 8.5 and 3.6 servings vegetables and fruit were daily eaten for 8 weeks. Three hundred milliliters cranberry juice was eaten daily for 6 months and brought a decrease in bacteriuria and pyuria.

According to Fuhrman (2003), excess fat is the culprit in candida, not sugar per se. When fat levels in the blood rise, so does blood sugar, because excess fat inhibits insulin from performing its function of escorting sugar out of the bloodstream. The excess fat lines the blood vessel walls, the cells' insulin receptor sites, the sugar molecules themselves, and the insulin with a thin coating of fat, thus blocking and inhibiting normal metabolic activity. Too much sugar in the blood is as life-threatening as too little and can result in serious illness or death. Yeast, or candida, is a constant presence in the blood; it serves as a life preservation mechanism, blooming when there is an excess of sugar in the bloodstream to bring blood sugar down to a non-threatening level. When the sugar is distributed and used by the cells of the body, the yeast quickly dies off as it is supposed to. If fat levels stay chronically high due to a poor diet, sugar will remain in the bloodstream and feed the large candida colonies instead of feeding the 18 trillion cells of your body. Starved for fuel, these cells can no longer metabolize energy, and you become tired, and feed run down. Because all the carbohydrate, fat, and protein that we eat is converted to simple sugar (glucose) if it is to be used by the cells for fuel, the way out of this cycle is not to eat less sugar, but to consume less fat. When fat levels drop, the sugar starts to get processed and distributed again, and the yeast levels drop because there is no longer excess sugar available.

According to WHO, present health trends focus on attaining the highest potential state of health over a person's lifetime, with prevention and health promotion taking priority over cure, along with improvement of the healthcare system, especially at the primary care level. The underlying mechanisms of many chronic diseases are now better

understood, and mitigating interventions have reduced the risk of suffering such diseases. There is now enough epidemiological evidence with regard to the diet/health relationship to identify risk factors for the most prevalent diseases and the dietary components that raise the likelihood of suffering or avoiding disease. According to the WHO, the ten greatest health risks are: unprotected sex, high blood pressure, smoking, alcohol, defective water supply and sanitation, high cholesterol, solid fuel fumes in indoor environments, iron deficiency, obesity, and being overweight. These factors cause 40% of the 56 million deaths recorded worldwide every year. Of the world's 10 main causes of death, six are directly linked to the human diet.

The WHO and the United Nations Food and Agriculture Organisation (FAO) recommend a minimum daily intake of 400 g of fruit and vegetables. But recent WHO data show that close to 2.6 million deaths worldwide in 2000 and 31% of cardiovascular diseases can be ascribed to insufficient fruit and vegetable intake. According to that paper, increasing recommended daily intake of fruit and vegetable to 600 g could lighten the world burden by 1.8%, and reduce ischemic heart disease and heart attacks by 31% and 19%, respectively, and stomach, throat, lung and colon cancer by 19%, 20%, 12% and 2%, respectively. The study demonstrates the potential long-term impact of increased fruit and vegetable consumption on reducing non-transmissible diseases (chronic and non-infectious diseases).

Recent research has shown, what is more, that in a diet featuring sufficient calcium intake, fruit and vegetable consumption aids bone mass formation in children aged 8 to 20 years. Research in children also shows that increased fruit and vegetable consumption reduces the risk of cancer in adulthood. In adults, a range of papers point to a link between increased fruit and vegetable consumption and lower risk of cancer and cardiovascular disease. Fruit and vegetables support cardiovascular health through their diversity of bioactive

substances, potassium and fibre. Consumption of at least 400 g of fresh fruit and vegetables (including berries, green-leaf and cruciferous vegetables) a day is recommended to reduce coronary heart diseases, strokes and high blood pressure. Although it was widely known that fruit and vegetables were healthy, the evidence of their protective effect against cardiovascular disease has only been fully identified in the past few years. Increased fruit and vegetable consumption is especially important for preventing obesity. The factors encouraging or protecting against weight gain and obesity can be delineated as follows:

1. Proven links: (a) Protective factors: regular exercise and high intake of NSPs (dietary fibre), (b) Risk factors: sedentary lifestyle, high intake of calorie-rich foods with low micronutrient content.
2. Probable links: (a) Protective factors: school and family environment encouraging choice of healthy foods for children and breastfeeding mothers, (b) Risk factors: mass advertising of calorie-rich foods, fast-food restaurants, high intake of soft drinks and sugared fruit juices resulting in adverse socio-economic conditions in developing countries, especially among women.
3. Possible links: (a) Protective factors: foods with a low glycemic index, (b) Unrelated: protein content of the diet, (c) Risk factors: large portions, high proportion of food prepared away from home (developed countries), alternating periods of strict dieting and inhibition.
4. Insufficient data: (a) Protective factors: higher meal frequency, (b) Risk factors: alcohol.

Two recent reviews of randomized tests have concluded that most studies show that NSP (dietary fibre) intake encourages weight loss.

Historical Background of Some Fruits

According to Wango, Hao, and Prior (1996), the origin of cultivated apple is not definitely known but the center of origin is probably in the area containing the Caucasus Central Asia and the Himalayas. The modern cultivated varieties probably derive from the Central Asia, perhaps with incursions of genes from other species present in the area of origin. Other species of the wild apple evolved both in the west (Europe) and the east (Western China) of the original range and genes from western species. Joseph, Shunktte, Danisova, Blenlinski, Martin, McEwen, and Bickford, (1999) also say that, avocado is probably descended from a very primitive wild form now limited to a small lowland area of Honduras and a small part of Costa Rica. There are three distinct race of avocado, some are found in Southon Mexico and Columbia. The wild avocado in its natural range had small fruit, a large stone, and little flesh. Hunters gather this nutrition of fruits from earliest times- the earliest evidence of human association with avocado is from cave deposit in the Ithacan Valley years ago. Archeological sites indicate that avocados may have been selected for large fruit size as long as 6,000 years ago.

Native South Americans had introduced the fruits far earlier and the Spanish continued its spread into their island colonies in Chile, the West Indies, and their colonized of West African media and the canaries. From there it spread to all the regions where the climate and the soil suited it. In recent times avocado varieties spread mainly from Western U.S.A. (California) to former British Colonies such as Australia, New Zealand and South Africa.

Hao et al., (1998) say that, Spanish and Portuguese colonies took guava to Europe with them and then on to their colonies in Africa and South East Asia. Tropical guavas are very subject to fruit fly infestation, which limits their production in some areas. Most fruit are consumed locally, as the fruit doesn't have a long shelf life.

Joseph et al., (1999) said that banana was taken from the European colonists African 'territories' to their tropical South African colonies earlier on. However, mainly the best varieties were taken which were seed free sterile varieties. As a consequence, much of the world banana biodiversity was left in Asia and the commercial crops were established on a very, very narrow genetic base.

Martin et al., (1999) said that melon is like ourselves. There are quite a few species of genus *cucumis* in Africa, and the wild melon that humans eventually domesticated is a native of sub Saharan eastern tropical Africa. It is believed to have been domesticated fairly late relative to other crop but once domesticated, other variable forms arose. It succeeded best in the drier longer season parts of India and South West Asia; in fact it naturalized in India and is regarded as a secondary center of wilgermplasm. From South West Asia it spread to Greece and Italy and part of the historic Mediterranean world. It captured the imagination of France not long after it reached there about the fifteenth century where one intellectual produced treaties enumerating fifty different ways of eaten melon.

Acording to WHO (2005), many things happen between the time of fertilization and the ripening of the fruit. The processes associated with the fruit development are dictated by plant hormones. As seeds develop inside the ovary wall, they produce cytokinins that migrate from the seed and promote cell division in the ovary wall. This results in added thickness to the fruit. The seeds follow up by producing gibberellins. Next, it is exported to the wall of the ovary and causes rapid expansion of each of the cells. The combination of more cells and expanding cells leads to a tremendous increase in the size of the ovary. Meanwhile, the pant produces abscisic acid, which causes the embryo in the developing seeds to become dormant. This is significant because it prevents the seed from sprouting inside the moist, unripened fruit. Fruits that lack seeds

can develop if a solution of gibberellic acid is applied to them. An example is Thompson seedless grapes. Thompson seedless grapes are treated about three times in the growing season with a dilute solution of gibberellic acid. The developing ovules produce cytokinins that cause nutrients to be stored in the endosperm tissues of the developing seed. In many species, these nutrients are later translocated to the cotyledons.

As the ovary wall thickens, the developing seeds begin to produce either gibberellins or auxins, depending on the species. These hormones cause cells to enlarge and the ovary wall to expand. The combination of cytokinins increasing the number of cells and gibberellins increasing the size of those cells leads to spectacular enlargement of the fruit. At about this stage, the enlarged ovary can be called a fruit, and the ovules have become mature seeds. The seeds have a drying seed coat (the former integument of the ovule) and contain a mature embryo. Abscisic acid causes the seed embryos to remain dormant. The seed embryos are prevented from growing until the seeds have been removed from the fruit or the abscisic acid in the seed breaks down.

Eventually, the fruit reaches full size. However, fruit at this stage tends to be sour (acid), mealy (starchy), green, hard, and lack fruit odor. It needs to be ripened before consumption. The ripening process could take a few days after picking or it could depend on an environmental cue. Most species must produce ethylene in order for the fruit to ripen. Ethylene diffuses throughout the fruit tissue and into the atmosphere around the fruit. An increase in the rate of cellular respiration in the fruit cells and synthesis of new enzymes usually accompanies the ripening process. Warm temperatures also speed the process. The ethylene released by one ripening fruit can cause neighbouring fruit to also ripen. The manufactured enzymes break down complex cell compounds. Acidic materials are broken down by an enzyme called kinase, so the

fruit is no longer sour. Amylase converts starches to sugars and, in the process, the fruit becomes juicier. Hydrolase breaks down chlorophyll and large organic chemicals. With the chlorophyll gone, yellow pigments become visible, and red pigments may develop. Some of the large organic compounds become smaller molecules that give ripe fruit its odour. Pectinase depolymerizes pectin, which is the glue that holds cells together. Without pectin, the fruit becomes soft.

Seedless fruits can develop by parthenocarpy, stenospermocarpy, and because the plants are triploid. In a process known as parthenocarpy, fruit may develop without fertilization. Seedless pineapples and cucumbers result when pollination fails to occur. Pineapples are self infertile. In other words, pineapple require cross-pollination for seeds to set. Cross-pollination does not occur when a field is planted with all one variety. Many citrus fruits are seedless for the same reason. Cucumbers may produce seedless fruit if not pollinated. If pollination takes place, they produce seeds. Technically, seedless grapes are not seedless. Normal pollination and fertilization occurs but the embryos abort when they are young. Often remnants of the seeds can be seen in the fruit. This process is called stenospermocarpy.

Bananas and seedless watermelon are seedless because the plants are triploid. Because they have three sets of chromosomes, meiosis fails to take place. The triploid banana varieties are propagated asexually by removing and planting offshoots. Watermelons are produced from seeds obtain by crossing diploid plants with tetraploid plants. The seeds from the cross are triploid. The triploid plants grow and produce fruits after being pollinated, because they are sterile, fail to produce seed. Triploid plants must be grown near pollen-producing diploid plants.

According to Joseph et al., (1999), pineapple is thought by some to be derived from Ananus, native to the tropical Paraguay basin. The native people of the American

tropical have grown pineapples by planting offshoots and crowns a very long time. The Carib Indians introduced the pineapple to their islands and named after them. The following are some reasons people eat fruits;

Medicinal Value

According to Payne and Hahn (2001) some fruits such as apple provide more than the Recommended Daily Allowance (R.D.A) in one relatively small fruits. Other fruits such as orange are both very good sources and are also cheap to obtain. So their importance is much greater than their Vitamin C content. Vitamin C is an important anti-oxidant which helps protect heart diseases and stress. It is essential for sperm production and for making the collagen protein involve in the building and the health of cartilage, joints, skin and blood vessels. Vitamin C helps in maintaining a hearty immune system. It aids in neutralizing pollutants, which are needed for anti body production and acts to increase the absorption of nutrient include iron the gut, and thins the blood. Just to mention its most important functions.

Hao, Vinson & Zubik (1998) said that fruit consumption results in reduced triglyceride level in the blood, a risk indicator for heart disease and reduces hypertension while increasing the level of high density lipoprotein (good) cholesterol.

Martin et al., (1999) also say the lemon, lime and orange have natural plant chemicals called monoterpenes in their skin that both protect against cells becoming cancerous and help fight existing cancers. At least as studied in laboratory mice but there is no reason to think these chemicals wouldn't be active in humans unless they are certified as 'organically grown' commercial citrus may; have been dipped / sprayed with anti fungal chemicals to prevent storage rots.

Joseph et al., (1999) state that pineapple contains the enzyme bromelain. Bromelain tablets (extracted from the pineapple plant stems) are sold in health stores with claims that they help combat heart disease, arthritis and various other illnesses.

Page (1998) quoted James Lind and says James Lind conducted an experimental epidemiologic study of the etiology and treatment of scurvy. He took twelve patients suffering from scurvy on board at sea. They lay together in one place being proper apartment for sick in the fore hold and had one diet common to all, later; some were grouped and were given different or additional food. Six days under this course, he noticed a remarkable improvement in a group; Lind was able to conclude from the result of this experiment that eating citrus fruits successfully treated scurvy and that consuming these fruits would also prevent the occurrence of scurvy.

Hansey (2003) said the correct way for eating fruits; we all think eating fruit means just buying fruit, cutting it and just popping it into mouths. It is not as easy as one thinks. It is important to know how and when to eat fruits. She said, our ancestors were not meat or seed eaters.

They were all fruit eaters. Fruits have the highest water content as compared with any other food. In addition, the vitamins, mineral, carbohydrate, amino acid, and fatty acids that a human requires can be derived from fruits when is consumed correctly nothing can surpass it.

Hansey further says, even for those who want to lose a little weight the proper consumptions of fruits will help. A survey made was found that those who eat more fruits every meal tends to want to eat less at the next meal, the reason being the sugar in the fruit. It was also found that a particular substance in some fruit could cut the risk of heart disease or heart attack. The substance protects the heart by preventing the blood from becoming too thick and plugging up the arteries from it cleansing.

