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# Integrated Nursing-Pharmacy Management: Vitamin C Levels at Air Itam Community Health Center

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A B S T R A C T

This study was conducted to find out the picture of vitamin C tablet levels at the Air itam Health Center and to find out the deviation in the vitamin C tablet levels at the Air Itam Health Center based on the comparison with the vitamin C levels stated on the packaging. This research was conducted at the Mathematics and Natural Sciences Laboratory, Faculty of Fisheries, Agriculture and Biology, University of Bangka Belitung. This type of research is experimental with a Posttest Only Design design. This research was carried out by determining the level of vitamin C tablets qualitatively and quantitatively. Determination of vitamin C levels is carried out by the iodymetry method and reaction with benedict reagents. The test tablets used were 20 tablets each test taken randomly. The results of this study showed that vitamin C tablets met the requirements for uniformity of weight and showed an irregularity in vitamin C levels. In conclusion, vitamin C levels have a deviation in levels.

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## INTRODUCTION

The body needs foods that contain essential substances such as protein, fat, carbohydrates, water, minerals, and vitamins. If we lack one of them, for example vitamins, then various processes in our body slow down. Even though vitamins (except vitamin D) cannot be made by the body. This means that vitamins must be given through food, for that people must consume foods that contain a lot of vitamins. There are several types of vitamins with different daily needs based on age, gender, and based on the type of work (Irianto, 2013).

Vitamins are complex compounds that are needed by the body to help regulate or process body activities. Humans who lack vitamins cannot perform life activities properly. Vitamin deficiency can cause the opportunity for disease in the body (Irianto 2013).

Vitamin C belongs to the group of vitamins that are easily soluble in water, slightly soluble in alcohol and glycerol. But it cannot be soluble in non polar solvents such as benzene, ether, chloroform and others. It is crystalline white, odorless and acidic (Thurnham, 2000 in Wardani 2012). Vitamin C has general properties, namely that excess vitamin C in the body is stored very little, must always be present in daily meals, does not have precursors or provitamins and deficiency symptoms often occur quickly. If a person experiences a vitamin C deficiency, symptoms such as weakness, anemia, gum disease (ginggivitis)/bleeding gums, and bleeding that appears on the skin due to the rupture of small blood vessels in the body (Linder, 2006). The community's need for a source of vitamin C cannot be met from daily food due to the low interest of the public in consuming vegetables and fruits, therefore people need supplements containing vitamin C to meet the intake of vitamin C in the body (Saputra, 2013).

Storage of Drugs and Medical Consumables Storage of Drugs and Medical Consumables is an activity to regulate the Drugs received so that they are safe (not lost), avoid physical and chemical damage and the quality is still guaranteed, in accordance with the stipulated requirements. The goal is so that the quality of drugs available in health centers can be maintained in accordance with the requirements set (Ministry of Health, 2014).

Puskesmas is a functional health organization that is a center for public health development that also fosters community participation in addition to providing comprehensive and integrated services to the community in its work area in the form of main activities. In other words, the Puskesmas has the authority and responsibility for the maintenance of public health in its work area (Ministry of Health, 2014). In maintaining public health, the health center must be supported by good quality drugs so that public health maintenance can be carried out properly. The quality of drugs in health centers can be affected by storage in health centers and storage at the time drugs are distributed. The distribution of drugs to health centers has a long flow so that the quality of the drug can be reduced. Reduced levels of the drug can be caused by improper storage.

Air itam Health Center is a health center located in Air Itam District, Bangka Regency, Bangka Belitung Islands Province. The distribution of drugs at

the Air itam Health Center has a long distance from the Bangka Regency health office. The distance from the Bangka Regency Health Office to the Air Itam District Health Center is 60 Km, so that with a long distance it can affect the quality or level of a drug such as vitamin C. Based on the above, a test was carried out on the level of vitamin C tablets at the Belinyu Health Center.

## THEORETICAL REVIEW

Vitamin C is highly unstable at neutral or alkaline pH, especially to heat, is highly stable to acids and moderately stable during temporary storage in a cold and fresh state (Linder, 2006). These properties that are present in vitamin C tablets must be maintained. One way to maintain vitamin C levels in vitamin C tablets is by distributing and storing them properly and appropriately. A decrease in the level of vitamin C tablets will affect its therapeutic effect so that it causes *Skorbut* disease, this disease can cause teeth to fall out easily, *gingivitis,* anemia because vitamin C has a specific function in hemoglobin synthesis and collagen synthesis (Goodman and Gilman, 2007).

