Hematological parameters among tuberculosis patients under treatment attending Kosti and Kenana teaching hospitals in White Nile state, Sudan

Mohamed Elyass, AmeraAbdullah, Exany Samuel, Nada yassen, Ahmed Mohamed Elnour

Medical Laboratory Sciences, Haematology and Immunohaematology Elimam Elmahadi University

ABSTRACT

Introduction: Complete blood count (CBC) is one of the most common blood test that used to diagnosis of hematological abnormalities. Tuberculosis is a major of a big health problem in the world especially in Sudan, This study done in Kosti and kenana teaching hospitals During January to April 2016.

Study design: Control study One hundred patients of tuberculosis andone hundred age and sex matched healthy controls, after individually filled the informed consent

Methodology: 2.5 ml blood samples were taken in ethylene diamine tetra acetic acid (EDTA) treated tube and were analyzed in KX-21 Sysmex® automated hematology analyzer. Differential leukocyte and Reticulocyte count was done manually by microscopy of Giemsa and New ethylene blue stained blood films respectively, and ESR were read using Westergren method.

Result: The results showed highly significant in all hematological parameters c in TB patients when comparing with the healthy person except Reticulocyte count and the P value were 0.000 in all parameters, 0.01 in the Hb and 0.692 for reticulocyte count.

Conclusion: Most of the patients showed anemic with low Hb and different types of anemia grading from normocytic hypochromic, or mild hypochromisia or microcytic hypochromic.

Key words: Complete blood count,Tuberculosis,ethylene diamine tetra acetic acid.

Abbreviations (CBC complete blood count, TB tuberculosis, EDTA ethylene diamine tetra acetic acid, Hb hemoglobin)

{Citation: Mohamed Elyass, AmeraAbdullah, Nada Yaseen Ahmed Mohamed Elnour, Exany SamuelHematological parameters among tuberculosis patients under treatment attending Kosti and Kenana teaching hospitals in White Nile state, Sudan. American Journal of Research Communication, 2017, 5(6): 58-94} www.usa-journals.com, ISSN: 2325-4076.

INTRODUCTION

Complete Blood Count (CBC) is the routine investigation done for patient irrespective of the type of infection that provides important information about the kinds and numbers of cells in the blood, especially red cells, white cellsand plateletsand provides much needed information for making decision of treatment.[1,2] A CBC test usually includes: Red blood cells count, White blood cells count, Haemoglobin estimation, Hematocrite, Red blood cells indices, Platelets count, White blood cells differential, Erythrocyte sedimentation rate and Reticulocyte count.[3]

Tuberculosis is a bacterial infection.[4] and I t is the second greatest killer due to a single infectious agent worldwide, and in 2012, 1.3 million people died from the disease, with 8.6 million falling ill. [5] The African Region had 28% of the world's cases in 2014. Most people who are exposed to TB never develop symptoms because the bacteria can live in an inactive form in the body. But if the immune system weakens, such as in people with HIV or elderly adults, TB bacteria can become active. In their active state, TB bacteria cause death of tissue in the organs they infect. Active TB disease can be fatal if left untreated.[4]

The present study was aims at assessing hematological parameters change among patient infected with tuberculosis under treatment attending Kosti and Kenana teaching hospitals, White Nile state, Sudan, which have not been studied before in this area.

MATERIAL AND METHOD

Study design: Case control studyhospital based study was conducted during January to April 2016 in Kosti and kenana teaching hospitals in Sudan .One hundred patients of tuberculosis randomly involved in this study and one hundred age and sex matched healthy controls were

enrolled for study by convenient non-probability sampling, after individually filled the informed consent.

Study area: the study was carried out at 2 areas in Sudan (Kosti and kenana teaching hospitals) are located in white Nile state about 500 kilometer from Khartoum.

Materials: During the study, the following equipments and materials were used: syringes. Cotton, EDTA containers, slides. Water path.-21 Sysmex® automated hematology analyzer, Racks,Westergrentubes ,Giemsa and new ethylene blue stains. Allresults sited inthe questioner.

Data analysis: Data were analyzed using the Microsoft Excel program and SPSS version21 was used for data entry and analysis. The P.value less than 0.05 consider significant except reticulocyte count P.value 0.692consider not significant

RESULTS

Two hundred Venous blood samples, 100 from patients infected with TB attending Kosti and kenana teaching hospitalsand 100 from healthy individuals as control, were analysis for hematological parameters change using automated hematological analyzers method (Sysmex) and the result were processed statistically by using SPSS (version21). The following tables showed the results obtained.

Table 1: Gender, Age, Education, Family history and Address of TB Patients under effective Anti tuberculosis therapy and control

No	Parameters	Category	Study group n=100		Control group n=100	
			Frequency	percent	Frequency	Percent
1	Gender	Male	78	78	78	78
		Female	22	22	22	22
2	Age	<15years	9	9	6	3
		15-30years	44	50	50	56.4
		31-45years	26	30	35	18.5
		>45years	21	11	9	26.5
3	Education	Not educate	35	52.9	10	8.2
		Primary	24	12.7	20	12.8
		Secondary	33	17	42	47.7
		University	8	17.4	32	32.3
4	Family history	Yes	27	27	0	0
		No	73	73	100	100
		No smoker	93	92.3	100	100
		1-2 years	95	94.6	0	0
		>2years	1	1	0	0
5	Address	Kenana	25	25	80	80
		Kosti	30	30	15	15
		Rabak	16	16	5	5
		Rural area	29	29	0	0

- 78% of cases are Male.
- The most frequencies of TB patients age (15-30) represent 50%.
- Most of patients are not Educate represent 52.9%, and 27% of patients had a history of Tuberculosis in their families.
- Almost of patients from Kosti and Kennana (30%, 29%) respectively.

Table 2: Smoker and duration of smoking of TB patients under effective Anti tuberculosis therapy and control

No	Parameters	Category	Study group n=100		Control group n=100	
			Frequency	percent	Frequency	Percent
1	Smoker	Smoker	7	6.7	0	0
		Non smoker	93	92.3	100	100
2	Duration of smoker	<year	4	3.4	0	0
		1-2 years	95	94.6	0	0

- 93% of patients included in this study are non smoker.
- Duration of smoking in smoker patient (1-2 years) represent 94.6%.

Table 3: Hb, RBCs counts, RBCs indices, RDW and Reticulocyte counts of TB patients under effective Anti tuberculosis therapy and control

No	Parameters	Category	Study group n=100		Control group n=100		t value	P value
			Frequency and percent	Mean ±SD	Frequency and percent	Mean ±SD		
1	Hb	4-5.9g/dl	2	9.93±1.827	0	12.95± 1.728	12.014	**0.010***
		6-7.9g/dl	16		0			
		8-9.9g/dl	24		0			
		10-11.9g/dl	53		22			
2	RBCs count	(1.8-3.79) x10^9cell	31	3.92±0.735	1	4.55±0.400	7.545	**0.000***
		(3.8-5.5) x10^9cell	69		99			
		>5.5x10^9cell	0		0	39.22±3.50	12.576	**0.000***
3	PCV	< 20%	2	31.3±5.27	20			
		20-35%	85		80			
		36-50%	13		0			
4	MCV	53-67.9fl	10	79.63±8.85	0	87.4±4.20	7.939	**0.000***
		68-82.9fl	55		10			
		83-101fl	35		90			
5	MCH	13-19.9pg	4	25.6±3.61	1	28.72±1.76	7.542	**0.000***
		20-26.9pg	71		13			
		27-32pg	22		85			
		>32pg	3		1			
6	MCHC	26.4-31.4%	2	31.88±1.38	6	32.7±0.93	4.939	**0.000***
		31.5-34.5%	98		89			
		>34.5%	0		5			
7	RDW	11.6-14%	17	16.06±2.66	71	13.58±0.9	8.827	**0.000***
		14.1-18%	62		29			
		>18%	21		0			
8	Retic count	<0.5%	3	1.03±0.45	0	1.22±0.42	3.115	**0.692**
		0.5-2.5%	97		100			

*** Significant (P≤0.05)**

- The most of Hb concentration in patientsis low (9-11.9 g/dl) represent 53%.
- The most of RBC count of patients is normal (3.8-5.5)x10^9cell represent 69%.
- The most of PCV of patients is low (20-35%) represent 85%.
- The more than the half of MCV of patients is low (68-82.9 fl) represent 55%.
- The most of MCH of patients is low (20-26.9 pg) represent 71%.
- The most of MCHC in patients is normal (31.5-34.5%) represent 98%.
- The more than the half of RDW of patients is low (14.1-18%) represent 62%.
- The most of Reticulocyte count of patients is normal (0,5-2.5%) represent 97%.

Table 4: ESR of TB patients under effective Anti tuberculosis therapy and control

No	Parameters	Category	Study group n=100		Control group n=100		t value	P value
			Frequency and percent	Mean ±SD	Frequency and percent	Mean ±SD		
1	ESR	10-35mm/hr	2	69.07± 17.68	100	20.71±4.80	25.071	**0.000***
		>35mm/hr	98		0			

*** Significant (P≤0.05)**

- The most of ESR of patients is high (>35 mm/hr) represent 98%.

Table 5: WBCs counts and differential counts of TB patients under effective Anti tuberculosis therapy and control

No	Parameters	Category	Study group n=100		Control group n=100			
			Frequency and percent	Mean ±SD	Frequency and percent	Mean ±SD	t value	P value
1	WBCs counts	1--3.9x10^{9}cell	12	7.081±2.97	10	5.628±1.35	4.455	**0.000***
		4--10 x10^{9}cell	67		90			
		10-13x10^{9}cell	18		0			
		>13 x10^{9}cell	3		0			
2	Neutrophil counts	<40%	1	57.22±10.58	68	54.25±6.04	2.437	**0.000***
		40-80%	99		32			
						6.24±2.123	4.487	**0.000***
3	Eosinophil	1-6%	43	8.74±5.151	4			
		>6%	57		96			
4	Basophil	<1%	0	0.66±0.68	0	0.74±0.463	0.968	**0.000***
		1-2%	100		100			
5	Monocyte	2-10%	80	8.93±5.07	76	9.30±3.07	0.623	**0.000***
		>10%	20		24			
6	Lymphocyte	10-19%	30	24.91±9.46	100	29.21±5.63	3.906	**0.000***
		20-40%	64		0			
		>40%	6		0			

*** Significant (P≤0.05)**

- The more than the half of WBC count of patients is normal ((4-10)x10^9cell) represent 67%.
- The most of Neutrophil counts in patients is normal (40-80%) represent 99%, and 1% showed neutropenia
- The more than the half of Neutrophil counts in patients is high (57%) represent >6%, and 43% showed normal Eosinophil count
- The almost of Basophil counts in patients is normal (1-2%) represent 100%.
- The most of Monocyte counts in patients is normal (2-10%) represent 80%, and 20% showed monocytosis.
- The most of Neutrophil counts in patients is normal (40-80%) represent 99%, and 1% showed neutropenia
- The more than the half of lymphocyte counts in patients is normal (20-40%) represent 64%, 30% showed lymphopenia and 6% show lymphocytosis.

Table 6: Platelet count of TB patients under effective Anti tuberculosis therapy

No	Parameters	Category	Study group n=100		Control group n=100		t value	P value
			Frequency and percent	Mean ±SD	Frequency and percent	Mean ±SD		
	Platelet counts	<150x10^9cell	14	275.19± 141.4	99	255.9 9± 67.50	1.226	**0.000***
		150-410 x10^9cell	73		1			

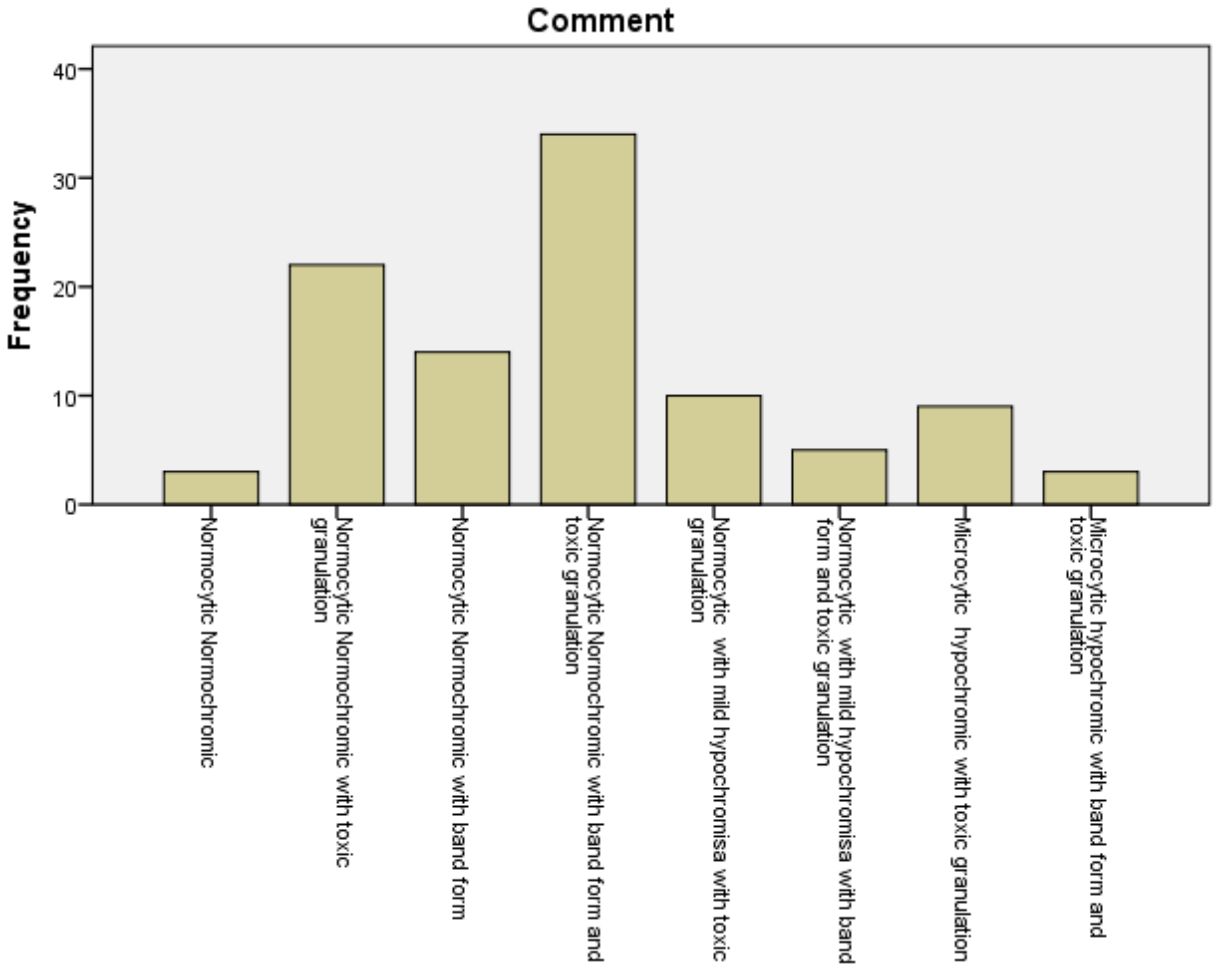
Significant (P≤0.05)