Hansey continues to say that people complain that they eat bananas; they feel like running to the toilet etc actually, all this will not arise if you eat the fruit in an empty stomach. If not, fruit mix with and putrefying other food and produce gas and hence one will bloat. Graying hair, balding nervous outburst, dark circles under the eyes, all these will not happen if you take fruit in an empty stomach. There is no such thing as some fruits like orange and lemon are acidic because all fruits become alkaline in our body. She continued to advise that, when one needs to drink fruit juice, the person must drink fresh fruit juice. Not from the cans. Don't even drink fruit juice that has been heated up. Don't eat cooked fruit because you don't get the nutrient at all you only get the taste. But eating a whole fruit is better than drinking the juice. If you should drink the juice drink it mouthful by mouthful slowly, because you must left it mix with your saliva before swallowing it. One can undergo a one or three-day fruit task to clean his or her body. Just eat fruit and drink fruit juice throughout the three days and will be surprised when a friend tells you how radiant you look.

Hansey (2005) said, all fruits contain acids which are necessary for the proper elimination of various toxins, poisonous acids and other impurities. These natural acids are highly alkaline after they have been reduced in the body. The value of fruit diet cannot be overestimated especially in sickness, health or whenever the body is filled with poisons. Germs cannot grow and live in fruit juice. The germs that cause typhoid fever and cholera cannot survive under the action of fruit juice such as lemon, orange, pineapple, strawberry, apple and grape fruit. Fresh fruits are more effective for this purpose than stewed or canned fruit. Maltic, citric and tartaric acids are powerful genocides found in fruits.

Hansey (2005) said 'Having a Bit of Heaven on Earth'. More than heredity luck, your health depends on your lifestyle, thanks to the advancement in medical science,

many illness which were fatal a couple of years ago can now be either cured or alleviated with fruit eating. Yet people continue to die of heart disease, cancer and disturbance caused by lack of circulation in the brain among other degenerative disease.

Hansey further says 'put body guards on your dining tables'. This incident of generative disease such as high blood pressure and diabetes is on the increase and a lot of time effort and finance are directed at treating them not mention the individual discomfort and the lives claimed in the long run. She also says, that lemon is one of nature's finest gift to man. A single average sized lemon contains; 16mg of Phosphorus, 2mg of Sodium, 26mg of Calcium, 13mg of Potassium, 53mg of Vitamin C and 0.6mg of Iron. Lemon are usefully in treating asthma biliousness (gas), cold, cough, sore throat, diphtheria, influenza, heartburn, liver complaints, scurvy, fevers and rheumatism.

Medically, lemons act as an antiseptic, an agent that will prevent infection or putrefaction. They also prevent scurvy. They assist in cleaning the system of impurities. The lemon is a wonderful stimulant to the liver and is also a solvent for uric acid and other poison. It liquefies the bellies and is very good in cases of malaria. Sufferers from chronic rheumatism, rickets, tuberculosis and gout will benefit by taking lemon juice as well as those who have the tendency to bleed or have uterine hemorrhages. During pregnancy, it will help to build a strong bone in the child. We find that the element which are in lemon help to build a healthy system and nerve cells. Its calcium strengthens the bony structure and makes healthy teeth.

Hansey (2005) directs various ways that some fruits can be used to cure some ailments.

DIPHTHERIA: For this disease use pure lemon juice every hour or more often. Use either as a gargle or swab the throats with it. Swallow some until it cuts lesion false membrane in the throat.

SORETHROAT: For this disease use pure lemon juice every hour or more often.

CORN IN LEG: A slice of lemon tied over a corn overnight will greatly relieve the pain. A slice of lemon tied over a felon will not fail to bring the pus to the surface where it can be easily removed.

ASTHMA: To relieve asthma, take a table spoon of lemon juice one hour before each meal.

LIVER COMPLAINTS: The juice of a lemon should be taken in a glass of hot water one hour before breakfast every morning.

INFLUENZA: To break up influenza take a large glass of hot water the juice of lemon added while at the same time keeping the feet in a deep bucket or other vessel of hot water. Have the water deep enough so that it comes almost to the knees. Keep the water hot for thirty minutes or until the patient is perspiring freely. The lemon should be taken every hour until the patient feels that all symptoms of the cold are gone.

HEARTBURN: A teaspoon of lemon juice in one or a half glass of water will relieve heartburn.

FEVER: Lemon with water is an agreeable and refreshing beverage if there is no ulcer in the bowels.

RHEUMATISM: One or two ounces of lemon juice freely diluted should be taken three times a day one hour before meals and at bedtime.

HEMORRHAGE: Lemon juice diluted and taken as cold as possible will help stop it.

SCURVY: Drink one or two ounces of lemon juice diluted with water every two or four hours.

EXCESSIVE MENSTRATION: The juice of three or four lemons a day will help to check the bleeding. It is best to take juice of one lemon at a time in a glass of cold water.

STOMACH ULCER: If lemon juice is diluted with water and taken stomach ulcer can be cured. Make sure that the juice is diluted at first.

According to Fuhrman et al., (2003) dentists have said that, fruit doesn't encourage tooth decay. Even though fruit contains sugar, it is generally not a problem because nature has packed a lot of fibre and water along with that natural sugar. The combined effect of fibre and water is to clean and rinse the mouth. With that in mind, we can clearly see the problem with dried fruit and fruit juice. With dried fruit, the water has been removed. Because of that, dried fruit will stick to your teeth and gums, greatly encouraging tooth decay and gum disease. Many perfectly healthy teeth have been ruined by the daily consumption of raisins, dates and other dried fruits. With fruit juice, the water is still present, but the fibre has been removed. You then end up with a product more concentrated in acids and sugar. If the fruit juice is sipped and not drunk all at once, it will encourage tooth decay. The fibre is no longer present to clean the teeth. This has long been known by preventative dentists, who have blamed apple juice for running the teeth of many of our children. Acids in fruits can have a negative impact on the teeth and contribute to enamel erosion and decay. That goes especially for the citrus fruits and for unripe fruits. For this reason, and also because many of us are prone to tooth decay, they highly recommend rinsing your mouth with water after eating fruit.

Kalt (2002) quoted Bushman and said a man could live on fruits alone for 3 months provided that water was available. Fruits of Southern African mango tree, not only provide astonishingly nutritious nuts, but then, spongy and dry outer flesh although not as sweet as date, the flesh has dried and shriveled up. The crumbly flesh is nutritious. It is important that, it could be stored as a kind of dried fruit for many

months. This fruit had been compared to date in sweetness. It is so full of sugar chiefly sucrose.

He continues and says, for our ancestors, fruit contributed to the required 'mix' of energy food, protein, minerals, vitamins and gums, fibre and photochemical. Most fruits are relatively poor source of vitamins other than vitamin C and vitamin A and minerals (other than potassium) but fruit, along with leaves and roots are most important, for supplying phytochemicals and ascorbic acid (vitamin C).

Joseph et al., (1999) also say that, avocados have the highest potassium content of any common domestic fruit (at about 600mg / 100grams). While most meats are high in potassium as fruit they are accompanied by more sodium (and we add far more in cooking). In the olden time, potassium and low sodium ratios were skewed very much towards high potassium and low sodium than our standard western urban diet. High potassium fruits help partially restore the evolutionary, balance, and avocados are top performers in potassium stakes.

According to Lampe (1999), the human immune system has a central role in protecting against various external disease-promoting factors and perhaps against malignant cells. It is a complex and highly interactive network of cells and their products. A subset of immune cells recognizes and responds to external stimuli (specificity) and another component is capable of mounting a more vigorous and effective response the next time it receives a particular stimulus (memory). The immune system regulates itself by means of helper and suppressor cells and soluble products. Nutrients and other constituents of fruit and vegetables have the potential to affect almost all aspects of the immune system.

Lampe continues to say that, the relation of single nutrients to immune function as well as the effect of nutrient-nutrient interactions in humans and in animal models

has been reviewed comprehensively. Several of the vitamins associated with diets high in fruit and vegetables have been shown to improve immune status, particularly in older individuals. In a placebo-controlled, double-blind trial, 12 mo of supplementation with an over-the-counter multivitamin-and-mineral supplement improved delayed-type hypersensitivity skin responses in subjects aged 59-85 y, an effect that was not detected after 6 mo of supplementation. This effect was associated with significant increases in serum concentration of ascorbate, β -carotene, folate, vitamin B-6, and α -tocopherol at 6 mo, 12 mo, or both. Vitamin E supplementation alone also improves response to delayed-type hypersensitivity tests in healthy individuals greater than 65 years of age. Subjects received a placebo or 60, 200, or 800 mg all-rac- α -tocopherol/d for 235 days. The group given 200 mg/d had the greatest percentage increase in delayed-type hypersensitivity and antibody titer to hepatitis B compared with the placebo and the other 2 α -tocopherol doses. The optimal response detected at 200 mg/d suggests that there might be a threshold level for the immunostimulatory effect of α -tocopherol.

Scurvy, a serious deficiency of vitamin C that has caused tremendous human suffering throughout history, was first described by ancient Egyptians, and then by the Greeks and Romans (Carpenter, 1986). For hundreds of years, scurvy was a scourge of long-distance sailors, soldiers, explorers and the poor in many countries where there was a lack of access to fresh fruits and vegetables. However, it was not recognized that scurvy could be prevented and cured by consuming citrus fruit until the eighteenth century. And it would be another 200 years before vitamin C was isolated and its deficiency identified as the cause of the disease.

The lesson from this is still important today; people do not need to understand everything about individual nutrients in order to consume nutritionally adequate and well-balanced diets. Even though deficiencies, there is still much that is not known, and

probably never will be known, about the relationships between diet and health. Fortunately, however, with a bit of common sense, people can still be well nourished even though the understanding of nutritional science may be incomplete.

For example, research efforts exploring the possible protective effects of phytochemicals against various forms of chronic diseases have often shown an association with the consumption of various foods rich in these compounds, but not with specific phytochemicals themselves. There are several possible explanations for this, including; the specific phytochemicals being investigated may not be the ones that have an effect; the effects of individual phytochemicals may be additive; and it may be the interaction of two or more phytochemicals and nutrients that produce an effect. Since the understanding of nutrition science and complex functions and interactions of the many vitamins, minerals, macronutrients and phytochemicals contained in food is still so incomplete, it is important that a rational and time-tested approach be taken to the promotion of good nutrition. It is also important to continue emphasizing the benefits of nutrient-dense foods, such as citrus fruits, and to recognize that the consumption of whole foods and natural juices is preferred over the consumption of individual nutrients that have been isolated from food and then consumed as dietary supplements. Focusing on single nutrients, instead of foods and the total diet, does not constitute a healthful approach to good nutrition.

Nutritional Value

According to Payne and Hahn (2002), Food Guide Pyramid is a food-group which contains nutrients a person needs each day. The number of servings that are right for a person depends on age, sex, size and levels of activities. The Food Guide Pyramid recommends 2 to 4 servings of fruits each day. One serving includes 1 medium apple, 1

banana or orange, ½ cup of chopped, cooked or canned fruit. Fruits canned or frozen in heavy sauces or syrups may add extra calories and sugar to the diet. Some vitamins and minerals are depleted from foods by oxidation, so it is not a good practice to cut fruits hours before they are used. It is not advisable to keep fruits in the refrigerator because of insufficient air in it. The juice can be squeezed from the fruit after it has been cooked and used for making jellies, or fruit may be cooked to a pulp and sieved for making ‘fruit fool’. Fruit should be washed before storing to remove insects and dust. Whenever possible, fruit should be served whole; in the case of large fruit like pawpaw and pineapple, you cut when about to serve to prevent the escape of vitamin C. cooking destroys the valuable vitamins in the fruits; therefore, ripe fruit are of more value in the diet than cooked fruits. Fruit salads and stewed fruit are very pleasant to eat, but vitamin C is destroyed by cutting up and by long cooking. In general, healthful dietary guidelines are based on appropriate research. According to William (2005), over the years, epidemiologists in America have attempted to determine the relationship between diet and the development of chronic diseases.

In general, many Americans eat too many calories, consume too much fat, saturated fat, cholesterol, refined sugars, salt and sodium and drink too much alcohol. Such dietary practices may predispose one to several chronic diseases including obesity, heart disease, hypertension and cancer.

This is because they rely more on highly processed foods, many Americans do not consume a diet rich in whole grain products, legumes, fruits and vegetables, foods that are rich in dietary fibre and other healthful nutrients such as antioxidant vitamins.

Avocados are only fairly good sources of vitamin C. They are rich in many vitamins. Avocados have appreciable level of the B vitamin thiamine (about the same as lamb muscle meat, and butter than beef muscle meat). They also have levels of

riboflavin (B2) with half an avocado also supplies about 10% of an adult's recommended minimum intake of niacin (B3) and about 15% of adult daily pantomimed acids (B5) and pyridoxine (B6) need. The recommended daily intake of fruit is 200mg (pregnant women may need more) and half an avocado will fill about a quarter of this required minimum daily quota.

Hao et al., (1998) said that, the tropical guava is the most outstanding fruit for vitamin C content of any commercial fruit. It has exceptional 165mg of vitamin C per fruit twice the amount of the second place holder. Kiwi, an exceptional good source itself, cooked guava product, in the form of 'guava sauce' (presumable cooked pulp) is also an exceptional vitamin C source of 14mg/100grams). According to the South African canning industry, some pink guava varieties have an astonishing 400 to 500gms of vitamin C. One guava (90grams) supplies about 5% of adult minimum daily niacin (B3 needs). A guava of this size has nearly 800 international units of vitamin A, very useful contribution to the daily requirement and making it sixth highest source amongst the fruit. Tropical guavas are also high in potassium and an excellent source of dietary fibre.

Martin et al., (1999) come out that most oranges are usually used to make orange juice and other products, with only about 20% of the U.S.A. crop at least going on the fresh market. Research into growing continues, and one of the more interesting development from nutritional point of view, is the increasing number of 'blood' orange being grown. There are anthocyanins in the juice, giving a red look to the flesh. Although none appears to have investigated the matter, it would be reasonable to suspect that they would have increased antioxidant value.

Tangerine are a good source of vitamin A: in fact, they rank number 5 in the list of top source from commercial fruit, with 920 international units per 100grams. They

are a very good source of vitamin C, one fruit provides almost half an adult daily requirement.

