Ministry of Higher education and scientific research
University of Baghdad
Al-kindy college of medicine

Prevalence of abnormal blood incidence in heart failure patients

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وَقُلْ رَبِّ زِدْنِي عِلْمًا

صدق الله العظيم

سورة طه

Abstract:

Introduction: Heart failure means that the heart isn't pumping as well as it should. The body depends on the heart's pumping action to deliver oxygen- and nutrient-rich blood to the body's cells. With heart failure, the weakened heart can't supply the cells with enough blood. With a lot of complications: Irregular heart rhythms, liver and kidney damage, lung dysfunction and loss of energy.

Objectives:

- ➢ Understande Pathophysiology HF.
- ➢ prognostic blood indices in heart failure.

Methods: The study was Conducted in AL-Kindy College of medicine University of Baghdad, from december 2020_2023 April. 100 patient sample collected from AL-kindy teaching hospital and IBN-Nfees hospital. The number of male74 and female 26. And the mean age 59.9 . We get information needed from patient's file in the hospital and Archives .Analysis using a statistical package for social sciences (spss) was applied on the collected data.

Result:

- That there is significant decrease in(RBC, PLT, HGB, HCT, MCV, MCH, MCHC, PDW) values (the mean difference was negative).
- That there is significant increase in (WBC, RDW, MPV) values (the mean difference was positive).
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Conclusions:

- Anaemia is highly prevalent in patients with HF particularly, in the elderly and in females.
- higher degree of thrombocytopenia is associated with higher all-cause mortality.
- High RDW is associated with a high mortality rate in HF patients.

Recommendations: Further studies among other hospitals and societies are needed about the effects of heart failure on kidney functions or lung functions.

List of content

Introduction:

Heart failure, also known as congestive heart failure (CHF), is a progressive condition that serves as a common endpoint for various forms of cardiac disease. It carries an extremely poor prognosis (Braunwald, 2008) **[3]** (Mayo Clinic)**[4]**. While the term heart failure may imply a complete cessation of heart function, it actually refers to a situation where the heart is unable to pump blood as effectively as it should. Although congestive heart failure is often used interchangeably with heart failure, it specifically denotes a type of heart failure that requires timely medical attention (American Heart Association, 2016) **[1].**
The body relies on the heart's pumping action to deliver oxygen- and nutrient-rich blood to the cells. In heart failure, the weakened heart fails to supply adequate blood to meet the body's needs. This results in symptoms such as fatigue, shortness of breath, and excessive coughing. Even simple everyday activities like walking, climbing stairs, or carrying groceries can become challenging (American Heart Association, 2016) **[1].**

Etiology:

Most cases of heart failure stem from systolic dysfunction, which refers to inadequate myocardial contractile function resulting from conditions like ischemic heart disease. However, heart failure can also arise from diastolic dysfunction, characterised by the heart's inability to relax and fill properly. Valve dysfunction, abnormal load burden, and increased tissue demands are additional causes of heart failure (Braunwald, 2008) **[3][4]**.

Pathophysiology:

In response to reduced myocardial contractility or increased hemodynamic burden, the cardiovascular system employs several homeostatic mechanisms:

- The Frank-Starling mechanism plays a role in heart failure compensation, where increased end-diastolic filling volumes lead to cardiac dilation and enhanced contraction, thereby increasing cardiac output. However, ventricular dilation increases wall tension and oxygen requirements, eventually leading to decompensated heart failure (Braunwald, 2008) **[3].**
- Activation of neurohumoral systems, including the release of norepinephrine, activation of the renin-angiotensin-aldosterone system, and release of atrial natriuretic peptide, further compensates for heart

failure by increasing heart rate, augmenting myocardial contractility, and regulating fluid balance (Braunwald, 2008) **[3].**

- Myocardial structural changes, such as augmented muscle mass, also occur in response to increased workloads. In pressure overload states like hypertension, the ventricular wall thickness increases (concentric hypertrophy), while volume overload states like valvular regurgitation can cause ventricular dilation with variable wall thickness. However, these compensatory changes increase myocardial oxygen demands and make the myocardium vulnerable to ischemic injury. Pathological cardiac hypertrophy is associated with increased mortality and is an independent risk factor for sudden cardiac death (Braunwald, 2008) **[3].**

Left-Sided Heart Failure:

The primary causes of left-sided cardiac failure include ischemic heart disease, systemic hypertension, mitral or aortic valve disease, and primary myocardial diseases like amyloidosis. Dyspnea on exertion is usually the earliest and most significant symptom of left- sided heart failure, along with coughing due to fluid transudation into air spaces. As heart failure progresses, patients may experience orthopnea (dyspnea when recumbent) and paroxysmal nocturnal dyspnea, characterised by breathlessness that awakens them from sleep. Other clinical features include an enlarged heart, tachycardia, a third heart sound (S3), and fine rales at the lung bases (Braunwald, 2008) **[3].**

Right Side heart failure:

Pure right-sided heart failure is associated with systemic and portal venous congestion, leading to manifestations such as hepatic and splenic enlargement, peripheral edema, pleural effusion, and ascites (Braunwald, 2008) **[3].**

Isolated right-sided heart failure also can occur in a few diseases. The most common of these is severe pulmonary hypertension, resulting in right-sided heart pathology termed cor pulmonale. In cor pulmonale, myocardial hypertrophy and dilation generally are confined to the right ventricle and atrium, although bulging of the ventricular septum to the left can cause left ventricular dysfunction. Isolated right sided failure also can occur in patients with primary pulmonic or tricuspid valve disease.

Complications of Heart Failure:

Heart failure can give rise to several complications that further impact overall health and well-being. And these complications are:

- Irregular Heart Rhythms: When the heart struggles to pump blood effectively, it can result in arrhythmias, which are irregular heartbeats. Arrhythmias disrupt the coordinated contraction of the heart chambers, impairing blood flow and oxygen delivery throughout the body (American Heart Association, 2020) **[2].**
- Liver and Kidney Damage: Heart failure can lead to reduced blood supply to vital organs like the liver and kidneys, impairing their normal functioning. Insufficient blood flow can result in liver and kidney damage over time, affecting their ability to filter waste products and maintain overall homeostasis (Braunwald, 2008) **[3].**
- Lung dysfunction: Congestive heart failure can interfere with the efficient movement of blood into and out of the lungs. This can cause blood to accumulate in the lungs, leading to pulmonary edema (fluid buildup in the air sacs), making breathing more difficult (American Heart Association, 2016) **[1].**
- Loss of Energy: Inadequate oxygen delivery to the body's tissues due to heart failure can result in a significant loss of energy. Individuals may experience fatigue, weakness, and an inability to engage in physical activities that require exertion (American Heart Association, 2016) **[1].**

Objectives:

1-knowledge the types and causes of HF.

2- Understanding Pathophysiology HF.

3-knowledge what is the symptom, complication, treatment and diagnosis of HF.

4- prognostic blood indices in heart failure.

Material and methods:

This Cross sectional study was Conducted in AL-Kindy College of medicine-University of Baghdad in december 2020_ 2023April. patients sample 100 collected from AL-kindy Teaching hospital and IBN-Nfees hospital.

Exclusion criteria are the following :

- arrhythmias patient
- Ischemic heart disease patient
- Pulmonary embolism
- Obesity patient
- Diabetes mellitus

Sampling methods a convenience sample type of non probability sampling, Type of sampling is known availability sampling.

Method of data collection:

The data were collected from both genders at different ages, but the most elderly male, the number of the male is 74 and the number of female is 26. We get information needed from the patient's file in the hospital and also take data from Archives. The patients were lying in the ccu (coronary care unit). Every patient subjected to clinical and physical examination had ECG, Chest x ray, Echo study to confirm heart failure and investigations were done to them including CBC.