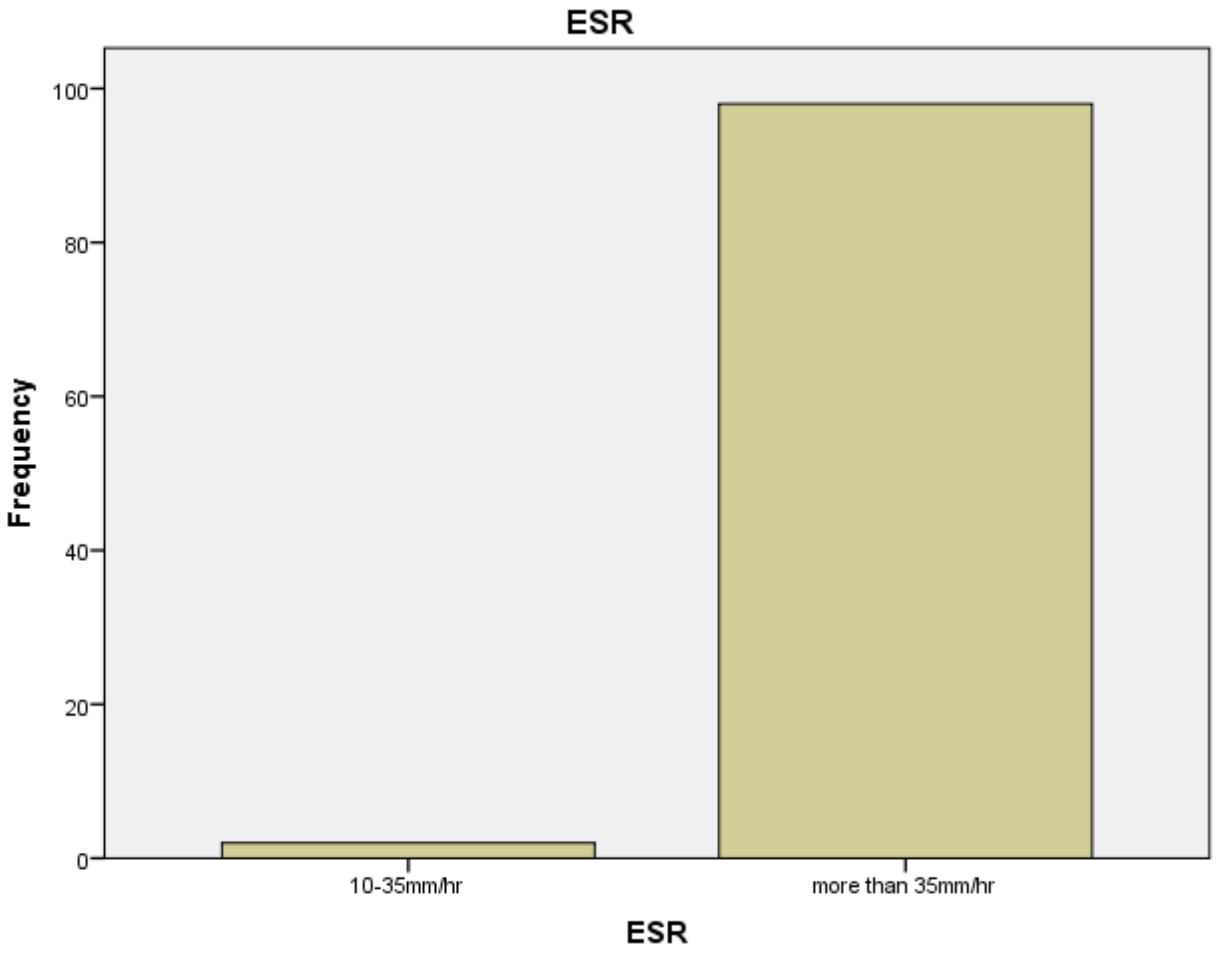
- The most of Platelet count of the patients is normal((150-410) x10^9cell) represent 73% and 14% show Thrombocytopenia.

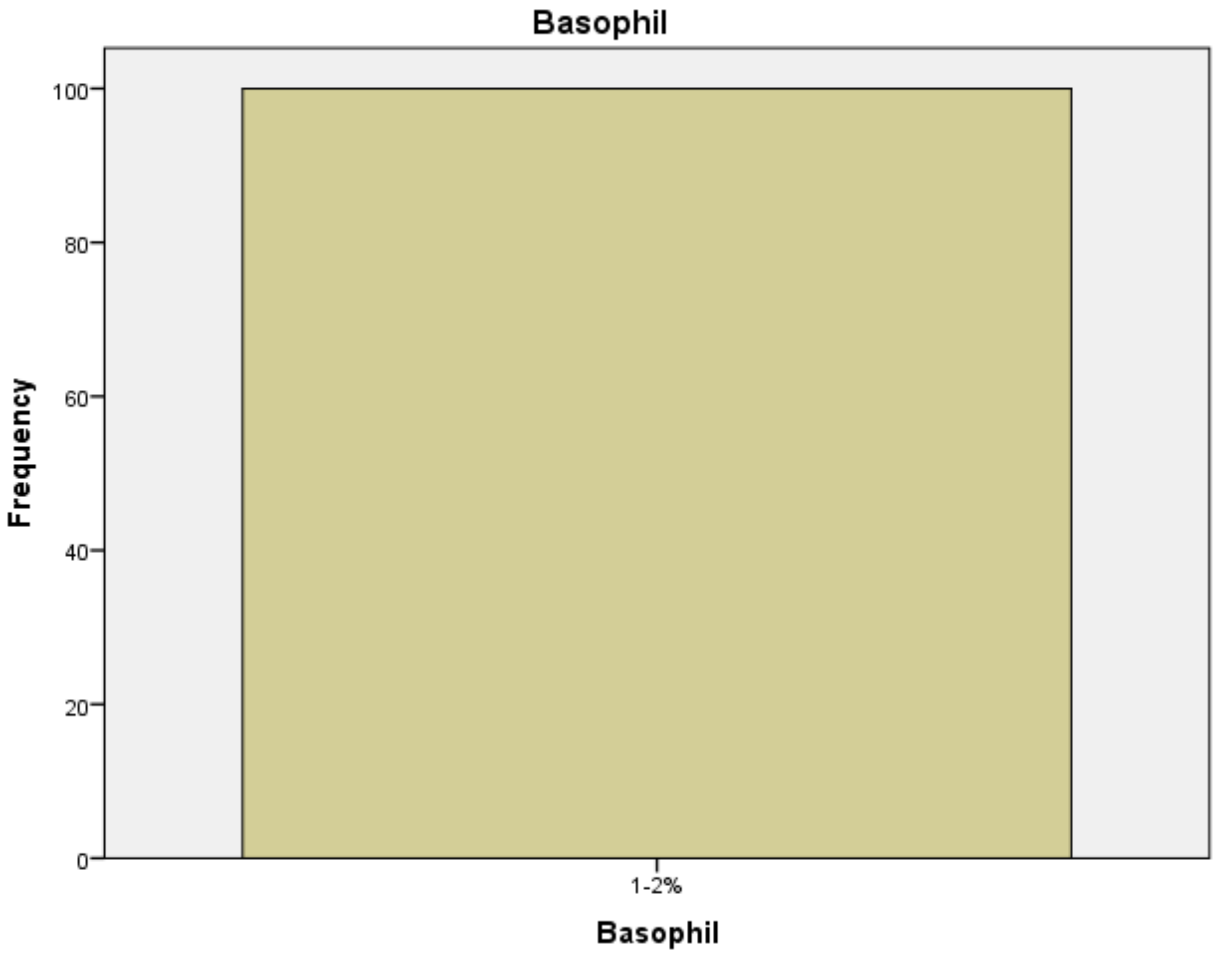
Table 7: Comment on blood film morphology of TB patients under effective Anti tuberculosis therapy and control

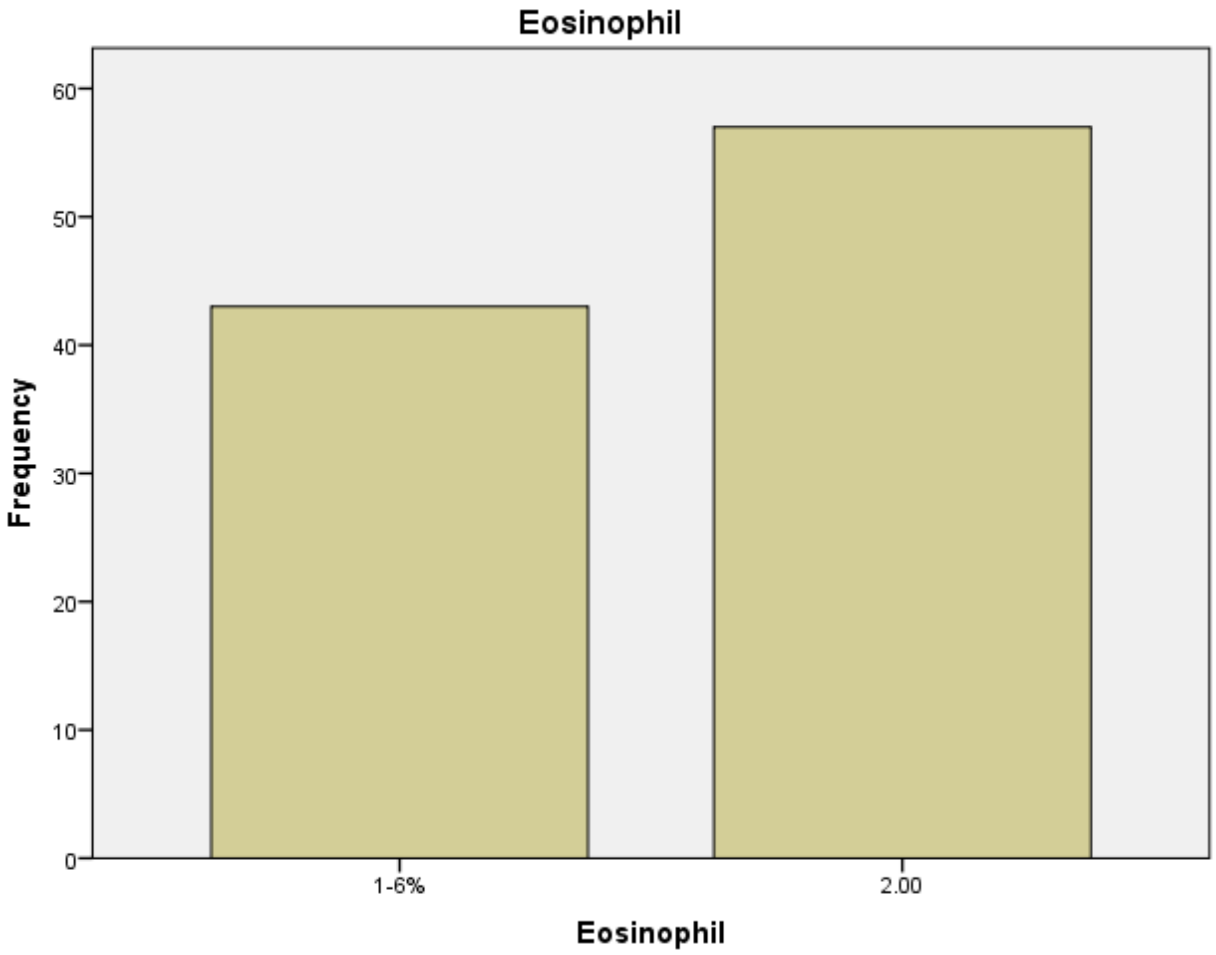
No	Parameters	Category	Study group n=100		Control group n=100	
			Frequency and percent	Mean ±SD	Frequency and percent	Mean ±SD
1	**Morphology of RBCs**	Normocytic normochromic	35	35	100	100
		Normocytic with mild hypochromisia	55	55	0	0
		Microcytic hypochromic	10	10	0	0
2	**Morphology of WBCs**	Toxic granulation	65	65	0	0
		Band form neutrophil	25	25	0	0
		Normal	10	10	100	100
3	**Morphology of platelet**	Normal	95	95	100	100
		Giant	5	5	0	0