Joseph et al., (1999) say bananas are a good source of vitamin C. although adult would need to eat 6 in a day to get even the rather conservative Recommend Daily Allowance (RDA) of 60mg (not anyone relies on a single type of food for their daily vitamin C needs). Bananas have useful level of riboflavin (B2) with one small banana providing about a sixteenth of an adult's recommended minimum daily intake of pyridoxine (B6). Bananas are probably the most easily digestible fruit, there is, while allergies to some fruit are not known, it is extremely rare for someone to be allergic to banana.

Martin et al., (1999) say that not only are mangoes excellence source of vitamin C (one fruit must fill an adults daily vitamin C requirements) they also have highest concentration of vitamin A of any commercial fruits (an excellent 3,895 international units per 100grams of flesh). They also confirm that, one orange supplying just over the entire US recommended daily intake (60mg for adult).

Gershoff (1993), said vitamin C, (ascorbic acid), an essential water-soluble vitamin, plays a key role in the formation of collagen, a primary component of much of the connective tissue in the body. Adequate collagen synthesis is essential for strong ligaments, tendons, dentin, skin, blood vessels and bones, and for wound healing and tissue repair. The weakening of these tissues is a symptom of vitamin C deficiency. Vitamin C is an important aid in the absorption of inorganic iron; it has also been shown to aid in the treatment of anaemia and stress. Contrary to popular belief, vitamin C does not seem to prevent the onset of the common cold, but in some studies it has been reported to reduce the length and severity of the symptoms.

Gershoff continued to say that, contemporary interest in vitamin C centres on its ability to perform antioxidant functions. As an antioxidant, it can help prevent the cell damage done by “free radical” molecules as they oxidize protein, fatty acids and deoxyribonucleic acid (DNA) in the body. Free radical damage has been implicated in the progression of several diverse and important disease states including cancer, cardiovascular disease and cataract formation. Being a good source of antioxidants, if regularly consumed, citrus can be an important part of a diet aimed at reducing the risk of such chronic disease.

Fleming et al. (1998) say for good health and sufficient body storage of vitamin C, 30 to 100 mg/day is generally recommended, although some recent studies have provided evidence that more than 200 mg/day may be optimal for the prevention of chronic disease. Too much vitamin C (above 500 mg), generally seen with very high levels of supplementation, may be dangerous, especially for those at risk of iron overload. Whitney and Rolfes (1999), also puts it across that consuming five servings of fruits and vegetables each day can result in an intake of about 200 mg of vitamin C. Citrus fruits are a particularly good source of vitamin C, with one medium orange or grapefruit providing approximately 70 mg and 56 mg, respectively. A 225 ml glass of orange juice contains approximately 125 mg of vitamin C. They continue to say that a 225 ml glass of orange juice provides 75 mcg of folic acid.

Whitney and Rolfes (1999) again continues to say that, potassium is an essential mineral that works to maintain the body’s water and acid balance. As an important electrolyte, it plays a role in transmitting nerve impulses to muscles, in muscle contraction and in the maintenance of normal blood pressure. The daily requirement of potassium is approximately 2000 mg and, while frank deficiency of potassium is rare, there is some concern that a high sodium-to-potassium intake ratio may be a risk factor

for chronic disease. Increased consumption of citrus fruits and juices is a good means of increasing potassium intake. One medium orange and one 225 ml glass of orange juice provide approximately 235 mg and 500 mg of potassium, respectively.

According to Steinmetz and Potter (1991), phytochemical, a naturally occurring compound found in plants have a wide range of physiological effects and may help to protect against various chronic diseases, including cancer and heart disease. The wide variety and number of known phytochemicals continue to grow, as does understanding of their role and importance in the diet. Harats et al. (1998), say it is well accepted that a diet low in saturated fat and cholesterol and rich in fruits and vegetables reduces the risk of heart disease. Epidemiological studies have also shown a significant association between vitamin C intake and protection against cardiovascular mortality, but the precise mechanism of protection is still unclear. One major culprit in the development of heart disease appears to be a high level of oxidized low-density lipoprotein (LDL), the so-called bad cholesterol. Significantly, a recent study has shown that high intakes of vitamin C (500 mg/day) obtained from the juice of freshly squeezed oranges, prevented a rise in the levels of oxidized LDL, even in the presence of a high-saturated fat diet.

Bloom (1998) said that a low dietary intake of folate contributes to the decrease of plasma folate and the raising of plasma of plasma homocysteine levels. Homocysteine is a toxic agent for the vascular wall and, when plasma levels rise above normal, there is an increased risk of cardiovascular disease. An inverse dose-response relationship has been identified for fruit and vegetable intake and plasma homocysteine levels. Frequent consumption of folate-rich foods, such as oranges and orange juice, tends to increase plasma folate levels and, thus, lower homocysteine levels. Block, Patterson and Subat (1992) also say that after numerous studies of fruit and vegetable

intake and cancer development, there is a consensus that consuming these foods has a protective effect. However, it is unlikely that one anticarcinogenic substance in particular is responsible for the benefit. There is reasonable scientific support for vitamin C's protective role in cancer. Many of the animal, cell culture and human studies have suggested it has a positive effect. However, epidemiological studies provide good evidence that protective effects are more closely associated with the consumption of fruits and vegetables rather than with the enormous levels of vitamin C often used in cell culture and animal studies.

Fleming et al. (1998) also say that vitamin C can increase the absorption of non-haem iron (the inorganic iron form found in plant foods) two- to fourfold. Whitney and Rolfes (1999) also say that the bioavailability of non-haem iron is much lower than that of haem iron, which is found in foods of animals' origin. Vegetarians and individuals who consume little meat and animal products are at an increased risk of iron-deficiency, which can progress to anaemia over time. Worldwide, anaemia is one of the most serious nutrient-related public health problems, resulting in poor growth, impaired psychomotor development, reduced physical performance and decreased cognitive function. Consuming citrus fruits rich in vitamin C can help prevent anaemia and its devastating consequences.

Jacques et al. (1997) say oxidation of the eye's lens plays a central role in the formation of age-related cataracts. The role of dietary antioxidants, such as vitamin C, in the aetiology of cataracts has been a recent focus of research. Lower cataract risk has been shown in individuals with high blood concentrations or intakes of vitamin C and carotenoids. There is now evidence to show that a high level of vitamin C intake over the long term decreases the risk of cataract development. Although epidemiological studies that measure past nutrient intake and status suggest a protective effect from

citrus, further studies and needed to examine the long-term benefits of citrus fruit consumption and cataract protection. New et al. (1997) also say that the influence of nutrient intake on bone density is an area of current research with many unanswered questions. Long-term intake of various foods may be important to bone health, possibly because of their beneficial effect on the acid base balance. Vitamin C intake has been associated with bone mineral density, but more work in this area is necessary to understand the mechanism of interaction.

Ortega et al. (1997) say elevated homocysteine levels are associated with cognitive dysfunction in the elderly. Older subjects with greater intakes of fruits and vegetables, and the corresponding nutrients vitamin C and folate, have been shown to perform better on cognitive tests. The consumption of a satisfactory diet, containing nutrient-dense foods, appears to be associated with better cognitive function in the elderly. More research is needed to determine the effect of long-term consumption on cognition. Hatch (1995), also says, some studies suggest that a diet low in vitamin C is a risk factor for asthma. Vitamin C is the major antioxidant substance present in the airway surface liquid of the lungs, where it could be important in protecting against oxidants. More research is needed to understand whether vitamin C and citrus consumption is protective in the causation and progression of asthma.

In many populations, even among people who know that citrus is nutritious; the consumption of citrus is often very low. The reasons for this are varied, but it indicates that knowledge of a nutritional benefit is just one of the many factors that influence food choices (Nestle, 1998). Among the other factors that greatly influence what foods people consume are: an individual's food preferences and previous experience with a give food; cultural values, perceptions, attitudes and societal influences including the media and advertising; and, most directly, the availability, taste and price of food items.

For these reasons, it is difficult to bring about widespread behavioural change. Clearly, strategies are more likely to modify behaviour and improve health if they are directed towards the relevant influences and barriers (Contento, 1995).

Folate is a water-soluble vitamin essential for new cell production and growth. It helps in the production of DNA and ribonucleic acid (RNA) and mature red blood cells, which ultimately prevent anaemia. In the United States, the recommended daily intake of folate is 180 mcg for females and 200 mcg for males. Over the past decade, however, it has become clear that higher levels of folic, 400 mcg, are associated with the prevention of neural tube defect (Centers for Disease Control and Prevention, 1992).

Hansey (2003) said fruit is a source glucose in the body. Its digestion, absorption and assimilation require only a short time, rather than to breakdown food like chicken, mutton etc. Other food spends about one to four hours in stomach. Fruits do not digest in the stomach. Some fruits are pre-digest except from bananas, dates and dried fruits. They pass through the stomach in 20 to 30 minutes if going through a tunnel. They break down release their life giving nutrient in the intestines.

Hansey (2003) also confirmed that the correct way of eating fruit is not eating fruit after meals, and must not be eaten in an empty stomach. If you eat fruit like that it will lay a major role to detoxify your system, supplying you with a great deal of energy for weight loss and other life activities. Fruits are the most important food. Let's say you eat two slice of bread and a slice of fruit, the slice of fruit readily goes straight through the stomach into the intestines, but it is prevented from doing so by the bread. In the meantime the whole meal rots and ferments and turns to acid. The moment the fruit comes into contact with the food and digestive juices secreted into the stomach, the entire mass of food begin to sell. Fruits should therefore be immediately before meals.

Hansey (2003) continued to say that, at present, medical experts recommend an increase in the use of whole grains, fruit and vegetables. Fruits and vegetables provide essential vitamins and minerals. They also supply fibre and provide energy. They are the only natural source of vitamin C, eating only orange which contains about 90 milligrams of vitamin C or tomatoes which have as much as 130 milligrams covers the daily allowance of 130mg recommended by the U.S. National Research Council.

Williamson and Monach (2005) said the nutritional value of fruit and vegetables lies mostly in their micronutrient content, their fibre content and their non-nutritional bioactive substances, such as vegetable phytochemicals and bioactive compounds. Many vegetables contain provitamin A in the form of betacarotenoids (a natural colouring that lends a yellow, orange or reddish hue, also present in green vegetables but masked by chlorophyll), vitamin C and several B vitamins, notably folic acid. Fruit is generally higher-calorie than vegetables, contains a large quantity of vitamins, such as C (citrus fruit, tropical fruit, melon and strawberries), provitamin A in the form of betacarotenoids (melon, apricot, peach, nectarine, khaki, mango, persimmon, berries), and, to a lesser extent, B group vitamins.

Almost all the vitamin C in our diet comes from fruit and vegetables. Light, mechanical shocks, exposure to atmospheric oxygen, prolonged storage, washing and the application of heat and water in cooking destroy up to 50 to 60% of vitamin content. Fruit and vegetables also contain minerals such as potassium, magnesium and, less importantly, iron and calcium, which are hard for the body to absorb and use. Fruit, vegetables and other plant-based foods are the main sources of fibre in the diet. It is now known that “dietary fibre” (formerly called “crude fibre”) comprises non-starch polysaccharides or NSPs (mainly cellulose, hemicellulose, pectins, gums and mucilages), lignin, oligosaccharides and resistant starches in varying combinations and

proportions. The health benefits of dietary fibre –especially pectins – have been widely demonstrated in research. The water-retention capacity of fibre adds bulk to the faecal bolus, solidified faeces, aids bowel movement and brings beneficial physiological effects, such as improved glucose tolerance, lowering of total and LDL blood cholesterol levels and prevention of some forms of cancer, particularly colon cancer.

Recent research has focused on a specific type of oligosaccharides: fructo-oligosaccharides or FOS. These are short chains of fructose linked by 2-1 β -glucosidic bonds with a terminal D-glucosyl unit linked by an alpha-1-2 bond, present in some cereals and vegetables (including asparagus and onion). FOS are non-digestible carbohydrates, because the human intestine lacks enzymes capable of breaking down its bonds. This chemical feature lends FOS attractive physiological properties, such as low caloric value (about 2 kcal per g), sweetness, low capacity for causing caries, and effects similar to those of dietary fibre. They are viewed as prebiotics for their ability to modify colon flora by fostering the selective growth of groups or individual species of bacteria that discourage the settlement of pathogenic bacteria; in addition, FOS fermentation acidifies the environment, thus reducing carcinogen production.

All fruit and vegetables contain non-nutritional bioactive substances (many of which are responsible for the characteristic pigmentation of a given fruit or vegetable) with proven health benefits. Notable among these compounds—known as phytochemical owing to their plant origin – are certain carotenoids, such as lycopene, a red pigment mainly present in tomato, red pepper and watermelon and though to be a powerful antioxidant that helps prevent prostate cancer, or zeaxanthines, especially lutein in green-leaf vegetables, with its widely demonstrated role in the prevention of macular degeneration. Phenols are an important and complex of phytochemicals that comprises flavonoids, catechines and anthocyanines. The most significant are anthocyanines

(present in red onion, red grapes, strawberries, pomegranates, blackberries, plums and cranberries), quercetin (grapes, onion, broccoli, apples) and elagic acid. Health benefits include antihistamin, anti-inflammatory, diuretic and – especially – antioxidant properties, and their proven preventive role in cancer processes.

Also important are indoles and isocyanates, present in cruciferous vegetables (broccoli, cauliflower and cabbages), which help prevent cancer; the antioxidant resveratrol in grapes and grape by-products; and organic sulphurs, which help prevent cancer and heart disease, present in garlic and onions. Fruit and vegetables also contain organic acids responsible for their smell and taste, such as citric acid (present in a wide variety of fruit and vegetables), tartaric acid (grapes) and malic acid (apples). Other substances present in some leafy vegetables can act as anti-nutrients, such as oxalic acid, which has a chelating effect on the absorption of divalent minerals, including iron and calcium. Fruit and vegetables are thus complex foods and provide significant quantities of carbohydrates (especially sugars), low quantities of protein and fat, and are essential in the human diet. They provide water, dietary fibre, numerous vitamins and minerals and bioactive substances with major health benefits.