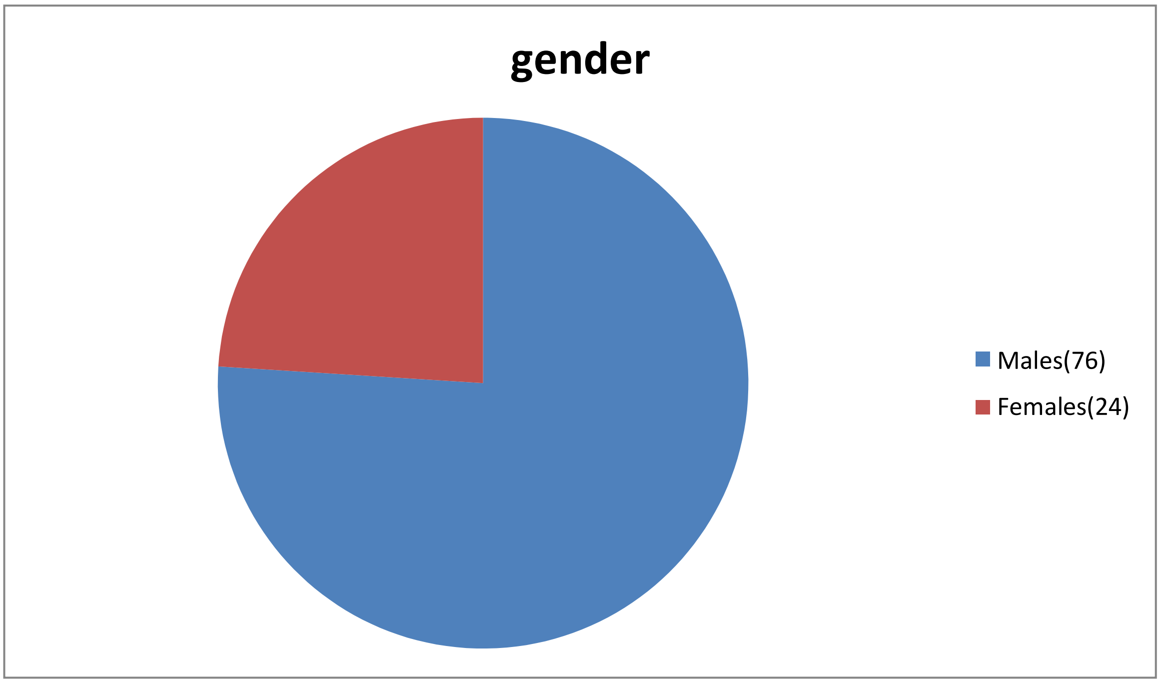
statistical methods :

The data were analysed using the statistical package for social sciences (spss) statistics version 29.0.0.0 (241)and microsoft Excel version 2010. Tables and figures will be used. We calculated the mean and standard deviations for CBC values of patients and explained the distribution on graphs. Independent sample t test was used to exclude effect of sex on CBC values in our sample, and chi-square test was used to exclude effect age on result in our sample. One sample t test was used for the patient's CBC values by using normal population mean to see if there is any change in the CBC of the heart failure patient values compared with normal population.

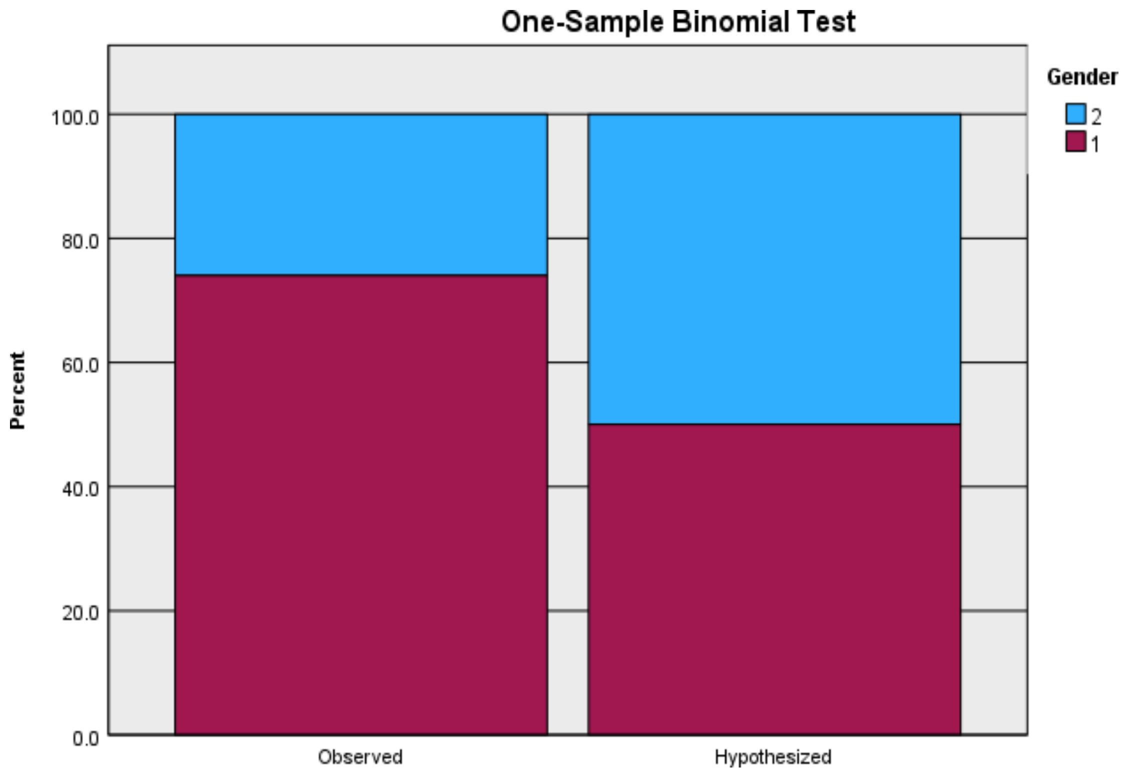
P value <0.05 used to be the level of significance.

Result

The Gender:



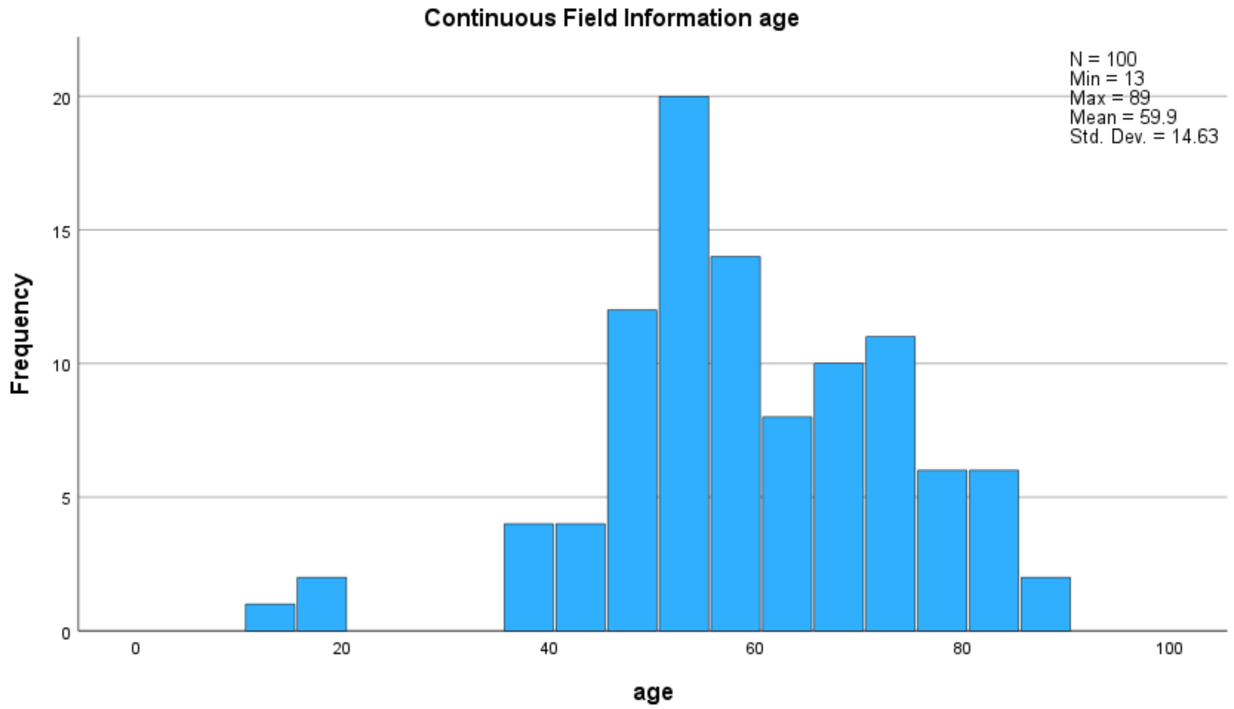
Chart(1)