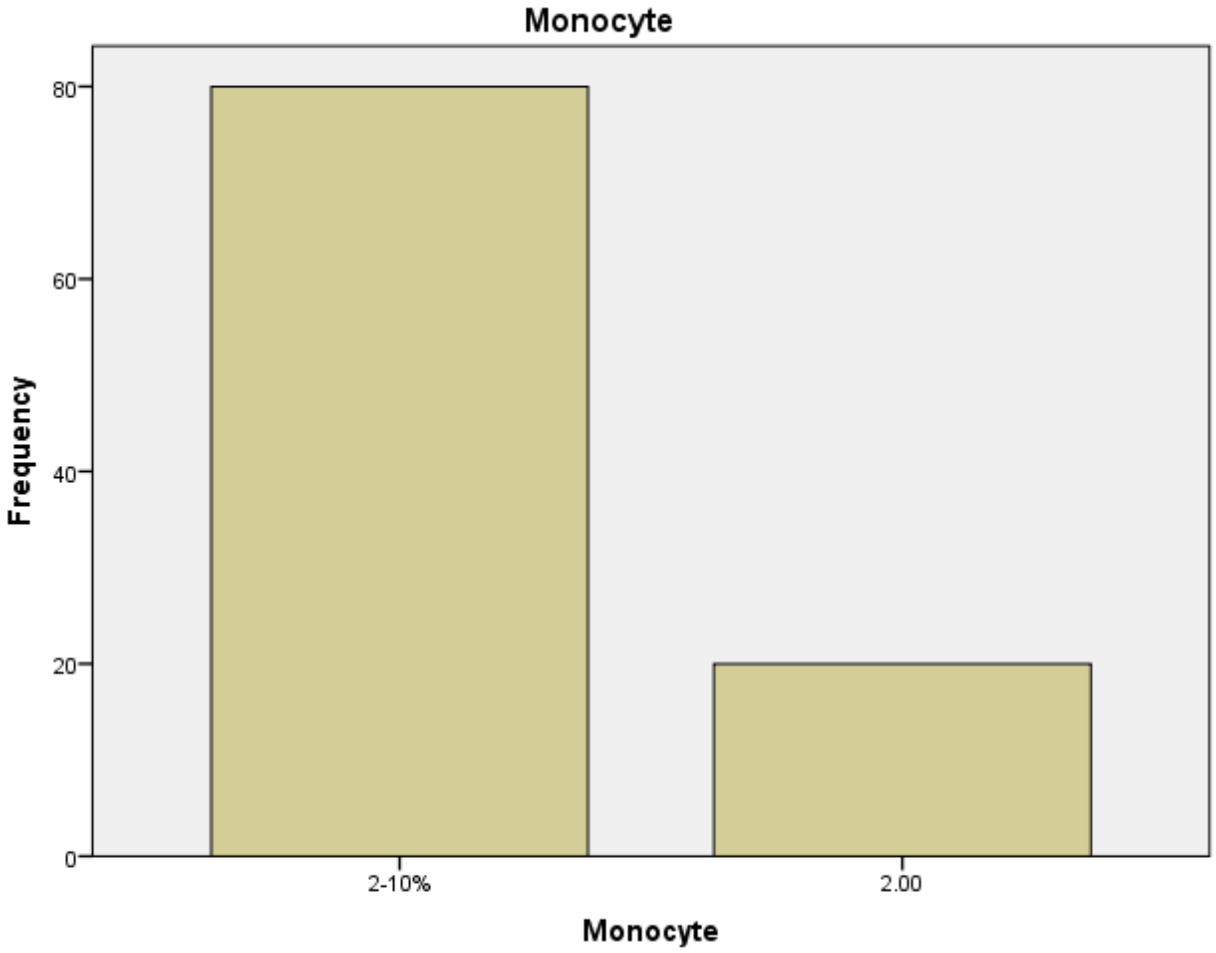
- 55% of patients show abnormal RBC morphology(Normocytic with mild hypochromisia), 35% show normal morphology and 10% of patient with Normocytic Normochromic picture.
- 65% of patients have Toxic granulation in their WBC, 25% show Band form of neutrophil and 10% normal WBC morphology
- Most of the patients show normal Platelet morphology represent 95% and %5 of patients show Giant Platelet**.**

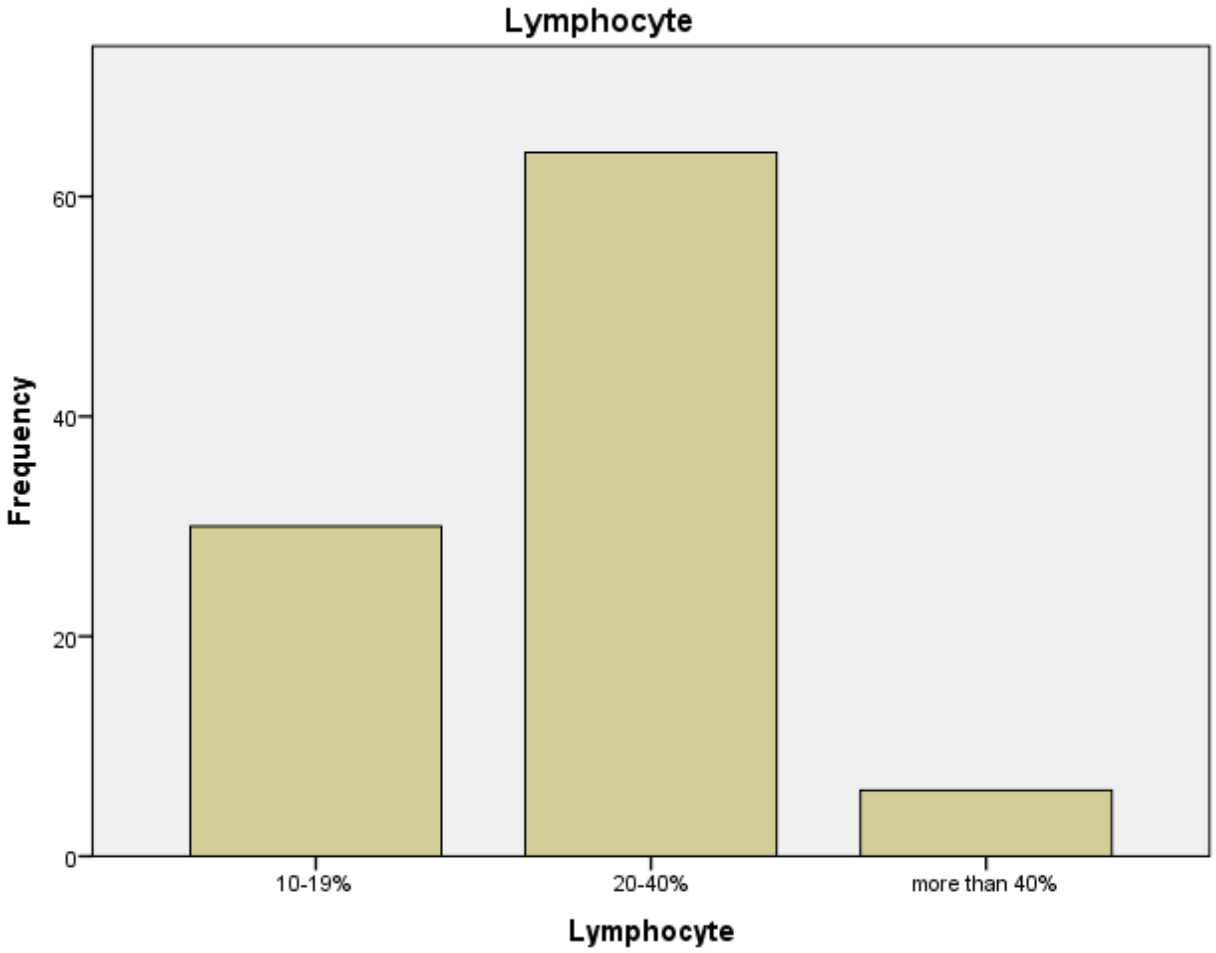

Comment
Frequency
40
30
20
10
0
Normocytic Normochromic
Normocytic Normochromic with toxic granulation
Normocytic Normochromic with band form
Normocytic Normochromic with band form and toxic granulation
Normocytic with mild hypochromisa with toxic granulation
Normocytic with mild hypochromisa with band form and toxic granulation
Microcytic hypochromic with toxic granulation
Microcytic hypochromic with band form and toxic granulation

