



## **Comparison of Hemoglobin (Hb) and Hematocrit (HCT) Value in Normal and Cancer Patients- An *In-vitro* Study**

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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**

**Introduction:** Hemoglobin is the molecule in Red blood cells (RBC) that carries oxygen from the lungs to the body's tissues and returns carbon dioxide gas from the tissues back to the lungs. The hematocrit is the ratio of the quantity of Red blood cells to the amount of these components together, called blood. The hematocrit measures the amount of red blood cells compared to the whole blood volume (red blood cells and plasma). The research is required to find out whether the cancer affects the traditional Hb and HCT value.

**Aim:** The aim of this study is to evaluate the difference between the normal and cancer patient's Hb and HCT values.

**Materials and Methods:** A Total of 20 samples were included in this study. Divided into two groups of normal and cancer patients. The details of Hemoglobin and Hematocrit values were noted down from the routine Complete blood count analysis and regression analysis is done through SPSS version 23.

**Results:** The results showed that there is significant difference between the Hemoglobin and Hematocrit value between normal and cancerous patients. Comparison of Hemoglobin and Hematocrit value in normal and cancer patients showed mean value of the Hb in control patients as 13.9g/dl with a standard deviation of 1.4 and in squamous cell carcinoma as 12.97g/dl with a

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standard deviation of 2.6 and the mean value of the HCT in the control group is 40.5% with a standard deviation of 3.9 and in the cancer group it is 39.0 with a standard deviation of 7.7. with a significant difference between Hb and HCT level with a p value <0.05

**Conclusion:** The study found that there is a significant difference between the Hemoglobin and Hematocrit value among Squamous cell carcinoma compared to normal patients. As the therapy for cancers target the bone marrow, proliferative cells, the hematological parameter analysis is necessary to know the prognosis of the cancer individual.

*Keywords: Red blood cells; hemoglobin; hematocrit; cancer cells; innovative technique.*

## 1. INTRODUCTION

Hemoglobin in Red blood cells carries oxygen from the lungs to the body tissues and returns Carbon-di-oxide gas from the tissues back to the lungs. Hemoglobin contains four globin chains connected together to the Hemoglobin (abbreviated Hgb or Hb) molecule that contains two alpha-globin chains and two beta globin chains [1] and infants with two alpha chains and two gamma chains. While as the infants grow, gamma chains are gradually replaced by beta chains, forming adult hemoglobin structure [2]. Each globulin chain contains a very important iron-containing porphyrin compound termed heme. Heme compound is an iron atom that is vital in transporting oxygen and carbon-di-oxide emission in our blood. The iron contained in hemoglobin is additionally to blame for the red colour of blood [3,4]. Hemoglobin also plays a crucial role in maintaining the form of the red blood cells [5].

The hematocrit is the volume of percentage of RBC in blood expressed as a percentage or fraction. The hematocrit measures the amount of red blood cells compared to the whole blood volume (red blood cells and plasma). The traditional hematocrit for men is 40 to 54%; for girls it is 36 to 48% [6]. This value is determined directly by microhematocrit centrifugation or calculated indirectly. Automated cell counters calculate the hematocrit by multiplying the red cell number (in millions/mm<sup>3</sup>) by the mean cell volume in femtoliter [7]. If a patient is severely dehydrated, the hemoglobin and hematocrit will appear more than if the patient were normovolaemic; if the patient is fluid overloaded, they're going to be less than their actual level. To assess true red cell mass, independent radionuclide evaluation of the red cells and plasma must be performed [8].

Hemoglobin is measured as a component of the routine complete blood count (CBC) test from a blood sample. Typical changes are as follows:

adult men: 38.8 to 50 percent adult women: 34.9 to 44.5 percent. The particular lab that analyses the results will determine the traditional hematocrit range of a particular age [9]. Some methods are there for measuring hemoglobin value, most of them are currently done by automated machines which are designed to perform different tests on blood. Within the machine, the red blood cells are de-escalated to urge the hemoglobin into an answer [10,11]. The free hemoglobin is exposed to cyanide which binds tightly with the hemoglobin molecule to make cyanmethemoglobin [12].

