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Effects of Vitamin C and E on Certain Blood Cell Parameters: A Study on Male Undergraduate Asthmatic of University of Port Harcourt, Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

An antioxidant is a substance that protects cells from the damage caused by free radicals (unstable molecules made by the process of oxidation during normal metabolism). Vitamin C and E are examples of antioxidants. This study was aimed at investigating the effect of Vitamin C and E on some Red blood cell parameters using 35 Subjects which were grouped into 7 groups. (Group A- Negative control, Group B- positive control administered with Vitamin E, Group C -Asthmatic subjects administered with Vitamin C, Group D-Smokers subjects administered with Vitamin E.) Subjects in group B, C and D were orally administered with 1000IU of Vitamin E once daily for 28days. Subjects in group B, C served as the positive control that were administered Vitamin C and Vitamin E once daily for 28 days while group A served as negative control without any administration of vitamins. Blood samples were taken on the 8th, 15th, 22nd and 29th day of administration through the venal puncture. The result of the study showed that Vitamin C and E was

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unable to attenuate the effects of Asthma on Red blood cell parameters such as Red blood cell count, hematocit and Heamoglobin concentration as the value of p>0.05 In both male and female subjects, However Vitamin E though did not proof to improve Red blood cell count and other parameters, Vitamin E was able to decrease the Red blood cell distribution width, the value of p<0.05 which signifies that Vitamin E intake in asthmatic subjects is capable of maintaining the shape and sizes of Red blood cells in male subjects.

Keywords: Vitamin C effect; antioxidant; vitamin E; oxygen concentrations.

1. INTRODUCTION

The lung is constantly exposed to higher oxygen concentrations than any hydrogen peroxide due to its huge surface area. As a result, the lung's exposure to free radicals is crucial. The burden of free radicals results from oxidative metabolism within cells, which produces oxygen species. Inhaled radicals (reactive oxygen species (ROS), nitrogen dioxide, and tobacco smoke), non-radicals (ozone), and other hazardous particles, including oxides of nitrogen and sulphur, further accelerate this in the lung [1,2]. Oxidants are a major cause of many lung diseases, including asthma and bronchopulmonary dysplasia. It has been found that people with asthma have very high levels of immunoglobin E (IgE) in their blood. IgE is an antibody that causes an immediate immune response [3,4].

The lungs do not just suffer from an oxidative attack. Instead, they are well equipped with antioxidant defence mechanisms. Antioxidant enzymes, superoxide dismutase (SOD), glutathione peroxidase (GPx), expiratory manoeuvre during pulmonary function, and catalase (CAT) are some of the main processes. SOD is essential for defending tissues and cells from oxidative stress [5-7,8]. The catalase and glutathione redox cycles work together to scavenge hydrogen peroxide and alkyl hydroperoxides, respectively. Significant information on oxidative stress can be learned from measuring these antioxidant defences in the blood.

Asthma is a major public health problem around the world. The disease affects approximately 20.3 million people, nearly 6.3 million of whom are under the age of 18 [9]. It accounts for an estimated 14.5 million lost workdays for adults and 14 million lost school days for children annually. The collective cost of the disease is estimated at $14.0 billion for the year 2002 [10,11]. According to the Environmental Protection Agency, secondhand smoke aggravates the asthma of between 200,000 and a million children each year in the United States. Additionally, it is thought to be the cause of 8,000–26,000 new cases of asthma in children each year in the United States. A 1996 meta-analysis by DiFranza and Lew found that household smoking is linked to an increased prevalence of asthma, accounting for between 307,000 and 522,000 cases among children under the age of 15, and that secondhand smoke aggravates asthma already present, leading to about 0.5 million paediatric doctor visits annually [12,13-17].

According to some reports [18,19,20,21], the severity and course of asthma can alter blood cell lineages. Eosinophilia, neutrophilia, leukocytosis, and an elevated erythrocyte sedimentation rate are common haematological abnormalities seen in asthma. Additionally, smoking has been proven to be one of the biggest causes of death worldwide. Smoking affects haematological markers both acutely and chronically [22]. Hence, this study aims to investigate the effect of vitamin C and vitamin E on the red blood cell parameters of male asthmatics and smokers at the University of Port Harcourt.

2. MATERIALS AND METHODS

The study used a description cross sectional method. A total of 35 male/ subjects were recruited for the study. The 35 subjects include 35 were selected from the University of Port Harcourt according to the following categories:

Group 1 - Consist of 5 apparently healthy subjects used as normal control group and were not administered with any drug, throughout the

period of the experiment. Group2 consist of 5 apparently healthy subjects male which were administered with Vitamin C only, Group 3 consist of 5 apparently healthy control subjects administered with Vitamin E, Group 4 consist of 5 asthmatic subjects administered with vitamin C, Group 5 consists 5 asthmatic subjects administered with Vit. E, Group 6 consists of 5 male smokers administered with vitamin C, while Group 7 consist of 5 smokers administered with vitamin E.