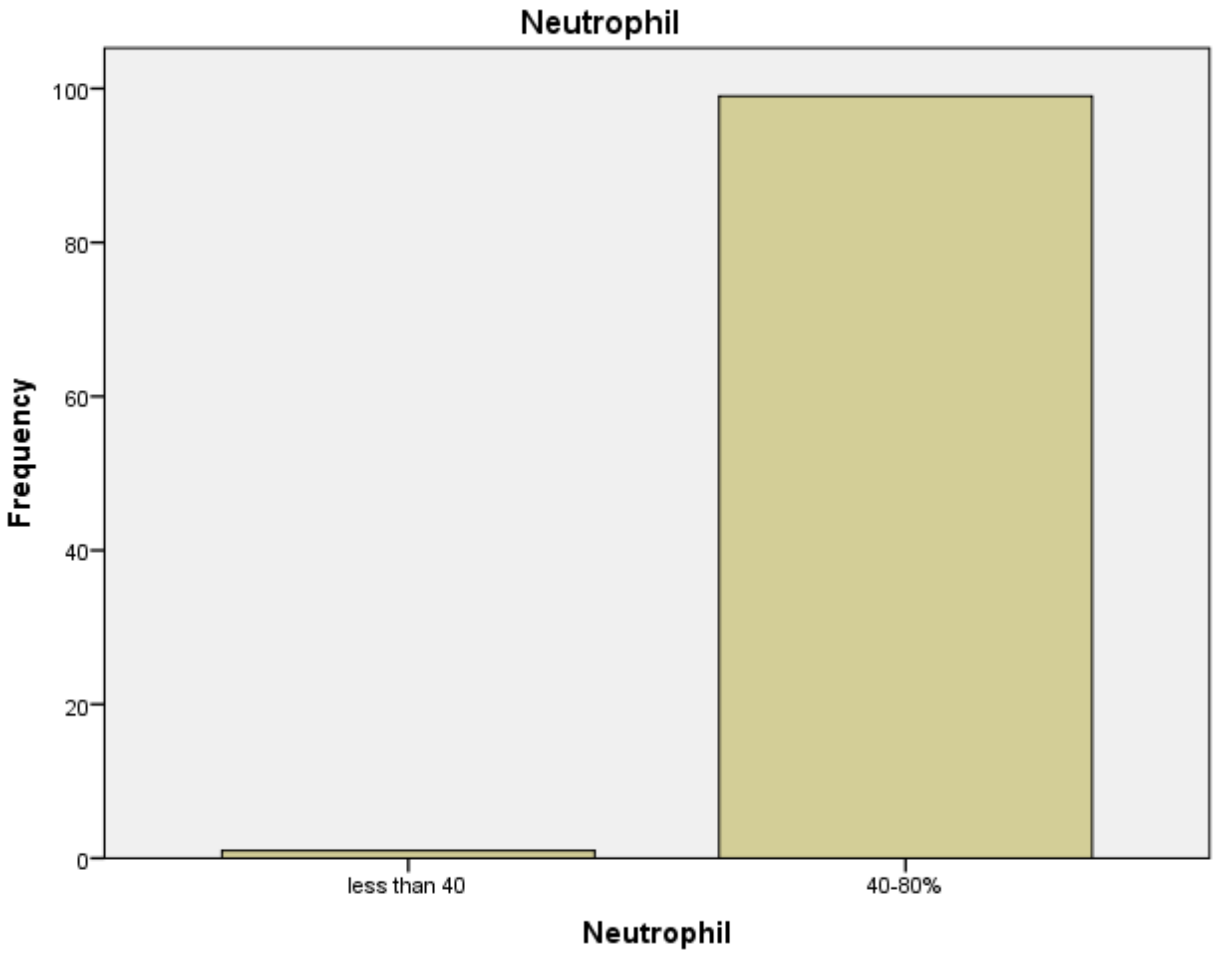

ESR
100
80
60
40
20
0
Frequency
10-35mm/hr
more than 35mm/hr
ESR

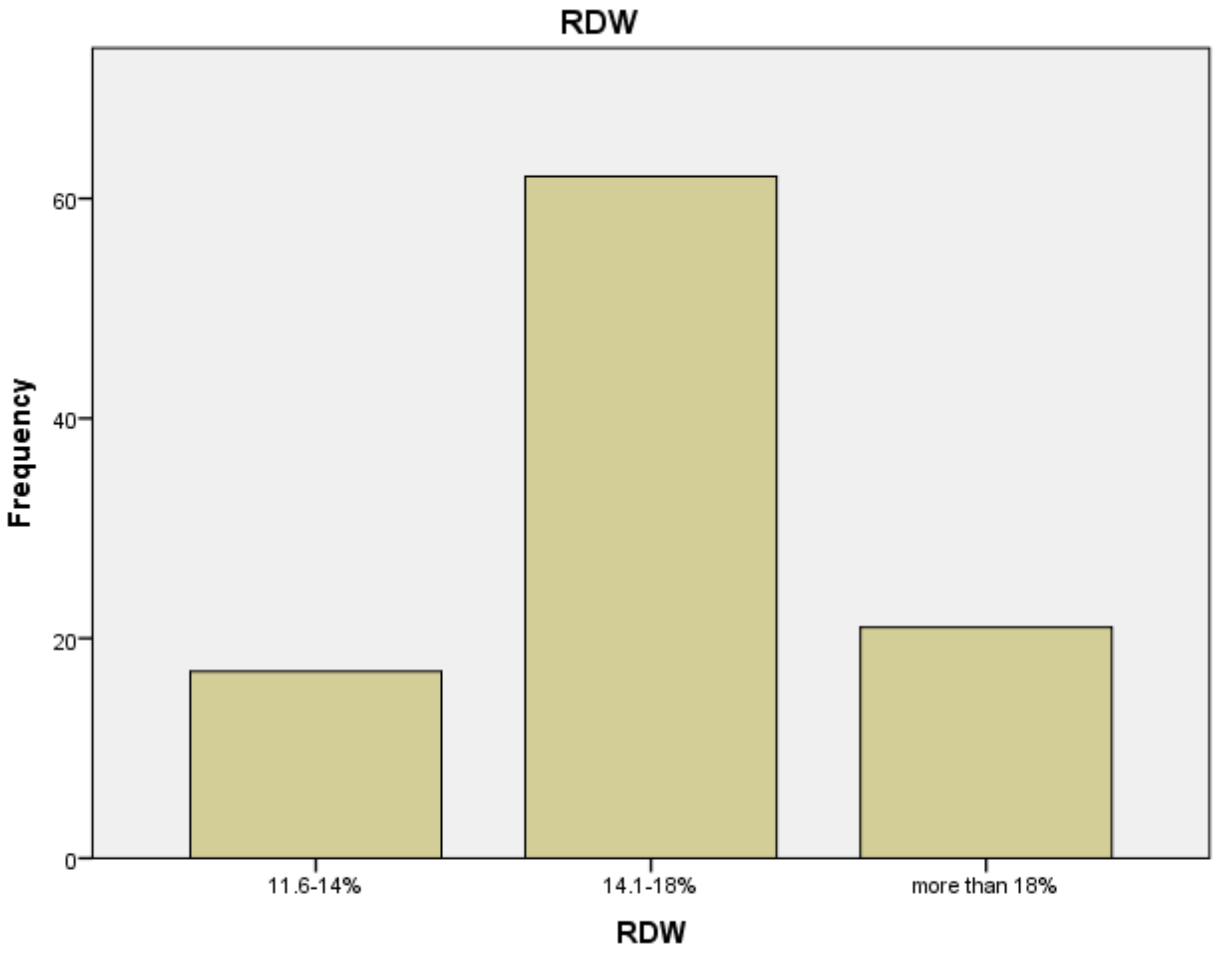

Basophil
100
80
60
40
20
0
Frequency
1-2%
Basophil

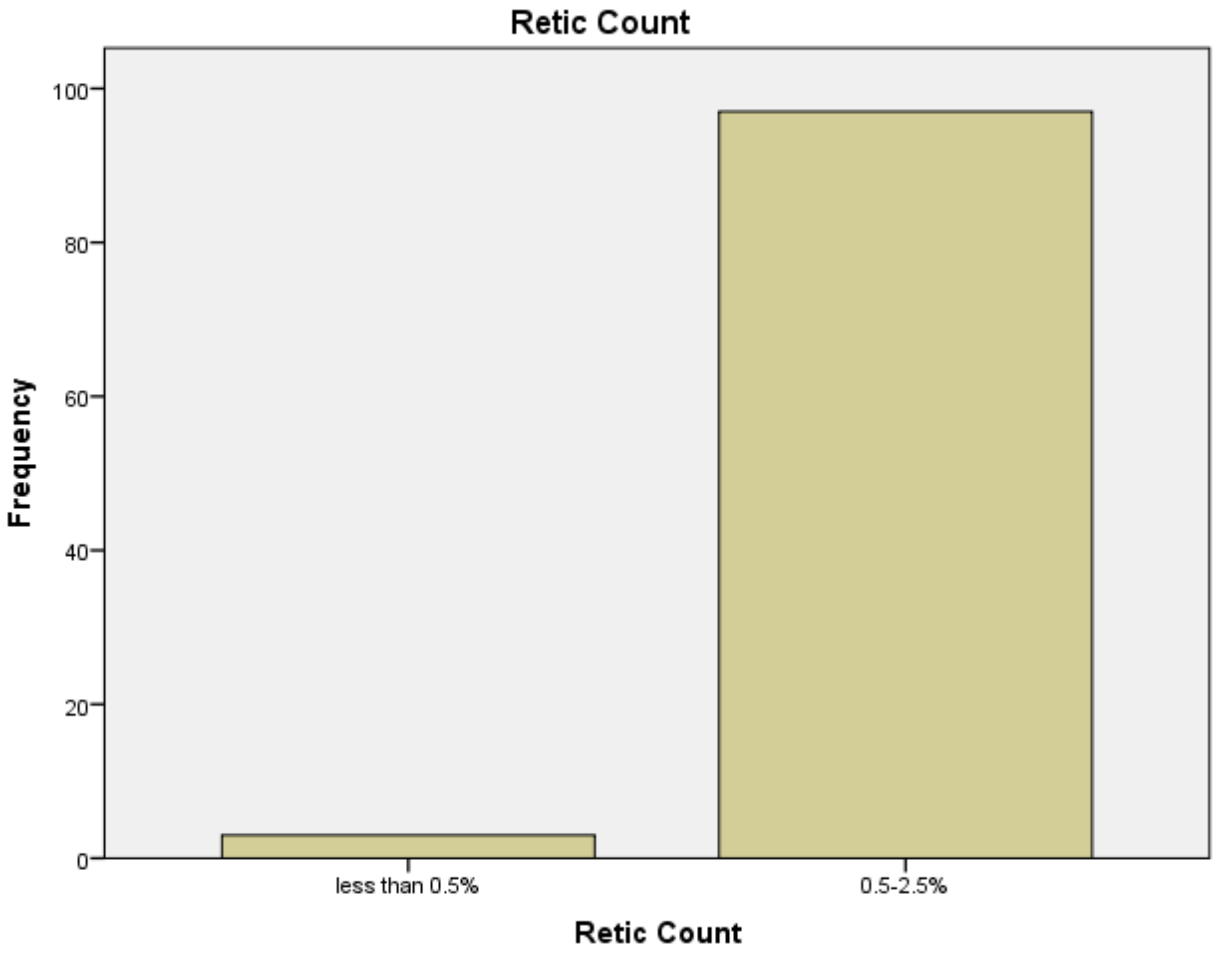

Eosinophil
Frequency
60
50
40
30
20
10
0
1-6%
2.00
Eosinophil

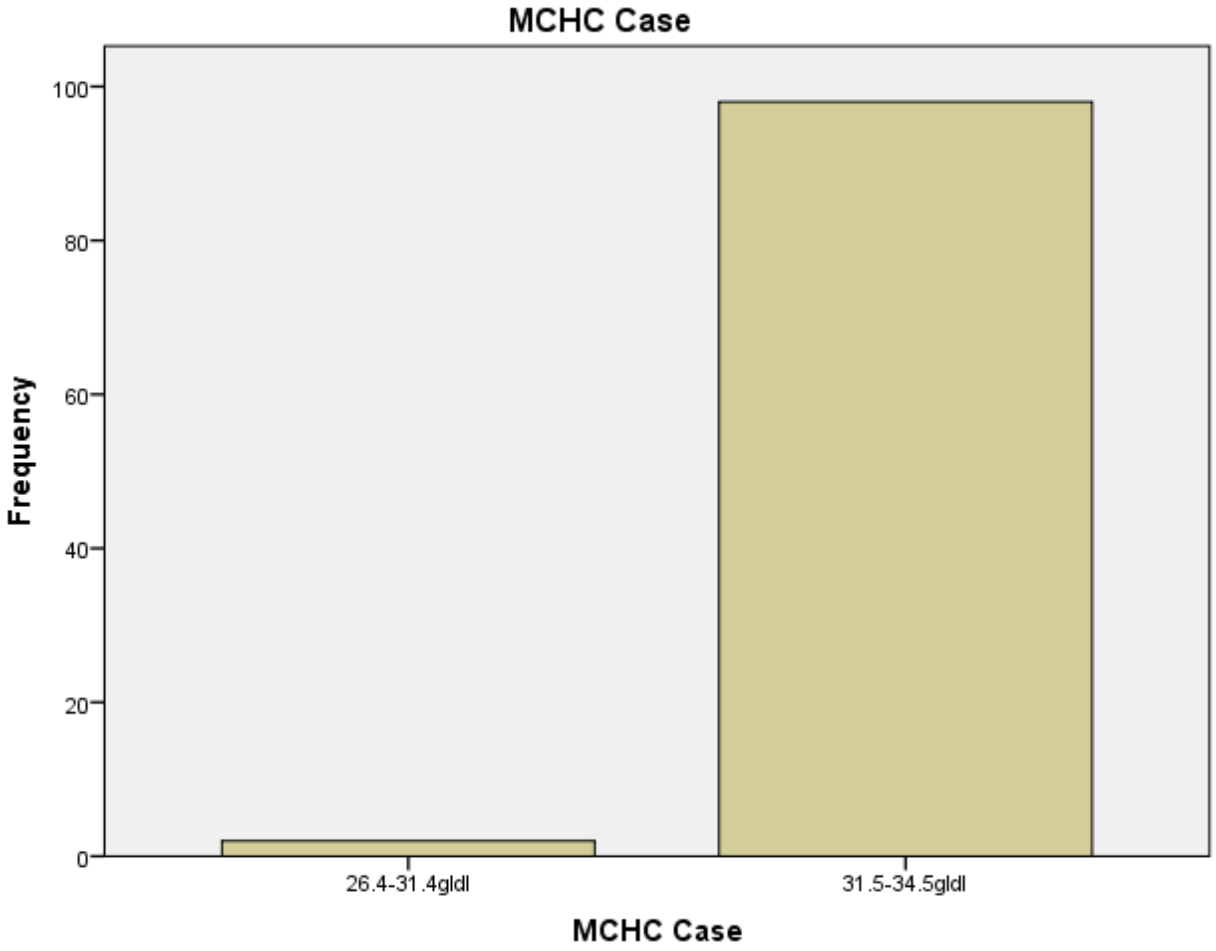

Monocyte
Frequency