The hemoglobin level is expressed in grams (gm) per deciliter (dL) of blood, a deciliter. The normal value ranges for hemoglobin rely on the age and gender of the person. The conventional ranges of Newborns: 15 to 20 gm/dL. Children: 11 to 13 gm/dL. Adult males: 14 to 18 gm/dL. Adult women: 12 to 16 gm/dL. No challenges were faced in previous research. Our team has extensive knowledge and research experience that has translate into high quality publications [13-34]. The aim of the study is to search out the difference between the Hemoglobin and Hematocrit values of Normal and Cancer patient.

## 2. MATERIALS AND METHODS

An in vitro study was conducted in Saveetha Dental College and Hospital, Chennai in the month of Febraury 2021. The study and data collected were approved by the Institutional ethical committee. Routine blood sample datas were taken from the clinical lab of both squamous cell carcinoma and normal patients. Supporting the previous research work, articles are collected and also the work be applied accordingly. A collected sample data size was twenty and the data was randomly taken, and divided into two groups. Of those ten were from cancer patients and ten were from normal or control patients. The samples were collected in a lavender vacutainer tube which is used for cell counting. This lavender vacutainer tube contains

anti-coagulant. Then the samples undergone for CBC test - Complete blood count test. The Hb and HCT values of both squamous cell carcinoma and normal patients were noted and tabulated. Regression analysis was done through SPSS software version 23.

### 3. RESULTS

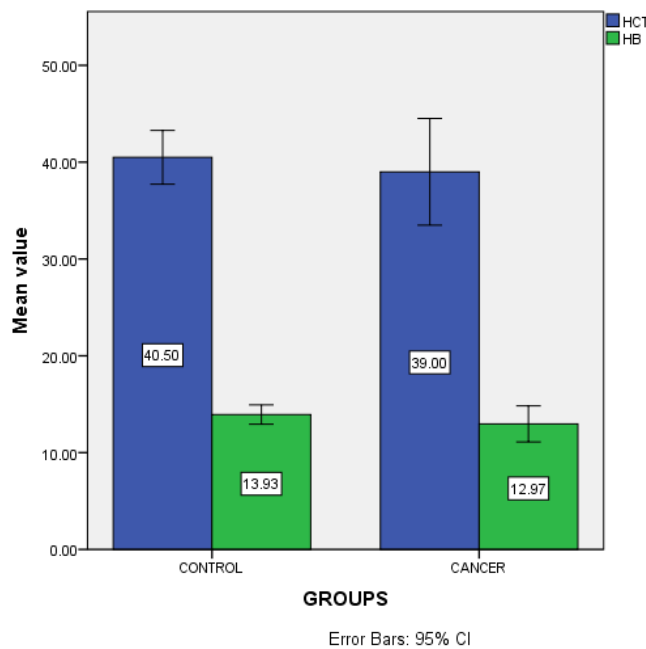
The present study depicts the mean value of HCT is 40.5% in control patients with a standard deviation of 3.9 and squamous cell carcinoma patients with HCT of 39% and standard deviation of 7.7. The mean value of Hb in control patients is 13.9g/dl with a standard deviation of 1.4 and in squamous carcinoma patients with 12.97g/dl with a standard deviation of 2.6 (Table 1).

Depicts the difference between the normal and cancer patients in the Hb and HCT value. The blue colour denotes the HCT value and the green colour denotes the Hb value.

The difference between Hb and Hematocrit values of cancer and normal patients showed a mean value of hemoglobin as 13.93+1.4 in control patients and 12.97+2.6 in cancer patients. Mean value of Hematocrit as 40.5+3.9 in control cases and 39+7.7 in cancer patients (Fig. 1). Regression analysis of Hb and HCT showed statistically significant values ( $p < 0.05$ ) of squamous cell carcinoma and normal patients (Table 3).

