To Evaluate the Prevalence of Vitamin C Deficiency in different Individual

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Abstract - **Aim: To evaluate the prevalence of vitamin C deficiency. Objective: To assess consumption of vitamin C. To compare the vitamin C deficiency between different individuals. To calculate the consumption of vitamin C in the individual. Materials and methods: A prospective observational study and random sampling technique was used. The data on vitamin C consumption of individuals were obtained through a three-day recall method and the amounts of vitamin C consumed were calculated using Indian Food composition Table. Result: There has been a difference in the actual consumption of vitamin C and the normal range of vitamin C in all age group. We deduced the result with the help of three day recall method. We were able to infer that the individual from the age group 8-18 consume less amount of vitamin C. conclusion : From the three day recall method we got to know that the women consume vitamin C more than The vitamin c consumption in the age group of 19-50 is greater compared to the age group of 8-18. So the individuals in the age group of 8-18 might be more prone to vitamin c related diseases.**

Index Terms - **Ascorbic acid, ene-diol structure, reductant, antioxidant, water soluble, dyspnea, alcoholism, scurvy, iron absorption.**

I.INTRODUCTION

Vitamin C or ascorbic acid was first isolated in 1923 by Hungarian biochemist and Nobel laureate Szent – Gyori and synthesized by Hogwarts and Hirst. It exists in reduced and oxidized forms as dehydroascorbic acid which are easily inter- convertible and biologically active thus it acts as an important antioxidant. Vitamin C is easily oxidized acid and destroyed by oxygen, alkali and high temperature as it is a water-soluble vitamin.

Vitamin c is a simple low molecular weight molecule; it has an ene diol structure which makes it as a water-soluble electron donor in nature. Vitamin c is synthesized by most of the species except the guinea pigs, some bats and fish. Vitamin c biologically functions by acting as a reductant. If Vitamin C intake in humans exceeds ~400 mg/dl, a homeostatic state is reached with maximal plasma concentration of~60 to 90 μmol/L and intracellular concentration ranging from 0.5 to 10 mmol/L depending on the tissue. Large amount of vitamin c found in the brain, eye and adrenal gland. The biological role of vitamin c is related to Ascorbate and that can be separated into enzymatic and non enzymatic functions. Vitamin C also plays an important role in vascular functions. Ascorbate is a powerful antioxidant .Vitamin C can also regenerate vitamin E from its oxidized form. It will allow the vitamin C to indirectly inhibit lipid peroxidation. [1]

II.RECOMMENDED DIETARY ALLOWANCES

Based on the vitamin C intake required to achieve near-saturation of plasma and leukocytes with minimal urinary excretion, and adjusted for body mass, an RDA of 75 and 90 mg/d for women and men respectively, was established by the U.S. Institute of Medicine (IOM) in 2000. In addition, the RDA for pregnant and breastfeeding women (≥19 years) was set at 85 and 120 mg/d, respectively. No RDA was established for infants; instead, the Adequate Intake of vitamin C was set at 40 mg/d for infants up to 6 months of age, and 50 mg/d for infants up to 12 month. For older children, the recommendation is based on estimated body mass in relation to an adult: 15 mg/d for children up to 3 years of age, 25 mg/d for children up to 8 years. The RDA for teenagers is based on gender: 75 mg/d for boys and 65mg/d for girls between the age group of 13-17 years of age. [2]

III. PREVALENCE OF VITAMIN C DEFICIENCY IN CHILDREN AND ADULT IN INDIA AND CHENNAI

The age, sex and season standardized prevalence of vitamin C deficiency was 73.9% in 2668 people in north India and 45.7% in 2970 from south India. Only 10.8% in the north and 25.9% in the south met the criteria for the appropriate level of vitamin C. [3]

IV. RISK FACTOR ASSOCIATED IN VITAMIN C DEFICIENCY

Risk factors for Vitamin C deficiency include: Alcoholism, Babies only fed cow's milk, Seniors only consuming tea and toast diet, Poor people who are not able to afford fruits and vegetables, Smokers, Individuals with eating disorders, Type 1 diabetes who have high vitamin C requirements, Individuals with disorders of the GI tract like inflammatory bowel disease, Individuals with iron overload, which leads to wasting of vitamin C by the kidneys, Individuals with restrictive diets, food allergies.[4]