Chart(2):

asymptotic significance (2-sided test)<0.001

The Age(years):



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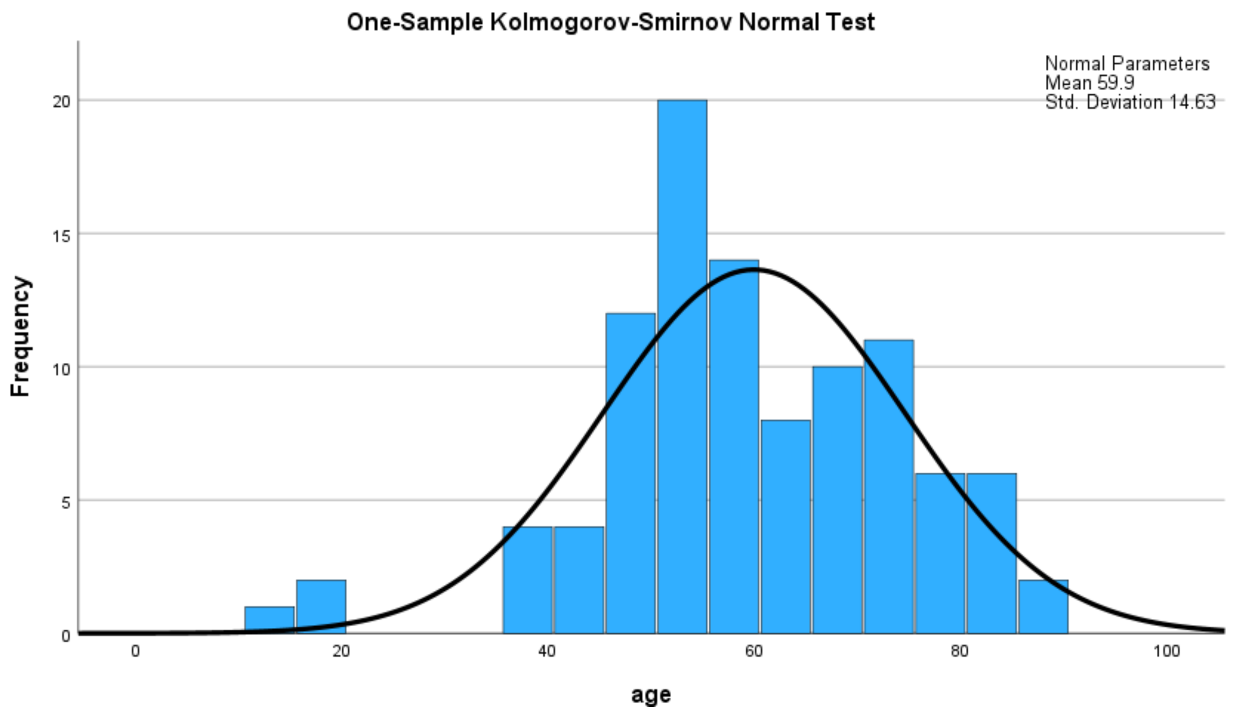
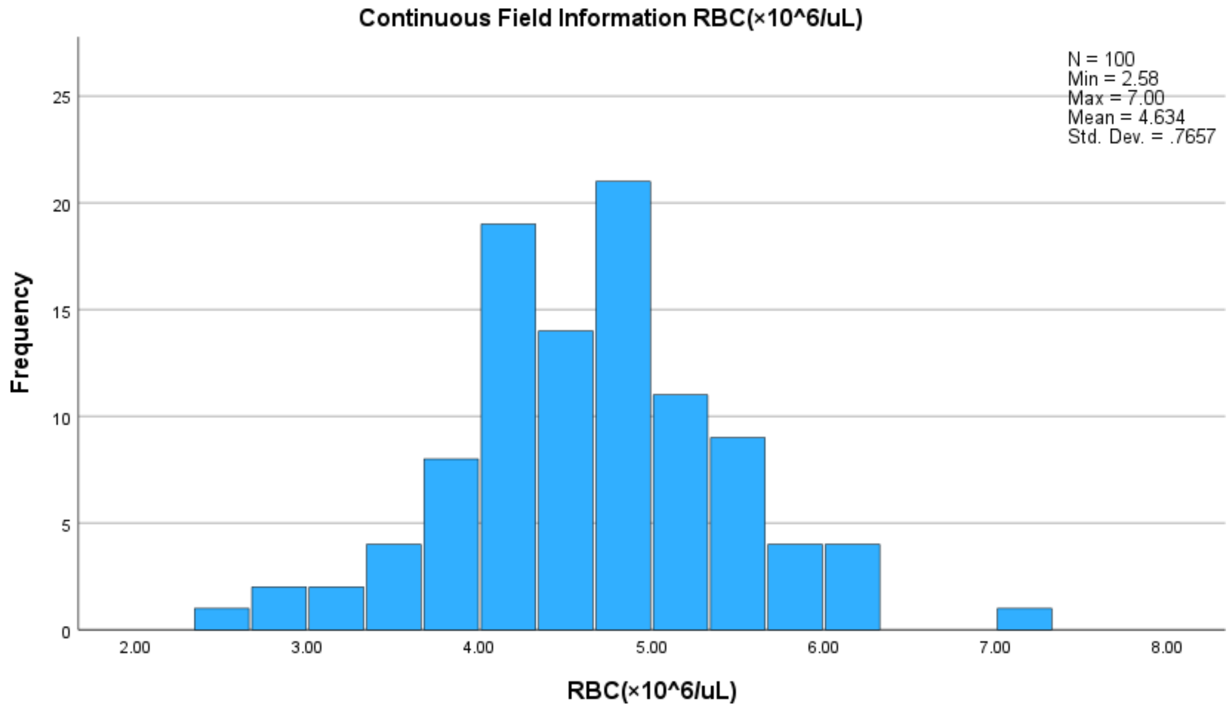


Chart(4):

asymptotic significance (2-sided test)=0.148

The RBC Values(×10^6/uL):



