COMPARISON OF HEMOGLOBIN(Hb) AND HEMATOCRIT(HCT) VALUE IN NORMAL AND CANCER PATIENTS

ABSTRACT:

INTRODUCTION: Haemoglobin is the molecule in red blood cells 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 value is 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 research is required to search out whether the cancer affects the traditional Hb and Hct value. The research also fulfills the deficiency of labor on regression of hb.

AIM: The aim of the research is to evaluate the difference between the normal and cancer patient's hb and hct values. It is an in vitro study.

MATERIALS AND METHODS: a total of 20 samples were included in this study. Divided into two groups of normal and cancer patients. Routine Complete blood count analysis reports were collected from the clinical lab, Saveetha Dental College. The demographic details of the patients and Hemoglobin and Hematocrit values were noted down and exported to SPSS version 23 and analysed for independent t tests with a significant level of $P < 0.05$.

RESULTS: The results showed that there is no significant difference between the hemoglobin and hematocrit value between normal and cancerous patients.

CONCLUSION:

It was concluded that the Hemoglobin value and Hematocrit values were not significantly changed among the normal and cancer patients even under the treatment.

Keywords: red blood cells, hemoglobin, hematocrit, cancer cells, innovative technique

Running Title: Comparison of hemoglobin(hb) and hematocrit(hct) value in normal and cancer patients

INTRODUCTION:

Haemoglobin is the molecule in red blood cells that carries oxygen from the lungs to the body's tissues and returns CarbonDioxide gas from the tissues back to the lungs. Haemoglobin is formed of four protein molecules (globulin chains) that are connected together. the adult hemoglobin (abbreviated Hgb or Hb) molecule contains two alpha-globin chains and two beta globin chains (1) In fetus and infants, beta chains aren't common and also the hemoglobin molecule is created from two alpha chains and two gamma chains. While infants grow, the gamma chains are gradually replaced by beta chains, forming the adult hemoglobin structure (2). Each globulin chain contains a very important iron-containing porphyrin compound termed heme. Embedded within the heme compound is an iron atom that's vital in transporting oxygen and carbondioxide 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. In their shape, red blood cells are round with narrow centres resembling a donut without a hole within the middle. Abnormal hemoglobin structure can, therefore, disrupt the form of red blood cells and impede their function and flow through blood vessels.(5)

The hematocrit could be a ratio of the quantity of red blood cells to the amount of these components together, called blood. The worth is 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's 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/mm3) by the mean cell volume in femtoliter. When so assayed, it's subject to the vagaries inherent in obtaining an accurate measurement of the mean cell volume . Both the hemoglobin and also the hematocrit are supported blood and are therefore passionate about plasma volume.(7) If a patient is severely dehydrated, the hemoglobin and hematocrit will appear more than if the patient were normovolemic; 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)

While the laboratory that tests the blood sample may have its own ranges, generally accepted ranges for hematocrit rely upon your gender and age. Hemoglobin is sometimes 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 for a baby 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 a chemical containing cyanide that binds tightly with the hemoglobin molecule to make cyanomethemoglobin. By shining a lightweight through the answer and measuring what quantity light is absorbed (specifically at a wavelength of 540 nanometers), the number of hemoglobin may be determined.(12)

The hemoglobin level is expressed because the amount of hemoglobin in grams (gm) per deciliter (dL) of blood, a deciliter being 100 milliliters. The normal ranges for hemoglobin rely upon the age and, beginning in adolescence, the gender of the person. the conventional ranges are: Newborns: 17 to 22 gm/dL. One week neonate: 15 to 20 gm/dL. One month of age: 11 to 15 gm/dL. Children: 11 to 13 gm/dL. Adult males: 14 to 18 gm/dL. Adult women: 12 to 16 gm/dL. Men after middle age: 12.4 to 14.9 gm/dL. Women after middle age: 11.7 to 13.8 gm/dL(13). Some laboratories don't differentiate between adult and "after middle age" hemoglobin values. pregnant females are advised to avoid both high and low hemoglobin levels to avoid increased risks of stillbirths (high hemoglobin – above the conventional range) and premature birth or neonate (low hemoglobin – below the traditional range).(14)No challenges were faced in previous research. The research is required to search out whether the cancer affects the traditional Hb and Hct value. Our team has extensive knowledge and research experience that has translate into high quality publications (15).(16–29) ,(30–34) The aim of the research is to

search out the difference between the Hemoglobin and hematocrit values of normal and cancer patient.

MATERIALS AND METHODS:

An in vitro study was conducted in Saveetha Dental College and Hospital In the month of february 2021. The study and sample collection were approved by the institutional ethical committee. The blood sample is taken from cancer patients and normal patients from the College OP. Supporting the previous research work, articles are collected and also the work be applied accordingly. A sample size of 20 was set, the sampling technique was random sampling , and divided into two groups, 10 were cancer patients and 10 were normal or control patients.The samples were collected in a EDTA tube which is employed for cell counting.This EDTA tube contains anticoagulant EDTA, which prevents coagulation within the tube. Then the samples are undergone for CBC test - Complete blood count test. The Hb and Hct values were noted. Then independent t tests with a significant level of $P<0.05$, were done to compare the values of Hemoglobin and Hematocrit for normal and cancer patients, and further regression analysis was done to know the relation between Hemoglobin and hematocrit values of the samples obtained using SPSS version 23.