V. FOODS RICH IN VITAMIN C:

Citrus fruits like kiwi, mango, orange, Vegetables like broccoli, tomatoes and potatoes, Alternative sources of vitamin C such as medicinal herbs (herbal teas, pine needles and tree barks), Animal organs such as raw liver and whale skin, green peas, Spinach and other green leafy vegetables.[5]

VI. VITAMIN C DEFICIENCY

The deficiency of vitamin C in an individual is known as scurvy. Symptoms of scurvy include Fatigue, subcutaneous bleeding, Poor wound closure, bruising easily, Joint pain and swelling muscle weakness, Swollen and bleeding gums, Loss of teeth, Impaired wound healing, Weakness, Weight loss, Dyspnea. The scurvy is potentially fatal and sudden death occurred as a consequence of a cerebral/myocardial hemorrhage or pneumonia. Biochemically, vitamin C plasma levels below 11 μM are considered to coincide with clinical symptoms of scurvy. Similarly, symptoms are not seen unless the total vitamin C content in the body falls below 300–400 mg.[6]

VIII. TREATMENT TO OVERCOME VITAMIN C DEFICIENCY

Treatment involves administering vitamin C supplements by mouth or by injection. Nutritious diet with supplemental ascorbic acid. For scurvy in adults, ascorbic acid 100 to 500 mg orally 3 times a day is given for 1 to 2 weeks, until signs disappear, and followed by a nutritious diet supplying 1 to 2 times the daily recommended intake. In scurvy, therapeutic doses of ascorbic acid restore the functions of vitamin C in a few days. The symptoms and signs usually disappear over 1 to 2 weeks. Chronic gingivitis with extensive subcutaneous hemorrhage persists longer. [7]

VIII. PREVENTION OF VITAMIN C

Vitamin C 75 mg orally once a day for women and 90 mg orally once a day for men prevents deficiency. Smokers should consume an additional 35 mg/day. Five servings of most fruits and vegetables (recommended daily) provide > 200 mg of vitamin C. [8]

IX. TOXICITY

High amounts of vitamin C intake have been associated with an increased risk of kidney stones, although the evidence is mixed and inconsistent. The current recommendation is to avoid vitamin C supplementation in those susceptible to kidney stone formation. Vitamin C consumed with iron could increase the risk of iron overload in susceptible individuals. Patients with these conditions should not avoid eating fruit and vegetables but limit their intake of iron instead.[9]

X. MATERIALS AND METHOD

The study is done to know the vitamin C consumption of different individuals and men and women of different age groups in order to know who is more prone to vitamin C deficiency. Our study design was prospective observational study and the sampling technique we used was randomized sampling technique. We did the research using a 3-day recall method. A three-day record method helps to get an accurate description of one's daily diet. This method helps in making appropriate dietary changes and helps

to understand the eating pattern of the individual. We asked the individual about the three-day menu.

For our research the sample size is 54. The target population for our research are boys and girls of the age group 8-18 men and women of the age group from 19-50.The vitamin C consumption of the individual was calculated through the three-day recall method. We asked the individuals specifically about their breakfast, lunch and dinner. Samples included our age group 8-18 years, 19-30 and 30-50 and both gender and exclusion criteria are the people who were not willing to give us the data.

XI. RESULT AND DISCUSSION:

The study was based on the calculation of vitamin C consumption in different individual and it is done using the three day recall method. The study has the sample size of 50 in which 48% are male and 52% are female. The mean ± SD of the age group 8-18 years is 0.375 ± 0.491, 19-30 years is 0.618 ± 0.605, 31-50 years is 0.583 ± 0.532. Out of the total 50 participants,36% of them are in the age group 18-18,34% of them are in the age group 19-30 years and 30% of them are in the age group 30-50 years. In the age category of 8-18, 23% of them consume vitamin C around 1g or less than that, 33% of them consume vitamin C around 1.1-1.5 and 44% of them consume vitamin C 1.6 and above. In the age category of 19-30, 24% of them consume vitamin C around 1g or less than that, 47% of them consume vitamin C around 1.1-1.5 and 29% of them consume 1.6 and above. In the age category of 31-50, 27% of them consume 1g or less than that,40% of them consume vitamin C around 1.1-1.5, and 5% of them consume vitamin C 1.6 and above.

