ANTIOXIDANT-VITAMIN C: LUNG FUNCTION; LUNG CANCER

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ABSTRACT

Non-enzymatic vitamin C (ascorbic acid) plays an important role in the medicinal field and acts as antioxidants use in fruits and vegetable such as lemon, orange, grapes, carrots, tomatoes, grapefruit, beans, broccoli, and mangos. It helps to prevent and stop of various diseases such as lung cancer, asthma, and wheezing and finding an antibronchospastic effect. Other factors such as diet have also been implicated in the development of lung cancer. Despite the extensive research conducted in this area, the relationship between diet and lung cancer is still not clear. Diets high in fat and low in vegetables and fruits may increase the risk of lung cancer and other fact eating of tobacco and smoking of cigarette. Lung tissue damage due to high levels of free radicals in cigarette smoke causes direct (tissue oxidation) and indirect (release of oxidizing agents and enzymes). Vitamin C is necessary for phagocytosis. It plays a significant role in daily life, dietary system like eating food, vegetable and smoking of cigarette. It helps to prevent or stop the damage the lung tissue/or cause lung cancer. The present review studied that application of vitamin C act as antioxidant in lung cancer like diseases such as lung-cancer and role in lung function.

Keywords: Review, Non-enzymatic antioxidant (vitamin C), Lung function, Lung diseases.

BACKGROUND

Since an early 18th and/or 20th century research on these compounds run to the discovery of vitamins:

1747 - Lind cured scurvy in British sailors with oranges and lemons.

1907 - It is reproduced experimental scurvy in guinea pigs.

1928 - Eascott identified bios-I as meso-inositol. Szent-Gyorgy and Glen published the isolation of vitamin C or hexuronic acid.

1933 - Allison, Hoover, and Burk describe a compound that promotes the respiration and growth of rhizobium, which designated "Coenzyme R." Then, it is defined the molecular structure and synthesis of vitamin C.

1937 – For the determining the structure of ascorbic acid scientist "Walter Haworth" was awarded a Nobel Prize in chemistry to for his work.

1981 - Bergman *et al.* effect of vitamin C on bile acid pattern.

Chemistry of vitamin C

The structure of vitamin C (ascorbic acid) (Fig. a): Vitamin C is five member oxygen-containing cyclic organic compound. Oxygen containing an electron donar, and it reacted with base and abstracted proton and becomes to more nucleophilic in nature. The isomeric form (Fig. b) and act as nucleophilic in nature. It reacts with base gives ascorbate ion then speedy react with electrophile (Fig. c).

Acidity

At different levels of vitamin C, it gives different hydrogen ion concentrations; at pH 7.4, 99.95% of vitamin C will be present as $AscH^-$; 0.05% as $AscH_2$, and 0.004% as Asc^{2-}. Thus, the antioxidant chemistry of vitamin C is the chemistry of $AscH^-$ (Fig. d).
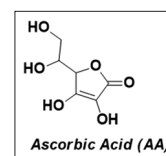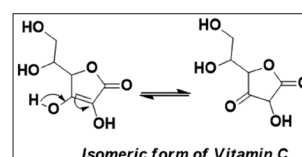

Fig. a: Ascorbic acid

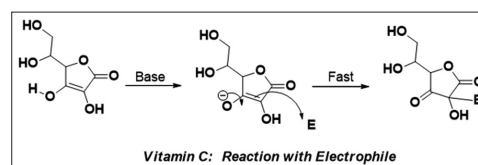Fig. b: Isomeric form of vitamin C

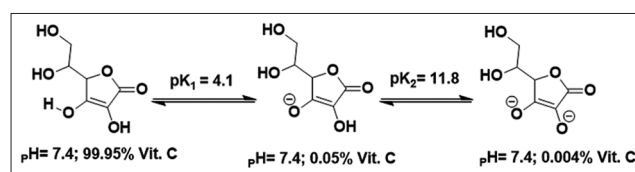Fig. c: Electrophilic reaction of vitamin C

Fig. d: Acidity in different condition of vitamin C

INTRODUCTION

An essential dietary component vitamin C, also known as L-ascorbic acid (hexuronic acid, cevitaminic acid, or xiloascorbic acid) (Fig. 1), is a water-soluble vitamin that is naturally present in some foods, added to others, and available as a dietary supplement. Humans, unlike most animals, are unable to synthesize vitamin C endogenously [1].