RESULTS:

Group Statistics

	GROUPS	N	Mean	Std. Deviation	Std. Error Mean
HCT	CONTROL	10	40.5000	3.87499	1.22538
	CANCER	10	39.0000	7.70022	2.43502
HB	CONTROL	10	13.9300	1.40004	.44273
	CANCER	10	12.9700	2.59746	.82139

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 13.9g/dl with a standard deviation of 1.4 and in cancer it is 12.97g/dl with a standard deviation of 2.6.

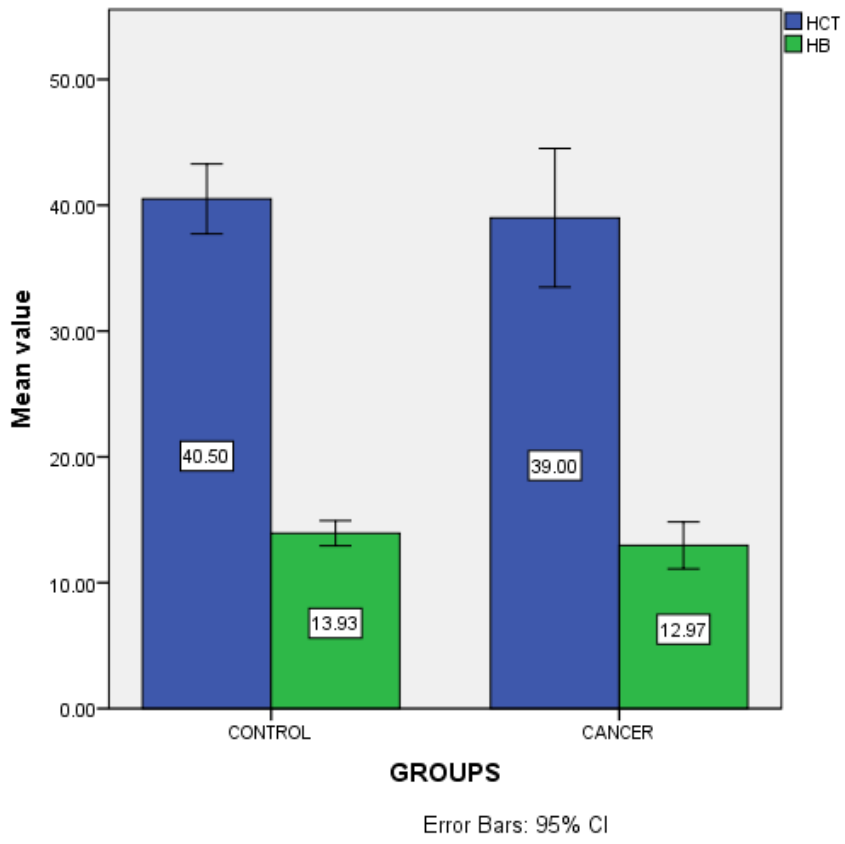

Figure 1: This bar chart depicts the difference between the normal and cancer patients in the hb and hct value. The blue colour denotes the HCT value and the green colour denotes the hb value. The mean value of hemoglobin is 13.93+1.4 in control while in cancer patients it is 12.97+2.6. The mean value 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).**						

LITERATURE	**HAEMOGLOBIN(g/dl)**	**HEMATOCRIT(%)**	**P- VALUE**
(35)	9± 1.2	39.7889 ± 3.45	P < 0.05
(36)	10.66 ± 2.08	-	P < 0.05
Jerome E. Groopman et al	12.56 ± 8.6	-	P > 0.05
(37)	-	36.9	P < 0.05

Present Study	12.97	39.0	P > 0.05

TABLE 3: Literature comparison.

DISCUSSION:

As the table 1 showed, the mean value of Hemoglobin of a normal person was 13.9±2.8 g/dl and in cancer individuals was 12.97±5.2 g/dl. The mean difference of hemoglobin between the groups was 1.0 g/dl. It was found that the hemoglobin value of the cancer patients were reduced than the normal persons. It can be suggested that the cancer individuals after surgical treatment because of the major blood loss got a reduced hemoglobin level than the normal individual in our study. It was 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 ± 2.08g/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(38) mentioned that cancer individual's hemoglobin levels have not changed much than the normal individuals.

The mean hematocrit value of cancer individuals is 39% and the normal average hematocrit value of females and males is 40.5% in our study. The mean difference between the averages was 1.5% and it was found to have no significant difference between the hematocrit of normal and cancer individuals. This finding is well accepted with the study done by (35) in 2019(35). In that study the authors found that the hematocrit value in cancer individuals was 39.7%, and the statistical analysis showed a significant difference among the cancer and control groups. (37) in

his study mentioned that the hematocrit value was 36% and the cancer patients have a reduced HCT value than the 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 3 unit increase in the hemoglobin value showed one unit increase in the hematocrit value(39).

The limitations of this study includes 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 all the hematological parameters with a maximum sample size of cancer and control population.

CONCLUSION:

Within the limitations of the study, in spite of mild reduction, we found that there is no significant difference between the hemoglobin and hematocrit value among normal and cancerous patients. According to the treatment the hematological parameters also have significant changes. As the therapy for cancers target the bone marrow, proliferative cell pool, the hematological parameter analysis is necessary to know the prognosis of the cancer individuals.

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