Actual Consumption of vitamin C consumption for 30 days	Normal range of vitamin C consumption for 30 days	Gap
1.5 g	1.3 g	-0.2 g
1.0 g	1.3 g	0.3 g
1.7 g	1.3 g	-0.4 g
1.1 g	1.3 g	0.2 g
1.9 g	1.3 g	-0.6 g
1.9 g	1.3 g	-0.6 g
1.3 g	1.3 g	-
0.9 g	1.3 g	0.4 g

1.5 g	1.3 g	-0.2 g
Male : 8-18 years		
1.0 g	1.3 g	0.3 g
2.1 g	1.3 g	-0.8 g
1.1 g	1.3 g	0.2 g
2.1 g	1.3 g	-0.8 g
1.2 g	1.3 g	0.1 g
2.5 g	1.3 g	-1.2 g
1.9 g	1.3 g	-0.6 g
1.0 g	1.3 g	0.3 g
2.1 g	1.3 g	-0.8 g
Female:19-30 years		
1.4 g	2.2 g	0.8 g
1.5 g	2.2 g	0.7 g
0.4 g	2.2 g	1.8 g
0.5 g	2.2 g	1.7 g
1.7 g	2.2 g	0.5 g
1.0 g	2.2 g	1.2 g
0.9 g	2.2 g	1.3 g
0.8 g	2.2 g	1.4 g
1.1 g	2.2 g	1.1 g
Male:19-30 years		
1.8 g	2.7 g	0.9 g
2.5 g	2.7 g	0.2 g
1.9 g	2.7 g	0.8 g
1.5 g	2.7 g	1.2 g
1.4 g	2.7 g	1.3 g
1.4 g	2.7 g	1.3 g
1.5 g	2.7 g	1.2 g
2.0 g	2.7 g	0.7 g
Female :31-50years		
1.3 g	2.2 g	0.9 g
1.6 g	2.2 g	0.6 g
1.9 g	2.2 g	0.3 g
0.9 g	2.2 g	1.2 g
1.5 g	2.2 g	0.7 g
0.9 g	2.2 g	1.3 g
1.2 g	2.2 g	1.1 g
1.6 g	2.2 g	0.6 g
Male : 31-50 years		
1.4 g	2.7 g	1.3 g
1.1 g	2.7 g	1.6 g

1.1 g	2.7 g	1.6 g
1.8 g	2.7 g	0.9 g
0.8 g	2.7 g	1.9 g
0.9 g	2.7 g	1.8 g
1.6 g	2.7 g	1.1 g

TABLE 1: AGE AND VITAMIN C CONSUMPTION (n=50)

Gender & Age	Variables	F	P value
Gender	1.0 and Below	5.145	0.002**
	1.1 - 1.5	4.812	0.001**
	1.6 and above	5.311	0.002**
Age	1.0 and Below	4.347	0.003**
	1.1 - 1.5	3.462	0.004**
	1.6 and above	2.761	0.002**

Note: ** Significant at 1% level

TABLE 2 PAIRED DIFFERENCES BETWEEN NORMAL AND ACTUAL CONSUMPTION OF VITAMIN C (n=50)

Gap between Age and Vitamin C Consumption		Mean	SD	Correlation
8 - 18	Normal Consumption	2.14	0.776	0.774**
	Actual Consumption	1.76	0.603	
19 - 30	Normal Consumption	2.26	0.812	0.689**
	Actual Consumption	1.64	0.701	
31 - 50	Normal Consumption	2.18	0.635	0.716**
	Actual Consumption	1.60	0.749	

TABLE 3 ETA SQAURED STATISTICS VALUE

Gap between Age and Vitamin C Consumption		Eta value
8 - 18	Normal Consumption	0.37
	Actual Consumption	
19 - 30	Normal Consumption	0.51
	Actual Consumption	
31 - 50	Normal Consumption	0.55
	Actual Consumption	

Age Group between 8 and 18 years

It is inferred from the above table that there is a statistically significant difference between normal consumption mean score (M = 2.14, SD = 0.776) and actual consumption mean score ((M = 1.76, SD = 0.603) of respondents under the age group of 8 – 18 years. Since the P value is less than 0.01,. Hence, it is concluded that there is a positive relationship between normal consumption and actual consumption of respondents under the age group of 8 – 18 years. (0.774**).