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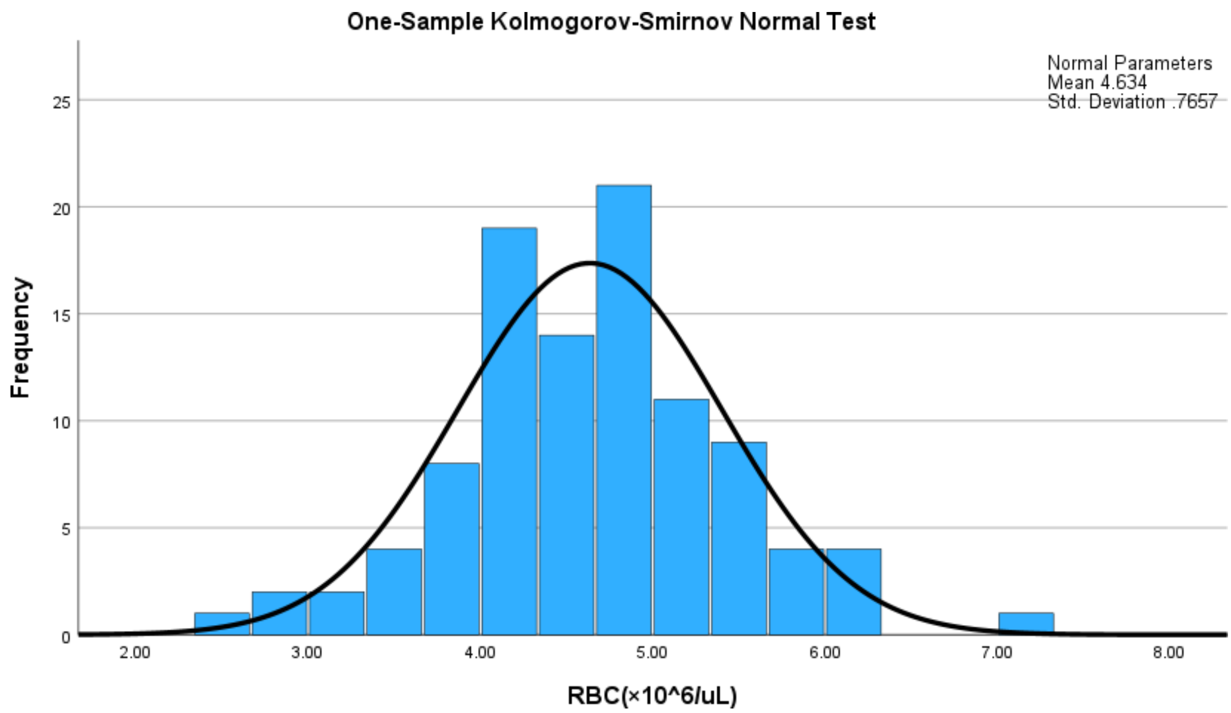
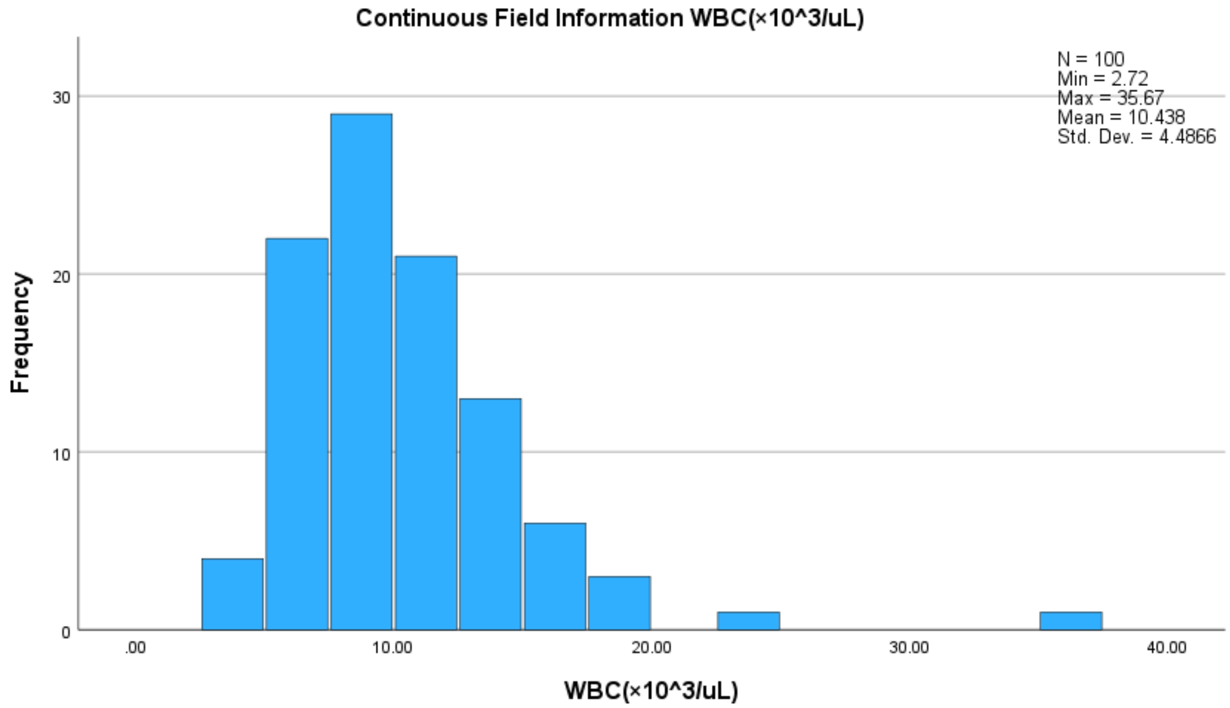


Chart(6):

asymptotic significance (2-sided test)=0.2

The WBC Values(×10^3/uL):



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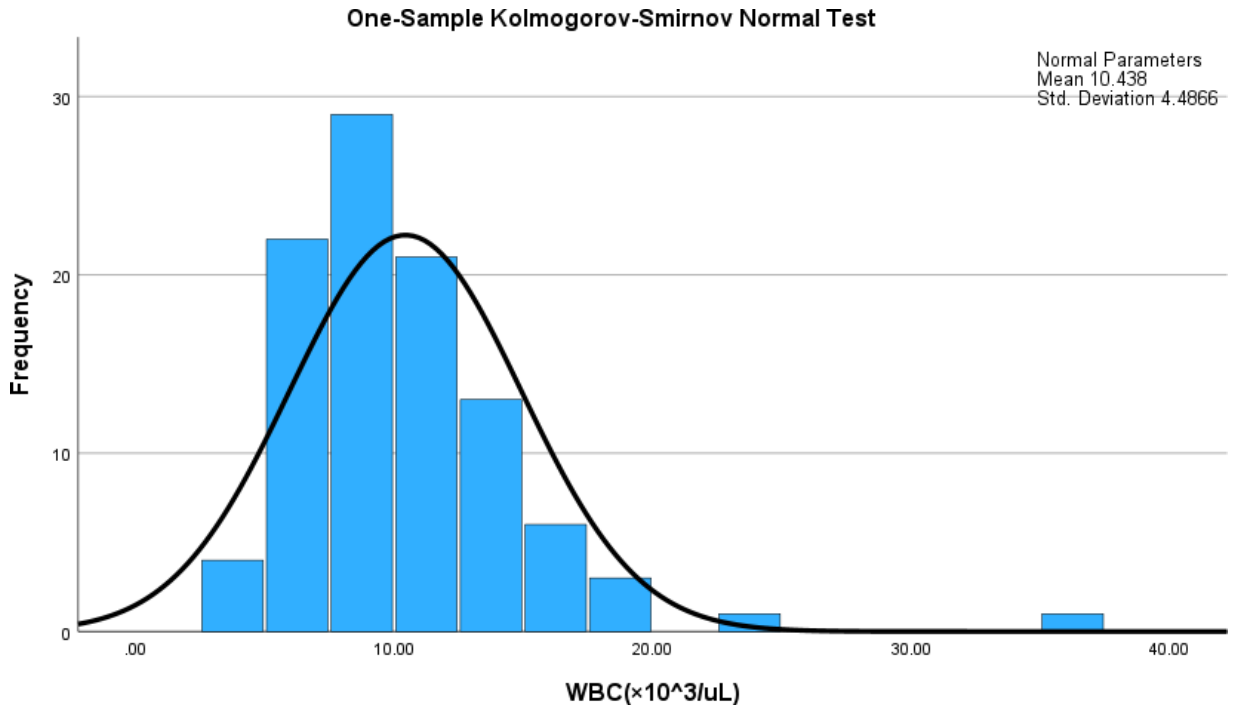
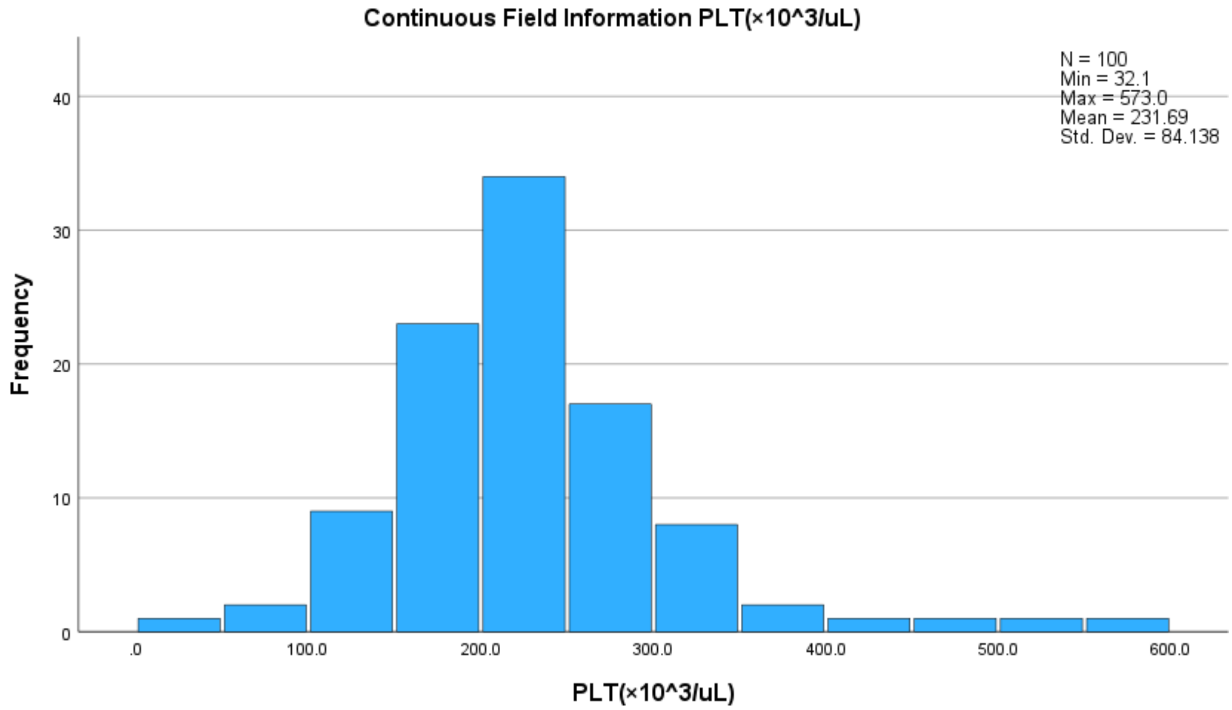