80
60
40
20
0
2-10%
2.00
Monocyte

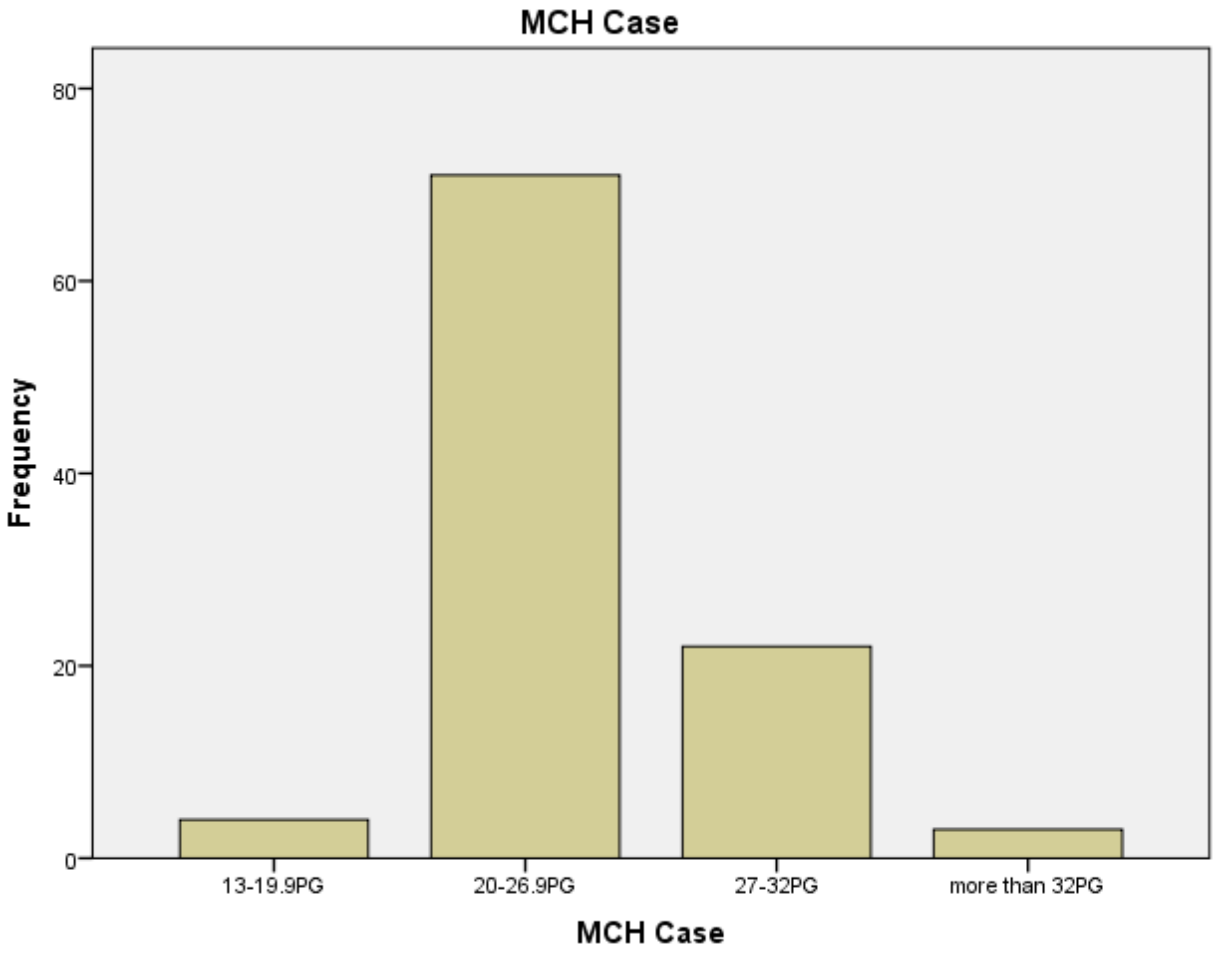

Lymphocyte
Frequency
60
40
20
0
10-19%
20-40%
more than 40%
Lymphocyte

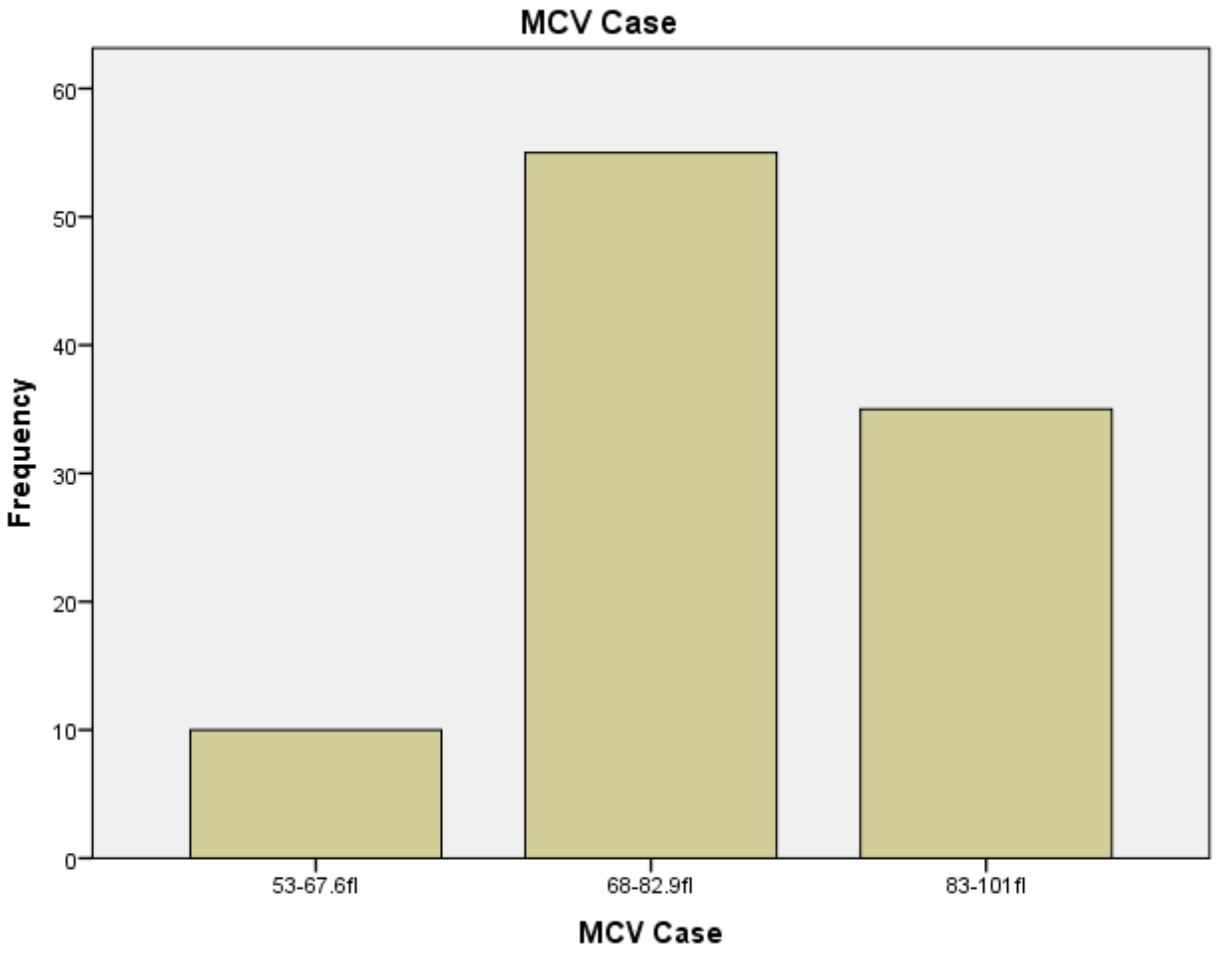

Neutrophil
100
80
60
40
20
0
Frequency
less than 40
40-80%
Neutrophil

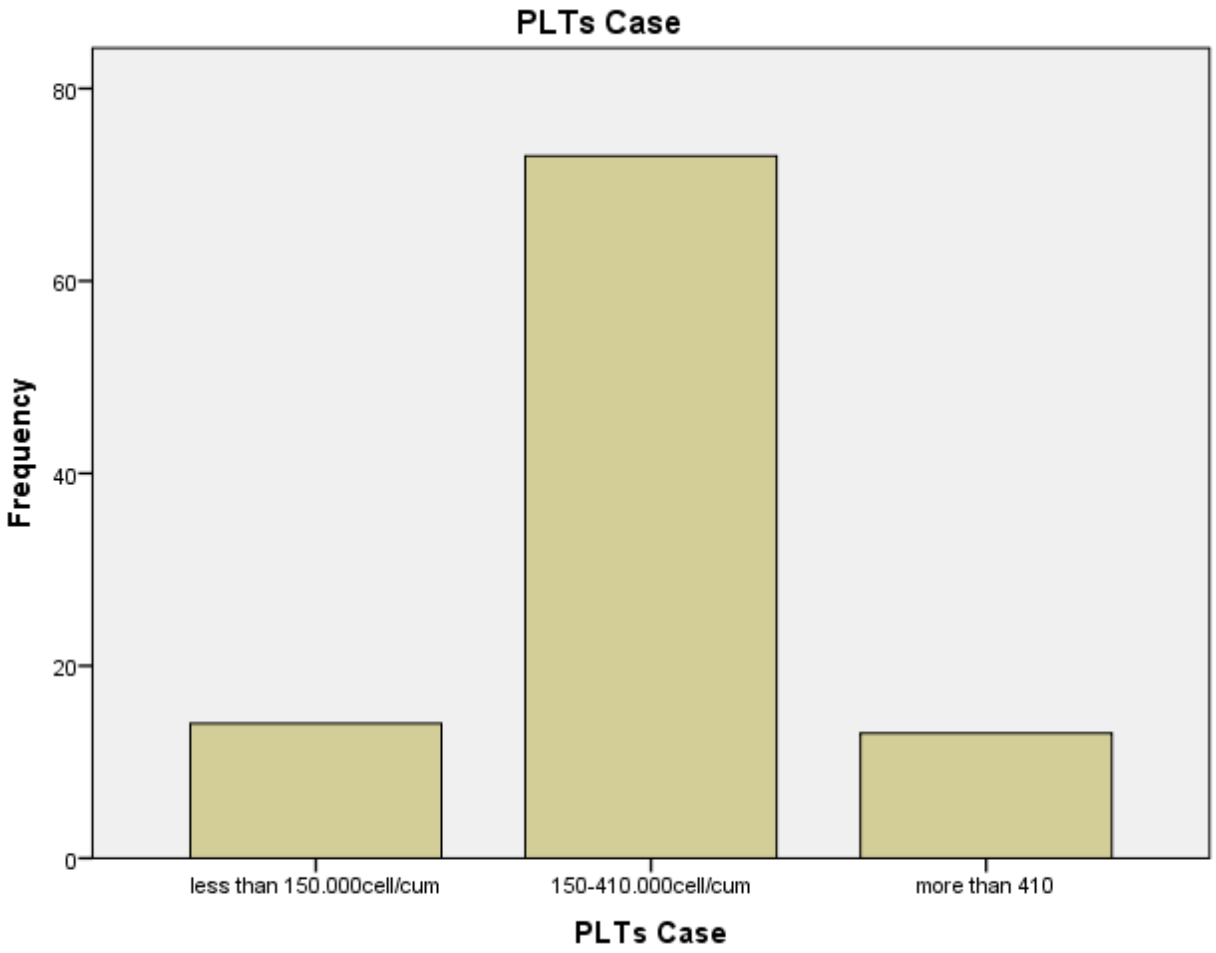

RDW
Frequency
60
40
20
0
11.6-14%
14.1-18%
more than 18%
RDW