Prior to the start of the experiment, approval was sort and gotten from the university of Port Harcourt research ethical committee. All participating subjects were recruited within the campus with appropriate sensitization of the research procedures and they voluntarily gave their informed consent. Inclusion criteria for control group were apparently healthy subjects who were not on any form of drugs. Currently on any disease condition. Asthmatic patients were recruited on the bases, that they have no underlying treatment of any other health challenges, and has been asthmatic for a minimum of 2 years subjects were only subjected to bronchodilators for the management of Asthma. While smokers were selected on the bases of duration of smoking with a minimum of 1 year smoking experience. The study population includes smokers and asthmatic students of the Department of Human Physiology, Faculty of Basic medical sciences. Anthropometric parameters such as (Age, height, weight, BMI, systolic and diastolic blood pressure were measured at the beginning of the study.

1000mg of vitamin C and E respectively were administered daily for 28 days. Blood samples were collected from the cubital vein and transferred to EDTA bottle for haematological analysis using auto haematology analyser. Data obtained from the study were subjected to statistical analysis using SPSS version 23. statistical significant was determined using one way analysis of variance followed by post hoc multiple comparison test and $p<0.05$ was considered statistically significant, the values were expressed as mean ± standard deviation.

3. RESULTS

The data in Table 1 shows the anthropometric parameters of male subjects used in this study. The age of the study subjects ranges between 21 and 26 years. Considering the mean age of group 4 (ASVC) with respect to the mean age of group 1, the mean age was significantly higher than group 1, thus $p< 0.05$.

Considering the changes in the height of the respective study groups, there were generally non-significant changes when the heights of the groups were compared, except for group 6, which showed a significantly higher mean height when compared to group 4.

The weight of the respective subjects varied from 68 to 77 kg. However, there was no statistical significance when compared among the groups, thus $p> 0.05$.

Considering the BMI and SBP, there was no statistical significance when compared between their groups. The DBP of group 7 (SVE) was significantly higher when compared to group 3 (PCVE). There was also no statistical significance of the study MAP when compared between the groups, thus $p> 0.05$.

The result in the table above indicates the investigation of possible weekly changes in some red blood cell parameters among group 1 (negative control) male subjects in Port Harcourt. The total red blood cells at day 8 were significantly lower than those at day 0 when compared; day 15 was significantly lower than those at day 0 and 8, and days 22 and 29 were significantly lower than those at days 0, 8, and 15 when compared. But generally, the total red blood cells of group 1 male subjects decreased from days 0 to 29. The hemoglobin generally showed no statistical significance when compared among the days but decreased from days 0–22 and then increased on day 29. The hemocrit at day 15 of group 1 male subjects was significantly lower than day 0, and days 22 and 29 were significantly lower than days 0 and 8; however, the hemoglobin decreased serially from days 0 to 29. The mean corpuscular volume was generally non-significant when compared among the groups but decreased serially from days 0 to 29. The mean corpuscular hemoglobin of group 1 male subjects at days 22 and 29 was significantly higher when compared to days 0 and 8. Generally, the mean corpuscular hemoglobin increased serially from days 0–29. The mean

corpuscular hemoglobin concentration of group 1 male subjects at days 15 and 22 was significantly higher than on days 0 and 8, and on day 29, it was significantly higher than on days 0, 8, 15, and 22. Generally, hemoglobin increased serially from days 0–29. The RDW-SD at days 15 and 29 was significantly lower than day 0, and day 22 was significantly lower than days 0 and 8.

The result in Table 2 indicates the investigation of possible weekly changes in some red blood cell parameters among group 2 (positive control vitamin C) male subjects in Port Harcourt. The total red blood cell count on day 8 was significantly lower than on day 0 when compared, and on days 15, 22, and 29, it was significantly lower than on days 0 and 8 when compared. Generally, hemoglobin decreased serially from days 0–29.

The hemoglobin showed no statistical significance.

The hemocrit at day 8 was significantly lower than day 0, and days 15, 22, and 29 were significantly lower than days 0 and 8. Generally, the hemocrit decreased from 0-29.

The mean corpuscular volume at day 15 was significantly lower when compared to day 0, and the mean corpuscular volume at day 29 was significantly lower when compared to days 0 and 8. Generally, the MCV is from days 0-29.

The mean corpuscular hemoglobin at days 15, 22, and 29 was significantly higher than at days 0 and 8 when compared.

The mean corpuscular hemoglobin concentration at days 15, 22, and 29 was significantly higher than at days 0 and 8 when compared.

The RDW-SD at 29 was significantly lower than on day 8 when compared.

