Bio lab report

Business

The vitamin C content of fruit juice Date of experiment: 29 July 2013 Lecturer: Puan Zakiah binti Zakaria Title : The vitamin C content of fruit juices.

Objective : To determine the vitamin C content of various fruit juices. Introduction : Because of its widespread use as a dietary supplement, vitamin C may be more familiar to the general public than any other nutrient. Studies indicate that more than 40% of older individuals in the U. S. take vitamin C supplements; and in some regions of the country, almost 25% of all adults, regardless of age, take vitamin C.

Outside of a multivitamin, vitamin C is also the most popular supplement among some groups of registered dietarians, and 80% of the dietarians who take vitamin C take more than 250 milligrams. Why is this nutrient so popular? Vitamin C, also called ascorbic acid, is a water-soluble nutrient that is easily excreted from the body when not needed. It’s so critical to living creatures that almost all mammals can use their own cells to make it. Humans, gorillas, chimps, bats, guinea pigs and birds are some of the few animals that cannot make vitamin C inside of their own bodies. Humans vary greatly in their vitamin C requirement. It’s natural for one person to need 10 times as much vitamin C as another person; and a person’s age and health status can dramatically change his or her need for vitamin C.

The amount of vitamin C found in food varies as dramatically as our human requirement. In general, an unripe food is much lower in vitamin C than a ripe one, but provided that the food is ripe, the vitamin C content is higher when the food is younger at the time of harvest. Vitamin C serves a predominantly protective role in the body. As early as the 1700's, vitamin C was referred to as the " antiscorbutic factor," since it helped prevent the disease called scurvy. This disease was first discovered in British sailors, whose sea voyages left them far away from natural surroundings for long periods of time. Their body stores of vitamin C fell below 300 milligrams, and their gums and skin lost the protective effects of vitamin C.

Recognizing limes as a good shipboard source of vitamin C, the British sailors became known as " limeys" for carrying large stores of limes aboard ship. The protective role of vitamin C goes far beyond our skin and gums. Cardiovascular diseases, cancers, joint diseases and cataracts are all associated with vitamin C deficiency and can be partly prevented by optimal intake of vitamin C. Vitamin C achieves much of its protective effect by functioning as an antioxidant and preventing oxygen-based damage to our cells. Structures that contain fat (like the lipoprotein molecules that carry fat around our body) are particularly dependent on vitamin C for protection.

Full-blown symptoms of the vitamin C deficiency disease called scurvy—including bleeding gums and skin discoloration due to ruptured blood vessels—are rare in the U. S. Poor wound healing, however, is not rare, and can be a symptom of vitamin C deficiency. Weak immune function, including susceptibility to colds and other infections, can also be a telltale sign of vitamin C deficiency. Since the lining of our respiratory tract also depend heavily on vitamin C for protection, respiratory infection and other lung-related conditions can also be symptomatic of vitamin C deficiency.

There are very few research studies that document vitamin C toxicity at any level of supplementation, and there are no documented toxicity effects whatsoever for vitamin C in relation to food and diet. At high supplemental doses involving 5 or more grams of vitamin C, diarrhoea can result from the fluid in the intestine becoming too concentrated (“ osmotic diarrhoea”). Large supplemental doses of vitamin C can also increase levels of uric acid in the urine, because vitamin C can be broken down into uric acid. However, it is not clear that increased uric acid in the urine can increase a person’s risk of forming uric acid kidney stones. Finally, vitamin C can increase a person’s absorption of iron from plant foods; and persons who have health problems related to excess free iron in their cells may want to consider avoiding high supplemental doses of vitamin C.

It is important to remember that all of the above toxicity-related issues involve vitamin C in supplemental form, not as it naturally occurs in food. In 2000, the National Academy of Sciences set a Tolerable Upper Intake Level (UL) for vitamin C at 2, 000 milligrams (2 grams) for adults 19 years or older. Poor ntake of vitamin C-rich vegetables and fruits is a common contributor to vitamin C deficiency. In the U. S. , one third of all adults get less vitamin C from their diet than is recommended by the National Academy of Sciences, and 1 out of every 6 adults gets less than half the amount recommended.

Smoking and exposure to second hand smoke also increase the risk of vitamin C deficiency. The body’s immune and detoxification systems make special use of vitamin C, and overload in either of these systems can increase risk of deficiency. The immune system relies on a wide variety of mechanisms to help protect the body from infection, including white blood cells, complement proteins, and interferons; and vitamin C is especially important in the function of these immune components. Vitamin C is also critical during the first phase of the body's detoxification process. This process occurs in many types of tissue, but it is especially active in the liver. When the body is exposed to toxins, vitamin C is often required for the body to begin processing the toxins for elimination.