Vitamin C is one of the most common antioxidants in fruits and vegetables, and it may exert chemopreventive effects [2], play a role in lung function and wheezing [2]. It has generally been acknowledged that vitamin C protects cells from oxidative DNA damage, thereby blocking carcinogenesis [3]. The role of ascorbic acid (vitamin C) in asthma has long been argued, early as 1803 Reisseissen suggested that vitamin C prevents the wheezing observed in patients with diseases scurvy [4]. More recently, animal studies have shown that ascorbic acid may prevent anaphylaxis and other allergic phenomena [5,6]. In guinea pigs, ascorbic acid has been shown to reduce the airway obstruction prompted by 5-hydroxytryptamine, bradykinin, and histamine [7]. In healthy human subjects demonstrated that vitamin C inhibits histamine-induced bronchospasm [8]. These findings suggest that vitamin C may have an antibronchospastic effect, although some authors have failed to find evidence to support these results [9,10]. To further study the potential role of ascorbic acid in patients with asthma, we investigated the effect of vitamin C on exercise-induced bronchospasm, a common asthmatic syndrome that can be easily reproduced under controlled laboratory conditions [11].

Vitamins and lung cancer [11]: Lung cancer is the most common cancer in the world. In the year 1996, an estimated 1·3 million new cases were diagnosed worldwide accounting for 12.8% of all new cases of cancer (World Cancer Research Fund and American Institute for Cancer Research, 1997). Prevention, detection, and early treatment are the tools to reduce lung cancer morbidity and mortality. Early detection of lung cancer has not been successful, as symptoms often do not appear until the disease is advanced. Similarly, screening of asymptomatic subjects with regular chest X-rays or sputum cytology has not been successful. Despite advances in the treatment of lung cancer, the 5-year survival for lung cancer is only 10-15%. Thus, the only efficient way to reduce the burden from lung cancer is prevention.

Smoking of cigarette is the predominant risk factor for lung cancer; about 90% of the cases are attributable to cigarette smoking. Other risk factors for lung cancer include passive smoking, asbestos, radon, chemical carcinogens, previous chronic inflammatory lung disease, and genetic predisposition. Diet has also been implicated in the development of lung cancer. Despite the extensive research conducted in this area, the relationship between diet and lung cancer is still not clear. Diets high in fat and low in vegetables and fruits may increase the risk of lung cancer [11]. The specific mechanisms of the interaction between diet and lung cancer remain to be elucidated. As the worldwide lung cancer cause due to various polluted and/or deficiency dietary food and vegetable for the year 2011-2016 were increased (Fig. 2).

The number of epidemiologic studies has been published exploring the relationship between vitamin C intake and lung cancer risk (Fig. 3). The result of these studies are not consistent and a meta-analysis to: (1) Assess lung cancer risk for the highest versus lowest categories of vitamin C intake; (2) assess the dose-response association of lung cancer for every 100 mg/day increment in vitamin C intake; (3) assess heterogeneity and publication bias among the studies analyzed [12]. The cancer-related deaths worldwide, furthermore, the overall survival rate for lung cancer patients is extremely low [13] such as lung cancer.

An account for a significant amount of the age-adjusted incidence rate of lung cancer was recently reported at 62.6 cases/100,000 pessople/year, and the age-adjusted death rate at 50.6 per 100,000 people/year [14]. Thus, primary prevention of lung cancer is serious. Many studies have shown that lung cancer is associated with genetic factors [15,16] and environmental factors including tobacco use [17],
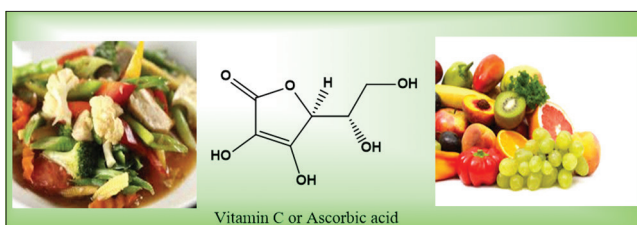