The RDW-CDP at day 29 was significantly lower than day 22 when compared.

The result in Table 3 indicates the investigation of possible weekly changes among group 3 (positive control vitamin E) male subjects in Port Harcourt. The total red blood cell count, haemoglobin, mean corpuscular volume, RDW-SD, and CDP generally showed no significance when compared among the weeks.

The haematocrit at day 29 was significantly lower when compared to days 0 and 22.

The mean corpuscular haemoglobin at day 15 was significantly higher than day 0 when compared; days 22 and 29 were significantly higher than days 0, 8, and 15.

The mean corpuscular haemoglobin concentration at day 8 was significantly higher than at day 0 when compared; at days 15 and 22 was significantly higher than at day 0; and 8, day 29, it was significantly higher than at days 0, 8, 15 and 22 when compared. Generally, the mean corpuscular haemoglobin concentration increased serially from day 0-29.

The result in Table 4 indicates the investigation of possible weekly changes among group 4 (asthmatic vitamin C) male subjects in Port Harcourt. The total red blood cell count at days 15 and 22 was significantly lower than day 0 when compared, and day 29 was significantly lower than day 0 and 8.

The haemoglobin, mean corpuscular volume, RDW-SD, and RDW-CDP were generally non-significant when compared among the weeks.

The hemocrit at day 29 was significantly lower than at day 0 when compared.

The mean corpuscular haemoglobin at days 22 and 29 was significantly higher than on days 0 and 8, at day 29 , the hemocrit was significantly higher than on days 0. 8 and 22.

The mean corpuscular haemoglobin concentration at days 15 and 29 was significantly higher than at days 0 and 8. At day 22, the haemoglobin was significantly higher than at day 0. Generally some of the parameters decreased while some increased but at day 22, there were general changes among the parameters where some increased (mean corpuscular haemoglobin and mean corpuscular hemoglobin concentration), day 22 decreased, where some decreased (red blood cell count, hemocrit, and mean corpuscular volume). day 22 increased.

List 1. Anthropometric parameters of male subjects

Groups	Age (years)	Height (m)	Weight (Kg)	BMI (Kg/m^2)	SBP (mmHg)	DBP (mmHg)	MAP (mmHg)
Group 1: Negative control (n=5)	21.00 ± 3.94 (18.00-27.00)	1.72 ± 0.12 (1.56-1.90)	77.60 ± 21.52 (58.00-113.00)	25.97 ± 5.57 (20.55-32.05)	118.00 ± 4.47 (110.00-120.00)	75.00 ± 8.66 (60.00-80.00)	89.33 ± 5.96 (80.00-93.33)
Group 2: PCVC (n=5)	23.00 ± 1.41 (22.00-25.00)	1.79 ± 0.03 (1.75-1.83)	68.20 ± 7.72 (60.00-78.00)	21.25 ± 3.02 (17.91-25.47)	116.00 ± 5.48 (110.00-120.00)	84.00 ± 6.52 (80.00-95.00)	94.66 ± 5.05 (90.00-103.33)
Group 3: PCVE (n=5)	23.50 ± 2.88 (20.00-27.00)	1.77 ± 0.10 (1.66-1.87)	72.75 ± 5.91 (64.00-77.00)	23.32 ± 3.83 (18.90-27.22)	115.00 ± 5.77 (110.00-120.00)	73.75 ± 9.46 (60.00-80.00)	87.50 ± 7.87 (76.67 ± 93.33)
Group 4: ASVC (n=5)	26.00 ± 2.83 [a] (24.00-28.00)	1.65 ± 0.06 (1.61-1.70)	68.00 ± 11.31 (60.00-76.00)	24.72 ± 2.23 (23.15-26.30)	112.00 ± 2.83 (110.00-114.00)	82.50 ± 3.53 (80.00-85.00)	92.33 ± 3.30 (90.00 ± 94.67)
Group 5: ASVE (n=5)	22.00 ± 0.00 (22.00-22.00)	1.75 ± 0.00 (1.75-1.75)	68.00 ± 0.00 (68.00-68.00)	22.20 ± 0.00 (22.20-22.20)	120.00 ± 0.00 (120.00-120.00)	80.00 ± 0.00 (80.00-80.00)	93.33 ± 0.00 (93.33-93.33)
Group 6: SVC (n=5)	22.80 ± 0.45 (22.00-23.00)	1.81 ± 0.09 [d] (1.69-1.92)	74.20 ±10.08 (60.00-85.00)	22.45 ± 2.17 (21.01-26.23)	134.00 ± 28.81 (110.00-180.00)	85.60 ± 15.39 (70.00-110.00)	101.73 ± 19.62 (83.33-133.33)
Group 7: SVE (n=5)	23.66 ± 3.78 (19.00-30.00)	1.72 ± 0.08 (1.60-1.82)	73.66 ± 13.21 (62.00-91.00)	25.11 ± 5.63 (19.97-35.15)	126.66 ± 10.33 (120.00-140.00)	87.16 ± 9.17 [c] (78.00-100.00)	100.33 ± 8.78 (92.00-113.33)