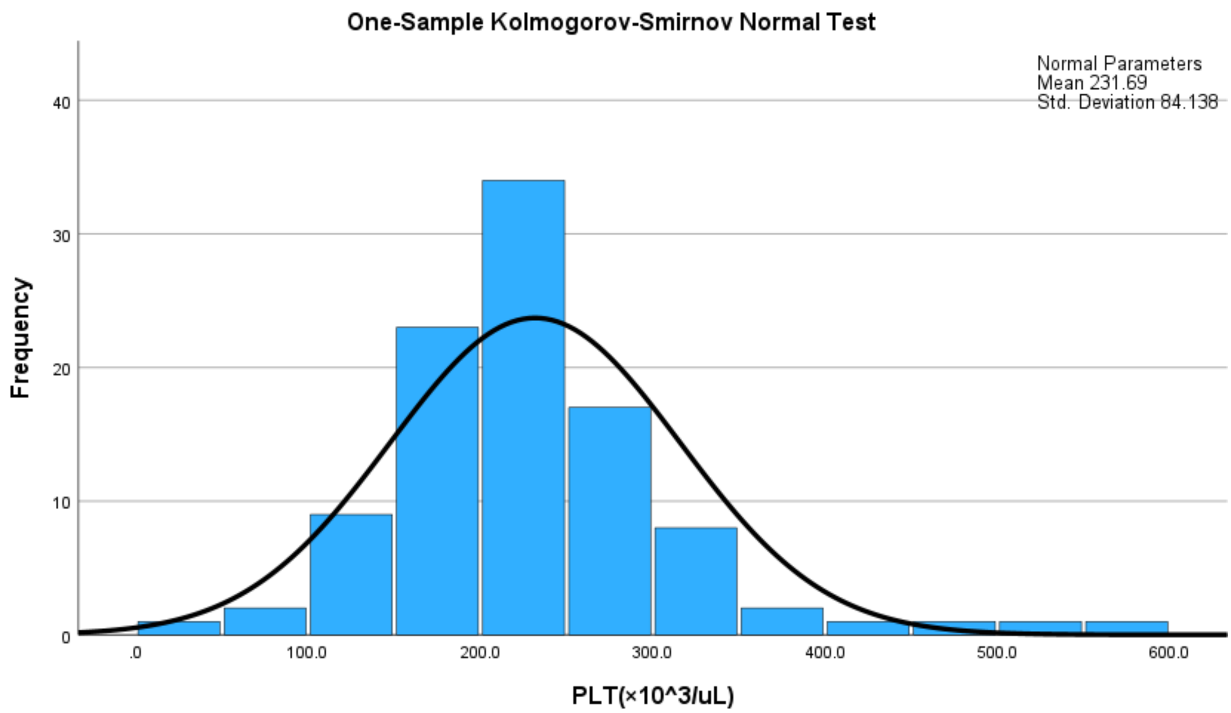
Chart(8):

asymptotic significance (2-sided test)=0.009

The PLT Values(×10^3/uL):



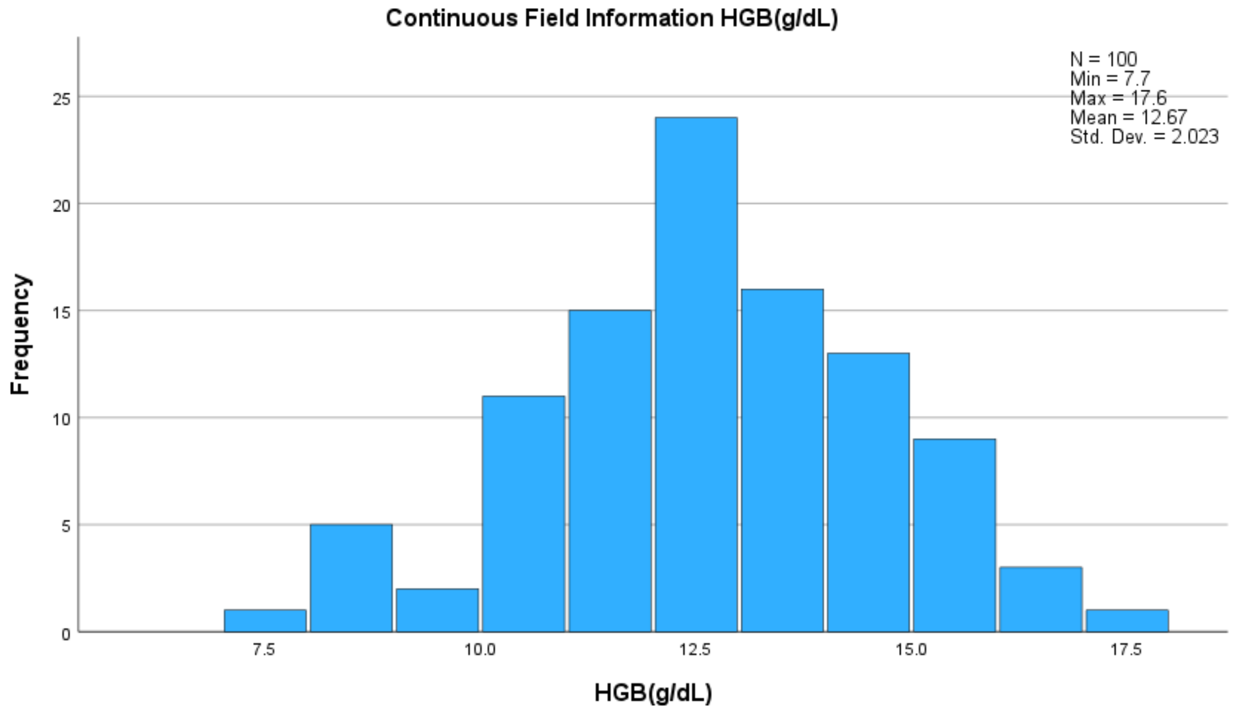
Chart(9)