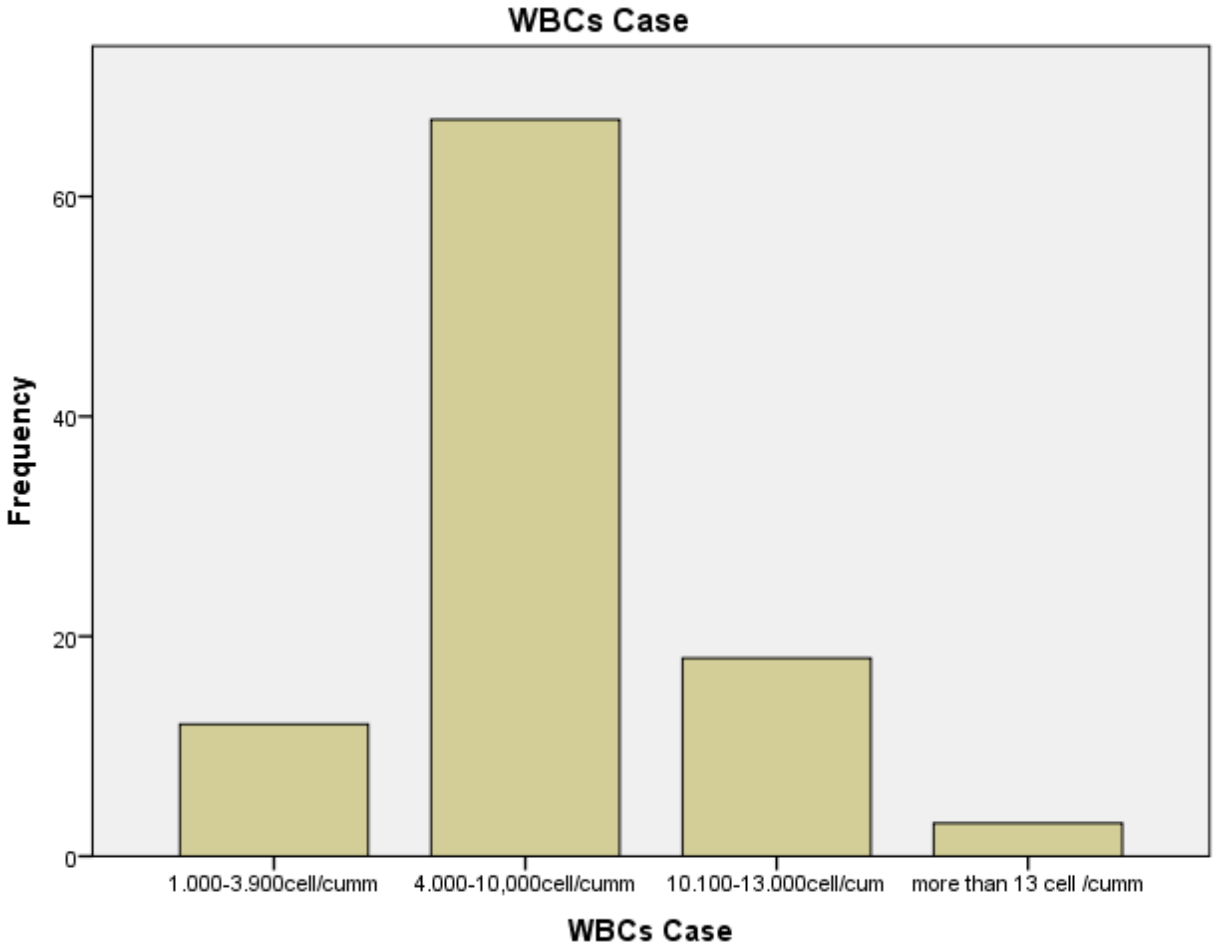

Retic Count
Frequency
100
80
60
40
20
0
less than 0.5%
0.5-2.5%
Retic Count

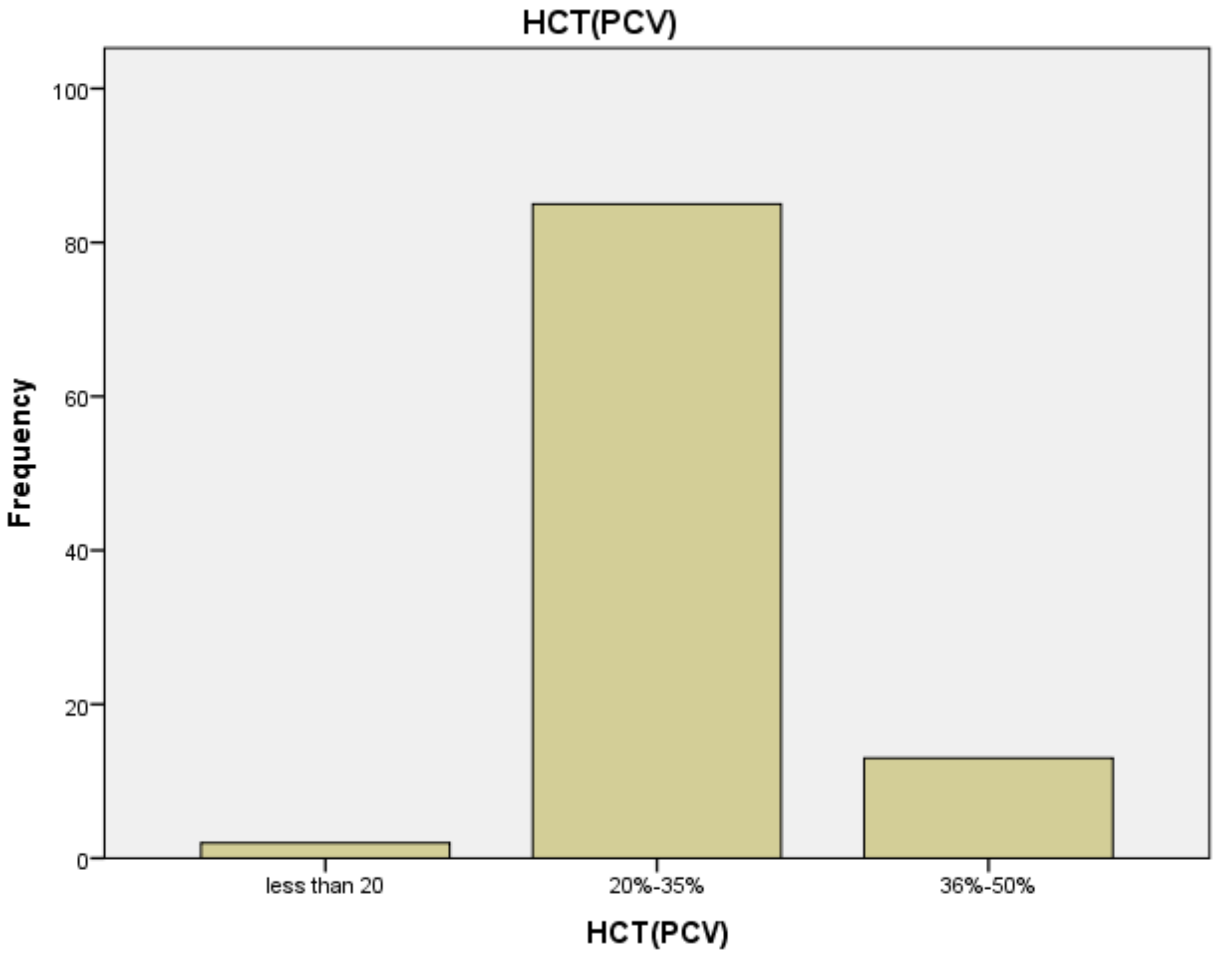

MCHC Case
Frequency
100
80
60
40
20
0
26.4-31.4gldl
31.5-34.5gldl
MCHC Case

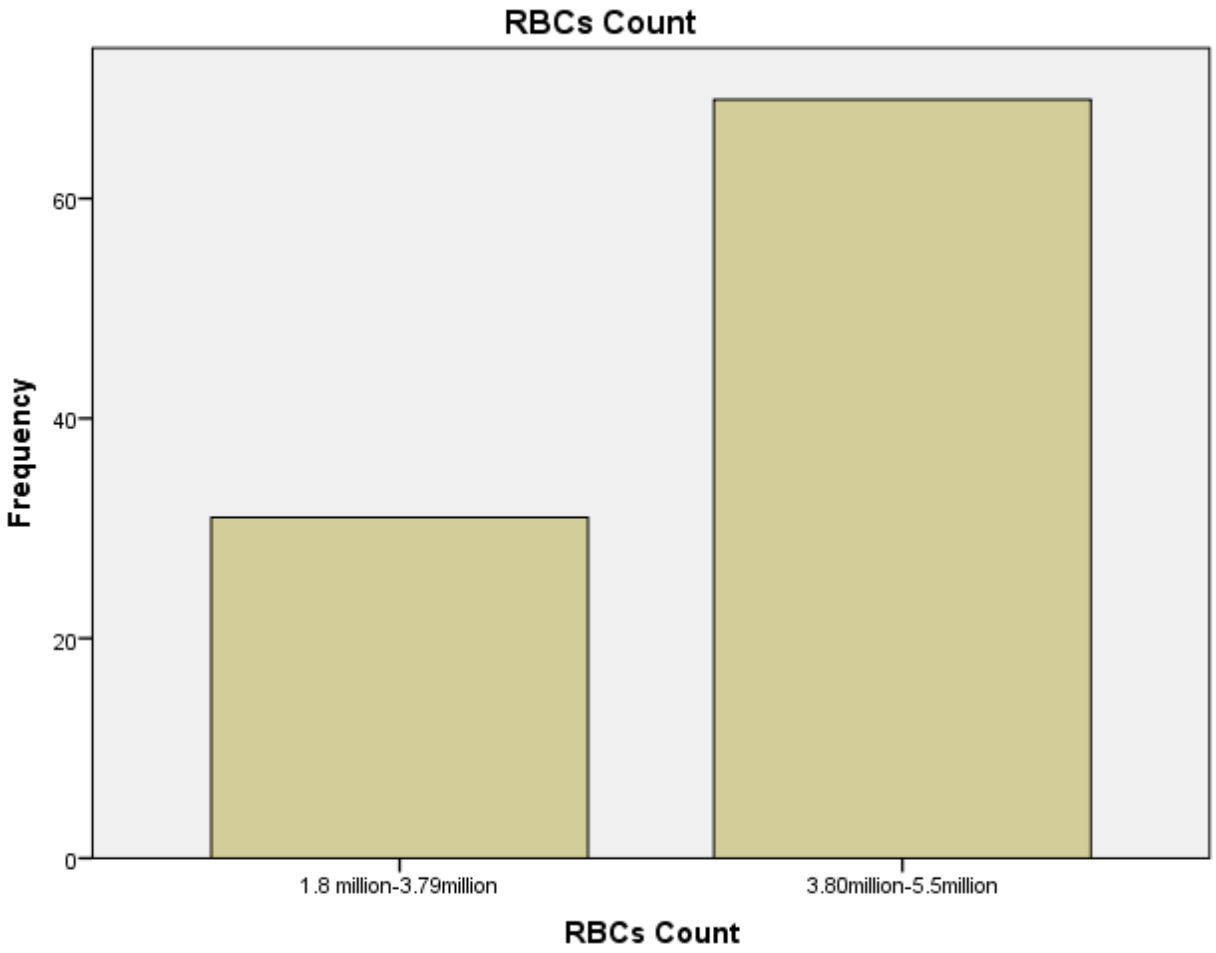

MCH Case
80
60
40
20
0
Frequency
13-19.9PG
20-26.9PG
27-32PG
more than 32PG
MCH Case