**Table 1. This table depicts the independent t test results of the two groups containing 10 samples in each group. The mean value of the HCT in the control group is 40.5% with a standard deviation of 3.9 and in the cancer group it is 39.0 with a standard deviation of 7.7. The mean value of the HB in control is 13.9 g/dl with a standard deviation of 1.4 and in cancer it is 12.97 g/dl with a standard deviation of 2.6**

Group Statistics					
Groups			Mean	Std. deviation	Std. error mean
HeT	Control	10	40.5000	3.87499	1.22538
	Cancer	10	39.0000	7.70022	2.43502
HB	Control	10	13.9300	1.40004	4427
	Cancer	10	12.9700	2.59746	82139



**Fig. 1. This bar chart depicts the difference between the normal and cancer patients in the Hb and HCT value. The blue color denotes the HCT value and the green color denotes the Hb value. The mean value of hemoglobin is 13.93+1.4 in control while in cancer patients it is 12.97+2.6. The mean value of hematocrit is 40.5+3.9 in control while in cancer patients it is 39.0+7.7**

**Table 2. The table depicts the regression analysis of hemoglobin and hematocrit**

Coefficients					
Model	Unstandardized coefficients		Standardized coefficients	T	Sig.
	B	Std. Error	Beta		
1 (Constant)	1.689	1.391		1.214	.240
Hb	2.830	.102	.988	27.673	.000

a. Dependent Variable: HCT

Y=a+bx; y- dependent variable (HCT); x- independent variable (Hb); a= 1.689; b= 2.83. Hence, HCT = 1.689 + 2.83 (Hb)

**Table 3. Literature comparison of hemoglobin, hematocrit value of oral squamous cell carcinoma patients and its significance**

Literature	Haemoglobin (g/dl)	Hematocrit (%)	P- value
Takahashi et al., [35]	9 ± 1.2	39.7889 ± 3.45	P < 0.05
Ni Y et al. [36]	10.66 ± 2.08	-	P < 0.05
Groopman et al. [38]	12.56 ± 8.6	-	P > 0.05
Wondimneh [37]	-	36.9	P < 0.05
Present Study	12.97	39.0	P > 0.05

#### 4. DISCUSSION

The mean difference of hemoglobin between the groups was 1.0 g/dl and the mean difference of hematocrit between groups was 1.5%. It was found that the hemoglobin and hematocrit values of the cancer patients were reduced than the normal persons. The result of the study is well correlated with the study done by Ali et al. in 2019. In their study the authors found a mean value of 9±1.2 g/dl in cancer individuals and found a significant difference between the normal and cancer patients which was still lesser than the present study. In a study done by Ni et al. [36] found a hemoglobin average of 10.66 ± 2.08 g/dl and mentioned that there was a significant reduction of hemoglobin value in cancer individuals. In contrast to above, the study done by Jerome E. Groopman et al. [39] mentioned that cancer individual's hemoglobin levels have not changed much than the normal individuals.

The mean hematocrit value in our study of the cancer individuals was 39% and the normal individuals with an average hematocrit value of females and males is 40.5% in our study. The mean difference was 1.5% and it was found to have significant difference between the hematocrit of normal and cancer individuals. This finding was well accepted with the study done by Takahashi et al., in 2019<sup>(35)</sup> were the hematocrit value in cancer individuals was 39.7%, and the statistical analysis showed a significant difference among the cancer and control groups. Similar study by Wondimneh et al., in 2019

evaluated that the hematocrit value obtained is 36% and the cancer patients have a reduced HCT value than normal individuals.

Correlation and regression analysis confirmed that the hemoglobin and hematocrit values are inter-related as shown in Table 2, the HCT value is thrice that of the hemoglobin value and was having a significant correlation, our study showed that there is significant correlation and regression showed every three unit increase in the hemoglobin value and one unit increase in the hematocrit value<sup>(39)</sup>.

Since the mean difference between cancer and normal patients Hb level is 1g/dl it can be suggested that the cancer individuals after surgical treatment with a major blood loss got a reduced hemoglobin level than the normal individual in our study. The limitations of this study include only small sample size to which Hemoglobin and Hematocrit values of cancer individuals were checked and correlation between hemoglobin and hematocrit were analysed. Further studies can be done, including other hematological parameters with a larger sample size of cancer and control population.

#### 5. CONCLUSION

The study delineates the significant difference between the hemoglobin and hematocrit value among squamous cell carcinoma compared to normal patients. As the therapy for cancers target the bone marrow, proliferative cells, the hematological parameter analysis is necessary to know the prognosis of the cancer individual.

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## CONSENT

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

## ETHICAL APPROVAL

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

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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