Original Article

Estimation of Vitamin C Status Among University Students During COVID-19 Pandemic

Vitamin C Status Among Students During Covid-19

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ABSTRACT

Objective: Vitamin C is known as a powerful antioxidant and immune booster vitamin. During the period of the rise in COVID-19 infections, it was medically advised to consume a sufficient amount of vitamin C. This study was very essential to estimate the status of Vitamin C among University Students during the peak period of COVID-19 infections.

Study Design: Cross-Sectional Descriptive Study

Place and Duration of Study: This study was conducted at the University of Sindh from December 2020 to February 2021.

Materials and Methods: There were a total of 232 randomly selected male and female university students during the research work. The data was statistically calculated in percent and frequencies by using SPSS software version 21. The statistical difference was determined by applying a t-test and the P- value of < 0.05 was set as significant.

Results: Only about 5-9% of male and female university students were consuming a moderate amount of vitamin C-rich food every day whereas, the majority were not taking vitamin C-enriched foods or citrus fruits in their diet. Only 9% of males and 14% of females were taking vitamin C supplements. 56% of females reported bleeding gums issue and 34% of males also reported teeth sensitivity with bleeding gums. Skin discoloration was not found in most of the cases (> 90%). About 47% of females and 37% of males were susceptible to COVID-19 infection due to their critical plasma vitamin C levels < 0.3 mg/dl.

Conclusion: Both male and female university students were susceptible to COVID-19 infection due to their critically low levels of Plasma vitamin C. Females were more prone to COVID-19 infections compared to males due to their lower intake of vitamin C-rich foods and supplements. The male and female students of the university were found to lack sufficient intake of vitamin C. There were more females than males who reported bleeding gum issues. The students at the University level must be well aware of the immune-supportive, antiviral, and anti-inflammatory role of vitamin C.

Key Words: Vitamin C, University Students, COVID-19 and Pandemic.

INTRODUCTION

Vitamin C (Ascorbic acid) is a very important kind of micronutrient for human beings. It is not only just a powerful antioxidant but also an important cofactor for many metabolic enzymes[1].

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Vitamin C cannot be synthesized inside the human body but yet it plays a very crucial role in the immune system's smooth functioning. The essential biological functions such as the absorption of iron (non-heme), synthesis of bile, production of hormones, collagen synthesis, etc. are attributed to Vitamin C. Previous research work has also reported the role of vitamin C in the regulation of neurotransmitters inside the brain[2]. The deficiency of Vitamin C often leads to Scurvy, bleeding gums, neurological problems, metabolic issues, a rise in infections, a weakened immune system, etc.[3] The intravenous administration of Vitamin C has proven positive effects in patients with cancer and sepsis[4]. Acute respiratory distress syndrome has also been cured with high doses of vitamin C[6]. The previous research also suggested that Vitamin C expedited the recovery of COVID-19 patients[6,7]. The concentration of vitamin C in blood plasma is considered an important indicator of the occurrence and recurrence of any infection in individuals. Normally, the chances of infections are more if the plasma concentration of

vitamin C is found below 0.2 mg/dl. The intake of vitamin C was suggested by many medical professionals during the peak period of COVID-19 infection in order to cope with the pandemic situation8. One pilot study done in Colorado reported that the COVID-19-infected patients admitted to ICU had a very low plasma level of vitamin C and the study also linked morbidity with vitamin C deficiency[8]. One study reported that vitamin C can not only reduce the susceptibility to infection but also can prevent, shorten and cure the infection in humans[9]. Scientists have also reported that vitamin C reduced the rate of mortality in COVID-19 patients[10]. A group of scientists mentioned the therapeutic role of vitamin C against COVID-19 cases[11]. The recommended daily allowance of vitamin C for Men is 90-105 mg/day whereas for Women it is 75-85 mg/day[12]. Unlike Vitamin D (a fat-soluble vitamin), vitamin C is having a water-soluble nature thus it cannot be stored sufficiently inside the human body and, it needs to be supplied in the diet very frequently. At the time of COVID-19's emergence, the supply of fresh foods was severely affected on one hand and on the other side, there was less awareness about the immunoprotected role of vitamin-rich foods against COVID-19 infections. Our study aimed to estimate the status of vitamin C among University Students during the peak period of COVID-19 infections and to observe their attitude, knowledge, and practice toward the use of Vitamin C.