Chart(10):

asymptotic significance (2-sided test)=0.001

The HGB Values(g/dL):



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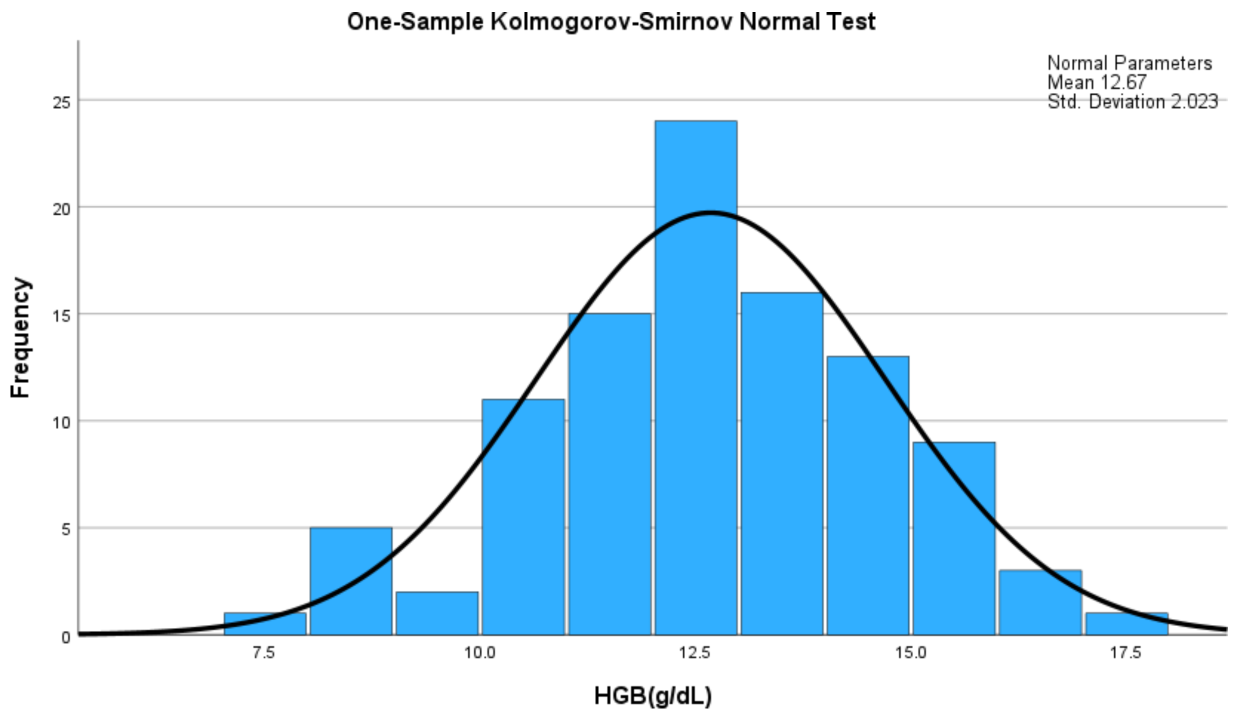
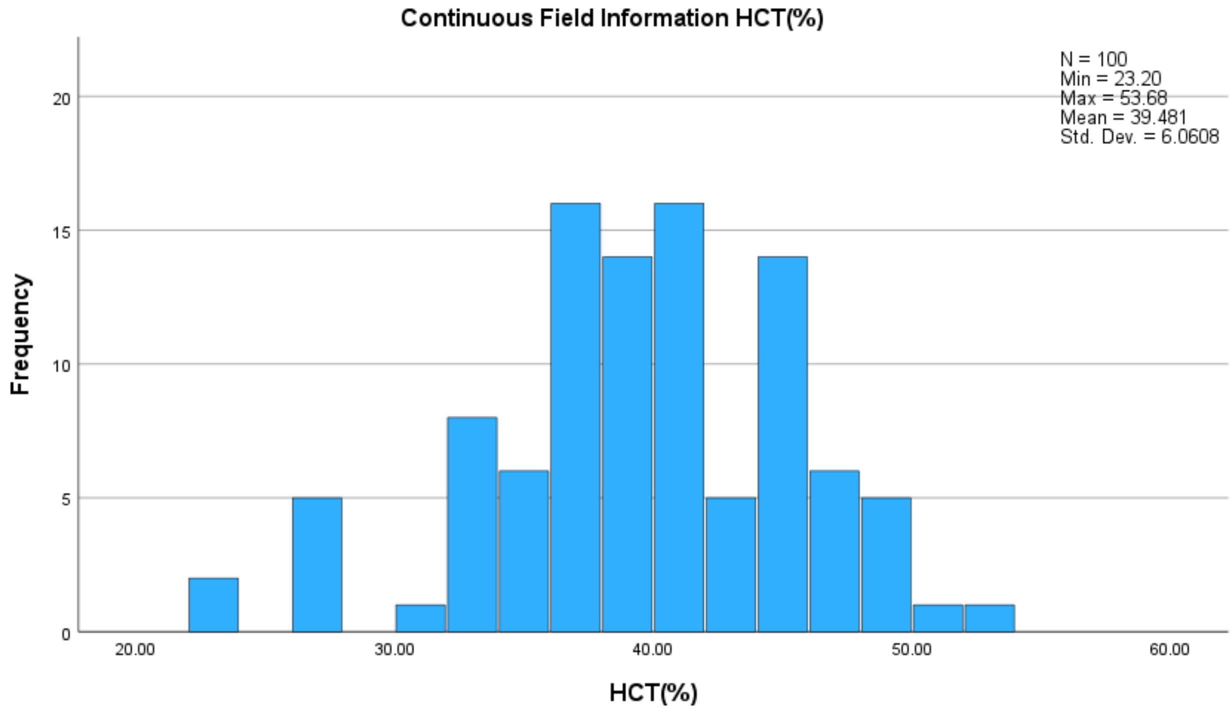


Chart(12):

asymptotic significance (2-sided test)=0.2

The HCT Values(%):