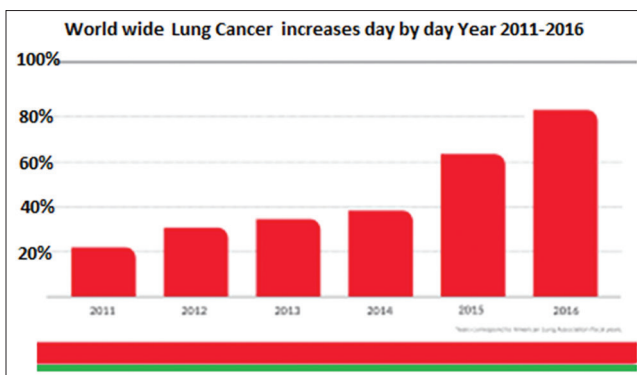**Fig. 1: Ascorbic acid in food and vegetable**

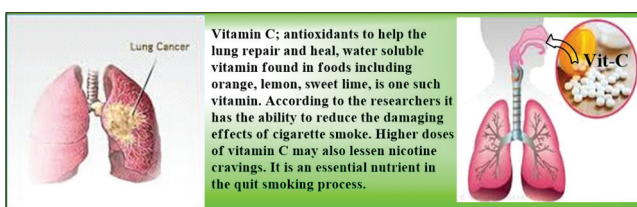**Fig. 2: Worldwide; lung cancer increase between 5 year**

Fig. 3: Lung cancer; intake vitamin C

alcohol consumption [18], and intake of fruit, vegetables [19], and vitamins [20,21] can also affect the incidence of lung cancer. The work influence that dietary factors may have upon the occurrence of this neoplasm and on the causes of possible effect [22]. Increased cancer mortality risks associated with low plasma cholesterol were not explained by the confounding effect of antioxidant vitamins but were attributed in part to the effect of preexisting cancer [23]. High levels of free radicals in cigarette smoke (CS) cause direct (tissue oxidation) and indirect (release of oxidizing agents and enzymes) damage to lung tissue [24]. About the diet, several cross-sectional epidemiological studies have suggested that dietary antioxidants and foods rich in antioxidants (i.e., fruit and vegetables) may protect the airways against oxidant-mediated damage leading to chronic obstructive airways disease (COPD) [25]. Only three longitudinal studies on the relation between diet and COPD-related outcomes have been published. In the Zutphen study, an inverse relationship was observed between baseline consumption of total and solid (¼ apples, pears) fruit and 25-year incidence of chronic lung disease [26]. To observe a relationship with intake of antioxidant Vitamin C and β-carotene, follow-up in the other two studies was relatively duration 5-7 year [27]. Non-statistically significant longitudinal relationship between vitamin C and E or apple intake with pulmonary function. However, baseline apple consumption did tend to be inversely related to change in forced expiratory volume 1 [28]. In addition to the above-mentioned dietary factors with antioxidant capacities, a protective effect against the development of COPD has been suggested for fish consumption. Fish oils are thought to have anti-inflammatory effects because of the influence of the polyunsaturated fatty acids eicosapentaenoic acid and docosahexaenoic acid on arachidonic acid metabolism [29]. The cross-sectional studies published in 1990 and 1994 suggested an inverse association between

fish consumption and COPD-related outcomes [30]. However, all cross-sectional studies published in later years reported negative findings [31], no association of fish consumption with 25-year incidence of chronic lung disease was observed [32].