Values represent mean ± SD. The values in parenthesis indicate minimum and maximum limits of the respective variables. [a] Significant at p<0.05 when compared to Group 1; [b] Significant at p<0.05 when compared to group 2; [c] Significant at p<0.05 when compared to group 3; [d] Significant at p<0.05 when compared to group 4; [e] Significant at p<0.05 when compared to group 5; [f] Significant at p<0.05 when compared to group 6. BMI= Body Mass Index; SBP= Systolic Blood Pressure; DBP=Diastolic Blood Pressure; MAP=Mean Arterial Pressure

Table 1. Investigation of weekly changes in some Red blood cell parameters of group 1 (negative control) male subjects in Port Harcourt

Day	Red blood cell count (10^6/uL)	Hemoglobin (g/dL)	Hematocrit (%)	Mean corpuscular cell volume (fL)	Mean corpuscular cell haemoglobin (pg)	Mean corpuscular haemoglobin concentration (g/dL)	Red blood cell distribution width-standard deviation (fL)	Red blood cell distribution width-coefficient of variation (%)
0(n=5)	5.56± 0.29	13.76±2.29	47.40±5.02	85.30±6.78	24.64±3.53	28.84±2.11	47.90 ± 1.93	15.50± 1.13
8(n=5)	4.90±0.10 [a, b]	12.65±2.61	38.45±5.30	78.40±9.05	25.70±4.81	32.70±2.26	43.80 ± 4.52	15.45 ± 3.04
15(n=5)	3.59±0.25 [a, b]	12.50±3.53	27.85±5.87 [a]	77.30±10.75	34.50±7.35	44.45±3.32 [a, b]	42.75 ± 3.04 [a]	15.15 ± 2.76
22(n=5)	3.01±0.05 [a, b, c]	11.70±3.39	22.80±3.67 [a, b]	75.8±10.61	44.50±2.40 [a, b]	50.75±6.72 [a, b]	37.40 ± 1.55 [a, b]	13.50 ± 1.98
29(n=5)	2.74±0.08 [a, b, c]	12.25±2.89	20.45±3.75 [a, b]	74.60±11.17	44.50±9.19 [a, b]	59.60±3.25 [a, b, c, d]	40.60 ± 2.97 [a]	14.95 ± 2.90

Values represent mean ± SD, [a] Significant at p<0.05 when compared to Group 1; [b] Significant at p<0.05 when compared to group 2; [c] Significant at p<0.05 when compared to group 3; [d] Significant at p<0.05 when compared to group 4.

Table 2. A Investigation of possible weekly changes in some red blood cell parameters of Group 2 (positive control vitamin C) male subjects in Port Harcourt

Day	Red blood cell count (10^6/uL)	Hemoglobin (g/dL)	Hematocrit (%)	Mean corpuscular cell volume (fL)	Mean corpuscular cell haemoglobin (pg)	Mean corpuscular haemoglobin concentration (g/dL)	Red blood cell distribution width-standard deviation (fL)	Red blood cell distribution width-coefficient of variation (%)
0(n=5)	2.48 ± 0.23	13.80 ± 1.64	41.50 ± 4.99	86.48 ± 2.79	28.74 ± 2.26	33.30 ± 2.76	42.08 ± 3.56	13.44 ± 0.83
8(n=5)	2.76 ± 0.53 a, b	14.54 ± 1.11	30.76 ± 1.79 [a]	85.88 ± 1.69	40.48 ± 4.22	47.91 ± 15.21	43.18 ± 3.50	13.92 ± 0.98
15(n=5)	2.83 ± 0.51 a, b	15.88 ± 3.79	23.32 ± 4.63 [a, b]	82.46 ± 1.93 [a]	59.86 ±19.31 [a, b]	68.64 ± 21.22 [a, b]	41.06 ± 2.75	13.07 ± 0.76
22(n=5)	3.59 ± 0.18 a	14.76 ± 0.96	22.94 ± 4.79 [a, b]	83.00 ± 4.25	54.64 ± 6.01 [a, b]	65.88 ± 9.68 [a, b]	42.74 ± 3.36	14.12 ± 0.63
29(n=4)	4.79 ± 0.49ab	14.25 ± 0.60	20.12 ± 2.23 [a, b]	80.82 ± 1.95 [a, b]	57.82 ± 7.03 [a, b]	73.57 ± 10.52 [a, b]	38.47 ± 3.01 [b]	12.82 ± 0.74 [d]

Values represent mean ± SD, [a] Significant at p<0.05 when compared to Group 1; [b] Significant at p<0.05 when compared to group 2; [c] Significant at p<0.05 when compared to group 3; [d] Significant at p<0.05 when compared to group 4.