Excessive toxic exposure is therefore a risk factor for vitamin C deficiency. Excellent food sources of vitamin C include broccoli, bell peppers, parsley, Brussels sprouts, cauliflower, lemon juice, strawberries, mustard greens, kiwifruit, papaya, kale, cabbage, romaine lettuce, turnip greens, oranges, cantaloupe, summer squash, grapefruit, pineapple, chard, tomatoes, collard greens, raspberries, spinach, green beans, fennel, cranberries, asparagus, watermelon, and winter squash. Vitamin C has significant interactions with several key minerals in the body. Supplemental intake of vitamin C at gram-level doses can interfere with copper metabolism. Conversely, vitamin C can significantly enhance iron uptake and metabolism, even at food-level amounts. Vitamin C also has important interactions with other vitamins.

Excessive intake of vitamin A, for example, is less toxic to the body when vitamin C is readily available. Vitamin C is involved in the regeneration of vitamin E, and these two vitamins appear to work together in their antioxidant effect. Problem Statement : Do different types fruit juice contain the similar amount of vitamin C? Hypothesis : 1. Fresh lime juice contain higher concentration of vitamin C compared to fresh orange juice. 2.

Fresh juices contain higher concentration of vitamin C compared to commercial juices. Variables : Manipulated: Type of fruit juices and State of fruit juice Responding: Volume of fruit juice needed to decolourise DCPIP solution Constant : Volume and concentration of DCPIP solution Experiment A Apparatus : 5ml syringe, dropper, test tubes, 5ml measuring cylinder, 250ml beaker and knife Material : 1. % dichlorophenolindophenol (DCPIP) solution, freshly squeezed fruit juice (orange and lemon) and commercial juices (orange and lemon). Experiment B Apparatus : White tile, knife, 5ml syringes, 10ml measuring cylinder, 100ml measuring cylinder, test tubes, test tube rack, glass rod, 250 ml beaker, mortar and pestle and dropper Materials : Vitamin C tablets, 1. 0% dichlorophenolindophenol (DCPIP) solution and distilled water. Experiment A Procedure : 1.

Orange and lemon fruits are squeezed to obtain fresh juices and they are placed in a 250ml beaker separately. . Commercial lemon and orange juices from its respective cartons are poured into a beaker each. 3. DCPIP solution is put into 5ml measuring cylinder using a dropper.

1ml DCPIP solution is poured into a test tube. 4. 5ml syringe is used to take 5ml of fresh lemon juice from its beaker. 5. The fresh lemon juice is added drop by drop into the DCPIP solution in the test tube.

The test tube is swirled gently. 6. The colour changes of the DCPIP solution (dark blue to light mud green) is observed. The volume of fresh lemon juice used to change colour of DCPIP solution is read from the syringe and recorded in a table. . Step 3 to 6 is repeated using fresh orange juice, commercial lemon juice and commercial orange juice.

Experiment B Procedure : 1. 250 mg of vitamin C tablet is prepared by cutting the one whole tablet which is 1000 mg into four pieces using blade on a white tile. 2. The tablet is crushed by using mortar and pestle. 3.

100 ml of distilled water is measured using 100 ml measuring cylinder. 4. The distilled water is poured into a beaker and the vitamin C is dissolved into the solution. 5. 1 ml of 1% of DCPIP solution is measured using a syringe and put into test tube. 6.

ml of the vitamin C is measured using a syringe and is added drop by drop to the 1% of DCPIP solution until the dark blue solution became colourless. The mixture must be swirled gently. 7. The volume of vitamin C needed to decolourise 1% of DCPIP solution is recorded. 8.

Steps 1-7 is repeated by using different mass of vitamin C tablets which 500 mg, 1000 mg, 1500 mg, 1750 mg and 2000 mg. 9. All results are recorded and tabulated in table 1. Concentration of vitamin C (mg/ml) = Mass of vitamin C tablet (mg) Volume of distilled water (ml)Concentration of vitamin C (mg/ml) = Mass of vitamin C tablet (mg) Volume of distilled water (ml) 10. The concentration of vitamin C was calculated by using formula: 11.

A graph of the volume of the vitamin C needed to decolourise 1% DCPIP solution against the concentration of vitamin C is drawn which known as the standard curve. Experiment A Results : Types of Fruit Juice| Volume of fruit juice needed to decolourise 1ml of DCPIP solution (ml)| Fresh Lemon| 5. 0| Fresh Orange| 2. 0| Commercial Lemon| 10. 0| Commercial Orange| 8.

0| Table 1 Experiment B Table 2 Results : Amount of Vitamin C Tablet(mg)| Concentration Of Vitamin C (mg/ml)| Volume of Vitamin C needed to decolourise 1ml DCPIP solution (ml)| 250| 2. 50| 2. 00| 500| 5. 00| 1. 90| 1000| 10. 00| 1.