MECHANISM AND/OR ROLE OF ANTIOXIDANTS

Antioxidant system available to cells during oxidative stress is that of free-radical-scavenging agents. It is the first line of defense against oxygen free radicals damaging to cellular components and contributing to inflammation. In short, these agents are present to varying degrees in the intracellular and extracellular spaces, and they function by either eliminating oxidants or preventing their conversion to more toxic compounds. Normally, the lung exists in an oxygen-rich environment generated through normal cellular function or exposure to pro-oxidants and the protective activities of several intracellular and extracellular antioxidant defense systems. A tight control of redox balance is critically important for the maintenance of normal pulmonary cellular function [33]. A shift of the oxidant/antioxidant balance in favor of oxidants has been termed "oxidative stress" [34]. Researchers have hypothesized that a diet low in antioxidants such as 3-carotene, vitamins C and E may reduce natural defenses and increase susceptibility to oxidant attack and airway inflammation [33]. CS and atmospheric pollutants such as ozone (O_3) and nitrogen oxide (NO) are rich in free radicals and exposure to them can induce oxidant-mediated lung injury by direct tissue oxidation, as well as through endogenous oxidizing agents and proteolytic enzymes released after recruitment and activation of neutrophils during the inflammatory response [35]. Inhaled oxidants also amplify the effect of neutrophil proteases by oxidative deactivation of 1-proteinase inhibitor [33-36]. The antioxidant defenses of the lung have been reviewed [33,35,36]. Antioxidants may act at different levels in the oxidation process, for examples, by scavenging initiating radicals, binding metal ions, by scavenging peroxyl radicals, or by removing oxidatively damaged biomolecules [34]. Antioxidant defenses in the lung are provided by endogenous enzyme systems and non-enzymatic antioxidant compounds. The major enzymatic antioxidants are superoxide dismutase, which degrades superoxide anion, and catalase and the glutathione redox system, which inactivates hydrogen peroxide (H_2O_2). The antioxidant defenses of the lung have been reviewed [37-39]. Non-enzymatic antioxidants such as vitamin E (tocopherol), vitamin C (ascorbic acid), and β-carotene (a precursor of vitamin A) Fig. 4, ubiquinone, flavonoids, and selenium are present in foods and are considered dietary antioxidants [33]. Vitamin E, a lipid-soluble vitamin, represents the body's principal defense against oxidant-induced membrane injury in human tissue, via its role in breaking the lipid peroxidation chain reaction [40]. Water-soluble vitamin C, contributes to antioxidant activity through several mechanisms, including scavenging the superoxide radical $O_2\sim$. Vitamin C acts on airways by affecting arachidonic acid metabolites, particularly prostaglandins. Vitamin C appears to be the most abundant antioxidant substance in the extracellular fluid lining of the lung [41], and it also contributes to the regeneration of membrane-bound oxidized vitamin E, allowing it to function again as a chain-breaking antioxidant [42]. In addition, vitamin C plays a role in immune function and is transported into neutrophils and lymphocytes [36]. β-carotene, a precursor to vitamin A, accumulates in tissue membranes, scavenges superoxide anion, and reacts directly with peroxyl free radicals, thereby serving as a lipid-soluble antioxidant [33].

Thus, dietary intake of these vitamins may play a role in host defense against oxidative lung damage. Flavonoids such as quercetin (Fig. 5) are scavengers of superoxide anion; they exhibit singlet oxygen-quenching proprieties, scavenge lipid peroxyl radicals, and can act as chelators of iron (Fe) ions [33]. Selenium (Se) is incorporated into the antioxidant enzyme glutathione peroxidase, which reduces H_2O_2 and other organic peroxides, thereby preventing lipid peroxidation and subsequent in stability of cell membranes. Antioxidant intake may act primarily on the evolution of asthma, modulating the impact of oxidants on the lung, decreasing inflammation of the airway. Infection and inhaled pollutants activate leukocytes to produce oxidants. Neutrophils, eosinophils, and alveolar macrophages from asthmatic patients produce more reactive
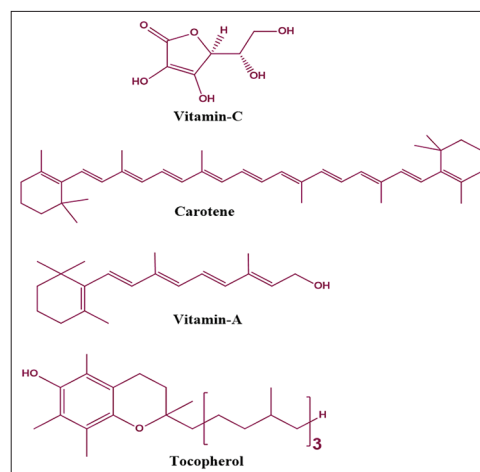