## METHODOLOGY

### *Tools and Materials*

*Tool*

The tools used are Buret, Bunsen, Funnel, Erlenmeyer 250 ml, 100 ml Chemical Cup, Measuring Cup; Watch glass, Pots and pestles, Drip pippettes, Volume pipettes, Staves and clamps, Test tubes, Furnaces.

*Material*

The materials used are Vitamin C tablets with 0.1 N iodine solution, H2SO4 1% solution, amylum indicators, Aquaades, benedict reagents.

### *Iodine Manufacturing*

Weighing 20 grams of KI crystals (free of iodate compounds) in a small beaker containing 25 ml of aquades, then dissolved 12.7 grams of iodide into the KI solution, then transferred into a 500 ml measuring flask, diluted with aquades to the limit mark.

### *Vitamin C Tablet Weight Uniformity Test*

Twenty vitamin C tablets taken were randomly weighed and calculated by average weight. Next, the vitamin C tablets were weighed one by one to see any weight deviations. Then it is calculated on average and compared in the table listed in the Indonesian Pharmacopoeia. The test was repeated 5 times (Ministry of Health, 1995).

### *Qualitative Test of Vitamin C Tablets*

Vitamin C tablets were taken as many as 20 tablets, while taking tablets was done randomly. The sample is mashed first, then dissolved with acuples up to 100 ml. The sample that has been completed is taken as much as 2 ml. The sample is put into the test tube. 15 drops of the benedict reagent were added.

Heated over low heat for 5 minutes. It is homogenized and then observed the changes that occur. A positive test is yellowish-green and a brick-red deposit is formed.

*Quantitative Test of Vitamin C Tablets*

Vitamin C tablets were taken as many as 20 tablets, while taking tablets was done randomly. The sample is mashed first, then weighed according to the average weight of the sample that has been weighed, dissolved with aqueducts up to 50 mL. Then it is added with a solution of H2SO4 as much as 25 mL. Added 3 drops of amylum indicator. The sample is then titrated with an iodine solution and the required volume of iodine is recorded.

## RESEARCH RESULTS

In this study, vitamin C levels were determined in vitamin C tablets at the Belinyu Health Center. This study used 200 samples of vitamin C tablets at the Belinyu Health Center. The study used 100 vitamin C tablets for the qualitative test and 100 vitamin C tablets for the quantitative test. The sample used was 20 tablets taken at random. Vitamin C tablet levels can be seen by the iodimetric titration method.

*Vitamin C Tablet Weight Uniformity Test*

The weight uniformity test was carried out with 20 test tablets that were weighed using a digital balance. The weighing results can be seen in the table below:

Table 1. Results of the observation of the uniformity test of the weight of the tablets
vitamin C qualitative test samples per 20 tablets.

| Sample | P1 (mg) | P2 (mg) | P3 (mg) | P4 (mg) | P5 (mg) |
|---|---|---|---|---|---|
| Tablet vitamin C | 1991,6 | 2006,2 | 2014,5 | 2020,2 | 1998,1 |
| Average weight | 99,58 | 100,31 | 100,72 | 101,01 | 99,9 |

Table 2. The results of the observation of the uniformity test of vitamin C tablet weight samples are qualitative test samples per tablet.

| No | Vitamin C tablet samples | | | | |
|---|---|---|---|---|---|
| | P1 (mg) | P2 (mg) | P3 (mg) | P4 (mg) | P5 (mg) |
| 1 | 100,5 | 98,6 | 99,8 | 101,4 | 101,1 |
| 2 | 99,1 | 99,8 | 102,4 | 100,7 | 99,2 |
| 3 | 99,9 | 99,9 | 102,1 | 99,5 | 99,2 |
| 4 | 101,1 | 99,5 | 102,5 | 102,4 | 96,6 |
| 5 | 100,6 | 100,1 | 100,7 | 98,5 | 99,9 |
| 6 | 98,8 | 99,8 | 101,0 | 101,1 | 100,2 |