Fruit and vegetable consumption is essential to varied and nutritious diet. But World Health Organisation data shows that fruit and vegetable consumption is low in many areas of the world. Only a minority of the world population consumes the quantity recommended by the FAO and WHO. The worldwide trend toward city-dwelling has driven people away from the production of primary foods. This hinders the consumption of a varied, nutritious diet with an adequate proportion of fruit and vegetables. The poorest city-dwellers are not only remote from primary food production; they also find it harder to access healthy, varied diets. On the other hand, increased urban dwelling may support other aims, because people with enough purchasing power have wider

access to a varied, nutritious and healthy diet. World food production trends and the availability of fruit and vegetables indicate that present output and consumption differ greatly from region to region. These production statistics do not include wild and native vegetable output. Consumption may be underestimated, therefore.

In 2000 the average availability of vegetables per person worldwide was 102 kg per annum. The highest figure was recorded in Asia (116 kg), while the lowest were recorded in South America (48 kg) and Africa (52 kg). In Europe, the availability per capita in 2000 was 112.5 kg. In Spain in 2004, per capita consumption of fresh fruit and vegetables was 68.2 kg and 102.3 kg, respectively. These figures reflected a rising trend, with fruit and vegetable consumption increasing 5.4% and 4.7%, respectively. Nutrient intake: the role of fruit, vegetables, dietary fibre and non-starch polysaccharides (NSPs). Recommended intake is at least 400 g of fruit and vegetables per day. Wholegrain cereals, fruit and vegetables are the main sources of non-starch polysaccharides (NSPs), with consumption of these three foods providing in excess of the daily recommended intake of 20 g of NSP (>25 g total dietary fibre).

These intake bands consider fruit and vegetables for their energy value rather than their nutrient content. This approach takes account of the fact that the health benefits of fruit and vegetables cannot be attributed to a sole nutrient or mix of nutrients and bioactive substances, but to fruit and vegetable consumption as a whole. Hence fruit and vegetables are listed as a food category, instead of the individual nutrients. Tuber (e.g., potato, sweet potato and manioc) should not be included among fruit and vegetables. Recommendations on total fat intake consider countries where intakes is commonly high (above 30%) or very low (below 15%). An intake of at least 20% total fat in the diet is compatible with good health. In countries with a highly active population and a diet rich in fruit, vegetables, pulses and wholegrain cereals, total fat

intake can be up to 35% without risk of harmful weight gain. High intake of simple sugars detracts from the nutritional quality of the diet, because it provides energy lacking in nutrients to the detriment of other foods of high nutritional quality. After drinking a very sugary drink, in fact, it has been shown that the compensating reduction in food intake is less than for other foods of the same energy content.

Free Bowel

Hansey (2003) said people complain that any time they eat fruit they feel like running to the toilet etc, actually all this will not arise if you eat the fruit in an empty stomach. When eaten after meal, they mix with and putrefying other food and produce gas and hence you will bloat! Graying hair, balding nervous outburst, dark circles under the eyes all will not happen if you take fruit in an empty stomach. There is no such thing as some fruit like orange and lemon are acidic because all fruit becomes alkaline in our body.

Graham (2007) said in the mainstream world, it is not common for people to say to me that they cannot eat fruit because it upsets their stomach. When he demands how they determined this, they tell me it was easy: 'I tried that fruit in the morning and right away I got an upset stomach.' According to Graham, he tries explaining that it is very likely that the food they ate the night before is still in their stomach, and that pouring orange juice or other fruit on top of this food is likely to result in a fermenting mess, a 'combo-abombo.' Graham suggests waiting until the stomach is truly empty before adding in fresh fruit for better results. Still, since fruit was the last thing consumed before the indigestion ensued, fruit very often takes the blame. Similarly, in the raw food movement, fruit takes the blame for problems it did not cause.

Food Substitute

Young (2002) comes out that, fruits are such a delight to the senses. Of all the foods available to use, fruits are the most attractive, delicious and enjoyable. Of all natural foods, that is the foods we can eat in their natural state, fruit is the food we are most attracted to and that first entices our senses. Humans are born with a natural instinct for sweet foods, and in nature that instinct naturally draws us to fruit. When we are hungry-, and I mean really hungry- fruit is often the most satisfying food we can eat. Is there anything better than to devour a delicious ripe mango on a hot summer day? Or to bite into a luscious, freshly-picked apple? Or to enjoy a sweet, juicy, ripe orange? Is there any man-made dish that can beat the perfection?

Fruits have been consumed by human beings going as far back in time as we know, whereas grains, legumes and dairy products have only been cultivated for 10,000 years or less, which is just a breath in the life of humanity. Anthropological studies have proved that.

Fruit has always been recognized as one of the healthiest foods there is. In the minds of most people, fruit is seen as a healthy food we should eat more due to its vitamin content. But even when realizing the exceptional nutritional qualities of fruit, very few people actually give it the place it deserves in the diet. Fruit is still eaten as a 'snack' or a 'dessert', but is rarely seen as a staple food. In the mind of the masses, fruit is a 'healthy snack' but not something that can really sustain a hard-working man, like meat in bread can. They don't realize that fruit should be a staple in the diet, and has been for thousands upon thousands of years, long before today.

Fuhrman (2003) also said that with any good thing, there always seems to be someone to take it to the extreme. A very few people are claiming that since fruit is an ideal food, it is all we should eat.

Every credible nutrition expert knows that living on fruit alone will deteriorate health. That doesn't mean that fruit is not healthy. Eating green vegetables only will also prove to be unsustainable- but that doesn't change the fact that green vegetables are healthy food.

Graham (2007) has this to say that, fruit has been consumed by people for as long as there have been people. It has lengthy and prestigious history that has of late been somewhat tarnished. It is the opinion of Graham that fruit has been given a bad rap.

From the earliest written history, fruit has played a key role in human health. It was the main food consumed in the proverbial Garden of Eden for an untold number of years. During the Golden Age of Man some 2500 years ago, fruit was the predominant food. This period of time in ancient Greece fostered the development of a hugely disproportionate number of history's greatest thinkers, philosophers, artists and athletes. Fruit has always been recognized as health food, and still firmly holds that esteemed position. The old saying, 'an apple a day keeps the doctor away', has been replaced by 'eat fruit everyday, the five-a-day way'. Indicating that the benefits of eating fruits are being more fully recognized. Our government, the health industry, the nutritionists, dietitians, and every disease-control organization that offers nutritional advice suggest that we eat more fruit. Meanwhile on the other side of the coin, there are people who literally shun fruit and others who are actually afraid of eating fruit. A few leaders in the raw food movement actually have suggested that we should learn to live without eating fruit at all. Obviously, someone is mistaken. Let's see if we can discover where the error rests.

According to Graham (2007) one of the most common complaints related to fruit is the idea that fruit's satiating power is not lasting. 'I tried that, 'fruit in the morning'

and about an hour later I was starving’, is about the way the story usually goes. At first glance, this may look like a valid indictment of fruit’s inadequacy as a meal, but the situation deserves a bit more investigation. When I ask the nature of the fruit meal, I am usually told, ‘I had an orange’, or ‘a slice of melon’ ‘a banana’ or ‘some grapes’. For most people, a typical breakfast usually contains close to 750 calories. A medium sized piece of fruit averages about 75 calories. When we eat a breakfast of just ‘a piece of fruit or two’, we are eating only 10-20% of the calories that we previously did, thus we feel empty and low on energy. Even if the goal is weight loss, this is too extreme a reduction to be satiating, maintainable, or nutritionally adequate. When I explain that fruit has a lower caloric density than all other foods except for vegetables and, therefore, fruit must be eaten in greater volume if one endeavours to consume sufficient calories, there is sometimes a glimmer of comprehension before the curtain of dismissal falls again.

He continued to say that one can train himself to comfortably eat satisfying fruit meals, allowing himself to actually eat fruit until completely satiated. This could mean that you eat an entire melon for breakfast or six, twelve, or even a greater number of bananas for lunch. There are three main factors involved in feeling satiated, and here is how fruit figures in each. A small rise in blood sugar to the above normal range results in a satiated feeling. Fruit certainly supplies the necessary sugars for such a rise and, hence, is very satiating. This is why many people are initially satisfied to eat just a small amount of fruit.

Another reason why fruit eating results in satiation is the high content of essential nutrients. The nutritional composition of fruit comes closer to mimicking the full spectrum of human nutrient needs than that of any other food group. Also, the nutrients in fruit are the most easily accessed and absorbed, as fruit requires less

digestion than do other foods. Many of the nutrients in fruit require no digestion at all- they are readily absorbed. These include, but are not limited to: water, sugar, minerals, vitamins and many phyto-nutrients.

Add up to Food

A study published in the British Medical Journal (September 2001), natural hygienists have known for a long time that fruit doesn't combine well with other foods. The reason is that fruit contains simple, sugars that require no digestion. Thus, they do not need to stay in the stomach for long. Other foods, such as foods rich in fat, protein and starch, will stay in the stomach for a longer period of time because they require more digestion. So if you eat fruit after a meal containing protein, fat and or starch, the fruit sugar will be held up in the stomach for too long and will ferment. This is why people experience digestive trouble when eaten fruit immediately after eaten food. Natural hygienists have been recommending for a long time that fruit be eaten alone with no other foods. They have also recommended eating melons alone and avoiding mixing acid fruits with foods. Many people have a difficult time eating a meal of fruit alone. They'll eat a meal of melon and not so long afterwards they'll be hungry again, for the simple and obvious reason that melons are not caloric dense. Eating a small cantaloupe (200 calories) is not going to sustain you for very long. But because they have read somewhere that mixing melons with other fruits is not allowed, they'll try to wait until the next meal to eat.

The solution to this is very simple since fruit digests so fast, it is possible to eat fruit before any other food. When you are hungry, you can eat as much fruit as you care for. One type of fruit only would be ideal. Then wait a little bit, like 5-10 minutes, and have any other food you desire. The same goes for mixing other fruit together. You can

eat all the melon you want and then, if you are still hungry, eat another type of fruit to satisfy your appetite. It is not necessary to eat melons alone if they are eaten before other foods.

According to Graham, a great way to eat more fruit is to make fresh fruit smoothies. Smoothies need not be complicated to be tasty. For example, blend bananas with water and have that as a smoothie. Blend a few bananas with about 1 cup of water and drink it after my exercise session; I also like blending mangoes with other fruits. For example, mango blended with papaya or a peach is amazingly delicious. Frozen bananas go pretty well in all sorts of fruit smoothies. Try, for example, blending a few frozen bananas with a little water and some fresh berries. You'll be amazed by the taste. This report will encourage you to incorporate more fresh fruit into your diet. In conclusion, remember that, fresh fruit plus more exercise plus less grains and refined foods is equal to better health and energy. Less fat plus more fruit plus more green vegetables is equal to even better health and energy. A good diet plus a balance mind plus fun minus extremism is equal to unexpected benefits.

According to Fuhrman (2003), we should avoid eating a lot of fruit because it does not contain enough minerals. He recommends that we eat more vegetables instead. But does he realize that if fruit grown today has less minerals than it used to have, then vegetables, which are grown in the same soil, have less minerals too? Is he suggesting that we eat fewer vegetables too? He also claims that we should avoid fruit because it is too hybridized. According to him, hybridized fruit contains too much sugar. The process of hybridization is a natural one. What humans have done is the same as what nature had done for thousands of years. We have selected the seeds from the best-tasting fruits and planted those seeds instead of the seeds of inferior fruits. Fruits that we buy have been hybridized for hundreds of year. Problems arise when fruits are hybridized for

purely commercial reasons. For example, we have witnessed the arrival of seedless fruits in the marketplace in the last few years. These fruits have been hybridized extensively solely in order to produce a fruit of inferior nutritional quality but with other qualities that the market is looking for. Those fruits are certainly of inferior quality, taste and nutritional value, not food with certain cosmetic aspects that the market seeks. We can still ensure a complete nutritional balance from the foods that we find in the stores. The fact that these fruits contain a lot of sugar is certainly not a problem, unless one decides to eat only fruit, which I do not recommend. I would not recommend that you base your diet on one fruit, such as bananas. I believe in eating a large variety of foods.

The body needs natural sugar as a source of energy. When starchy foods such as potatoes and bread are eaten, the digestive enzymes break down the complex sugar (starch) into simpler sugars. When fruit is eaten, the body uses the simple sugars (fructose and others) directly, without needing to break them down any further. However, this is not like eating refined sugar. In the case of refined sugar, the food is devoid of nutrients and fiber. Thus, the sugar enters the blood quickly and is not slowed down by the process of digesting fibre. If you cut out most sweet fruit (sugar) and most or all complex carbohydrates (starch), then you will need to get your calories from other sources – protein or fat. It is difficult to get a lot of calories from protein, and high-protein diets are generally recognized to be harmful for health. So what will happen inevitably is that you will end up eating large amounts of fats. But many raw-food enthusiasts are unaware of this. They live on a very high-fat diet. They eat raw nut butters, nut pates, refined oils, flax crackers, etc. They will make a salad with 2-3 avocados thrown in there (sometimes more!), and the bag of macadamia nuts becomes their comfort food.

An unfortunate side-effect of that unhealthy diet is that they can no longer handle sweet fruit. It has been proven that high-fat diets decrease insulin sensitivity (the effectiveness of insulin in carrying sugar to the cells), and thus raise blood sugar levels. So those living on high-fat diets, that is, most raw-foodists, will inevitably experience more blood sugar swings when they eat fruit. So the problem is not the fruit per se, but the high amounts of fat consumed. Once you substantially reduce other fatty foods, your body will be able to process and utilize fruit sugar much more efficiently. A fruit-based diet would be a diet in which you get most of your calories from sweet fruit. This means at least 50% of your calories are from fresh fruits.

He continued to say that it takes a bit of practice to learn how much fruit is sufficient for a meal which will satiate for several hours. It is equally true that a mental adjustment is required in order to expand one's understanding of how much fruit is actually appropriate at a meal. With sufficient experience, one's ability to consume extremely satisfying fruit meals will grow to become ones of life's great pleasures. After all, fruit is health food. Anyone interested in attaining, maintaining, and gaining increased health should consider consuming fruits as their predominant food.

Seasonal Reasons

Kalt (2002) quoting Bushman says, the number of fruits in our ancestral forests in South West Africa according to one source fruit of 200 indigenous trees are eaten by some people whether raw or cooked. These fruits cover the spectrum from sweet and good, through tasteless to active astringent. Another author counts 200 inedible fruits in Zimbabwe alone. Such fruits are inevitable seasonal and often erratic and some would be eaten only as a last resort.