Table 3. Investigation of possible weekly changes in some red blood cell parameters of Group 3 (positive control vitamin E) male subjects in Port Harcourt

Day	Red blood cell count (10^6/uL)	Hemoglobin (g/dL)	Hematocrit (%)	Mean corpuscular cell volume (fL)	Mean corpuscular cell haemoglobin (pg)	Mean corpuscular haemoglobin concentration (g/dL)	Red blood cell distribution width-standard deviation (fL)	Red blood cell distribution width-coefficient of variation (%)
0n=5	4.87 ± 0.15	13.57 ± 1.00	45.42 ± 2.48	93.32 ± 2.52	27.82 ± 1.45	29.82 ± 0.91	41.67 ± 2.15	12.37 ± 1.02
8n=5	4.36 ± 0.41	14.42 ± 0.78	39.80 ± 3.92	91.30 ± 2.17	33.20 ± 3.51	36.40 ± 3.57 [a]	42.20 ± 2.05	12.82 ± 0.93
15n=5	3.46 ± 0.39	14.07 ± 0.73	31.20 ± 3.47	90.17± 2.47	40.87 ± 4.36 [a]	45.40 ± 4.28 [a, b]	41.12 ± 2.01	12.62 ± 0.79
22n=5	6.28 ± 5.81	16.05 ± 3.39	43.50 ± 28.98	83.15 ± 14.37	52.87 ± 12.36 [a, b, c]	47.90 ± 5.16 [a, b]	34.57 ,± 14.47	12.70 ± 0.24
29n=5	2.51 ± 0.17	14.47 ± 0.75	21.67 ± 1.74 [a, d]	86.35 ± 2.98	57.92 ± 5.34 [a, b, c]	66.97 ± 5.75 [a, b, c, d]	40.07 ± 3.66	12.90 ± 1.29

Values represent mean ± SD, [a] Significant at p<0.05 when compared to Group 1; [b] Significant at p<0.05 when compared to group 2; [c] Significant at p<0.05 when compared to group 3; [d] Significant at p<0.05 when compared to group 4.

Table 4. Investigation of possible weekly changes in some red blood cell parameters of group 4 (asthmatic vitamin C) male subjects in Port Harcourt

Day	Red blood cell count (10^6/uL)	Hemoglobin (g/dL)	Hematocrit (%)	Mean corpuscular cell volume (fL)	Mean corpuscular cell haemoglobin (pg)	Mean corpuscular haemoglobin concentration (g/dL)	Red blood cell distribution width-standard deviation (fL)	Red blood cell distribution width-coefficient of variation (%)
0n=5	5.01 ± 0.83	14.70 ± 2.54	45.20 ± 10.89	89.80 ± 6.79	29.25 ± 0.21	32.75 ± 2.33	45.95 ± 4.59	14.15 ± 0.35
8n=5	4.52 ± 1.21	14.15 ± 1.90	40.70 ± 13.72	89.10 ± 6.50	31.80 ± 4.24	35.95 ± 7.42	45.95 ± 4.59	14.25 ± 0.35
15n=5	2.72 ± 0.51 [a]	14.90 ± 0.85	23.00 ± 6.36	83.95 ± 7.56	55.30 ± 7.35 [a, b]	66.75 ± 14.78 [a, b]	41.70 ± 4.52	13.65 ± 0.35
22n=5	3.04 ± 0.56 [a]	14.30 ± 2.83	26.05 ± 6.86	85.25 ± 6.86	46.90 ± 0.56 [a, b]	55.35 ± 3.75 [a]	39.70 ± 4.81	12.70 ± 0.56
29n=5	2.38 ± 0.11 [a, b]	14.65 ± 1.48	19.65 ± 0.21 [a]	82.90 ± 4.81	61.70 ± 9.19 [a, b, d]	74.45 ± 6.72 [a, b]	40.85 ± 5.72	13.45 ± 1.34

Values represent mean ± SD, [a] Significant at p<0.05 when compared to Group 1; [b] Significant at p<0.05 when compared to group 2; [c] Significant at p<0.05 when compared to group 3; [d] Significant at p<0.05 when compared to group 4.