| | | | | | |
|---|---|---|---|---|---|
| 7 | 102,2 | 106,2 | 100,8 | 99,5 | 99,1 |
| 8 | 99,7 | 100,2 | 99,9 | 99,8 | 100,6 |
| 9 | 100,1 | 100,8 | 101,8 | 103,8 | 100,8 |
| 10 | 100,1 | 100,2 | 99,0 | 99,1 | 102,4 |
| 11 | 99,0 | 100,3 | 101,3 | 100,2 | 99,9 |
| 12 | 99,3 | 102,1 | 99,1 | 101,6 | 101,3 |
| 13 | 100,5 | 101,1 | 98,7 | 100,9 | 100,8 |
| 14 | 101,3 | 101,6 | 100,2 | 101,1 | 100,3 |
| 15 | 99,9 | 100,3 | 101,2 | 100,7 | 100,4 |
| 16 | 99,4 | 101,0 | 100,5 | 100,8 | 98,6 |
| 17 | 99,2 | 100,6 | 101,6 | 101,1 | 100,9 |
| 18 | 98,1 | 99,2 | 100,2 | 101,2 | 97,3 |
| 19 | 98,4 | 98,0 | 101,4 | 102,0 | 98,6 |
| 20 | 100,3 | 100,2 | 100,7 | 101,4 | 98,3 |
| **sum** | 1997,5 | 2009,6 | 2014,9 | 2016,8 | 1995,5 |
| **Average weight** | 99,87 | 100,48 | 100,74 | 100,84 | 99,775 |

Table 3. Results of the observation of the uniformity test of the weight of the tablet vitamin C quantitative test sample per 20 tablets

| **Sample** | **P1 (mg)** | **P2 (mg)** | **P3 (mg)** | **P4 (mg)** | **P5 (mg)** |
|---|---|---|---|---|---|
| Tablet vitamin C | 2010,4 | 2008,1 | 2014,7 | 2006,5 | 2013,5 |
| Average weight | 100,52 | 100,40 | 100,73 | 100,37 | 100,67 |

Table 4. Observation results of vitamin C tablet weight uniformity test sample quantitative test per tablet

| **No** | **Vitamin C tablet samples** | | | | |
|---|---|---|---|---|---|
| | **P1** | **P2** | **P3** | **P4** | **P5** |
| 1 | 101,2 | 99,9 | 100,6 | 100,3 | 102,0 |
| 2 | 102,2 | 100,9 | 100,8 | 98,9 | 103,2 |
| 3 | 101,4 | 101,5 | 100,7 | 100,2 | 100,6 |
| 4 | 100,5 | 98,6 | 101,1 | 100,4 | 100,3 |
| 5 | 100,9 | 99,7 | 100,1 | 99,5 | 99,7 |
| 6 | 100,3 | 100,8 | 102,3 | 101,9 | 101,9 |
| 7 | 101,2 | 100,8 | 102,6 | 100,3 | 98,9 |
| 8 | 100,3 | 100,1 | 99,8 | 100,4 | 103,1 |
| 9 | 99,7 | 100,1 | 101,6 | 100,2 | 99,1 |
| 10 | 100,3 | 99,9 | 100,6 | 100,5 | 101,3 |
| 11 | 99,9 | 101,1 | 100,2 | 100,7 | 99,3 |
| 12 | 98,7 | 101,9 | 101,1 | 101,2 | 100,1 |
| 13 | 101,0 | 99,9 | 101,7 | 99,5 | 100,9 |
| 14 | 99,1 | 99,5 | 99,9 | 101,6 | 100,9 |
| 15 | 99,2 | 102,1 | 102,0 | 100,4 | 98,5 |
| 16 | 102,8 | 100,4 | 100,8 | 101,3 | 99,9 |

| | | | | | |
|---|---|---|---|---|---|
| 17 | 100,5 | 101,5 | 98,8 | 100,9 | 100,3 |
| 18 | 100,5 | 99,1 | 102,5 | 99,6 | 99,7 |
| 19 | 100,4 | 99,4 | 101,5 | 99,8 | 100,9 |
| 20 | 98,7 | 100,0 | 100,5 | 99,9 | 102,3 |
| **sum** | 2008,8 | 2007,4 | 2019,2 | 2007,5 | 2012,9 |
| **Average weight** | 100,4 | 100,37 | 100,96 | 100,37 | 100,64 |