Martin et al., (1999) say that melon is like ourselves. There are quite a few species of genus cucumis in Africa, and the wild melon that humans eventually domesticated is a native of sub Saharan Eastern Tropical Africa. It is believed to have been domesticated fairly late relative to other crop but once domesticated other variable forms arose. It succeeded best in the drier longer season parts of India and South West Asia in fact it naturalized in India and is regarded as a secondary center of wilgermplasm. The English aristocracy prided themselves on the perfect melons then gardeners produced in their glasshouse. From England and the continent the melon went to America and all the colonies. Melon are reasonable priced and seasonable available in countries that span several climatic zones such as Australia and U.S.A.

According to the Holy Bible (Genesis 2:17), God ordered man to eat everything except the tree of the knowledge of good and evil, Genesis 2:17. At Leviticus 11, God told Moses and Aaron the type of flesh or animal they should eat and not to eat. All these passages did not mention fruit as forbidden. The Holy Quran Surai: 5 also speaks about the forbidden animal flesh but the verse 4 which are to be eaten and these include fruits. So none of the holy books speak against the eating of fruit but rather encourages it.

Summary

The review showed that, fruits have strong medicinal values to human health. Most fruits can be used to cure many ailments provided they are properly used. So many common diseases around today can either be prevented or cured using fruit eaten.

Just as James Lind used fruit to cure scurvy as quoted by Page (1995), Joseph (1999) also come out that heart diseases, arthritis and various other illnesses could be combated using fruits. Hansey (2003-2005) listed a whole lot of illness and how fruits

can be used to cure them. Graham (2007) also warned that if fruits, even though are excellent food, when not properly eaten may cause harm to human health. Payne and Hahn (2001), Joseph et al., (1999), Martin et al., (1999) and Graham (2007) have also echoed on almost the same thing on the nutritional value of fruit to human health. Much has been said about the nutritional value of fruits to human development. It's immediate supply of nutrients to the body and it's assistance to digestion of other food.

Other purpose of fruit which may either be medicinal or nutritional but people eat fruit base on them are, to add to normal food, it serve as food substitute and to free bowel. Other authorities like Wango, Cao & Prior (1998), Joseph et al., (1999) and Hao et al., (1998) vividly stated the origination of some fruits. Some are of African origin and others are of foreign origin.

CHAPTER 3

METHODOLOGY

The purpose of the study was to investigate various reasons why student-teachers eat fruits. This chapter therefore explains the method and procedures, which were adopted and used for the investigation.

The following were the areas and how they were carried out: Research design, Population and Sample, Selection of instrument, Pilot study, Data collection and Data analysis.

Research Design

The descriptive survey research design was used as my overall plan for obtaining answers to the research questions asked in the study. This design involves collecting data in order to test or answer research questions concerning the current status of the subject of the study. The study concerns finding the nature of prevailing conditions, practices and attitudes of student-teacher towards the eating of fruits. This design has this strength; it deals with the process of developing specific predictions from general principles and reasoning to arrive at generalizations. Variables and procedures are described as accurately and completely as possible so that the study can be replicated by other researchers.

Population

The population for the study was drawn from teacher trainees of Foso College of Education. The whole targeted population was 945. Two hundred and ninety-eight were females and the remaining 647 were males. But the study made use of 150 students, 75

were males and 75 were females. Each year group was represented by 50 trainees, 25 males and 25 females for the three year groups.

Sampling Technique

The selection was done using simple random sampling. Students were made to pick cards from a box which had the inscription “Yes” and “No” written on them. In each class, the men had their turn first and the women followed. Those who picked the cards with “Yes” on it were used as respondents for the study. In all, each class was represented by ten members. Each year group has five classrooms so fifty for each year group making the total 150 from the three-year groups.

Selection of Instruments

The closed ended form of validated questionnaire was used. This was presented in questions and statement form to make it easy to read and follow, easy to identify and distinguish from other questions and responses. Sufficient questions were asked to cover the scope of the study adequately. The questionnaire comprised both the data blank mode and a checklist mode. Provision was made for a respondent who cannot find his response among those listed to write it. (See Appendix B)

The respondents were made to answer questions based on their characteristics and their reasons for eating fruits. This is to find out their;

1. Frequency of fruits consumption.
2. Choice of fruits.
3. Knowledge of the benefits of fruits to human development.
4. Reasons for eating fruits.
5. Quantity of fruits eaten.

6. Why do they choose some fruits among others?

Questionnaire item 7 took care of research questions 1 and 6, questionnaire item 5 was for research question 2, item 8 was for research question 3, item 9, was for question 4, item 6 was also for research question 2 and questionnaire item 10 was for research question 5. Questionnaire item 11-14 was for question 6.

Pilot Study

Before the main data collection, a pilot study was conducted with the untrained teacher training diploma in basic education UTDBE students. Twenty students (20) were sampled using convenience method of sampling. Twenty (20) questionnaires were distributed to a class, one afternoon after the normal classes to be answered and submitted to the class leader the following day. This even though convenient, was carefully done to have 10 males and 10 females representing the chosen population. Little verbal orientation was done to give them insight into the work and as to how it should be done and the confidentiality attached to it.

Early the next morning, the researcher collected the work from the class leaders in their classrooms. Comments on the clarity, inadequacies, ambiguities and other problems concerning the items in the instrument were received in written form. As a result of such comments, statements felt to be ambiguous or misleading were either removed or revised for clarity. The reliability of the test items was checked using Cronbach's alpha equation and it was 0.76.

Data Collection Procedure

Seventy-five male students and 75 female students were given the questionnaire to respond. The researcher himself did the distribution and the collection of responses.

The exercise was carried out in their classroom during their prep periods and the responses collected by class captains instantly after responding to them and later handed them over to the researcher. In every class, after obtaining the sample population, and distribution of questionnaire had been done, verbal explanation was done before the start of response.

This was done after seeking permission from the Vice Principal Academic through night studies committee in writing (See Appendix A). Completed questionnaire were given to the class representative. These were later collected by the researcher at an agreed period within the night studies period the same day.

Data Analysis

Results were gathered and the following were used to find the validity of the responses. Percentage was used for the first research question which wanted to find out reasons student-teachers give for eating fruit. The calculation for the mode was possible to help arrive at the answer to the question. The second research question which demanded the type of fruit student-teachers eat was analyzed using percentages. In this situation, the determination of the mode was necessary to help arrive at an answer for the question.

The third research question, which was to find how often student-teachers eat fruit was analyzed using percentages. The research question four which is on the factors that determine student-teachers' choice of fruits was analyzed using percentage. This same tool was used to analyze the fifth question which sought to find out how much fruit they eat. Determination of the mode answered the question.

The sixth research question which demanded the knowledge student-teachers have about the benefits of fruits to human health was analyzed using percentages. The response with the highest percentage answered the question.

CHAPTER 4

RESULTS AND DISCUSSION

The chapter focused on the results of the study. Detailed findings on the results were discussed along side the result of each research question given clear and explanatory information to describe the results. Discussion on the results was done and data were interpreted in light of other research which has link with the study, relating it to the literature reviewed. It was logically written to reflect the issues investigated. Possible weakness of the methodology was spelt out.

Research Question 1: What Reasons do Student-Teachers give for Eating Fruits?

Table 1 shows reasons student-teachers give for eating fruits. Suggested reasons were; anytime I feel like, when I am hungry, when want to free bowel, when it is cheaply sold at the market, to add to make up the required quantity of food eaten and for health reasons. The optional reason obtained in addition to suggested reasons was for its sweetness.

Table 1

Student-Teachers' Reasons for Eating Fruits

Reason	Yes (%)	No (%)	Total (%)
Anytime I feel like	74 (49)	76 (51)	150 (100)
When I am hungry	18 (12)	132 (88)	150 (100)
To free bowel	63 (42)	87 (58)	150 (100)
When it is cheaply sold at the market	19 (13)	131 (87)	150 (100)
Add to diet to make up the required quantity	46 (31)	104 (69)	150 (100)
For health reasons	90 (60)	60 (40)	150 (100)
Others (for its sweetness)	1 (1)	149 (99)	150 (100)

Greater number of respondents said they eat fruits for health reasons. Those who eat fruit only when they are hungry had the least number even though one person opted for sweetness of fruit as reason for eating fruits. Considering the result critically, those who eat fruit for health reasons were many and their number was more than a half of the total respondents, and comparing it with those who eat fruit anytime they feel like, 74 of the respondents were in this group and those who eat to free the bowel were 63. One may ask that, how come people who eat fruit for health reasons may also eat fruits anytime they feel like or to free the bowel since eating fruits for health reason must be done regularly. But if the result is to be accepted the way it is, then the number of respondents who have the knowledge about the health reasons of eating fruit are quite acceptable. It is not surprising to notice that, 42% of the respondents eat fruits to free bowel. But only one person eats fruits for its sweetness is also a surprising result. Those who eat fruits at anytime they feel like happened to be 49% and this may be the true reflection, and because of the nature of respondents, the reason “when I am hungry” could not score much because most of the respondents find themselves in a community where fruits are not easy to come by for it to be eaten when hungry. Respondents are students and most of have limited financial resources to be buying fruits very often, so the number of those who eat fruits only when it is cheaply sold at the market should have been larger than this. It may also be true that 31% may add fruit to their food to make up the required, because food served at school may be inadequate and they may eat fruits sold around to add it to be satisfied. It may also be seen that, those who eat fruits as dessert all fall under this group.

Hansey (2003) and Graham (2007) agree to the fact that fruits free bowel but this happens only when it is not appropriately eaten. This is not the real duty of fruit to

the body; it only does that when it is inappropriately eaten. These authorities go further to explain the nutritional and medicinal benefits of fruit to the human body.

Young (2002), Fuhrman (2003) and Graham (2007) all agree that fruit can be eaten as food substitute but make it clear that, since it digests easily and fast, one feels hungry within a short period after it has been eaten alone. They all suggest that, even though it supplies the body with the necessary nutrients it cannot stay in the stomach for a longer time. British Medical Journal (September 2001) accepts that fruit could be added to food to make up the required quantity but one must know its benefits. Also it must be combined well to achieve good result. Thompson (1999) and Martin et al., (1999) all opined, the seasonal reason why fruit is eaten, but all these agree to these reasons but they talk about the nutritional and medicinal values of fruit.

According to Fuhrman (2003), we should avoid eating a lot of fruit because it does not contain enough minerals. He recommends that we eat more vegetables instead. But does he realize that if fruit grown today has less minerals than it used to have, then vegetables, which are grown in the same soil, have less minerals too? Is he suggesting that we eat fewer vegetables too? He also claims that we should avoid fruit because it is too hybridized. According to him, hybridized fruit contains too much sugar. The process of hybridization is a natural one. What humans have done is the same as what nature had done for thousands of years. We have selected the seeds from the best-tasting fruits and planted those seeds instead of the seeds of inferior fruits. Fruits that we buy have been hybridized for hundreds of year. Problems arise when fruits are hybridized for purely commercial reasons. For example, we have witnessed the arrival of seedless fruits in the marketplace in the last few years. These fruits have been hybridized extensively solely in order to produce a fruit of inferior nutritional quality but with other qualities that the market is looking for. Those fruits are certainly or inferior quality,

taste and nutritional value, not food with certain cosmetic aspects that the market seeks. We can still ensure a complete nutritional balance from the foods that we find in the stores. The fat that these fruits contain a lot of sugar is certainly not a problem, unless one decides to eat only fruit, which I do not recommend. I would not recommend that your base your diet on one fruit, such as bananas. I believe in eating a large variety of foods.

According to Southon (2000), dieticians and nutritionist around the globe emphasize the need to make fruits and vegetables an important part of our diets. They give the following reasons. The first is cancer prevention. There are abundant supplies of antioxidant substances in fruits and vegetables that are proven to be helpful in preventing cancer. These give protection against reactive substances that harm human cells and off set cancer. They are also rich in phytochemicals which main function is to detoxify substances leading to cancer.

Another reason is staying slim. It's proven that most vegetables contain a very low caloric count as compared to junk food, such as a bag of potato chips or a small cookie. This leaves a person feeling fuller and wards of his hunger. In this way you will consume lesser quantities of high-calorie meats and desserts to limit the use of saturated fat and cholesterol which are found guilty to damaging the heart. Also to protect blood vessels from getting clogged with fatty deposits, provide fibre that helps lower cholesterol and generally lower the risk factors for heart diseases, you must include more fruits and vegetables in your diet as compared to meat and dairy products.

Veggies and fruits lower blood pressure. Studies have shown that, people who eat high fruit and vegetable diets control their BP levels. This is probably due to the presence of potassium and magnesium in them. Another reason is that fruit and vegetable diets can lower the risk of stroke by an amazing 25%. The high potassium

content as well as antioxidants and phytochemicals contained in these may be responsible. Fruits and veggies in the diet lower the risk of contracting cataracts and macular degeneration which are the two main causes of adult blindness. They also help to prevent diabetes. They raise blood sugar less than other carbohydrate containing food. Fibre found in fruits and vegetables can also slow down the process of sugar absorption in the blood.

The varieties of colours of fruits and veggies like greens, reds, yellows and purples have the power to make any dish more visually tantalizing. The variety of taste and texture adds an interesting dimension to food as well as flavour. These reasons given have some relationship with those given by the respondents even though, reasons mentioned by Southon are numerous, detailed and specific unlike reasons given by respondents. The health reasons and other reasons given by respondents are more or less related to what Southon gave by quoting American Institute for Cancer.

According to WHO, fruit and vegetable consumption is essential to varied and nutritious diet. But data shows that fruit and vegetable consumption is low in many areas of the world. Only a minority of the world population consumes the quantity recommended by the FAO and WHO. The worldwide trend toward city-dwelling has driven people away from the production of primary foods. This hinders the consumption of a varied, nutritious diet with an adequate proportion of fruit and vegetables. The poorest city-dwellers are not only remote from primary food production; they also find it harder to access healthy, varied diets. On the other hand, increased urban dwelling may support other aims, because people with enough purchasing power have wider access to a varied, nutritious and healthy diet. World food production trends and the availability of fruit and vegetables indicate that present output and consumption differ

greatly from region to region. These production statistics do not include wild and native vegetable output. Consumption may be underestimated, therefore.