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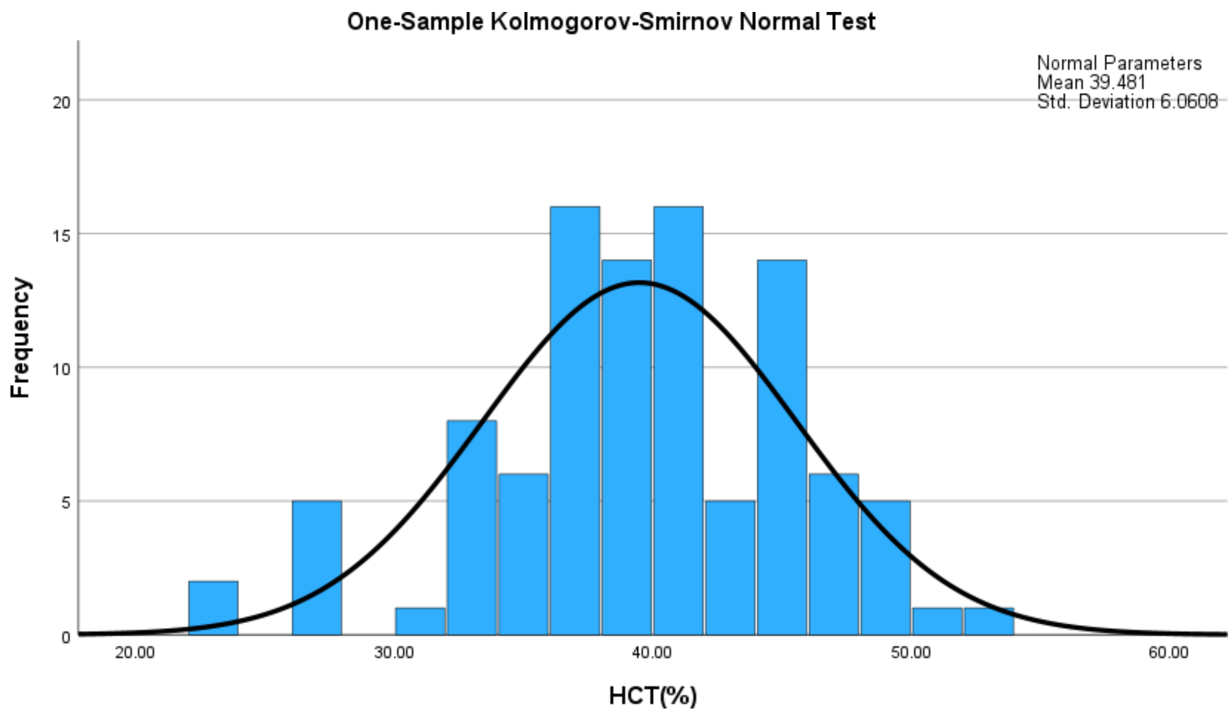
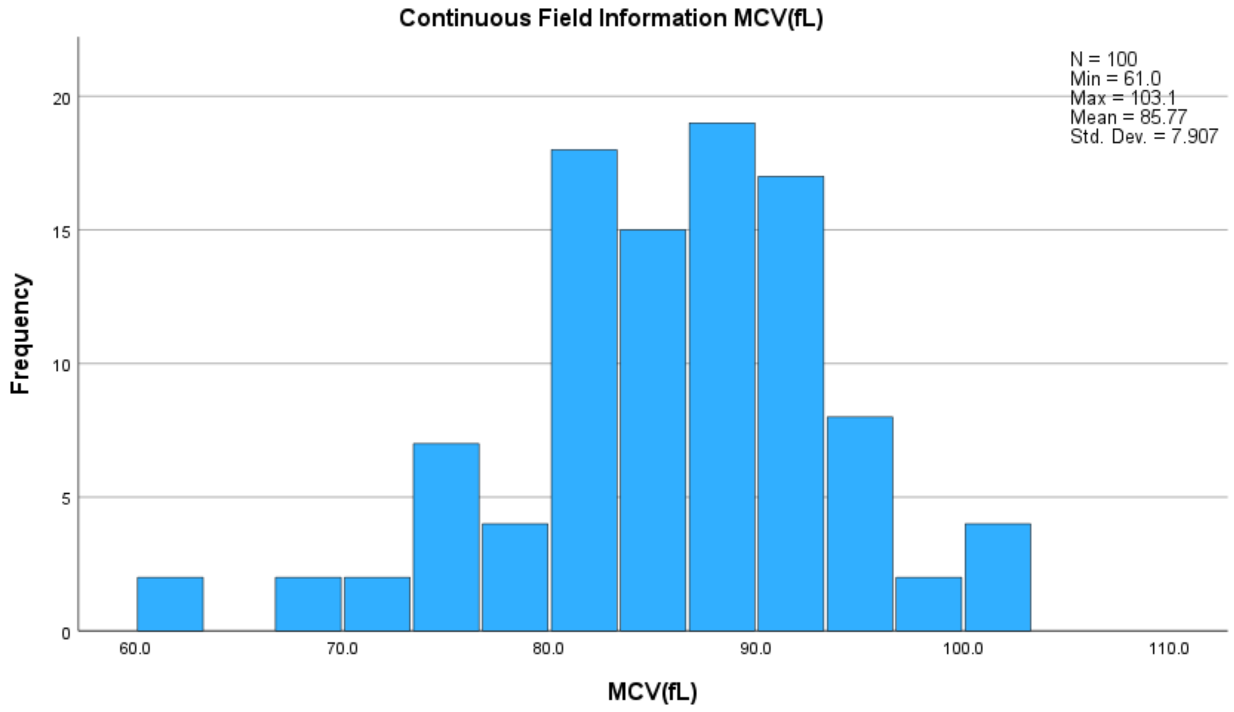


Chart(14):

asymptotic significance (2-sided test)=0.077

The MCV Values(fL):



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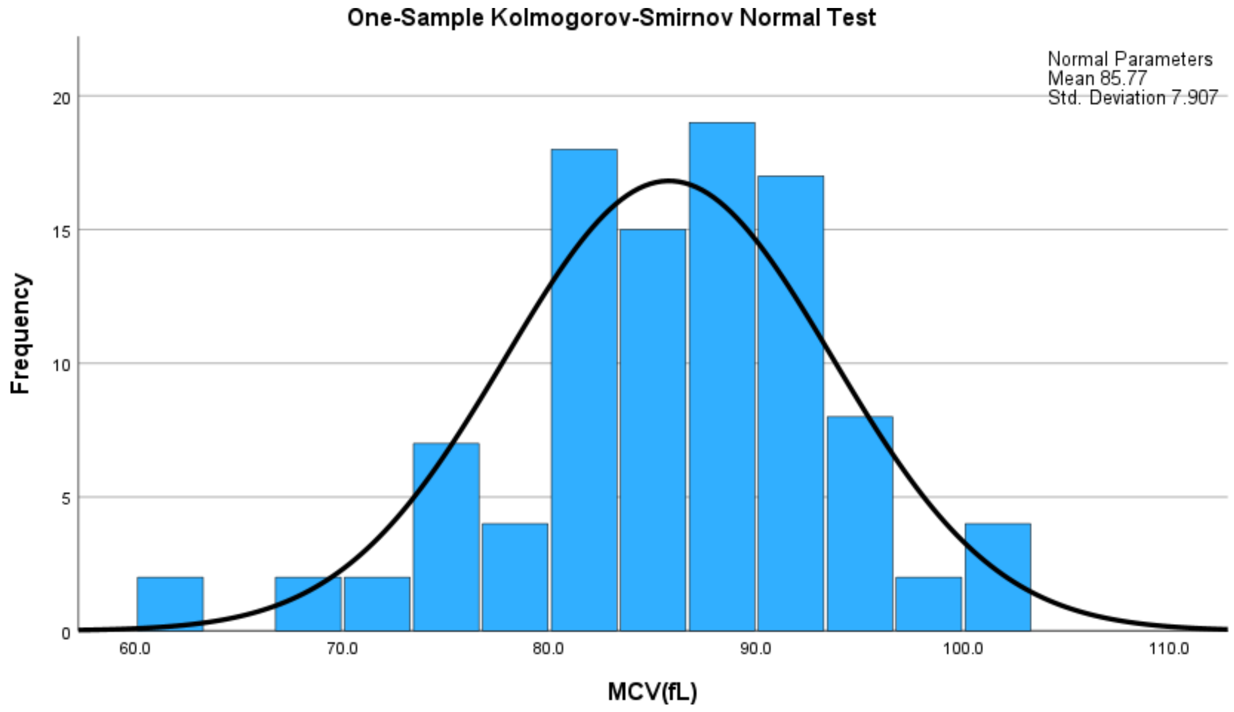
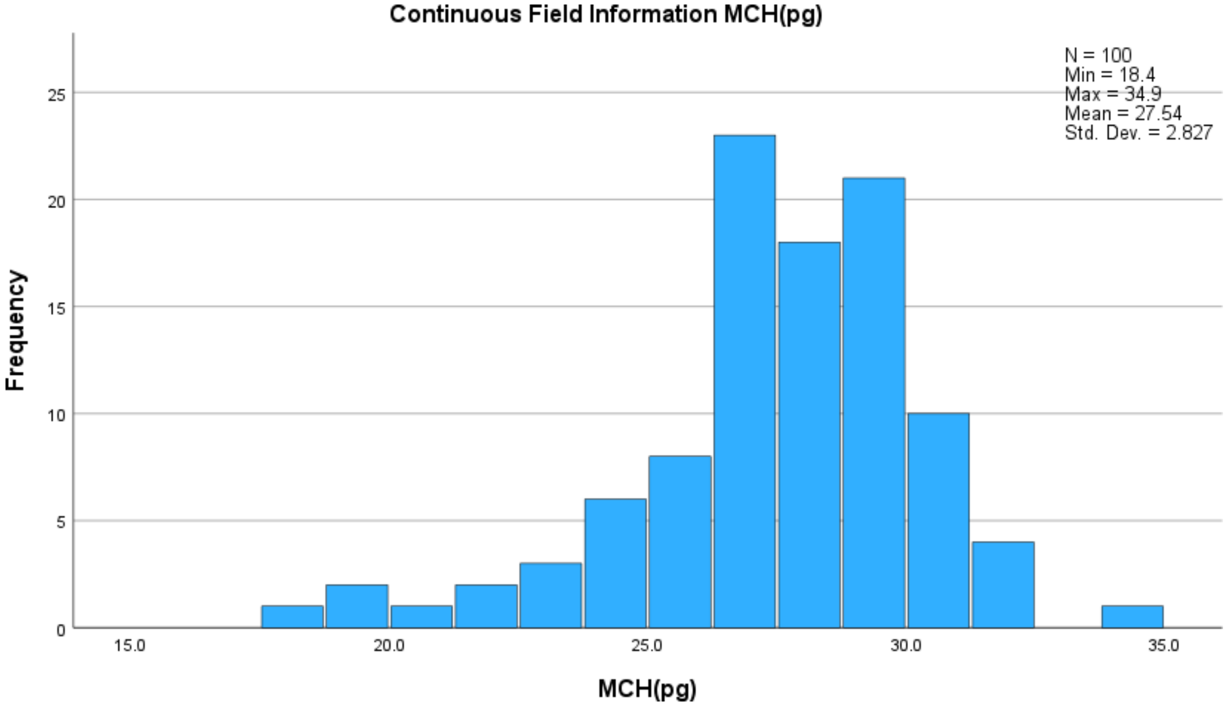