MATERIALS AND METHODS

We conducted a cross-sectional study during the peak period of COVID-19 in Hyderabad Pakistan and it's adjacent areas from the month of December 2020 to February 2021. We distributed about 500 questionnaires among university students and received their responses regarding the impact of the COVID-19-based situation on their daily lives. The informed consent was initially signed by the participants who were willing to participate in our study. The questionnaire was also designed after following officially approved protocols. We received the response of 232 participants who showed their interest to take part in our research work. There were 116 male and 116 female university students from different locations in Hyderabad and adjoining areas. The questionnaire was divided into two main portions such as demographic details and estimation of vitamin C. The questionnaire consisted the questions related to the daily consumption of Vitamin C. The questionnaire had questions related to the daily intake of foods rich in vitamin C. The university students were also asked about their attitudes, knowledge, and practice toward the consumption of vitamin C on a regular basis. One portion of the questionnaire was composed of questions related to the symptoms of vitamin C deficiency such as tiredness, nose bleeding, skin dryness, joint pain, gum

bleeding and inflammation, fatigue, depression, hair loss, etc. The Data from filled responses was transferred to MS Excel and organized into different groups. The data was also inserted into the Pivot table to separate the categorical variables for the Chi-square test. The calculations were made by using SPSS software version 21 and a t-test was applied to determine the significant difference between two groups. A p-value of <0.05 was considered statistically significant.

RESULTS

The results from our research work have shown that the majority of the students were not taking Vitamin C-enriched foods or citrus fruits in their diet. Our data suggested that 232 respondents took part in our research work and allowed us to record their responses about the estimation of vitamin C status (Table 1).

Table No. 1: Demographic details of respondents

Category	N (%) of respondents
Gender	
Male	116 (50.0)
Female	116 (50.0)
Age group (years)	
18-20	80 (34.48)
21-23	100 (43.10)
24-26	52 (22.41)
Native place	
Urban	92(39.65)
Rural	140 (60.34)
Housing	
Hosteler	104(44.82)
Non-Hosteler	128 (55.17)
Citrus food intake	
Daily	22 (9.42)
Alternate Day	50 (21.55)
Weekly	60 (25.86)
Occasionally	100 (43.10)
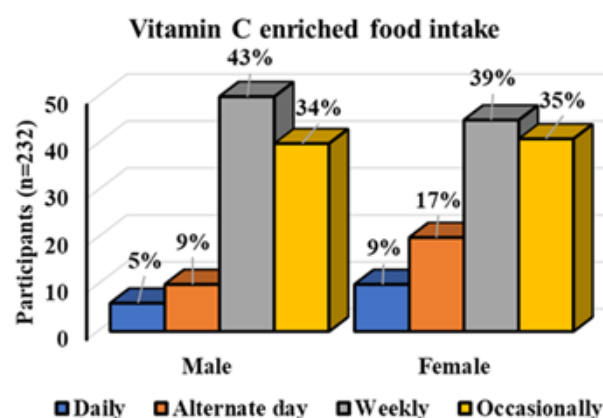
Figure No. 1: Consumption of vitamin C rich foods

Out of 232 respondents, 116 (50%) were male participants whereas there was also an equal number of

female respondents for comparison (Table 1).We divided the age groups of respondents (University students) into three groups such as 18-20 years, 21-23 years, and 24-26 years old participants (Table 1). About 45% of students belonged to different hostels and they included both male and female students, whereas 55% of students were not residing in any hostel as they were living in urban areas (Table 1).

According to our results, only 5% of males and 9% of females could consume vitamin C-rich foods every day. About 39-43% of male and female university students were consuming moderate amounts of vitamin C-rich food in a week (Figure 1). Mostly, the university students (34-35%) were those who took a rich source of vitamin C occasionally (Figure 1). The results showed that both males and females were almost equal in number who were deprived of daily doses of vitamin C. Only 9% of males and 17% of females could manage to consume the required amount of vitamin C on alternate days. The tallest column in grey color represents the group of males consuming good sources of vitamin C after one week. The smallest column of the Graph (Figure 1) represents the males eating a good quantity of vitamin C after one week.
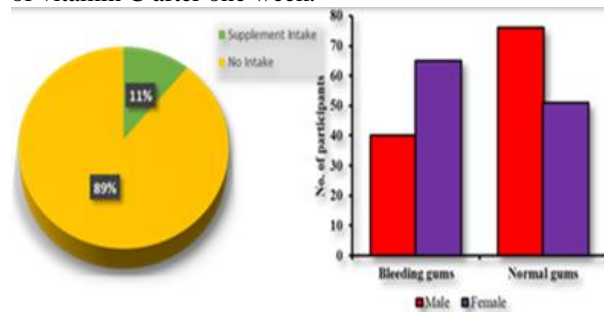