According to Fuhrman (2003), that it takes a bit of practice to learn how much fruit is sufficient for a meal which will satiate for several hours. It is equally true that a mental adjustment is required in order to expand one's understanding of how much fruit is actually appropriate at a meal. With sufficient experience, one's ability to consume extremely satisfying fruit meals will grow to become ones of life's great pleasures. After all, fruit is healthy food. Anyone interested in attaining, maintaining, and gaining increased health should consider consuming fruits as their predominant food.

There is increasing evidence that consumption of whole foods is better than isolated food components such as dietary supplements and nutraceuticals. For example, increased consumption of carotenoid-rich fruits and vegetables was more effective than carotenoid dietary supplements in increasing LDL oxidation resistance, lowering DNA damage, and including higher repair activity in human volunteers who participated in a study conducted in France, Italy, Netherlands, and Spain (Southern, 2000). In another study, adding antioxidant (vitamins A, C and E) dietary supplements into the diet of cancer treatment patients, who were eating a balanced diet of fruits and vegetables, negatively impacted their radio- and chemotherapies (Seifried, 2003). High consumption of tomatoes and tomato products has been linked to reduced carcinogenesis, particularly prostate cancer, and has been thought to be due to the presence of lycopene, which give red tomatoes their colour (Giovannucci, 2002). Similar comparative studies are needed on other constituents of fruits and vegetables and on the bioavailability of nutrients taken as dietary supplements or as foods that contain these nutrients.

Research Question 2: What Type of Fruit do Student-Teachers Eat?

Tables 2 and 3 which answer the type of fruit student-teachers eat handled this question in two folds. Table 2, shows the choice of fruits by student-teachers while table 3 indicated the state of fruits student-teachers eat. Among the choice of fruits are mango, guava, banana, pawpaw, water melon, pineapple, lime, lemon, orange/tangerine, avocado (pear) and apple. And the state of fruits also includes raw fruits, bottled or canned, raw fruit juice, frozen fruits and cooked fruits.

Table 2

Choice of Fruit Eaten by Student-Teachers

Choice of fruit	Yes (%)	No (%)	Total (%)
Mangoes	90 (60)	60 (40)	150 (100)
Guava	58 (39)	92 (61)	150 (100)
Banana	111 (74)	39 (26)	150 (100)
Pawpaw	88 (59)	62 (41)	150 (100)
Water Melon	71 (47)	79 (53)	150 (100)
Pineapple	112 (75)	38 (25)	150 (100)
Lime	29 (19)	121 (81)	150 (100)
Lemon	23 (15)	127 (65)	150 (100)
Orange/Tangerine	116 (77)	34 (23)	150 (100)
Avocado (Pear)	38 (25)	112 (75)	150 (100)
Apple	43 (29)	107 (71)	150 (100)

Table 3**State of Fruit Eaten by Student-Teachers**

State of fruit	Yes (%)	No (%)	Total
Raw fruit	145 (97)	5 (3)	150 (100)
Bottled / canned	43 (29)	107 (71)	150 (100)
Raw fruit juice	49 (33)	101 (67)	150 (100)
Frozen fruit	22 (15)	128 (85)	150 (100)
Cooked fruit	7 (5)	143 (95)	150 (100)

Tables 2 and 3 are for research question 2 which seeks to find out the type of fruit student-teachers eat. Table 2 finds out the choice of fruit they eat and table 3 investigates the state of fruit. The result realized from table 3 shows that only 3% of the respondents do not eat raw fruit. This may be a true picture because, there are others who may be allergic to fruit of any kind if it is raw and they depend on canned or bottled fruit. Looking at the result, respondents did not consider their stay on campus alone to respond to the questionnaire because some of them visit town and at times travel home. Also, looking at nature of the respondents, one may be deceived by thinking that most of them may bring canned drinks to college, but only a few of this number and some of them may take the drink only when they are at home.

Table 2 of this question realized a whole lot of intersections. The result realized is a true picture because of availability of fruits around. Lime, lemon and pear had least number of respondents who eat them. There are so many reasons assigned to this. Mangoes did not record as high number as orange, banana and pineapple because of its seasonal nature. Unlike mangoes, orange, banana and pineapple all have their seasons but when the season is off, you can find some at market. This may be the reason why

orange, banana and pineapple had high number of respondents. Some fruits like watermelon and apple are very expensive so student-teachers cannot afford to buy and that may contribute to their low consumption as compared to orange, banana and pineapple. Guava too is not found to be plenty in the market even during its season as compared to orange, banana and pineapple but lime, lemon and pear are also available as orange, banana and pineapple but only few respondents said they eat them. It is also possible that those who chose lemon and lime chose them not that they consumed it raw but they take canned or bottled fruit drink which contains either lime or lemon. Few others may add it to other herbs for treatment. Others take them with the intention to reduce weight and burn fat. Apples also did not record high number because other local brands are not easy to come by. The foreign type too is very expensive so it will be difficult to rely on apples too much hence its low consumption.

Hansey (2005) asserted it clear that, lemon is one of the nature's fruit gift to man. She said it is useful in treating asthma, cold, cough, sore throat, diphtheria, influenza, heartburn, liver complaints, scurvy, fevers and rheumatism. She further stated that, medically, lemons act as an antiseptic, an agent that prevents infection or putrefaction. They also prevent scurvy. They assist in cleaning the system of impurities. Lemon is a wonderful stimulant to the liver and it is also a solvent for uric acid and other poison. It liquefies belies and is very good in cases of malaria. Sufferers from chronic rheumatism, rickets, tuberculosis and gout will benefit by taken lemon juice as well as those who have the tendency to bleed or have uterine hemorrhages. During pregnancy, it helps to build strong bone in the child. We find that the elements which are in lemon help to build a healthy system and nerve cells. Its calcium strengthens the bony structure and makes healthy teeth.

Table 3 clearly shows that, raw fruits are eaten more than any state of fruit. Since this is the cheapest as compared to other states, most people normally don't cook fruits before eating nor extract the juice or put it in the refrigerator before eating, that may be the reason why raw fruit eaters are the largest group. Pineapple also recorded a high number of respondents; this may not be true in every part of the country because the region within which the research was carried out is a pineapple producing area. Mangoes couldn't attract many respondents because of its seasonal nature unlike orange, banana and pineapple. Watermelon also had a quite number of respondents but not as large as orange, banana and mango because it is expensive than orange, banana and mango. Cooked fruits recorded least number of respondents; this may be that most student-teachers know the effect of damage that can be caused to cooked fruits hence the practice of raw fruit eating is high. Frozen fruits also recorded low number of respondents and this may be that student-teachers don't store fruits for future use. They may only take frozen fruits when they are canned or bottled. Even though raw fruit juice recorded the second largest respondents, the number is very low as compared to respondents who eat fruit raw. This may be that student-teachers don't have a means to extract juice from the raw fruit; instead they will eat the fruit raw together with the fibre. And if they extract the juice, they have to keep it in a refrigerator for future use and this may not be ideal since they may not have access to refrigerators.

Williamson and Monach (2005) said recent research has focused on a specific type of oligosaccharides: fructo-oligosaccharides or FOS. These are short chains of fructose linked by 2-1 β -glucosidic bonds with a terminal D-glucosyl unit linked by an alpha-1-2 bond, present in some cereals and vegetables (including asparagus and onion). FOS are non-digestible carbohydrates, because the human intestine lacks enzymes capable of breaking down its bonds. This chemical feature lends FOS attractive

physiological properties, such as low caloric value (about 2 kcal per g), sweetness, low capacity for causing caries, and effects similar to those of dietary fibre. They are viewed as prebiotics for their ability to modify colon flora by fostering the selective growth of groups or individual species of bacteria that discourage the settlement of pathogenic bacteria; in addition, FOS fermentation acidifies the environment, thus reducing carcinogen production.

They continue to say that indoles and isocyanates are also important, present in cruciferous vegetables (broccoli, cauliflower and cabbages), which help prevent cancer; the antioxidant resveratrol in grapes and grape by-products; and organic sulphurs, which help prevent cancer and heart disease, present in garlic and onions. Fruit and vegetables also contain organic acids responsible for their smell and taste, such as citric acid (present in a wide variety of fruit and vegetables), tartaric acid (grapes) and malic acid (apples). Other substances present in some leafy vegetables can act as anti-nutrients, such as oxalic acid, which has a chelating effect on the absorption of divalent minerals, including iron and calcium. Fruit and vegetables are thus complex foods and provide significant quantities of carbohydrates (especially sugars), low quantities of protein and fat, and are essential in the human diet. They provide water, dietary fibre, numerous vitamins and minerals and bioactive substances with major health benefits.

Research Question 3: How Often Do Student-Teachers Eat Fruits?

Table 4 is to investigate how often time student-teachers eat fruits. This includes the following suggested times; daily, every other day, weekly, fortnightly, once a month and occasionally.

Table 4
Frequency of Fruit Consumption

Period	Frequency	(%)
Daily	68	45
Every other day	38	25
Weekly	3	2
Fortnightly	1	1
Once a month	1	1
Occasionally	39	26
Total	150	100

In answering research question 3, which finds out the frequency student-teachers eat fruit, those who eat fruit daily had the largest number even though their number was 45% of the total respondents. Those who eat occasionally and every other day group followed. Considering the reasons respondents gave, and looking at these responses given, there is a linkage. The percentage of people who eat fruits anytime they feel like can support those who eat fruits occasionally. This practice may cause one to eat fruits occasionally. When you combine the percentage of those who eat fruits every other day and daily, and since most student-teachers have different reasons for eating fruits, there is the likelihood that they would have different times of eating fruits.

Since the percentage of people who eat fruits weekly, fortnightly and monthly is very low, it can also support the claim that some student-teachers eat fruits other than for health reasons. Those who fall within this group are not large. Looking at the percentage of those who eat fruit occasionally which is second to those who eat fruit daily then it means some group of people don't have any plan to eat fruits, they only eat

fruit based on other reasons other than for health reasons. When you consider the response for research question 6, 71% strongly believe that fruits supply nutrient to the body. So if these student-teachers have such belief and most people eat fruit daily and every other day then it is true that people eat fruit as claimed in the study.

Graham (2007) said that man started eating fruit from the day he was created. Fruit eating has been part of human beings and its history cannot be overemphasized. It is the opinion of Graham that fruit has been given a bad rap. From the earliest written history, fruit has played a key role in human health. It was the main food consumed into the proverbial Garden of Eden for an untold number of years. During the Golden Age of Man some 2500 years ago, fruit was the predominant food. This period of time in ancient Greece fostered the development of a hugely disproportionate number of history's greatest thinkers, philosophers, artists and athletes. Fruit has always been recognized as health food and still firmly holds that esteemed position. The old saying, 'an apple a day keeps the doctor away', has been replaced by 'eat fruit everyday, the five-a-day way' indicating that the benefits of eating fruit are being more fully recognized. Ones, government, the health industry, the nutritionists, dietitians and every disease control organization that offers nutritional advice suggested that we eat more fruit. Meanwhile on the other side of the coin, there are people who literally shun fruit. A few leaders in the raw food movement actually have suggested that we should learn to live without eating fruit at all. Obviously, someone is mistaken.

Kalt (2002) quoted Bushman who said, man could live on fruits alone for 3 months provided that water was available. Nestle (1998) stated that, many populations, even among people who know that citrus is nutritious, the consumption of citrus is often very low. The reasons for this are varied, but it indicates that knowledge of a nutritional benefit is just one of the many factors that influence food choices. Contento (1995) also

asserted that among other factors that greatly influence what foods people consume are: an individual's food preferences and previous experiences with a given food; culture values, perceptions, attitudes and societal influences including the media and advertising, and most directly, the availability, taste and price of food items. For these reasons, it is difficult to bring about wider spread behavioural change. Clearly, strategies are more likely to modify behaviour and improve health if they are directed towards the relevant influences and barriers.

Graham (2007) said that, from the earliest written history, fruit has played a key role in human health. It was the main food consumed in the proverbial Garden of Eden for an untold number of years. During the Golden Age of Man some 2500 years ago, fruit was the predominant food. This period of time in ancient Greece fostered the development of a hugely disproportionate number of history's greatest thinkers, philosophers, artists and athletes. Fruit has always been recognized as health food, and still firmly holds that esteemed position. Considering all that have been said, it holds that people still don't eat fruits the way it was eaten centuries ago.

Research Question 4: What Factors Determine Student-Teachers' Choice of Fruit?

Table 5 describes factors that determine student-teachers' choice of fruits. It presents the following suggested determinants; religious factors, health factor, special like for it and abundance in the community factor.

Table 5**Determinants of Student-Teachers' Choice of Fruit**

Factors	Yes (%)	No (%)	Total
Religious factor	2 (1)	148 (99)	150 (100)
Health factor	105 (70)	45 (30)	150 (100)
Special like for it	58 (39)	92 (61)	150 (100)
Abundance in the community factor	15 (10)	135 (90)	150 (100)

Obviously, more than half of the respondents said health reasons determine their choice of particular fruit. Since most student-teachers' choice of fruits are determined by health factor, it is a good indication that they know the benefit of food to human health. Even though student-teachers have various reasons for eating fruits but as to what fruit to eat because of what they can derive from it determines what type of fruit to eat. Also since eating raw fruits is the best and most respondents eat raw fruits than any other state of fruit indicates their reasons and determinants of their fruit eating. Looking at the number of respondents who selected health reasons as their reason for eating fruit and the number of respondents who said, health factors determine their choice of fruit, the difference is quite large. Ninety (90) as against a hundred and five (105). But the difference can be deduced by considering those who add to diet to make up the required quantity and those who eat fruit to free their bowel as part of those who this time said they eat fruit for health reason, it is clear that they eat fruit due to health factors. Also, there is a link between those who eat fruit only when they are hungry, anytime they feel like and when it is cheaply sold at the market and those who select a type of fruit because of their special like for it.

According to the result, fifty-eight (58) out of a hundred and fifty (150) choose a particular fruit because of their special like for it and fifteen (15) selected a particular fruit when it is abundant in the community. Adding the two together and comparing it to response in research question one, one can conclude that, there is a relationship between the responses for the two questions.