***Qualitative Test of Vitamin C Tablets***

The qualitative test was conducted using 20 test tablets taken at random. The qualitative test was carried out using a benedict reagent and then heated. A positive test is characterized by a yellowish-green color with brick-red deposits. The results of the qualitative test can be seen in the table below:

Table 5. Results of the observation of the qualitative test of vitamin C tablets

| **Sample** / **Repetition** | **Initial color (Vitamin C)** | **Color after benedict is added** | **Color after heating** | **Final result** |
|---|---|---|---|---|
| P1 | White | Yellowish-green | Brick-red deposits are formed | + |
| P2 | White | Yellowish-green | Brick-red deposits are formed | + |
| P3 | White | Yellowish-green | Brick-red deposits are formed | + |
| P4 | White | Yellowish-green | Brick-red deposits are formed | + |
| P5 | White | Yellowish-green | Brick-red deposits are formed | + |

***Quantitative Test of Vitamin C Tablet Levels***

The quantitative test was conducted using 20 test tablets taken at random. The quantitative test of vitamin C tablet levels was carried out using the iodimetric titration method and then calculated the vitamin C levels in vitamin C tablets.

Table 6. Results of observational quantitative test of vitamin C tablet levels

| Sample Repetition | Sample mass | Volume of iodine used | Up to % |
|---|---|---|---|
| P1 | 100,52 mg | 1,3 ml | 11.38% |
| P2 | 100,4 mg | 1,2 ml | 10,52% |
| P3 | 100,7 mg | 1,2 ml | 10,49% |
| P4 | 100,3 mg | 1,3 ml | 11,41% |
| P5 | 100,6 mg | 0,8 ml | 7,002% |
| **Sum** | | | 50,802 % |
| **Average** | | | 10,16 % |

***Deviation in vitamin C tablet levels at Belinyu Health Center***

Vitamin C is very unstable at neutral or alkaline pH, especially to heat. These properties can cause a decrease in vitamin C levels, a decrease in vitamin C tablet levels cause deviations in vitamin C tablet levels from the levels of vitamin C tablets listed on the packaging. Deviations in vitamin C tablet levels that do not match what is stated on the packaging can be seen in the table below:

Table 7. Results of deviation in vitamin C tablet levels

| Sample Repetition | Rates on the packaging | Up to tablets vitamin C | Rate deviation |
|---|---|---|---|
| P1 | 50 % | 11.38% | 0,77 % |
| P2 | 50 % | 10,52% | 0,78 % |
| P3 | 50 % | 10,49% | 0,79 % |
| P4 | 50 % | 11,41% | 0,77 % |
| P5 | 50 % | 7,002% | 0,85 % |
| **Sum** | | | 3,96 % |
| **Average** | | | 0,79 % |

## DISCUSSION

***Uniformity Test Weight Vitamin C Tablets***

The weight uniformity test was carried out to see the uniformity of the mass of the tablet using a digital balance. The results of weighing the average mass of vitamin C tablets for qualitative test samples were 99.58 mg, 100.31 mg, 100.72 mg, 101.01 mg, 99.9 mg. The results of weighing the average mass of vitamin C tablets for the quantitative test samples were 100.52 mg, 100.40 mg, 100.73 mg, 100.37 mg, 100.67 mg. The qualitative test sample had the lowest tablet mass of 96.6 mg and the highest tablet mass of 106.2 mg. The quantitative test sample had the lowest tablet mass of 98.5 mg and the highest tablet mass of 102.6 mg.