Since the P value is less than 0.05, it is concluded that there is a significant difference between normal consumption and actual consumption of respondents under the age group of 8 – 18 years. The mean difference score of normal consumption and actual consumption of respondents under the age group of 8 – 18 years is 37.5% with a 95% confidence interval ranging from 33.6% to 41.4%.

The Eta squared statistics value is 0.37 (>0.14) which indicates the difference between normal consumption and actual consumption of respondents under the age group of 8 – 18 years has a large effect size.

Age Group between 19 and 30 years

It is inferred from the above table that there is a statistically significant difference between normal consumption mean score (M = 2.26, SD = 0.812) and actual consumption mean score ((M = 1.64, SD = 0.705) of respondents under the age group of 19 – 30 years. Since the P value is less than 0.01,it is concluded that there is a positive relationship between normal consumption and actual consumption of respondents under the age group of 19 – 30 years (0.689**).

Since the P value is less than 0.05,Hence, it is concluded that there is a significant difference between normal consumption and actual consumption of respondents under the age group of 19 – 30 years. The mean difference score of normal consumption and actual consumption of respondents under the age group of 19 – 30 years is 61.8% with a 95% confidence interval ranging from 57% to 66.7%.

The Eta squared statistics value is 0.51 (>0.14) which indicates the difference between normal consumption and actual consumption of respondents under the age group of 19 – 30 years has a large effect size.

Age Group between 31 and 50 years

It is inferred from the above table that there is a statistically significant difference between normal consumption mean score (M = 2.18, SD = 0.635) and actual consumption mean score ((M = 1.60, SD = 0.749) of respondents under the age group of 31 – 50 years. Since the P value is less than 0.01,it is concluded that there is a positive relationship between normal consumption and actual consumption of respondents under the age group of 31 – 50 years (0.716**).

Since the P value is less than 0.05,it is concluded that there is a significant difference between normal consumption and actual consumption of respondents under the age group of 31 – 50 years. The mean difference score of normal consumption and actual consumption of respondents under the age group of 31 – 50 years is 58.3% with a 95% confidence interval ranging from 54.1% to 62.6%.

The Eta squared statistics value is 0.55 (>0.14) which indicates the difference between normal consumption and actual consumption of respondents under the age group of 31 – 50 years has a large effect size

XII. CONCLUSION

Vitamin c is an important antioxidant. For women the recommended dietary allowance of vitamin C is 75mg and for men it is 90 mg. South India is more prevalent to vitamin C deficiency than North India. Citrus foods like orange, lime and animal organs like whale skin and raw liver are good sources of vitamin C. Smokers and people who consume alcohol are more prevalent to Vitamin C deficiency. The deficiency of vitamin C is scurvy and some of the symptoms include fatigue, joint pain, weight loss, swollen gums. Biochemically, vitamin C plasma levels below   are considered to coincide with clinical symptoms of scurvy. Treatment includes consuming vitamin C supplements or following a diet with lot of fruits and vegetables. High consumption of vitamin C associated with the risk of kidney stones even though there isn't much evidence about it. Overall, there is large body evidence supporting that maintaining healthy vitamin C level can have a protective function against age related cognitive decline but avoiding vitamin C deficiency is likely to be more beneficial than taking supplements on top of normal healthy diet. From the research it was found that the individuals from the age group of 8-18 consume very little amount of vitamin C while the individuals in the age group of 19 -50 have normal vitamin C consumption.

XIII. LIMITATIONS

This study is done with samples only in Tamil Nadu. The research is done through 3 day recall method. The study includes samples of all ages (except for children below 8 years)

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