Fig. 4: Non-enzymatic antioxidants: vitamin E (α-tocopherol), vitamin C (ascorbic acid), and β-carotene
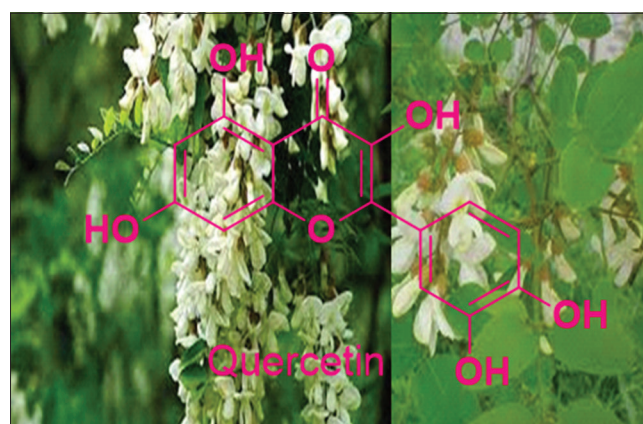

Fig. 5: Chemical structure of flavonoids-quercetin

oxygen species than do those from normal subjects. Reactive oxygen species directly contract airway smooth muscle preparation [42] and can stimulate histamine release from mast cells [41]. A number of antioxidant disturbances have also been observed in COPD patients, increase in lipid peroxidation products, and DNA damage. The Oxidative stress in chronic obstructive pulmonary disease, nutrition and metabolism of trace elements and reactive oxygen species and airway inflammation with clinical action[37, 43, 44]. Fresh fruits and vegetables contain considerable amounts of vitamin C (e.g., broccoli, spinach, tomatoes, and citrus fruits) and carotenoids (e.g., carrots, tomatoes, grapefruit, beans, broccoli, oranges, and mangos) [45]. The main carotenoids serving as provitamin β-carotene and cryptoxanthin may be transformed into vitamin A. The richest sources of vitamin E in the human diet are oil products such as mayonnaise, vegetable and seed oils (corn, safflower, and soybean), butter, and eggs. Flavonoids are mainly found in fruits and vegetables (apples, lemons, oranges, potatoes, and cauliflower) and tea [33]. The current recommended dietary allowance requirements are 60 mg/day for vitamin C (100 mg/day for smokers), 800-1000 retinol equivalents per day (1 retinol equivalent = 6 (i.e., of β-carotene) for vitamin A, and 55-70 u.g/day for selenium [46].

Vitamin C contributes to antioxidant activity through several other mechanisms. It does so primarily by scavenging O_2, but it also contributes to the regeneration of membrane-bound oxidized vitamin E, allowing it to function again as a chain-breaking antioxidant [47]. Dietary intake of these vitamins may, therefore, play a role in the host's defense against oxidative cell and lung damage, the oxidation of ascorbic acid using the oxidation of ascorbic acid by generate in situ H_2O_2 (hydrogen peroxide) to the dehydro ascorbate cell damage to dehydration by catalyse (Fig. 6).

VITAMIN C

Intake of vitamin C vegetables and fruits having shown six prospective studies the association between these indices and lung cancer risk [48]. The results have varied from an inverse association to no association [49a-g], but three of the most recent reports have demonstrated a significant inverse association between dietary vitamin C and the risk of lung cancer [50a-c]. An association between plasma ascorbic acid concentration and lung cancer risk has been reported in two studies; in one study, plasma ascorbic acid was not predictive of subsequent lung cancer [51]; in another study, a modest non-significant protection was noted [52]. No controlled trials of supplementation with vitamin C in relation to lung cancer have been published.

Lung cancer: Tomato and/or tomato-based food-vitamin C as containt

A several studies view has reported an inverse association between tomato and/or lycopene intake and the risk of some types of cancer. In 2004, Food and Drug Administration (FDA) received two petitions for qualified health claims regarding tomatoes, lycopene, and the risk reduction for some forms of cancer. Here, we describe FDA's review of the scientific data for tomato and/or lycopene intake with respect to risk reduction for certain forms of cancer. The FDA found no credible evidence to support an association between lycopene intake and a reduced risk of prostate, lung, and colorectal, gastric, breast, ovarian, endometrial, or pancreatic cancer. The FDA also found no credible evidence for an association between tomato consumption and a reduced risk of lung, colorectal, breast, cervical, or endometrial cancer [53]. The FDA found very limited evidence to support an association between tomato consumption and reduced risks of prostate, ovarian, gastric, and pancreatic cancers. FDA identified 18 observational studies on tomato and/or tomato-based food intake and the risk of lung cancer including three prospective cohort studies [54-56], two nested case-control studies [57,58], one case-cohort study [59], and 12 case-control studies [60-69]. Six studies [60-63,70,71] were not reviewed further. Of the 12 remaining studies, two studies [72,73] included subjects who were not pertinent to the general US population (i.e., tin miners from China), these studies pointed out that these subjects had unique environmental exposures (i.e., arsenic and severe pollution) that increased the incidence of lung cancer, and thus, their findings were not generalizable to a general population of the United States [72]. Further evaluation of the 10 remaining studies revealed that seven case-control studies [74-80] included a greater proportion of smokers among