Figure No. 2: Vitamin C supplement and bleeding gums

As far as the consumption of vitamin C in supplement forms was concerned, we noticed that only 9% of males and 14% of females were taking vitamin C supplements and in total, just 11% of university students were taking vitamin C supplements whereas the rest of the 89% were not taking vitamin c in any supplemental form (Figure 2). We also checked the swollen and bleeding gums of the individuals and found that about 34% of males and 56% of females were having the issue of bleeding gums (Figure 2). The results showed the issue of bleeding gums was more common in female university students compared to male university students (Figure 2). Skin discoloration was not found in most of the cases. After checking the plasma level of vitamin C among University students, it was observed that 37% of males and 47% of females had plasma vitamin C levels < 0.3 mg/dl respectively. Only 3 to 8% of students were found with plasma vitamin C levels> 2 mg/dl (Figure 3). However, 57 % of male university students and 50% of female university students had

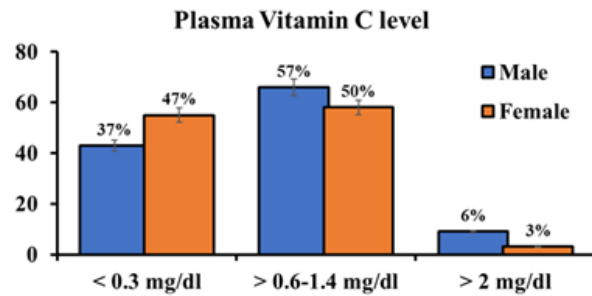plasma vitamin C levels in a normal range between 0.6-1.4 mg/dl (Figure 3).

Figure No. 3: Plasma level of vitamin C.

DISCUSSION

In our research work, we found that the consumption of vitamin C in university students was very poor during the period of the COVID-19 pandemic. Most of the male and female university students were not taking the proper amount of vitamin C in their daily diet. We found that university students were taking very low amounts of vitamin C against the Recommended Daily Allowance (RDA) of vitamin C[13]. Even on the alternative day (one day gap), both male and female university students were not reaching the targeted RDA values. The possible reason might have been the unawareness of University students about the role of vitamin C against COVID-19. The other reason might have been the attitude and dietary preferences of University students as we knew that most of the vitamin C-rich foods were sour and bitter (citrus) in taste. One reason might also have been the cheap availability of vitamin C-rich food sources as we knew about the shortage and high cost of food during COVID-19 around the world[14]. However, One large group of students was those who preferred or managed to take sufficient amounts of vitamin C-rich food around a week. These students were mostly living in the urban areas where they came across a variety of foods weekly compared to the hostelers who had little chance to find food variety in a week. One group of students (34-35%) consisted of those who got a food source rich in vitamin C occasionally. University students who were a little bit aware of the importance of vitamin C in their daily lives took vitamin C supplements. However, we noticed a very low percentage (9-14%) of the individuals who were taking supplement forms or tablet forms of vitamin C. The males were more in number compared to the females who took vitamin C supplements, possibly because male university students could frequently visit outdoors. We also noticed the majority (56%) of female university students with bleeding gum issues. Most of the females reported the feeling of sensitivity in their teeth during eating and brushing. The males were having less sensitive teeth and bleeding

gums compared to the females, possibly because of their supplemental intake. A recent study as our literature support was also consistent with our findings as that study mentioned the vitamin C deficiency in females due to poor intake of food[15]. Our research work could not identify any case of skin discoloration among university students due to the deficiency of vitamin C which indicates that the deficiency of vitamin C has not been prolonged and could be cured by taking some heavy doses of vitamin C in the form of supplement. The presence of teeth sensitivity, bleeding, and swollen gums does not always lead to scurvy as there might be several periodontal diseases. About one-half of our participants had a normal plasma level of vitamin C which indicated that the chances of scurvy and other vitamin C deficiency disorders were too low in half of the randomly selected population. As far as the cases of low vitamin C plasma levels were concerned, we found that 47% of females and 37% of males were affected and they were susceptible to COVID-19 infections[16]. The plasma level of vitamin C in female university students was significantly low ($p < 0.05$) compared to the male university students, which indicated that the females were more susceptible to COVID-19 infection during the peak time of COVID-19 infection cases at Hyderabad and it's adjoining areas.

CONCLUSION

The male and female university students were susceptible to COVID-19 infection during the peak time of the COVID-19 pandemic in Hyderabad and it's adjoining areas, because of their critically low levels of Plasma vitamin C. The university were not taking sufficient amounts of vitamin C in their daily diet. Females were more prone to COVID-19 infections compared to males due to their lower intake of vitamin C-rich foods and supplements. The females were also in the majority who reported bleeding gum issues. The students at the university level must be well aware in advance of the immune-supportive, antiviral, and anti-inflammatory role of vitamin C so that they may become able to protect themselves from not only common deficiency disorders or infections but also from the COVID-19 pandemic situation.

Author's Contribution:

Concept & Design of Study:	Autif Hussain Mangi
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Final Approval of version:	Autif Hussain Mangi

Conflict of Interest: The study has no conflict of interest to declare by any author.

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