The result in Table 5 indicates the investigation of possible wily changes in some red blood cell parameters among group 5 (asthmatic vitamin E) male subjects in Port Harcourt. The total red blood cell count at day 15 and 22 was significantly lower than day 0 and 8, day 29 was significantly lower than day 0, 8, and 15. Thus, > 0.05. Generally the total red blood cell count from day 0 to 29 decreased serially. The haemoglobin from day 0-29 was generally non-significant when compared among the weeks. The haematocrit at day 8 was significantly lower than day 0, day 15 was significantly lower than day 0 and 8, day 22 was significantly lower than day 0, 8 and 22, day 29 was significantly lower than day 0,8,15 and 22.

The mean corpuscular volume at day 15 was significantly lower than day 0, day 22 was significantly lower than day 0, 8, 15 when compared, day 29 was significantly lower than day 0, 8, 15 and 22 when compared. Generally, the mean corpuscular volume decreased from day 0-29 serially. The mean corpuscular haemoglobin at day 8 was significantly higher than 0, day 15 was significantly higher than day 0 and 8 when compared, day 22 was significantly higher than day 0, 8 and 15, day 29 was significantly higher than day 0, 8,15 and 22 when compared. Generally, the mean corpuscular haemoglobin increased serially from day 0-29 following the administration of vitamin E on asthmatic male subjects. The mean corpuscular haemoglobin concentration at day 8 was significantly higher than day 0, day 15 was significantly higher than day 0 and 8, day 22 was significantly higher than day 0,8 and 15, day 29 was significantly higher than day 0,8,15 and 22 when compared. Generally, the mean corpuscular haemoglobin concentration increased serially from day 0-29 following the administration of vitamin E on asthmatic male subjects.

The RDW-SD at day 8 and 15 was significantly lower than day 0, day 22 was significantly lower than day 0,8 and 15, day 29 was significantly lower than day 0,8,15 and 22 when compared. The RDW-CDP at day 0,15,22 and 29 was significantly lower than day 0.

The result in Table 6 indicates the investigation of possible weekly changes in some red blood cell parameters of group 6 (smoking vitamin C) male subjects in Port Harcourt. The total red blood cell count at day 8 was significantly lower than day 0, and days 15 and 22 was significantly lower than days 0 and 8 when compared. Day 29 was significantly lower than days 0, 8 and 15. Generally, the total red blood cell count decreased from days 0–29.

The haemoglobin, RDW-SD, and RDW-CDP generally showed no significance when compared among the weeks.

The haematocrit at day 8 was significantly lower than day 0, day 15 was significantly lower than day 0 and 8, day 22 and 29 were significantly lower than day 0, 8, and 15. Generally, the haematocrit decreased from days 0-29.

The mean corpuscular volume at day 29 was significantly lower than day 0 and 8 p> 0.05. Generally, the mean corpuscular volume decreased from days 0–29.

The mean corpuscular haemoglobin and mean corpuscular haemoglobin concentrations at day 8 were significantly higher than day 0, day 15 was significantly higher than day 0 and 8, day 22 was significantly higher than day 0, 8, and 15, and day 29 was significantly higher than day 0, 8, 15, and 22 when compared. Generally, both the mean corpuscular haemoglobin and mean corpuscular haemoglobin concentration were increasing serially from day 0–29.

The result in Table 7 indicates the investigation of possible weekly changes in some red blood cell parameters of group 7 (smoking vitamin E) male subjects in Port Harcourt. The total red blood cell count at day 8 was significantly lower than day 0, day 15 and 22 were significantly lower than days 0 and 8, and day 29 was significantly lower than days 0, 8, and 15. Generally, the total red blood cells decreased serially from days 0–29.

The haemoglobin and RDW-CDP were generally non-significant.

The hemocrit at day 8 was significantly lower than day 0, day 15 and 22 were significantly lower than days 0 and 8, and day 29 was significantly lower than days 0, 8, and 15. Generally, the hemocrit decreased serially from days 0–29.

Table 5. Investigation of possible weekly changes in some red blood cell parameters of group 5 (asthmatic vitamin E) male subjects in Port Harcourt