Fig. 6: Cell damage by oxidized ascorbic acid

the case patients than among the control subjects and reported results that were not stratified by smoking status. Because smoking causes lung cancer [81,82] and can lead to many dietary changes, including decreased weight and appetite [83], which may affect food intake and could have biased the results of these studies, it was not possible to determine whether differences in the consumption of tomatoes and/or tomato-based foods contributed independently to the results in the lung cancer case patients. Therefore, FDA concluded that scientific conclusions about the relationship between tomatoes and tomato-based food consumption and lung cancer risk could not be drawn from these seven studies, remaining three studies [84-86] were observational studies that evaluated the relationship between tomato consumption and lung cancer risk and had a high to moderate methodologic quality rating. The cohort of 89 284 nurses for approximately 16 years and identified 593 cases of lung cancer [84]. They found that eating one or more servings of tomatoes per day was not associated with lung cancer incidence [85], analyzed a case-cohort of 2814 female control subjects and 138 female case patients from Iowa to evaluate tomato intake and lung cancer risk. They found that tomato intake was not associated with lung cancer risk [86] conducted a nested case-control study that included a case-cohort study with 2953 control subjects and 1010 case patients from Netherlands. They observed no association between raw tomato consumption (25 g/day) and lung cancer risk. On the basis of its evaluation of these three reports, FDA concluded that there was no credible evidence supporting an association between tomato or tomato-based food consumption and lung cancer risk.

Tomatoes and cancer risk reduction

The FDA literature review on tomato consumption and cancer risk reduction; none was an interventional study that evaluated tomato consumption in subjects who had not been diagnosed with cancer [87].

A total of 64 observational studies of the association between tomato or tomato product consumption and cancer risk were identified. Of these, 25 [86,88-109] were not reviewed further because they were a republication or reanalysis of data that were already used to evaluate the health claim and/or because they had scientific deficiencies that prevented FDA from drawing scientific conclusions from the study (Table 1). For example, studies that measured biomarkers that had not been previously validated for the specific cancer under study (e.g., serum level of insulin-like growth factor and cervical dysplasia) [110,111] were excluded because they did not provide reliable evidence for risk reduction, and therefore, no scientific conclusions could be drawn from them for the evaluation of a qualified health claim about cancer. Studies for which no information was provided about the validation of the food frequency questionnaire used were also excluded because failure to validate a food-frequency questionnaire may lead to false conclusions about associations between dietary factors and disease risk [112,113]. To provide no information on the accuracy of measuring tomato intake, and hence, no scientific conclusions could be drawn from them for the evaluation of a qualified health claim. One study [114] was excluded because it lacked a statistical analysis of the data, which prevented FDA from determining if there was a difference in cancer risk between subjects who did and did not consume tomatoes. Finally,
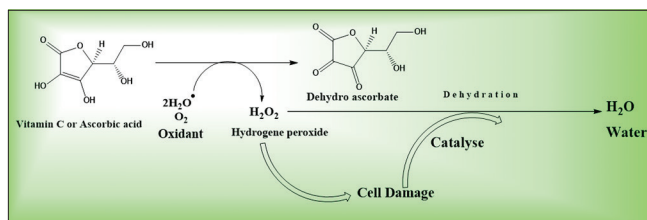
Table 1: Studies excluded from FDA's review of tomatoes and cancer risk reduction, by reason for exclusion[a]