No respondent chose other factor and only two respondents said their choice of fruit is determined by religious factors. Page, Cole & Timmreck (1995) refer to the experiment James Lind conducted on the treatment of scurvy that, Lind took 12 patients suffering from scurvy on board at sea. The patients laid together in one place being proper apartment for sick in the fore hold and had one diet common to all. Later, some were grouped and were given different or additional food. Six days under this course, he noticed a remarkable improvement in a group. Lind was able to conclude from the result of his experiment that eating citrus fruit successfully treated scurvy and that consuming these fruit would also prevent the occurrence of scurvy. In Ghana, some fruits become abundant during a particular season. Fruits like mango, guava and orange are sometimes got free and this situation forces eaters to either increase their quantity or how often they eat them. At times student-teachers cannot afford to buy some fruits during lean season. It is also clear that some student-teachers may not eat a particular fruit until that fruit can be obtained easily and this can only be possible when that fruit is in its season.

Hao et al., (1998) confirmed the health factor behind the choice of fruit. They said that, fruit consumption results in reduced triglyceride level in the blood, a risk indicator for heart disease and reduces hypertension while increasing the level of high density lipoprotein (good) cholesterol.

These intake bands consider fruit and vegetables for their energy value rather than their nutrient content. This approach takes account of the fact that the health

benefits of fruit and vegetables cannot be attributed to a sole nutrient or mix of nutrients and bioactive substances, but to fruit and vegetable consumption as a whole. Hence fruit and vegetables are listed as a food category, instead of the individual nutrients. Tuber (e.g., potato, sweet potato and manioc) should not be included among fruit and vegetables. Recommendations on total fat intake consider countries where intakes are commonly high (above 30%) or very low (below 15%). An intake of at least 20% total fat in the diet is compatible with good health. In countries with a highly active population and a diet rich in fruit, vegetables, pulses and wholegrain cereals, total fat intake can be up to 35% without risk of harmful weight gain. High intake of simple sugars detracts from the nutritional quality of the diet, because it provides energy lacking in nutrients to the detriment of other foods of high nutritional quality. After drinking a very sugary drink, in fact, it has been shown that the compensating reduction in food intake is less than for other foods of the same energy content.

So this condemns the idea of eating fruit only when it is abundant in the community and also supports it because if there are a number of fruits in a community and some are seasonal, then, when the season of a particular fruit is due then it will be abundant and people will eat them but when the season is off then they stop eating fruit. Taking the number of respondents into consideration, only two respondents said they eat fruits because of religious reasons. It is good for people to follow what their religion teaches them to do.

According to the Quran, Surai 5 verse 4, there is an emphasis on the eating of fruit but not specific type. The Holy Bible generalises the eating of plant food. Since the Quran mentions fruit as some of the good food to eat, one may be right to say that, his choice of fruit is determined by religious reasons.

Research Question 5: How Much Fruit Does Student-Teacher Eat?

Tables 6 and 7 present information on the quantity of fruits student-teachers eat. This was in two different quantities depending on the type of fruit. Some fruits are too small and a whole can be eaten so the number of fruits is used and other are too large and only part or full will be sufficient enough so the size of fruit is used in this situation.

Table 6

Quantity of Fruits Student-Teachers Eat (in numbers)

Fruit	Quantity						Total (%)
	< 1 (%)	1 (%)	2 (%)	3 (%)	4 (%)	> 4 (%)	
Mangoes	2 (2)	15 (17)	26 (29)	21 (23)	20 (22)	6 (7)	90 (100)
Bananas	1 (1)	3 (3)	8 (7)	15 (14)	80 (72)	4 (4)	111 (100)
Guava	4 (7)	21 (36)	21 (36)	4 (7)	6 (10)	2 (4)	58 (100)
Lime	20 (69)	8 (28)	1 (3)	0 (0)	0 (0)	0 (0)	29 (100)
Lemon	13 (57)	7 (30)	3 (13)	0 (0)	0 (0)	0 (0)	23 (100)
Orange/tangerine	2 (2)	8 (7)	44 (36)	27 (22)	35 (29)	0 (0)	116 (100)
Avocado/pear	7 (18)	17 (45)	10 (26)	4 (11)	0 (0)	0 (0)	38 (100)
Apple	4 (9)	15 (35)	11 (26)	8 (19)	5 (12)	0 (0)	43 (100)

Table 7

Quantity of Fruits Student-Teachers Eat (in size)

Fruit	Quantity			Total (%)
	Small Piece (%)	Medium (%)	Large (%)	
Watermelon	30 (42)	31 (44)	10 (14)	71 (100)
Pawpaw	21 (24)	55 (63)	12 (14)	88 (100)
Pineapple	24 (21)	55 (49)	33 (30)	112 (100)

Whitney and Rolfes (1999) and Payne and Hahn (2002) among others suggested size of fruit that is sufficient. Comparing it to the quantity of fruit respondents declared they eat can compel us to believe that people are not aware of the quantity of fruit that is suitable. Whitney and Rolfes say, sodium occurs naturally in almost all fresh, whole fruits so many people get far more sodium than they need, which tends to cause health problems. But people due to lack of knowledge about quantity of fruits to be eaten suffer as a result of excessive fruit eaten. It has been suggested that 500 mg/day for adults, 120 mg for infants and there should be no more than 2,400 to 3,000 mg/day even though different body types need different amount of sodium.

They said that, one medium orange and one 225 ml glass of orange juice provide approximately 235 mg and 500 mg of potassium respectively. If this quantity can provide the body with the appropriate nutrients, then the conclusion that excess potassium from fruit is most likely to occur is valid considering the quantity of fruit respondents eat. It is also clear that costly fruits like the apple, and sour fruits like lime and lemon recorded smaller quantity which is the normal quantity for the body's needs.

Even though the size of pineapple and water melon is relative, one person eating a large size is too much than the required quantity the body may need. About water melon, 10 out of 71 eat large and 33 out of 112 eat large size of pineapple. According to Lampe, the summary and their constituents on biological markers associated with disease risk, daily dosage of fruit agents that were used for the treatment of various diseases had the largest quantity of 300 mg which is about one orange or mango so when one eats two, three and four oranges, mangoes and the rest, then excess amount is created which may be waste or create problems to the body. But this practice is not regularly done and when the body needs nutrients from the fruit to function certain part well, it does not and this creates problems for the body. According to the result of the

study, lime and lemon which the quantity intake seems to be normal, only few eat it and not regularly eaten to provide the body with the required nutrients to do its work. Guava which also gave a very reasonable quantity intake also happened to be less consumed. Hao et al. (1998) said that guava is the most outstanding fruit for vitamin C content of any commercial fruit. It has exceptional 164 mg of vitamin C per fruit twice the amount of the second place holder. And according to the south African canning industry, some pink guava varieties have an astonishing 400 to 500 mg of vitamin C, one guava (90 g) supplies about 5% of adult minimum daily niacin (B₃ needs). A guava of this size has nearly 800 international units of vitamin A very useful contribution to the daily requirement and making it sixth highest source amongst the fruit. It is also high in potassium and an excellent source of dietary fibre. It can be said that unlike mango, orange, pineapple and water melon which are easily to come by in Ghana. Guava is not produced in larger quantity or not intentionally cultivated so it is not easily or cheaply obtained hence low consumption rate.

Banana recorded a high consumption rate. This may be that, it is easily obtained and very cheap. Because it is easily got consumers eat more than the quantity the body will need at a particular period and also Joseph et al., (1999) stated that while allergies to some fruit are not known, it is extremely rare for someone to be allergic to banana. And this may account for its high consumption rate. Since quite a number of respondents gave reason for eating fruit as when they are hungry, there is the possibility that these consumers will eat more than the body's requirement. Also, since others have the view that, fruits free the bowel, in an attempt to free the bowel with fruit, one may eat more than the body's requirement and the excess be dropped down by the body and this be regarded as freeing the bowel.

When Hansey (2005) directs various ways that some fruits can be used to cure some ailments, she directs the quantity to use for particular ailment. Joseph et al., (1999) say bananas are a good source of vitamin C. Although adult would need to eat 6 in a day to get cure than rather conservative Recommended Daily Allowance (R.D.A.) of 60mg.

Martin et al., (1999) say that one orange juice will meet about 20% of an adult daily foliate needs as well as being an excellent source of vitamin C. (One orange intake 960mg for adult). Graham (2007) said, one can eat an entire melon for breakfast or six, twelve, or even a greater number of bananas for lunch. These authorities in a way mention the quantity of fruit that to be eaten in brief. But, mostly they only talk about when and how fruit should be eaten and what fruit is capable of doing to mankind.

Graham (2007) for instance said how he likes his fruit by saying, a great way to eat more fruit is to make fresh fruit smoothies. Smoothes need not be complicated to be tasty. For example, I like to blend bananas with water and have that as a smoothie. When I make that smoothie, I will blend a few bananas with about 1 cup of water and drink after my exercise session. I also like blending mangoes with other fruits. For example, mango blended with papaya or peaches are amazingly delicious. Frozen go pretty well in all sorts of fruit smoothies. The authorities also talk about either the percentage of fruit needed by the body or milligrams of fruits the body requires but not state the quantity of fruit that should actually be eaten.

Fleming et al. (1998) said for good health and sufficient body storage of vitamin C, 30 to 100 mg/day is generally recommended, although some recent studies have provided evidence that more than 200 mg/day may be optimal for the prevention of chronic disease. Too much vitamin C (above 500 mg), generally seen with very high levels of supplementation, may be dangerous, especially for those at risk of iron overload. Whitney and Rolfes (1999), also asserted that consuming five servings of

fruits and vegetables each day can result in an intake of about 200 mg of vitamin C. Citrus fruits are a particularly good source of vitamin C, with one medium orange or grapefruit providing approximately 70 mg and 56 mg, respectively. A 225 ml glass of orange juice contains approximately 125 mg of vitamin C. They continue to say that a 225 ml glass of orange juice provides 75 mcg of folic acid.

Total cholesterol was reduced with carrot fibre, guar gum and pectin; HDL was reduced with carrot fibre as result of 20 g dietary fibre from carrot, cabbage, apple, wheat bran or guar gum, and 31 g pectin taken for 3 weeks. Daily dosage of 200 g raw carrot for 3 weeks reduced serum cholesterol, fecal bile acid and fat excretion increased. Serum total cholesterol was reduced by 4% to 7% with vegetable and fruit and pectin diets, respectively due to wheat bran daily dosage for 5 weeks. Mean plasma cholesterol concentrations were reduced by >10% when 350-400 g raw apple was taken daily for one month. Plasma LDL-cholesterol and fecal lithocholic acid concentrations decreased when 100 g prunes daily dosage for 4 weeks was administered. Serum total cholesterol and triglycerides decreased when 0.5-1.0 kg guava was eaten for four weeks. When 15 g dietary fibre as carrots was daily eaten for 3 weeks, there was no effect on serum cholesterol concentrations or fecal bile acid excretion.

Only a minority of the world population consumes the quantity recommended by the FAO and WHO. The worldwide trend toward city-dwelling has driven people away from the production of primary foods. This hinders the consumption of a varied, nutritious diet with an adequate proportion of fruit and vegetables. The poorest city-dwellers are not only remote from primary food production; they also find it harder to access healthy, varied diets. On the other hand, increased urban dwelling may support other aims, because people with enough purchasing power have wider access to a varied, nutritious and healthy diet. World food production trends and the availability of

fruit and vegetables indicate that present output and consumption differ greatly from region to region. These production statistics do not include wild and native vegetable output. Consumption may be underestimated, therefore.

In 2000 the average availability of vegetables per person worldwide was 102 kg per annum. The highest figure was recorded in Asia (116 kg), while the lowest were recorded in South America (48 kg) and Africa (52 kg). In Europe, the availability per capita in 2000 was 112.5 kg. In Spain in 2004, per capita consumption of fresh fruit and vegetables was 68.2 kg and 102.3 kg, respectively. These figures reflected a rising trend, with fruit and vegetable consumption increasing 5.4% and 4.7%, respectively. Nutrient intake: the role of fruit, vegetables, dietary fibre and non-starch polysaccharides (NSPs). Recommended intake is at least 400 g of fruit and vegetables per day. Wholegrain cereals, fruit and vegetables are the main sources of non-starch polysaccharides (NSPs), with consumption of these three foods providing in excess of the daily recommended intake of 20 g of NSP (>25 g total dietary fibre).

Research Question 6: What Knowledge Do Student-Teachers Have About The Benefits Of Fruits To Human Health?

Table 8 seeks to present student-teachers' knowledge on the benefit of fruits to human health. The suggested benefits for this study were; prevention of diseases, for body growth, supply of nutrients to the body and to free the bowel.

Table 8**Student-Teachers' Knowledge About the Benefits of Fruits to Human Health**

Benefits of fruit	SA (%)	A (%)	U (%)	D (%)	SD (%)	Total (%)
Prevention of disease	69 (46)	61 (41)	16 (11)	2 (1)	2 (1)	150 (100)
For body growth	94 (63)	40 (27)	4 (5)	9 (6)	3 (2)	150 (100)
Supply of Nutrient to body	108 (72)	36 (24)	4 (3)	2 (1)	0 (0)	150 (100)
Free Bowel	101 (67)	38 (25)	7 (5)	2 (1)	2 (1)	150 (100)

Considering the response for benefits of fruit to human health, only 1% each disagree or strongly disagree respectively that fruits prevent disease and only 11% were undecided whether fruit can be used to treat ailment or not. If this response is compared to their reasons for eating fruit, there is a contradiction, because 87% strongly agree and agree to this benefit but does not reflect the way they eat fruit.

The percentage of those who strongly agree and those who agree that fruits build the body is quite high that is 90%, so this knowledge should have reflected in their reasons for eating fruit or regularity of eating fruit. This means, when comparing their reasons for eating fruits and how often they eat fruit, one can conclude that, some do not practice what they know to be good. In the same way, 96 total percentage of the respondents either strongly agree or agree that fruits supply the body with nutrient and this does not go in line with their reasons for eating fruits or the frequency at which they eat fruits. Even though the highest number of student-teachers who eat fruit are those who eat fruit on health reasons and those who eat fruit daily and every other day but the percentage is not as large as it should be if respondents have these knowledge about

fruits. Quite a large number of respondents have the belief that fruits free the bowel but don't have the idea that it does that only when it is not eaten at the appropriate period.