80| 1500| 15. 00| 1. 40| 1750| 17. 50| 1. 00| 2000| 20. 00| 0.

80| Discussion : In this experiment, the aim is to determine the vitamin C concentration in various fruit juice. The manipulated variable in this experiment is the types of fruit juices which are fresh and commercial orange and lemon juices. The responding variable is the volume of fruit juice needed to decolourise the DCPIP solution which is from dark blue colour to colourless. The concentration and volume of DCPIP solution is fixed throughout this experiment in order to obtain an accurate volume of fruit juice which can decolourise this solution. Through the results in experiment B, a standard graph is plotted to obtain the concentration of vitamin C of fruit juices in experiment A.

From the results obtain, it is advised to repeat experiment B with more concentration of vitamin C so that the graph drawn is suitable to plot the points of experiment A. Table 1 shows volume of different types of fruit juice needed to decolourise DCPIP solution. There are differences in volume of juices needed due to their vitamin C content. Each fruit juice contains different amount of vitamin C in them. Through this experiment, it is clearly stated that fresh fruit juices contains more vitamin C content compared to commercial fruit juices. This is because less volume of fresh fruit juice is needed to decolourise DCPIP solution compared to the volume of commercial fruit juices needed.

Thus, we can roughly conclude that fresh fruit juices contain higher concentration of vitamin C compared to commercial fruit juices. The foremost reason that commercial fruit juices contain less vitamin C content is because during package, the juices might be added colourings or preservatives for longer lifespans and advertising purposes. Besides, these juices have been heated to kill bacteria to ensure the juice is long lasting. This step destroys the vitamin C content in fruit juices since it is vulnerable to heat. The volume of fresh lemon juice and fresh orange juice needed to decolourise 1ml of 1% DCPIP solution is 5. ml and 2.

0 ml respectively. Meanwhile, the volume of commercial juices which are carton lemon juice and carton orange juice needed to decolourise 1ml of 1% DCPIP solution is 10. 0 ml and 8. 0 ml respectively. During the experiment, DCPIP solution did not decolourise completely. As a result the intensity of brown colour varies as we determine whether the DCPIP had decolouries.

Thus this affects the accuracy of the experiment. Graph 1 shows the volume of Vitamin C needed to decolourise 1ml of 1% DCPIP solution against the concentration of vitamin C. This graph is also known as the standard curve. It enables us to determine the exact vitamin C concentration in the fruit juices. From the graph we can deduce that the volume of vitamin C needed to decolourise the 1ml of 1% DCPIP solution is inversely proportional to the concentration on vitamin C.

In other words, as the concentration of vitamin C increases, the volume of vitamin C needed to decolourise 1ml of 1% DCPIP solution decreases. Further Study : 1. Vitamin C determination by Iodine Titration * Determination vitamin C concentration involves iodine and iodate solution in a redox titration method. When iodine solution is a titrant, vitamin C is oxidised to form dehydroascorbic acid while the iodine is reduced to iodide ions. When all vitamin C has finished, the excess iodine solution will react will starch solution to form blue-black colour as endpoint of titration (ascorbic acid + I_2> $2I^-$ + dehydroascorbic acid).

2. Vitamin C determination by high performance liquid chromatography [HPLC] * The sample analysed were twentysix samples in three types of apricot commercial juices (5 organic, 5 inorganic and 16 conventional). The limit of detection (LOD) was 1. 6 and 1. 1 mg/L for LAA and D-IAA.

The best separation system to detect L-AA and D-IAA is by capillary electrophoresis using capillary zone mode and micelle electrokinetic capillary chromatography. 3. Vitamin C determination by enzymatic methods. * Enzymatic method is used to determine vitamin C in juice sample, milk and sour-milk products for babies’ nutrition from the signal of indicator reaction. The indicator reaction used were odianisdini (OD) and 3, 3’5, 5′ tetramethylbenzidine (TMB). 4.

pH transistor pH transistor as the indicator reaction o-phenylenediamine-ascorbic acid (AsA)- second substrate of horseradish (HRP), where vitamin C acts as a second substance of the enzyme. Safety Features : 1. Use a large beaker when dissolving vitamin C tablet in distilled water to avoid spillage. 2. Use different syringes for each fruit juice to avoid mixing. 3.

Do no shake the test tube vigorously when adding fruit juice into DCPIP solution. 4. Student should wear lab coat and tough-covering shoes to avoid any spillage on their attires or skin. 5. The colour of DCPIP solution doesn't change to colourless exactly thus a fixed colour change should be notified to ensure the accuracy of the volume of fruit juices used to decolourise the DCPIP solution. Conclusion : 1.

Fresh orange juice contains higher concentration of vitamin C in it compare to fresh lemon juice. 2. Fresh fruit juices contain higher concentration of vitamin C compared to commercial fruit juices.