Republication or reanalysis	Non-validated endpoint of cancer	No information on the validation of the food frequency questionnaire	No statistical analysis	No calculation of risk
Norrish, 2000 (20); Tzonou, 1999 (108); Garcia-Closase, 1998 (32); Giovannucci, 1995 (109); La Vecchia, 1987 (110)	Mucci, 2001 (111); de Vet, 1991 (112)	Seow, 2002 (113); Brennan, 2000 (114); Norrish, 2000 (20); Cohen, 2000 (21); Mayne, 1994 (115); Franceschi, 1994 (116); Levi, 1993 (117); Ramon, 1993 (118); Fraser, 1991 (119); Hu, 1991 (120); Bond, 1987 (121); Tuyns, 1988 (122); Tajima, 1985 (123); Kvale, 1983 (124); Haenszel, 1972 (125)	Boeing, 1991 (126)	Baghurst, 1991 (127); Graham, 1991 (128); Marshall, 1983 (129)

[a]Studies are listed by first author, year of publication (reference). FDA: Food and Drug Administration

three studies [115-117] were excluded because they did not calculate a risk ratio, which made it impossible to determine if tomato intake reduced the risks of the cancers under study. Here, the FDA's reviews of the remaining 39 observational studies for a qualified health claim for tomatoes and tomato products by cancer type.

VITAMIN CONTRIBUTING: EFFECT AND PLASMA CHAIN-BREAKING ANTIOXIDANTS

The study complications of prematurity to result from free radical generation and an inadequacy of antioxidative capacity. The plasma total peroxyl radical-trapping capability (TRAP) and concentrations of the main chain-breaking antioxidants contributing to it, i.e., uric acid, ascorbic acid, α-tocopherol, protein sulfhydryl groups, and bilirubin, in 21 preterm infants with a mean birth weight of 1440 g and gestational age of 30 weeks. The infants were divided into two groups according to their short-term outcome; the good outcome group (GOG) (n=11) with no signs of morbidity and the poor outcome group (POG) (n=10) with intraventricular hemorrhage and/or bronchopulmonary dysplasia and/or retinopathy. Arterial blood samples were obtained 3 and 10 days postpartum. TRAP was measured with a chemiluminescent method. As a comparison, venous blood samples from 13 adults (aged from 18 to 34) were used. At day 3, the POG had significantly higher TRAP than the good outcome or control group, mainly because of elevated uric acid concentration. Furthermore, the concentration of unidentified antioxidants was significantly lower in GOG. By day 10, the TRAP decreased substantially in both groups. However, from the components of TRAP, both ascorbate and the unidentified fraction decreased more in POG (p=0.017 and 0.021, respectively). Furthermore, in POG on day 10, urate concentration did not significantly differ from day 3 values. Plasma chain-break antioxidants in preterm infants with good and poor short-term outcome [118]. Some of the dietary and lung function: Smoking-environmental tobacco smoke decreases some plasma antioxidants and increases γ-tocopherol *in vivo* after adjustment for dietary antioxidant intakes [119-121]; Active and passive smokers are exposed to reactive free radicals that are present in CS [119]. Because free radicals cause oxidative damage to macromolecules such as lipids, proteins, and DNA, they are believed to be involved in the pathogenesis of cardiovascular diseases and cancer [120-122]. Free radicals in CS deplete some plasma antioxidants *in vitro* [122,123], and several studies found lower plasma antioxidant concentrations in smokers *in vivo* [124-130]. Less information is available on the effect of CS exposure on plasma antioxidant concentrations in passive smokers [131-135]. It has been difficult to determine whether differences in plasma antioxidants between smokers and non-smokers are actually due to the effect of CS exposure or are due instead to differences in dietary antioxidant intakes or in other covariates. Epidemiologic studies showed that CS consume fewer fruits and vegetables than do non-smokers [136-140]. In addition, CS consume fewer vitamin supplements than do non-smokers [141-145]. The dietary habits of passive smokers were found to be intermediate between those of smokers and non-smokers [144]. As a result, the *in vivo* effect of smoking or passive smoking on plasma antioxidant status remains unclear. The study confirmed active smoking, passive smoking, or non-smoking status with plasma cotinine measures, excluded current or recent vitamin supplement users, and adjusted for dietary antioxidant intakes and other covariates. This permitted us to examine the effect of active and passive smoking on several plasma antioxidants,

unconfounded by other factors. Non-smokers and passive smokers have antioxidant concentrations that are between those of smokers and non-smokers. These results indicate that CS and non-smokers exposed to CS have a significantly lower plasma antioxidant status than do unexposed non-smokers, independent of differences in dietary antioxidant intakes. Further research is required to explain why plasma γ-tocopherol concentrations were significantly higher in smokers and passive smokers than in non-smokers [144].