The requirement for mass deviation per tablet to the average mass of tablets with a mass of less than 150 mg (100 mg per tablet) of no more than 2 (two)

tablets deviated by 10% of the average mass obtained (column A requirement) and all tablets did not have a deviation of 20% from the average mass obtained (column B requirement). This means (column A requirement) that there can be 2 (two) tablets out of the 20 tablets tested. The qualitative test samples had the lowest masses of 89.88 mg, 90.43 mg, 90.66 mg, 90.75 mg, 89.79 mg (the average mass of the tablet minus 10% of the average mass of the tablet) and the highest mass of 109.85 mg, 110.52 mg, 110.81 mg, 110.92 mg, 109.75 mg (the average mass of the tablet plus 10% of the average mass of the tablet). The quantitative test samples had the lowest masses of 90.36 mg, 90.33 mg, 90.86 mg, 90.33 mg, 90.57 mg (the average mass of the tablet minus 10% of the average mass of the tablet) and the highest mass of 110.44 mg, 110.40 mg, 111.05 mg, 110.40 mg, 110.40 mg, 110.70 mg (the average mass of the tablet plus 10% of the average mass of the tablet).

The requirement of column B of 20 test tablets is no deviation of 20% from the average mass obtained. The qualitative test samples had the lowest masses of 79.89 mg, 80.38 mg, 80.59 mg, 80.67 mg, and 79.82 mg respectively (the average mass of the tablet minus 20% of the average mass of the tablet). The highest masses of the qualitative test samples were 119.84 mg, 120.57 mg, 120.88 mg, 121.008 mg, 119.73 mg (the average mass of the tablet plus 20% of the average mass of the tablet). The quantitative test samples had the lowest masses of 80.32 mg, 80.29 mg, 80.76 mg, 80.29 mg, 80.51 mg (the average mass of the tablet minus 20% of the average mass of the tablet) and the highest mass for the sequential quantitative test of 120.48 mg, 120.44 mg, 121.15 mg, 120.44 mg, 120.76 (the average mass of the tablet plus 20% of the average mass of the tablet).

The weighing results obtained concluded that vitamin C tablets at the Air itam Health Center met the weight uniformity requirements set in column A and column B.

***Qualitative Test of Vitamin C Tablets***

The presence or absence of vitamin C in vitamin C tablets at the Air itam Health Center can be done by qualitative tests. This test is based on the occurrence of color changes. Qualitative test of vitamin C using a benedict reagent. A total of 2 ml of vitamin C tablets are taken and dissolved, then put into a test tube, then added with 15 drops of benedict reagent, and finally heated for 5 minutes. The presence of vitamin C in the sample is characterized by a yellowish-green discoloration with brick-red deposits.

Benedict is a solution containing cuprisulfate, sodium carbonate, and sodium citrate. The presence of sodium carbonate and sodium citrate makes the benedict reagent weak acidic. Heating aims to convert black cuporioxide into brick-red cuprite. The reaction will proceed faster with heating because the activation energy used is very little. Vitamin C is a powerful reducer that is able to reduce Cu2+ ions from the benedict reagent to Cu+ ions by forming Cu2O deposits that are yellowish-green to brick-red. The reaction formed is in figure 1.


Figure 1. Reaction between ascorbic acid and benedict reagent

The results of the vitamin C qualitative test indicated that the vitamin C tablets at the Air itam Health Center were positive for vitamin C.

***Quantitative Test of Vitamin C Tablets***

This study aims to determine vitamin C levels in vitamin C tablets at the Belinyu Health Center. The method used is iodimetric titration with the principle of redox titration. Each sample is titrated using an Iodine(I) solution. The titration process is stopped after the solution changes color to blue (Figure 2).

Figure 2. Solution at titration endpoint

At the time of titration, I will be reduced to I- because it reacts with vitamin C causing the color to change from brown to clear. When all Vitamin C reacts with I2, the excess I2 will react with amylum forming a blue complex signaling the titration endpoint. The complex that forms looks like in figure 4.3.

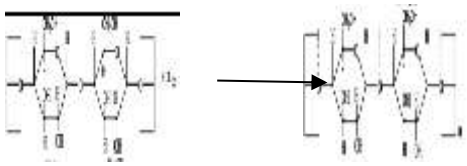

Figure 3. Formation of complexes between I2 and amylum

The volume of I2 used in this titration is equivalent to the amount of vitamin C in the sample so that the concentration of the sample can be calculated. Based on the research, the results of the calculation of the average level of vitamin C tablets at the Health Center in 2024 were 10.16%.