Day	Red blood cell count (10^6/uL)	Hemoglobin (g/dL)	Hematocrit (%)	Mean corpuscular cell volume (fL)	Mean corpuscular cell haemoglobin (pg)	Mean corpuscular haemoglobin concentration (g/dL)	Red blood cell distribution width-standard deviation (fL)	Red blood cell distribution width-coefficient of variation (%)
0n=5	5.57 ± 0.63	14.40 ± 0.42	48.65 ± 1.20	95.75 ± 1.34	27.50 ± 0.00	28.70 ± 0.42	64.40 ± 0.42	18.80 ± 0.57
8n=5	5.05 ± 0.21	15.30 ± 0.42	45.85 ± 0.35 [a]	93.50 ± 0.42	30.90 ± 0.42 [a]	33.00 ±0.28 [a]	43.05 ± 0.49 [a]	13.10 ± 0.56 [a]
15n=5	3.41 ± 0.39 [a, b]	14.80 ± 0.42	13.55 ± 0.35 [a, b]	91.05 ± 0.92 [a]	39.90 ± 0.99 [a, b]	42.90 ± 0.84 [a, b]	43.10 ± 0.56 [a]	13.90 ± 1.13 [a]
22n=5	2.73 ± 0.80 [a, b]	14.50 ± 0.71	24.15 ± 0.49 [a, b, c]	87.05 ± 1.20 [a, b, c]	53.45 ± 0.35 [a, b, c]	60.25 ± 1.34 [a, b, c]	40.15 ± 0.64 [a, b, c]	12..55 ± 0.35 [a]
29n=5	2.43 ± 0.12 [a, b, c]	14.45 ± 0.49	18.55 ± 0.35 [a, b, c, d]	78.65 ± 0.64 [a, b, c, d]	59.10 ± 1.27 [a, b, c, d]	77.50 ± 0.71 [a, b, c, d]	36.70 ±.0.56 [a, b, c, d]	13.15 ± 0.64 [a]

Values represent mean ± SD, [a] Significant at p<0.05 when compared to Group 1; [b] Significant at p<0.05 when compared to group 2; [c] Significant at p<0.05 when compared to group 3; [d] Significant at p<0.05 when compared to group 4.

Table 6. Investigation of possible weekly changes in some red blood cell parameters of Group 6 (smoker vitamin C) male subjects in Port Harcourt

Day	Red blood cell count (10^6/uL)	Hemoglobin (g/dL)	Hematocrit (%)	Mean corpuscular cell volume (fL)	Mean corpuscular cell haemoglobin (pg)	Mean corpuscular haemoglobin concentration (g/dL)	Red blood cell distribution width-standard deviation (fL)	Red blood cell distribution width-coefficient of variation (%)
0n=5	4.96 ± 0.68	15.00 ± 0.99	45.08 ± 5.48	91.18 ± 4.35	30.78 ± 5.87	33.80 ± 6.34	42.72 ± 2.61	13.02 ± 1.17
8n=5	4.03 ± 0.55 [a]	15.14 ± 1.18	36.52 ± 4.97 [a]	90.84 ± 4.45	38.12 ± 6.44 [a]	42.08 ± 6.98 [a]	41.04 ±2.77	12.54 ± 1.19
15n=5	3.15 ± 0.20 [a, b]	14.72 ± 0.74	28.46 ± 2.18 [a, b]	88.78 ±3.97	45.94 ±3.38 [a, b]	51.80 ± 3.07 [a, b]	40.18 ± 3.18	12.56 ± 1.18
22n=5	2.68 ± 0.31 [a, b]	20.48 ± 13.44	23.20 ± 2.26 [a, b, c]	86.78 ±3.34	54.34 ±5.34 [a, b, c]	62.76 ± 5.57 [a, b, c]	40.60 ± 4.26	13.46 ± 0.96
29n=5	2.20 ± 0.24 [a, b, c]	13.72 ± 1.19	18.48 ± 2.01 [a, b, c]	84.44 ± 4.00 [a, b]	64.78 ± 4.52 [a, b, c, d]	74.54 ± 6.27 [a, b, c, d]	40.28 ± 4.29	13.12 ± 1.00

Values represent mean ± SD, [a] Significant at p<0.05 when compared to Group 1; [b] Significant at p<0.05 when compared to group 2; [c] Significant at p<0.05 when compared to group 3; [d] Significant at p<0.05 when compared to group 4.

Table 7. Investigation of possible weekly changes in some red blood cell parameters of Group 7 (smoker vitamin E) male subjects in Port Harcourt

Day	Red blood cell count (10^6/uL)	Hemoglobin (g/dL)	Hematocrit (%)	Mean corpuscular cell volume (fL)	Mean corpuscular cell haemoglobin (pg)	Mean corpuscular haemoglobin concentration (g/dL)	Red blood cell distribution width-standard deviation (fL)	Red blood cell distribution width-coefficient of variation (%)
0n=5	5.66 ± 0.34	15.26 ± 0.61	50.04 ± 1.66	88.62 ± 3.45	26.92 ± 1.09	30.44 ± 0.53	46.18 ± 3.59	14.42 ± 1.08
8n=5	4.75 ± 0.48 [a]	15.35 ± 1.08	41.71 ± 3.65 [a]	87.96 ± 3.46	32.43 ± 3.27	36.96 ± 3.87	45.74 ± 3.25	13.73 ± 1.91
15n=5	3.03 ± 0.51 [a, b]	15.10 ± 0.63	25.62 ± 3.73 [a, b]	85.02 ± 2.69	51.00 ± 9.46 [a, b]	59.98 ± 9.60 [a, b]	42.74 ± 2.61	13.88 ± 0.61
22n=5	2.67 ± 0.95 [a, b]	12.56 ± 5.92	22.72 ± 8.34 [a, b]	84.24 ± 2.13	42.76 ±12.98 [a, b]	50.30 ± 15.39 [a, b]	41.24 ± 2.57 [a, b]	13.50 ± 0.70
29n=5	2.15 ± 0.53 [a. b, c]	13.34 ± 3.7	17.56 ± 4.08 [a, b, c]	81.44 ± 4.97 [a, b]	61.22 ± 3.56 [a, b, c, d]	75.40 ± 5.93 [a, b, c, d]	40.60 ± 2.10 [a, b]	13.70 ± 0.35