STUDY OF BLOOD VITAMIN C IN LUNG AND BLADDER CANCER PATIENTS BEFORE AND AFTER TREATMENT WITH ASCORBIC ACID

A systematic study of vitamin C blood levels in patients with cancer and an evaluation of their modifications when the patients were orally treated with daily large doses of ascorbic acid (5 g/day) have been carried out. For excluding any interference on intestinal vitamin C absorption, all patients with digestive tract cancer have been excluded. The study has shown hypo vitaminosis C subclinical conditions for the greater part of subjects: In fact, the average hematic rate of ascorbic acid approaches to a lower level of physiologic range, appearing very low particularly for the younger patients. Periodic hematic dosages of vitamin C of unoperable and operated patients treated with large doses of ascorbic acid have shown a rapid increase of its blood concentration which frequently has been very over 1500 mg%, the higher level of normal range. These high vitamin hematic levels, generally constant during the time, appear useful in increasing the defense reactions of the cancerous patient [146].

SEVERE HYPOVITAMINOSIS C IN LUNG CANCER PATIENTS

The utilization of vitamin C in surgical repair and lymphocyte-related host resistance [147]: Plasma and buffy-coat vitamin C were estimated in 158 samples from 139 lung cancer patients, at all stages of the disease. Most samples showed hypovitaminosis C in both estimations: 64% had plasma, and 25% buffy-coat values below the thresholds for incipient clinical scurvy (0.3 mg% and 10 jg/108 cells, respectively). Levels were diet-dependent and could be increased by oral supplements. Levels were low both in tumor-bearing patients and in those clinically free of disease after resection. The latter had particularly low values during the first 6 months, indicating the utilization of vitamin C in surgical repair. The vitamin C content of 13 primary lung tumors was assayed: Tumors had higher vitamin C content (mean 1116+551, ug/g tissue) than normal lung (58.5 + 20-4, ug/g). Mononuclear cells from normal individuals show a higher vitamin C content than polymorphs, but in lung cancer patients, the expected correlation of buffy-coat vitamin C with the proportion of lymphocytes in peripheral blood was obscured by an inverse correlation in patients with relative lymphocytosis (25% lymphocytes), confirmed by an inverse correlation of the proportion of lymphocytes in peripheral blood with mononuclear-cell vitamin C in 14 patients in whom this was measured. These correlations were unaffected by controlling for plasma values and indicate the utilization of vitamin C in lymphocyte-related antitumor mechanisms. Vitamin C is necessary for phagocytosis and for the expression of cell-mediated immunity. In view of the increasing circumstantial evidence that immune mechanisms exert some measure of control on tumor extension and metastasis in man, the effect of supplementation with vitamin C in lung cancer patients on survival should be tested in a clinical trial.

The results, over several years this laboratory has measured plasma and

Table 2: Comparison of the mean vitamin C values in normal individuals and patients with scurvy obtained in this laboratory with reports in the literature

Years	Mean vitamin C values				
	This laboratory (numbers in parentheses)		Literature		
	Buffy coat (Ug/108 cells)	Plasma (mg %)	Buffy coat (qtg/108 cells)	Plasma (mg %)	Number of studies*
<55 years	31.4 (46)	1.03 (31)	29.1	0.88	7
>65 years	25.6 (88)	0.45 (102)	20.8	0.45	13
Institutionalized	10.4 (142)	0.18 (246)	14.3	0.22	25
Scurvy	5.3 (5)	0.1 (5)	3.7	0.09	6

leukocyte vitamin C in a number of population groups, many concurrent with this survey of lung cancer patients. Values in these populations agree well with the literature (Table 2) [148] and allow us to establish tentative thresholds below which plasma and leukocyte levels are associated with scurvy and hypovitaminosis C; a condition in which reduced vitamin C reserves may affect health though not leading to overt scurvy [148].

CONCLUSION

The current review studied that a role of vitamins such as C, E, and A in medicinal field, particularly in lung disease-lung cancer. Vitamin C plays a significant role in daily life, dietary system like eating food, vegetable and smoking of cigarette. It helps to prevent or stop the damage the lung tissue/or cause lung cancer. The study reported that the use of vitamin C act as antioxidant in diseases such as lung disease, i.e., role of vitamin C in lung cancer.

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