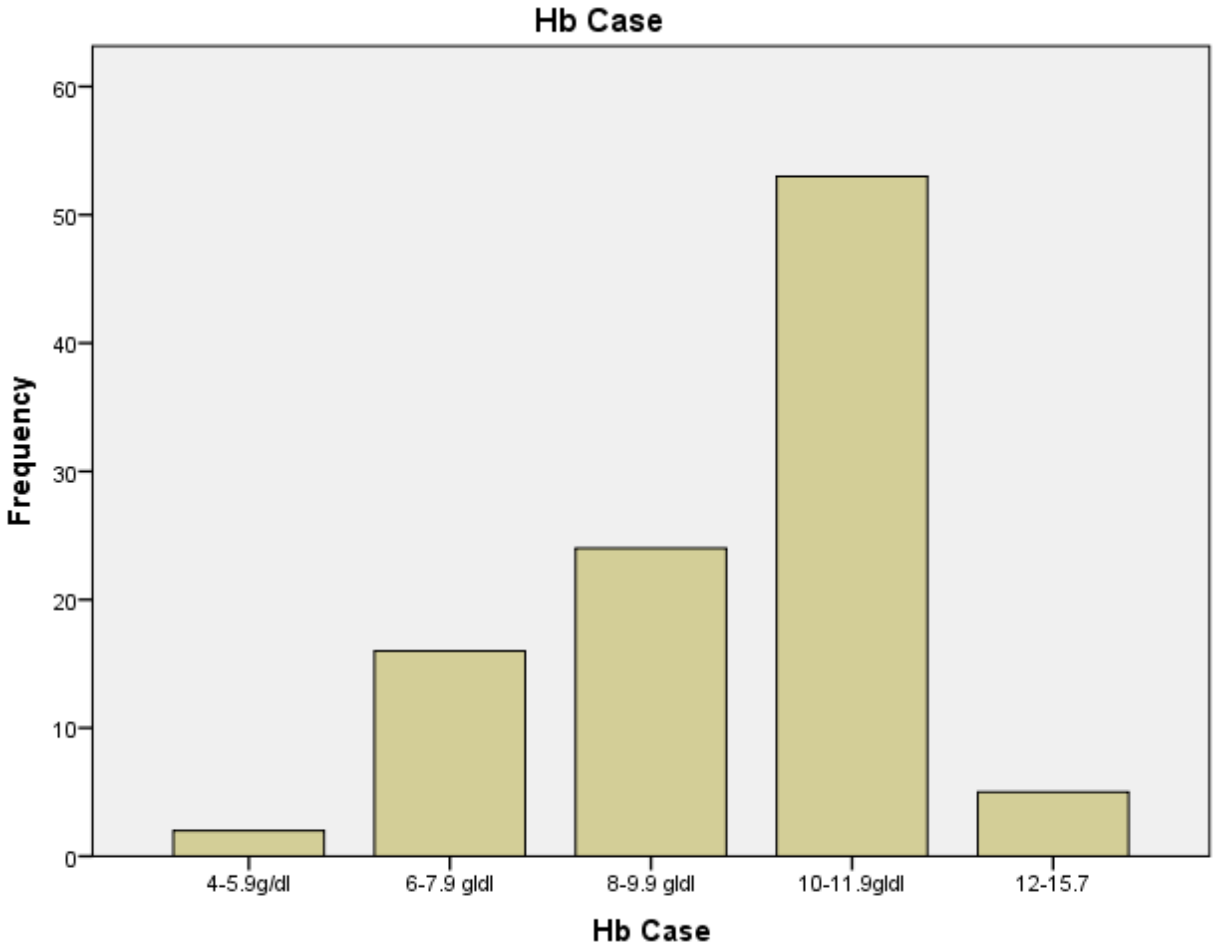

MCV Case
Frequency
60
50
40
30
20
10
0
53-67.6fl
68-82.9fl
83-101fl
MCV Case

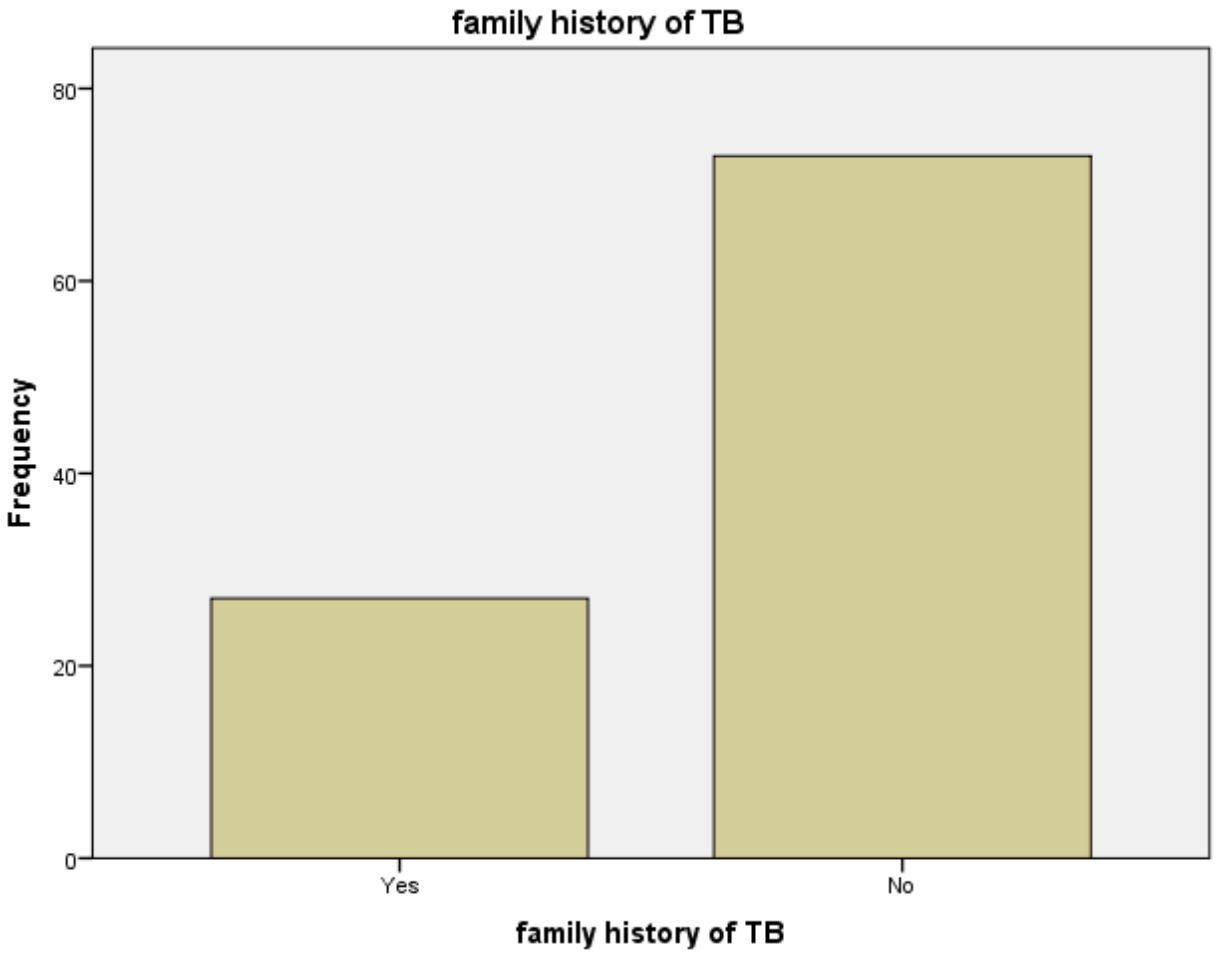

PLTs Case
Frequency
80
60
40
20
0
less than 150.000cell/cum
150-410.000cell/cum
more than 410
PLTs Case

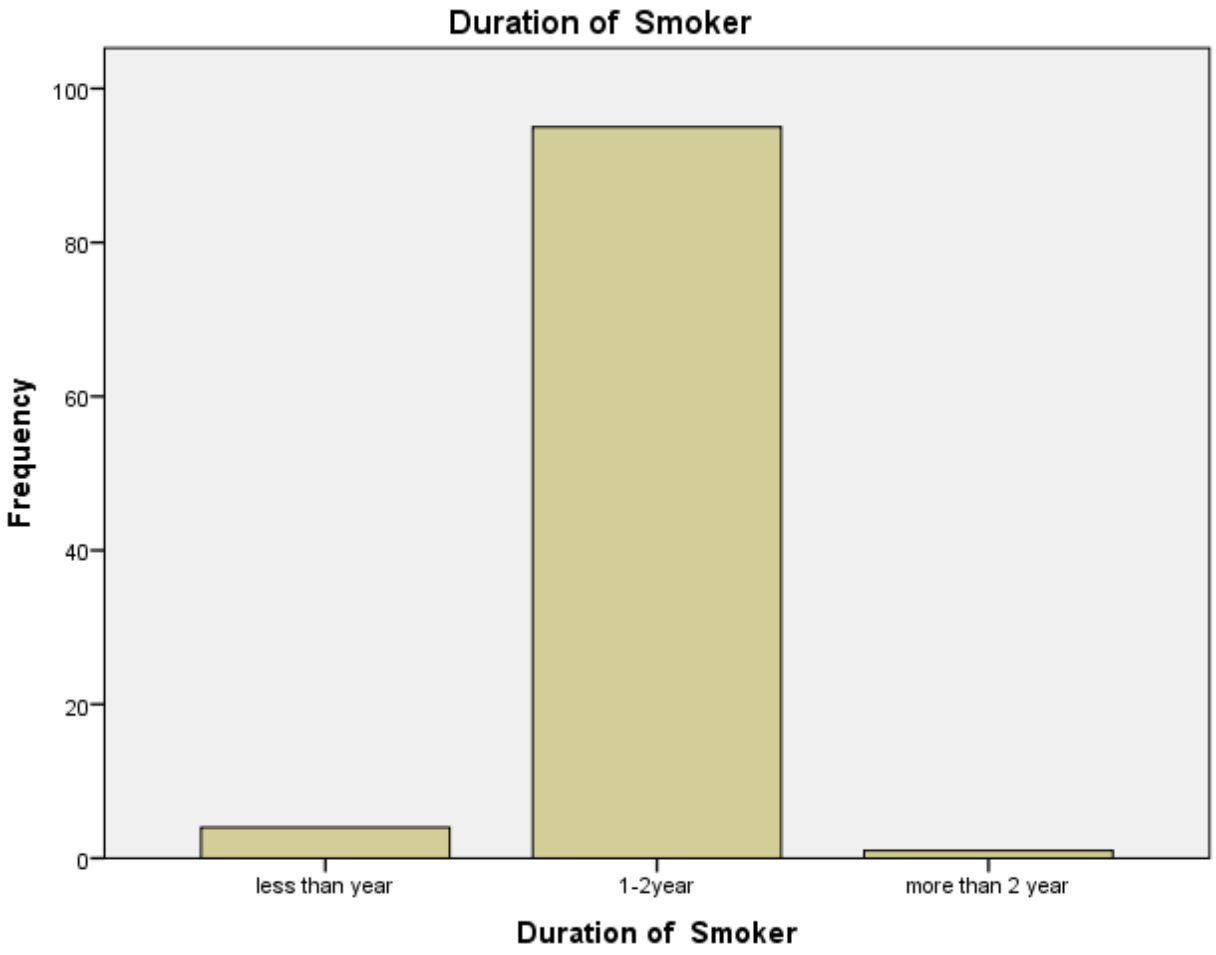

WBCs Case
Frequency
60
40
20
0
1.000-3.900cell/cumm
4.000-10,000cell/cumm
10.100-13.000cell/cum
more than 13 cell /cumm
WBCs Case

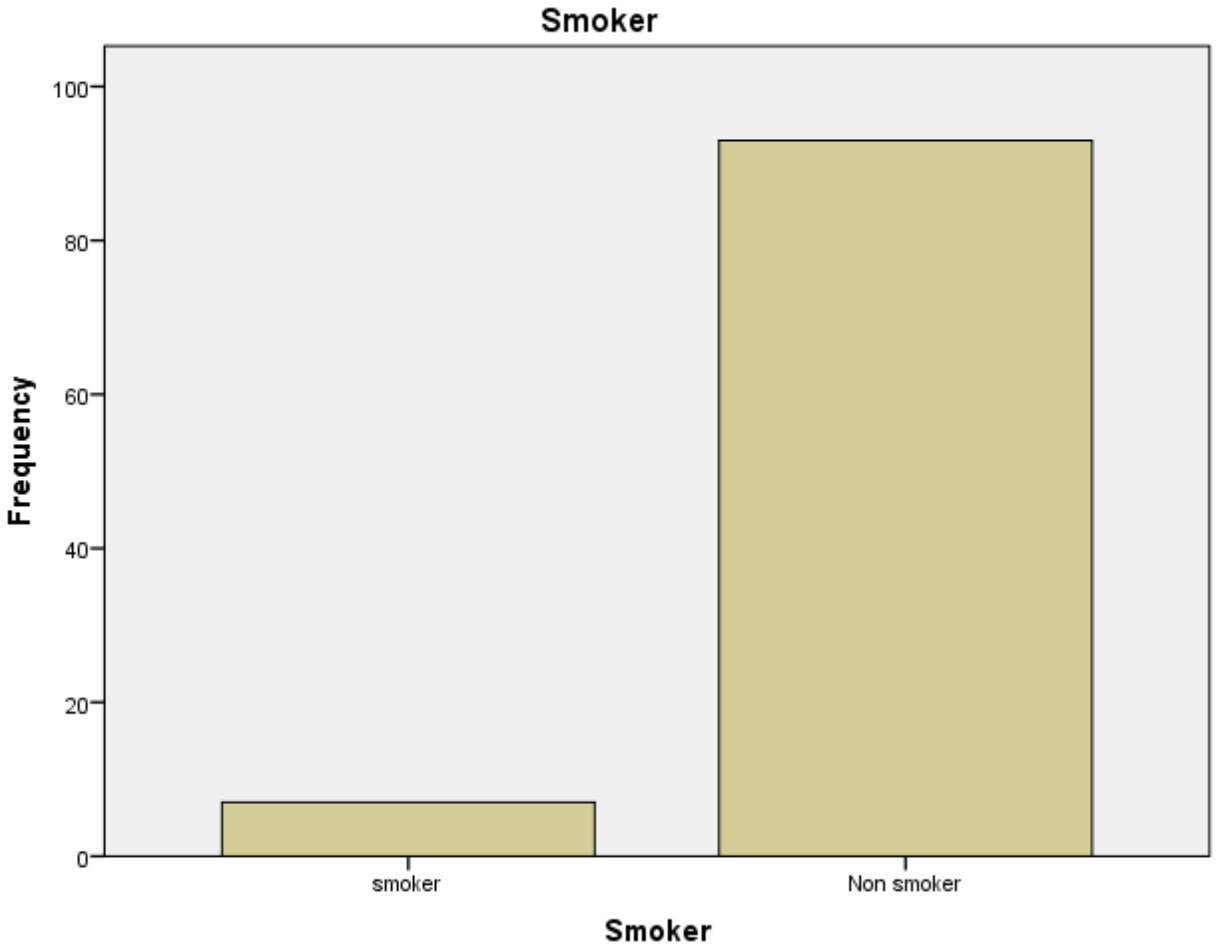

HCT(PCV)
100
80
60
40
20
0
Frequency
less than 20
20%-35%
36%-50%
HCT(PCV)

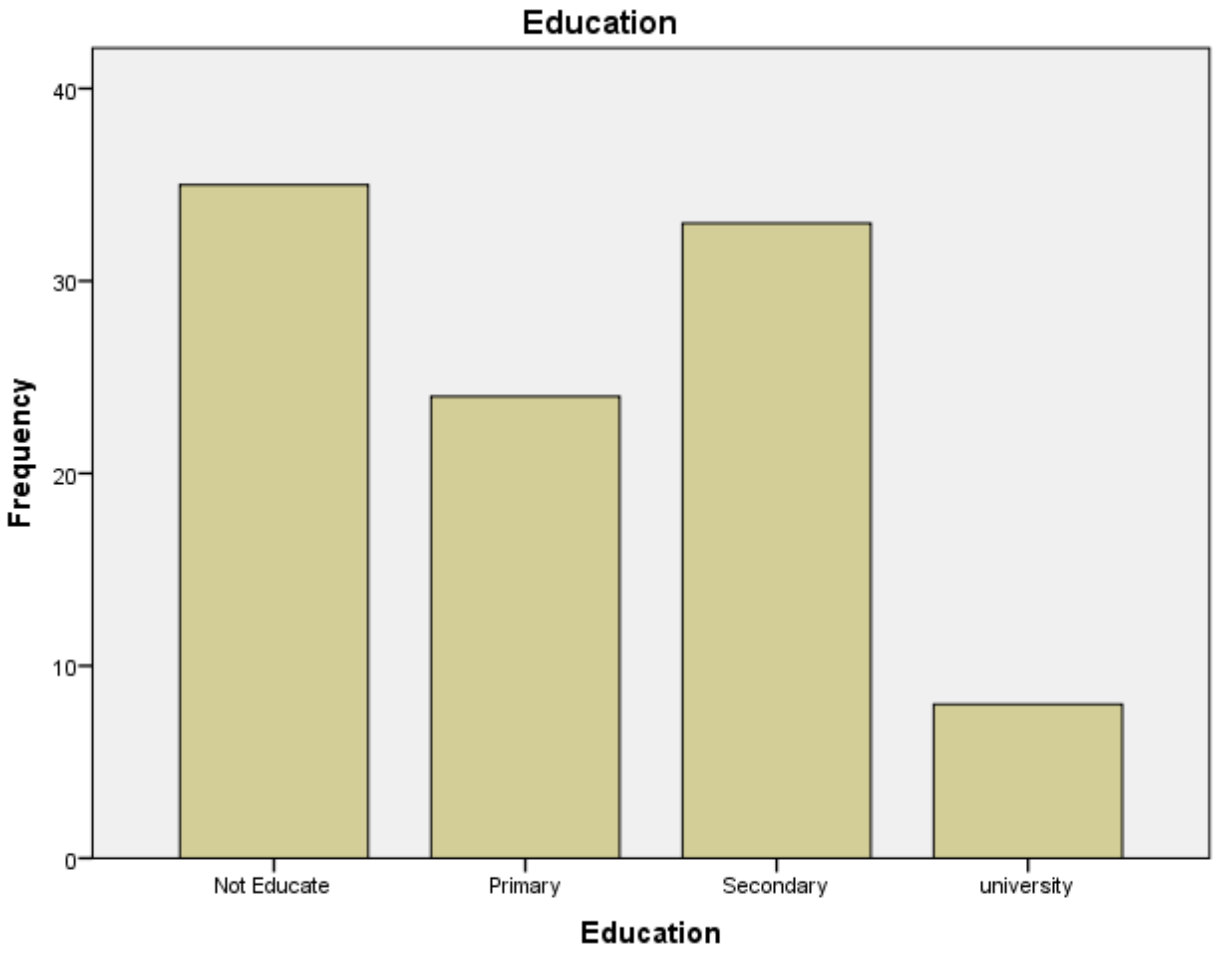

RBCs Count
Frequency
60
40
20
0
1.8 million-3.79million
3.80million-5.5million
RBCs Count