***Deviation in vitamin C tablet levels at Belinyu Health Center***

Based on the results of the study, it was found that the average deviation in vitamin C levels in the Air itam Health Center was 0.79%. Vitamin C tablets at the Air itam Health Center have irregularities, it is suspected that this is due to several factors, including:

*Temperature*

High temperatures can accelerate the speed of metabolic reactions. The relationship between temperature and respiration is similar to the relationship between temperature and other chemical reactions at a given range. The rate of respiration increases by two or three times with each temperature increase of 100 C until the temperature rises above 37.8 $^{0}$C (Citrosomo, 1984). According to Bender (1979), a decrease in vitamin C levels at room temperature storage indicates a change in the form of vitamin C (L-ascorbic acid) to another form. Vitamin C can be in the form of L-ascorbic acid and L-dehydroascorbate. Ascorbic acid is very easily oxidized reversibly into L-dehydroascorbic acid. L-dehydroascorbic acid is chemically highly volatile and can undergo further changes to L-diketoglyconate which no longer has the activeness of vitamin C.

*Light*

There are more rays in ordinary storage rooms than in special storage areas such as cabinets, causing a decrease in levels. Rays can catalyze vitamin C so that the more rays in the room, the greater the possibility of reducing vitamin C levels at the Belinyu Health Center.

Storage of vitamin C tablets at the Air Itamdi Health Center is stored on a medicine shelf. The medicine rack is directly facing the window so that the light entering through the window can affect vitamin C levels and the quality of the medicine.

*Packaging*

Packaging can affect the quality of vitamin C, among others, through physical and chemical changes due to the migration of chemical substances from the packaging material (plastic monomers, white tin, corrosion) and changes in aroma (flavor), color, and texture affected by the transfer of water vapor and O2 (Syarif et al., 1989).

*Distribution*

The distribution of vitamin C tablets is one of the factors that can affect vitamin C. Too long a distribution process and improper storage of vitamin C tablets during the distribution process can lead to a decrease in the level of vitamin C tablets.

Vitamin C tablets at the Air itam Health Center were distributed from the Bangka Regency Health Office. The distribution of vitamin C tablets from the Bangka Regency Health Office to the Air itam Health Center has a long distance and during the distribution of vitamin C is stored in a car that does not have a temperature regulator, so the distribution can affect the level of vitamin C tablets.

Based on the research of Lestari (2013), it shows that generic vitamin C tablets at factory A and factory B from four health centers in Pontianak in the first month have low levels, which is below the range of vitamin C tablet levels. The longer the storage time and the higher the temperature, the lower the vitamin C level. Helmiyesi et al. (2008) argue that vitamin C levels can decrease due to the properties of vitamin C which are easily degraded, both by temperature, light and ambient air so that they are reduced. In line with the opinion of Hartoyo

(1993) who stated that vitamin C is very easily degraded and decreases in levels caused by sunlight, oxidation by oxygen from air and moisture. Concerns about the expected effects will not be achieved because the levels are below 90% so the vitamin C tablets are not suitable for consumption. Eligible levels are expected to achieve the desired therapeutic effect, but levels above 110% can cause the drug to become toxic.

## CONCLUSION

1. Vitamin C tablets at the Air itam Health Center meet the weight uniformity requirements set in column A and column B.
2. The average vitamin C level in vitamin C tablets at the Air itam Health Center in 2024 is 10.16%.
3. The average deviation in vitamin C levels at the Air itam Health Center was 0.79%, so vitamin C tablets at the Air Itam Health Center experienced a deviation in the level.
4. The causes of deviations in vitamin C tablet levels are temperature, rays, packaging and distribution.

## RECOMMENDATION

1. For Puskesmas
   Based on the results of this study, it is hoped that the Air itam Health Center can store vitamin C tablets even better, namely in a cool and dry place, not exposed to direct sunlight and the storage time is not too long, so that the expected vitamin C needs from vitamin C tablets can be met.
2. For the Health Office
   It is hoped that the health office can store vitamin C tablets in the right place, namely a cool and dry place, not exposed to direct sunlight and not too long storage time. and can maintain the quality of vitamin C tablets during storage and distribution process

## FURTHER STUDY

Further research needs to be carried out using various samples of vitamin C tablets, namely vitamin C tablets from various health centers and various trademarks and using other more accurate methods.

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