Results gathered from research question one, which sought to find out reasons student-teachers gave for eating fruits, 90 out of one 150 responses collected said they eat fruit for health reasons. This figure is the highest and confirms the responses on their knowledge on benefits of fruits to human health on fruits being used to prevent disease. Also, about the factors that determine their choice of fruit also recorded that highest number, a hundred and five for those who said health factor determines their choice of fruit. But looking at the types of fruits that have high medicinal values and the student-teacher's type of fruit they eat, those which have high medicinal values are rather less consumed. Martin et al (1999), Hansey (2003) and (2005) mention some types of fruit like lime and lemon and their medicinal values, even though other fruits also have medicinal values but when the amount of fruits eaten is compared, it is clear that, lime and lemon recorded the lowest quantity. So it is clear that student teachers have the knowledge that fruits prevent disease.

Considering their knowledge on the benefit of fruit to build the body, sixty-one percent (61%) strongly agreed and twenty-six percent (26%) also agreed. This is a clear indication that about ninety percent of the respondents have the knowledge that fruit build the body. Thompson (1999), Joseph, Sunkist, Hale et al., (1999) and Hao et al., (1998) all stated what fruits can do to help the body grow well. They clearly said what most fruits are capable of doing to build body. Some authorities also said a lot about what fruits are capable of supplying to the body in terms of nutrients. Seventy-one percent (72%) strongly agree to the fact that, fruits supply nutrients to the body and twenty-five percent (24%) also agree to the same fact indicating ninety-five percent (95%) of the respondents. Almost every authority in this study mention what can be

derived from every fruits mentioned in this study. It is clear that fruit supply nutrients to the body so the fact that fruits supply nutrients means that, fruits build the body.

The last benefit of fruit the study sampled which is the ability of fruit to free bowel. Sixty-eight percent (67%) strongly agree and twenty-five percent (25%) agree to this. Even though fruit free bowel it has been clearly said that, it does this only when it is not eaten at an appropriate time. Hansey (2003) and Graham (2007) all confirm that fruit can free bowel but if not well eaten.

Carpenter (1986) said scurvy, a serious deficiency of vitamin C that has caused tremendous human suffering throughout history, was first described by ancient Egyptians, and then by the Greeks and Romans. For hundreds of years, scurvy was a scourge of long-distance sailors, soldiers, explorers and the poor in many countries where there was a lack of access to fresh fruits and vegetables. However, it was not recognized that scurvy could be prevented and cured by consuming citrus fruit until the eighteenth century. And it would be another 200 years before vitamin C was isolated and its deficiency identified as the cause of the disease.

The lesson from this is still important today; people do not need to understand everything about individual nutrients in order to consume nutritionally adequate and well-balanced diets. Even though deficiencies, there is still much that is not known, and probably never will be known, about the relationships between diet and health. Fortunately, however, with a bit of common sense, people can still be well nourished even though the understanding of nutritional science may be incomplete.

For example, research efforts exploring the possible protective effects of phytochemicals against various forms of chronic diseases have often shown an association with the consumption of various foods rich in these compounds, but not with specific phytochemicals themselves. There are several possible explanations for this,

including; the specific phytochemicals being investigated may not be the ones that have an effect; the effects of individual phytochemicals may be additive; and it may be the interaction of two or more phytochemicals and nutrients that produce an effect. Since the understanding of nutrition science and complex functions and interactions of the many vitamins, minerals, macronutrients and phytochemicals contained in food is still so incomplete, it is important that a rational and time-tested approach be taken to the promotion of good nutrition. It is also important to continue emphasizing the benefits of nutrient-dense foods, such as citrus fruits, and to recognize that the consumption of whole foods and natural juices is preferred over the consumption of individual nutrients that have been isolated from food and then consumed as dietary supplements. Focusing on single nutrients, instead of foods and the total diet, does not constitute a healthful approach to good nutrition.

Putnam and Allshouse (1997) said the health benefits associated with citrus consumption are clear. Citrus fruits are nutrient-dense foods that can be good sources of carbohydrates, including dietary fibre, and many vitamins and minerals. Citrus fruits are equally valuable among populations who need to overcome and prevent micronutrient deficiencies as well as those concerned with problems of overnutrition, obesity and diet-related chronic diseases. For example, citrus is an ideal component of low-fat, sodium-restricted diets. As nutritionists and public health specialists learn more about the relationship between diet and health, the importance of balanced and varied dietary intakes becomes ever more evident. Accordingly, there is an increasing emphasis on promoting high levels of fruit and vegetable intakes among most population. Citrus consumption has a considerable potential to expand as part of this overall recommended increase in fruit and vegetable consumption. While the supply of citrus is a problem in some areas, a greater obstacle is often the lack of effective demand for citrus.

Addressing both the supply and demand problems, as appropriate, will require that a range of issues, such as agriculture and trade policies, food and nutrition policies, dietary guidance and nutrition education, and marketing, are addressed effectively and in a comprehensive manner. In many countries, a multifaceted approach that brings together, as appropriate, representatives of producers, processors, importers, retailers and consumers with nutritionists and public health specialists can have a significant impact on citrus consumption. Given that increasing the consumption of citrus benefits both producers and consumers, building effective partnerships to that end should not be difficult and would be an invaluable investment in the nutritional well-being and health of the population.

Fruits, nuts and vegetables play a significant role in human nutrition, especially as sources of vitamins [C (ascorbic acid), A, thiamine (B₁), niacin (B₃), pyridoxine (B₆), folacin (also known as folic acid or folate) (B₉), E], minerals, and dietary fiber (Craig and Beck, 1999), Quebedeaux and Bliss (1998), Quebedeaux and Eisa (1990) and Wargovich (2000). Their contribution as a group is estimated at 92% of vitamin C, 48% of vitamin A, 30% of folacin, 27% of vitamin B₆, 17% of thiamine, and 15% of niacin in the U.S. diet. Fruits and vegetables also supply 16% of magnesium, 19% of iron, and 9% of the calories. Legume vegetables, potatoes, and tree nuts (such as almond, filbert, pecan, pistachio, and walnut) contributes about 5% of the per capita availability of proteins in the U.S. diet, and their proteins are of high quality as to their content of essential amino acids. Nuts are a good source of essential fatty acids, fiber, vitamin E, and minerals. Other important nutrients supplied by fruits and vegetables include riboflavin (B₂), zinc, calcium, potassium, and phosphorus. Fruits and vegetables remain an important source of nutrients in many parts of the world, and offer advantages over dietary supplements because of low cost and wide availability.

Dietary supplements, while advantageous for conditions where specific nutrients are needed in abundance such as with iron deficiency, may be poorly absorbed, and many are derived chemically rather than from natural sources. Climatic conditions, particularly temperature and light intensity, have an especially strong effect on the nutritional quality of fruits and vegetables oxidation (Mozafar, 1994).

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The purpose of the study was to investigate the reasons why teacher trainees of Foso College of Education eat fruits. This final chapter deals with three subsections. The summary of the whole write up, the conclusion of the researcher as far as the research questions are concerned and finally the researcher's recommendations based on the results of the findings and other issues that posed problems during the study.

Summary

The study was to find out reasons for eating fruits. But the study delimited itself to only 150 teacher-trainees of Foso collage of education. The researcher adopted probability random sampling techniques to obtain the population for the study. The researcher depended on the close ended form of validated questionnaires to collect data from the study. The results of the study are as follows; about the research question one, which sought to find out the reason student-teachers give for eating fruits, 74 said they eat fruits at any time they feel like. Eighteen said they eat fruits when they are hungry, 73 also said that they eat fruit to free their bowel, 19 of them said they eat fruit when it is cheaply sold at the market. Forty-six said they add to diet to make up required quantity. Ninety said for health reasons and only one person said for its sweetness.

The research question two was to find the type of fruits student-teachers eat. This, the responses were in two folds. A hundred and forty-five eat raw fruits. Forty-three said they take bottled/canned fruits. Forty-nine eat raw fruit juice. Twenty-two eat frozen fruits and seven cooked fruits. In the same situation, 124 chose banana. Ninety-eight selected pineapple; 74 opted for mangoes. Fifty-five chose watermelon, 84 for

pawpaw and 34 went for guava. A hundred and twenty-two said they like oranges/tangerine, 56 for avocado (pear), eight for apples. Ten people went for lemon and eight chose lime. The next question was to find out how often student-teachers eat fruits. The result had was, 68 said daily, 39 said occasionally, 38 said every other day, three said weekly. One person each said fortnightly and monthly. The fourth question demanded the determinant of their choice of fruits. Two said due to religious reasons, 15 chose when it is abundant in the community. Fifty-eight said they eat fruits because of special like for something. A hundred and five said for health reasons.

To find out the quantity of fruits they eat whenever they eat fruit. About mangoes, two persons said they eat less than 1. Fifteen said they eat one. Twenty-six said they eat two. Twenty-one said three and 20 said four. Six people said more than four.

About bananas too, only one person said less than 1. Three persons said one. Eight said two and fifteen said three. Eight said four and 14 said more than four. What the researcher found out about guava was that, four people said less than 1, 21 said one and 21 said two. Four said three and six people said four. Two said more than four. Pawpaw too produced this result. Twenty-one people said they eat small piece. Fifty-five said medium size and 12 said large size. Twenty-four people said they eat small piece of pineapple, 55 said medium size and thirty-three said large. About orange and tangerine, two said less than one, eight said one. Forty-four said four and six said more than four. Twenty people said less than one for lime, eight said one and one person said two. About lemon, 13 said less than one, seven said one and three said two. The last research question sought to know the knowledge they have about the benefits of fruits to human. As much as 102 each strongly agreed that fruits free the bowel and supply nutrients to the body. The next knowledge was that it builds the body. As much as

ninety respondents strongly agreed to that but only 69 said, it is used to treat ailment. Even though 61 agreed to being used to treat ailment, 40 agreed that, it builds the body. Thirty-six agreed to the supply of nutrients and 38 agreed that it free the bowel.

Conclusions

The researcher critically analyzing the results and the findings made the following conclusions.

Most respondents think that, fruit free bowel. The research made it clear that, fruit does not when it is properly eaten. That is, eaten before meals which is the appropriate way of eating fruit.

Raw fruits are popularly eaten because they are readily available and are cheapest. Orange, pineapple and banana are mostly eaten; this is because the community within which the research was carried out is an area where these fruits can be got throughout the year.

About the frequency of fruit consumption, even though respondents for daily were more than the other options, their number was not good enough if really people eat fruit for health benefits..

Considering the quantity of fruits respondents eat, it is also clear that, most respondents abuse fruit when compared to the Recommendation of the Food Guide and Recommended Daily Allowance for nutrients from fruits.

Even though most respondents claim to have had knowledge that fruit has impact on man's life, most respondents eat fruit at anytime they feel like. It is obvious that respondents don't add fruits to their diet to make up the required quantity. They either eat it more or less as required by the body.

Recommendations

This is the final section of the last chapter of the study. The following relevant recommendations in terms of the implication for practice have been made. The study revealed that most people are not aware of the fact that fruits can be used to treat ailment so sufficient education must be done on this to assist the public. Also some fruits like lime and lemon have been relegated to the background yet their importance to health is very great.

The perception that fruit is used to free the bowel should be taken away since fruits naturally do not do that but do it only when it is wrongly eaten. This is because when someone eats fruits correctly but with this intention and does not get the result, the person may stop eating fruits.

The crusade of fruits being eaten daily must also be fought. This is because the study revealed that most people don't eat fruit daily but rather occasionally and every other day.

The researcher suggests that future research should investigate which gender eats more fruit.

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APPENDIX A

A LETTER SEEKING PERMISSION TO ADMINISTER QUESTIONNAIRE

Department of Physical Education

Foso College of Education

Box 87

Assin Foso.

3rd December, 2008.

Vice Principal Academic

Foso College of Education

Box 87

Assin Foso

Dear Sir,

KNOWLEDGE AND PRACTICES OF FRUIT EATING BY TEACHER- TRAINEES

I am a tutor on staff at the Science department undergoing a Master in Philosophy, Health Education at the University of Cape Coast. My purpose of writing you is to solicit your co-operation and permission to administer my questionnaire to collect data for my thesis.

The study is being undertaken by me as part of the requirement for the award of Master degree in Philosophy. The nature of the exercise is that, sampling of the respondents in each class will be done, followed by distribution of questionnaire. This will take place during prep period. I wish to say that the nature of the questionnaire will not take more than thirty minutes to complete.

I would be most grateful if permission is given to me to administer the questionnaire. I promise not to do anything to undermine the smooth movement of the college programme.

Thanks for your co-operation.

Yours faithfully,

.....

E. A. Enniful.

8. How often do you take fruit?

- | | |
|--------------------------------------|--|
| <input type="checkbox"/> Daily | <input type="checkbox"/> Every other day |
| <input type="checkbox"/> Fortnightly | <input type="checkbox"/> Occasionally |
| <input type="checkbox"/> Monthly | <input type="checkbox"/> Others, specify |

9. What factor(s) determine your choice of fruits?

- | | |
|---|---|
| <input type="checkbox"/> Religious reasons | <input type="checkbox"/> Health reasons |
| <input type="checkbox"/> Special like for it | <input type="checkbox"/> Abundance in the community |
| <input type="checkbox"/> Other, specify | |

10. When you take fruits, how much do you take in a day?

- | | | |
|---|---|---|
| I. Mangoes | II. Banana | III. Guava |
| <input type="checkbox"/> Less than half | <input type="checkbox"/> Less than half | <input type="checkbox"/> Less than half |
| <input type="checkbox"/> One | <input type="checkbox"/> One | <input type="checkbox"/> One |
| <input type="checkbox"/> Two | <input type="checkbox"/> Two | <input type="checkbox"/> Two |
| <input type="checkbox"/> Three | <input type="checkbox"/> Three | <input type="checkbox"/> Three |
| <input type="checkbox"/> Four | <input type="checkbox"/> Four | <input type="checkbox"/> Four |
| <input type="checkbox"/> Other, specify | <input type="checkbox"/> Other, specify | <input type="checkbox"/> Other, specify |
| IV. Pawpaw | V. Watermelon | VI. Pineapple |
| <input type="checkbox"/> Small piece | <input type="checkbox"/> Small piece | <input type="checkbox"/> Small piece |
| <input type="checkbox"/> Medium | <input type="checkbox"/> Medium | <input type="checkbox"/> Medium |
| <input type="checkbox"/> Large | <input type="checkbox"/> Large | <input type="checkbox"/> Large |