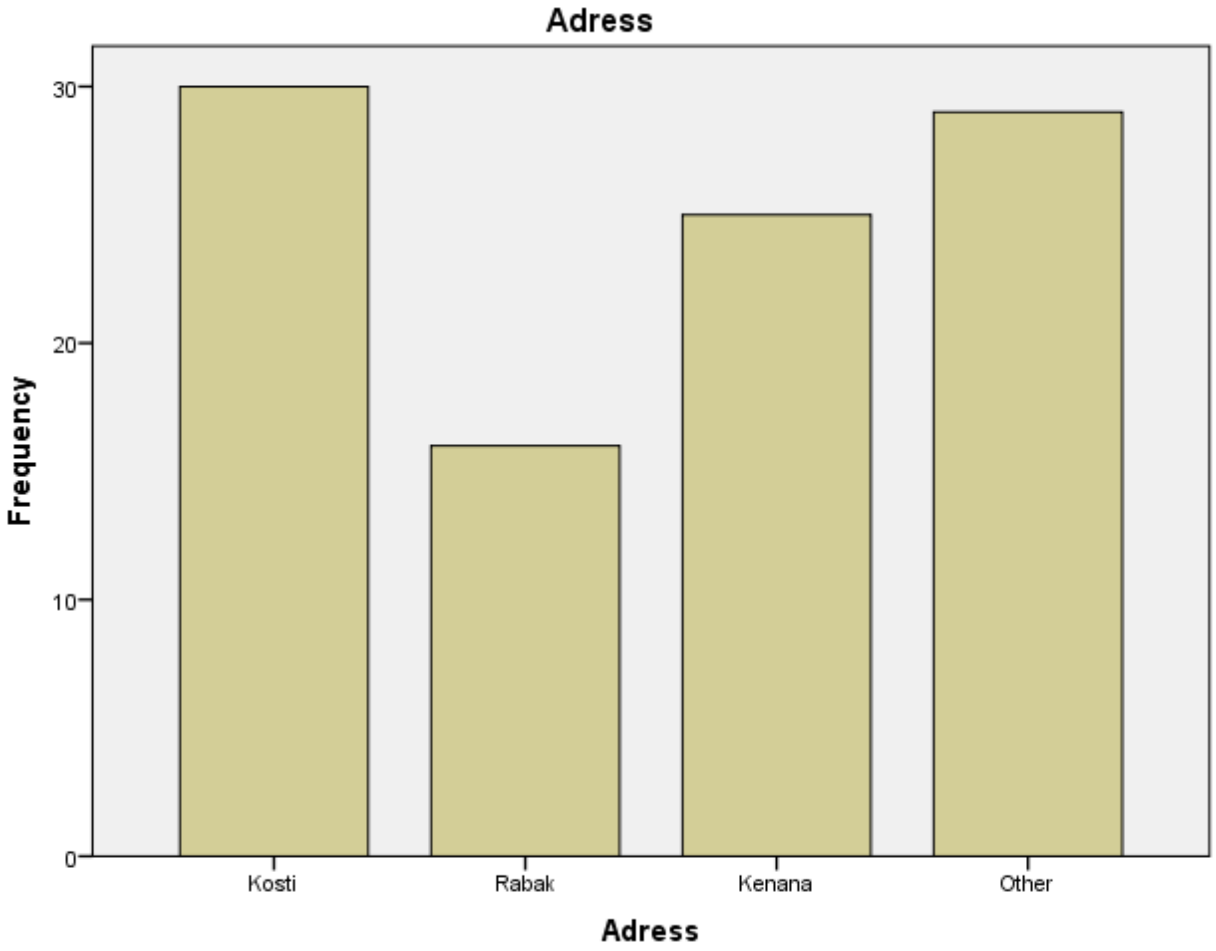

Hb Case
Frequency
60
50
40
30
20
10
0
4-5.9g/dl
6-7.9 gldl
8-9.9 gldl
10-11.9gldl
12-15.7
Hb Case


family history of TB
Frequency
80
60
40
20
0
Yes
No
family history of TB


Duration of Smoker
Frequency
100
80
60
40
20
0
less than year
1-2year
more than 2 year
Duration of Smoker


Smoker
100
80
60
40
20
0
Frequency
smoker
Non smoker
Smoker


Education
Frequency
40
30
20
10
0
Not Educate
Primary
Secondary
university
Education


Adress
30
20
10
0
Frequency
Kosti
Rabak
Kenana
Other
Adress

DISCUSSION

Pulmonary tuberculosis (PTB) is a major infectious disease with very high incidence in developing countries.[6] It causes ill-health among millions of people each year and ranks alongside the human immunodeficiency virus (HIV) as a leading cause of death worldwide The African Region had 28% of the world's cases in 2014 [7].

This is a case control study conducted in Kosti and Kenana teaching hospitals in White Nile State, Sudan, from January to April 2016 to reveal change in hematological profile in pulmonary tuberculosis patients who are clinically positive with acid fast bacilli (MTB) in sputum and under treatment.

The patients were lies in average of ages between 15-30 years, 31-45 years and <15 years with percentage 44%, 26% and 9% respectively**(Table 1)**.

This study shows close relation between educational state and the distribution of the disease among the patients, with significant distribution among 52.9% of non-educated patients in Kost30% , Rural area 29%, Kenana 25% and Rabak 16% **(Table 1)**.

27% of patients had a family history of TB **(Table 1)**.

Our present study show haemoglobin concentration, packed cell volume ,mean cell volume and mean cell haemoglobin of pulmonary tuberculosis patients (9.93±1.827, 31.3±5.27, 79.63±8.85, 25.6±3.61) respectively, was significantly lower ($p<0.05$) than that of control subjects (12.95±1.728, 39.22±3.50, 87.4±4.20, 28.72±1.76) ,whileRBC count and MCHC of patients was found normal (3.92±0.735, 31.88±1.38)near to that of control subject **(**4.55±0.400,32.7±0.93**)** .

These finding in agreement with result of Mubarak I Idriss, ..etal, that done on Kassala Area, Eastern Sudan on August 2013, who found that Sixty three (64.3 %) with haemoglobin between 7g/100ml and11g/100ml, (9.2 %) with haemoglobin lessthan 7g/100ml. 26 (26.5%) of thepatients with haemoglobin more than 11g/100ml, MCV 70.6 ± 9.5fl,MCH 25.3 ± 4.6pg, MCHC 35.8 ± 3.6g/dl and RBC count 4 471 000 ± 9 517. [8]

Concerning RDW value in PTB patients (16.06±2.66) were found in our current study, significantly higher when compared with control one (13.58 ±0.9) (p.value= .000). This result similar to those finding of a Gribel M. and her collageous which done in the

state of Rio de Janeri between March 2007 and December of 2010and concluded that high RDW(16.63± 3.47%) **(Table 3).** [9]

There was a negative correlation between Reticulocyte count and tuberculosis (p. value = 0.692) and the count revealed was (1.03±0.45) resemble that of the Mubarak I Idriss result..etal, that done on Kassala Area, Eastern Sudan on August 2013, who found thatReticulocytes Count, % 0.99 ± 0.51**(Table 3)**. [8]

The ESR values of PTB patients(69.07± 17.68 mm/hr) obtained in this study were significantly higher than control values (20.71±4.80 mm/hr). This agrees with previous findingswhich stated that high ESR (60.30± 39.84**)(Table 4)**.[9] ESR is often raised in infections and inflammatory conditions due to increased production of acute phase proteins often observed in chronic infections and release of proteins by the causative organism (*M.tuberculosis)* into the circulation.[10]

On the study done by Muhammad Shafee and his colleagues Platelets count was found in the normal range in most of the patients, however thrombocytopenia were observed in (15%) and (13%) while thrombocytosis in (12%) and (10%) in male and female patients respectively. This finding is consistant with our study which shows normal platelet count in 73% of cases, thrombocytopenia in 14% of cases and 13% have thrombocytosis**(Table 5)**.[11]

Leukocyte response varied from leukocytosis to leucopenia and normal Leukocyte count was documented in 67% of patients with pulmonary tuberculosis . The prevalence of normal leukocyte count in present study was coincide to study done by Iqbal and his collageous inMilitary Hospital, Rawalpindi [81]. Almost of the patients had normal neutrophil, Eosinophil, basophil, monocyte and ymphocyte in (99%, 43%,100%,80% and 64%) respectively. Also Eosinophilia is reported in (57%) of patient , monocytosis in (20%) of cases, and low lymphocyte count in(30%)of cases. This result agree in points and disagree in another point with various studies, like neutrophilia documented by by Iqbal and his collageous inMilitary Hospital, Rawalpindi [12] different from our result may due to improvent of patient status with successful treatment. [12]

Comparing with study done by Bala J. and his collageous in India at 2015 our findings in patients in case of lymphocyte count are matched, but concerning with

Eosinophil count mis matched results were obtained,Bala J. and his collageous, documented normal Eosinophil count in 92.5% of patient**(Table 6)**. [13]

The type of anaemia in our patients as seen from red blood indices and peripheral morphology was normocytic anaemia with mild hypochromisia, normocytic normochromic and severe microcytic hypochromic with percentages 55%, 35% and 10% respectively. Regarding to previous study done by Mubarak I Idrissand his collageous.type of anaemia is hypochromic microcytic or normochromicnormocytic anaemia. Haemolytic anaemia exceedingly rare in tuberculosis.Morphologically64% of samples show toxic granulations and band form neutrophils. Also five samples show giant platelets**(Table 7)**.[8]

CONCULSION

Most of the patients showed anemic with low Hb and different types of anemia grading from normocytic hypochromic, or mild hypochromisia or microcytic hypochromic.

ACKNOWLEDGEMENTS

First of all we thank Allah for giving us the strength and support to do this work. We wish to express our deep indebtedness to our supervisors Dr. Ahmed Mohammed Elnour Elkhalifa and U. Nada Yaseen Ali for their valuable supervision, inspiring guidance and unfailing interest he displayed throughout this study.

Loving thanks for our friends Ziyad Mudasir, Salma Mahjoub, Tsabeeh Elfadil and Hassan Abdelgadir for their participation along this work.

We are grateful to our *colleagues* at the Department of Hematology and Immunohaematology for their encouragement and support.

We want to express our deep thanks for our promoter Mr. Ahmed Ibn Edriss.

Also thankful extended for lab staff of tuberculosis in Kosti and kenana hospitals for their cooperation along this work. Also we want to thank all participants (Patients and control persons).

REFERENCES

1- Morris CD, Bird AR, Nell H. The hematological and biochemical changes in severe pulmonary tuberculosis. Q J Med. 1989; 73(3):1151–9.

2- E. Gregory Thompson, Brian D. O'Joseph O'Donnell. Complete blood count "CBC" .British Columbia Health Link BC. 2014.

3- Fischbach FT, Dunning MB III, eds. Manual of Laboratory and Diagnostic Tests. 8th ed. Philadelphia: Lippincott Williams and Wilkins. 2009.

4- Lisa B. Bernstein. Lung disease and respiratory health center. The Basics of Tuberculosis . WebMD. LLC. 2015.

5- World Health Organization Tuberculosis Key Facts. 2014.

6- Robson S. C. White N. W. Aronson I. Woollgar R. Goodman H. Jacobs P. Acutephase response and the hypercoagulable state in pulmonary tuberculosis. BritishJournal of Haematology. 1996; 93: 943– 949.

7-Global tuberculosis report 2015.WHO Library Cataloguing-in-Publication Data.20 Avenue Appia, 1211 Geneva 27, Switzerland 2015.

8. Mubarak I Idriss. Hiba B Khalil. Abbashar O Abbashar. Sara Widaah. MamounMagzoub. Hematological Changes Among Tuberculous Sudanese patients in Kassala Area, Eastern Sudan. Al Neelain Medical Journal.2013; .3(11).

9- Gribel M. Neves K. Marinho H. Ruffino A. Lineu A. and Maria M. Anemia in Hospitalized Patients with Pulmonary Tuberculosis. Journal Brasilerio de Pneumologia.the state of Rio de Janeri. 2014; 40 (4).

10- Akpan, Patience. A. AkpotuzorJosephine . O. Akwiwu. Ephoria.C. Some Haematological Parameters of Tuberculosis (TB) Infected Africans. The Nigerian Perspective.Journal of Natural Sciences, 2012;.2(1):50.

11-Shafee M. Abbas F. AshrafM. Alam M.Kakar N. Ahmad Z ....etal.Hematological profile and risk factors associated with pulmonary tuberculosis patients in Quetta, Pakistan.Pakistan Journal of Medical Sciences Pak J Med Sci. 2014; 36–40.

12- Iqbal S. Ahmed U. Alamgir Khan M. HAEMATOLOGICAL PARAMETERS ALTERED IN TUBERCULOSIS. Pak J Physiol. Military Hospital, Rawalpindi.2015; 11 (1).

13-Bala J. Bagdi R.Bedi S.Kumar A. Tuberculosis As A Cause Of Change In Hematological Parameters In A Tertiary Care Hospital. NJIRM. 2015; 6(4): (32-3).