Values represent mean ± SD, [a] Significant at p<0.05 when compared to Group 1; [b] Significant at p<0.05 when compared to group 2; [c] Significant at p<0.05 when compared to group 3; [d] Significant at p<0.05 when compared to group 4.

The mean corpuscular volume at day 29 was significantly lower than at days 0 and 8. Generally, the mean corpuscular volume decreased serially from days 0–29.

The mean corpuscular haemoglobin and mean corpuscular haemoglobin concentrations at days 15 and 22 were significantly higher than on days 0 and 8, and on day 29, they were significantly higher than on days 0, 8, 15, and 22 when compared.

The RDW-SD at days 15 and 22 was significantly lower than at days 0 and 8. Generally, the RDW-SD decreased serially from day 0.

4. DISCUSSION

The results revealed that there was a significant increase in mean corpuscular haemoglobin, MCHC, and MCH. In male subjects administered vitamin C on the 8th day of the experiment, vitamin E on the 8th day showed a significant decrease in RBC count, hematocit, MCH, and MCHC in asthmatic subjects. In smoker subjects, there was a significant reduction in red blood cell count, hematocit, and red blood cell distribution width on day 8 and an increase in MCH and MCHC.

The RBC count has been reported to significantly increase as the intensity of smoking increases, which is explained by the fact that tissue hypoxia is caused by the increased creation of carboxyhemoglobin, leading to an increased secretion of erythropoietin, thereby increasing erythropoiesis [23,24].

Haemoglobin concentrations are increased in groups administered vitamin E. Some researchers hypothesised that an increase in haemoglobin levels in smokers' blood might represent a compensatory mechanism [25,26]. Exposure to carbon monoxide is believed to be a mediator of the increase in hemoglobin concentration. To create carboxyhaemoglobin, which is an inactive version of haemoglobin with no ability to deliver oxygen, carbon monoxide binds to haemoglobin (Hb). Additionally, carboxyhemoglobin pushes the left side of the Hb dissociation curve, which reduces Hb's capacity to carry oxygen to the tissue [27,28]. Smokers continue to maintain a higher haemoglobin level than non-smokers in order to make up for the reduced oxygen-delivering capacity. On day 15, asthmatic male subjects administered vitamin C showed no significant changes in red blood cell parameters; however, in male subjects, there was an increase in MCV, MCH, and MCHC. Studies have shown that mean corpuscular volume (MCV) and mean corpuscular haemoglobin (MCH) are significantly higher among smokers [25,29]. This shows that administration of Vitamin E and C causes no significant changes in MCV and MCh. On day 29 of the experiment, asthmatic subjects administered vitamin E showed a significant decrease in RBC count, haemoglobin, MCCV, and red cell distribution width. (RDW). RDW is computed as the measure of variations in the mean body volume (MCV) [30,31]. Higher values for RDW suggest greater variation in MCV (anisocytosis), and these are typically caused by a disruption in erythro maturing or degradation. This is because RDW computes the mean corpuscular volume (MCV) itself. Accordingly, the current study's findings showed that vitamin E improved red cell distribution width in smokers and asthmatics and, as such, has the ability to preserve the size and shape of moving erythrocytes. There was an increase in MCH and MCHC in male smokers administered with Vitamin C and E at day 29. There was a significant decrease in RBC count, hematocrit, and MCV, while there was a significant increase in MCHC and MCHC. The increased MCV may reflect the presence of immature RBCs in the peripheral blood, perhaps arising from the body's compensatory mechanism to cater for the smoke- or asthma-induced deficit in RBC concentration [32,31,33].

5. CONCLUSIONS

The result of the study showed that vitamin C and E were unable to attenuate the effects of asthma on red blood cell parameters such as red blood cell count, haematocit and haemoglobin concentration. In both male and female subjects, however, vitamin E did not prove to improve red blood cell count, and other parameters were able to decrease the red blood cell distribution width, which signifies that vitamin E intake in asthmatic subjects is capable of maintaining the shape and

size of red blood cells in both male and female subjects.

CONSENT

As per international standards or university standards, Participants' written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

As per international standards or university standards written ethical approval has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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