Chart(16):

asymptotic significance (2-sided test)=0.099

The MCH Values(pg):



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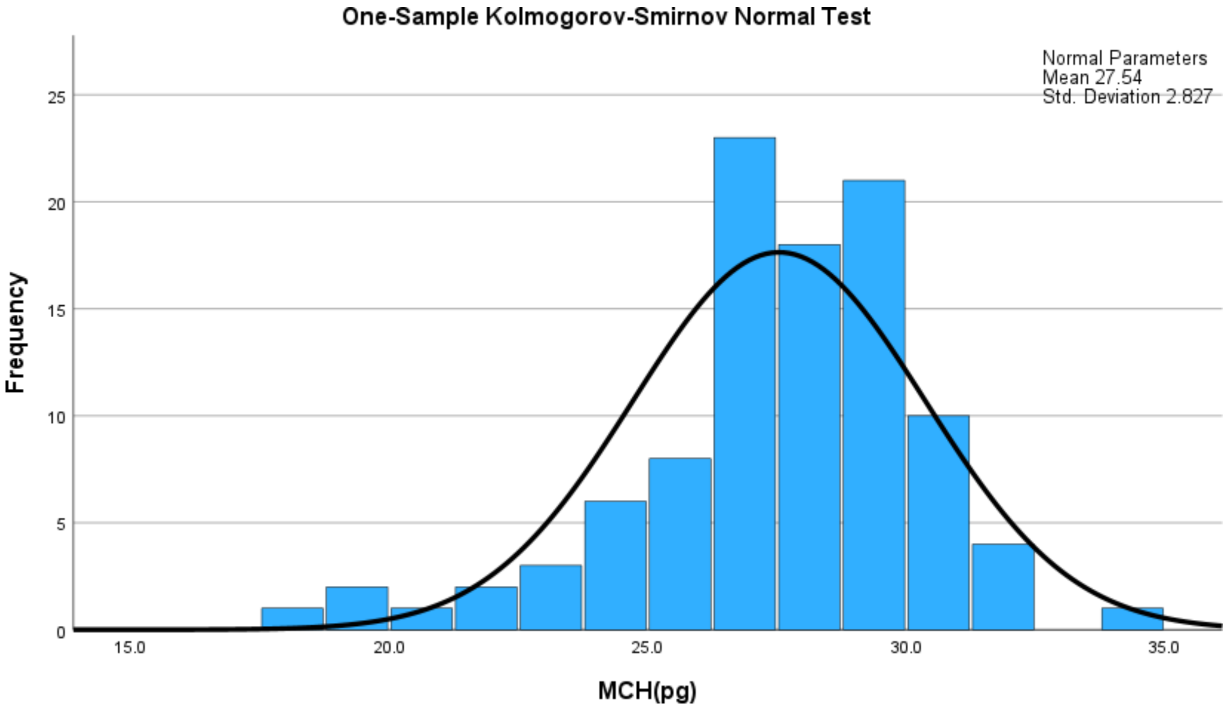
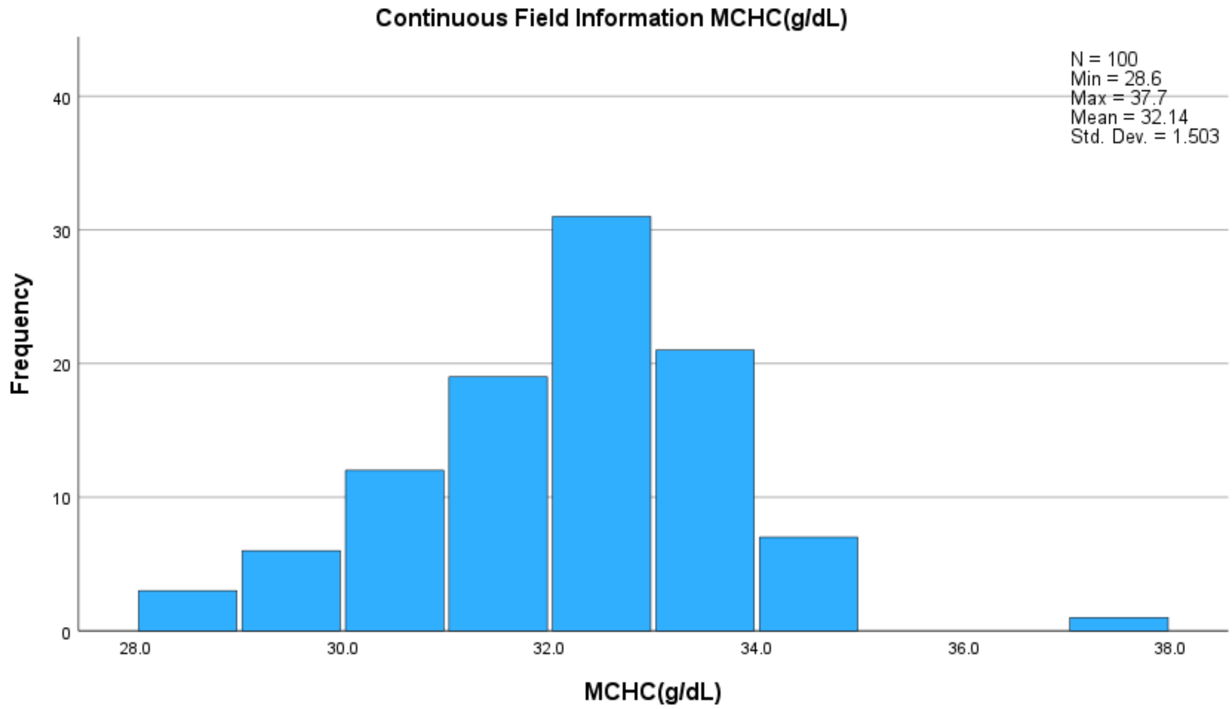


Chart(18):

asymptotic significance (2-sided test)=0.007

The MCHC Values(g/dL):



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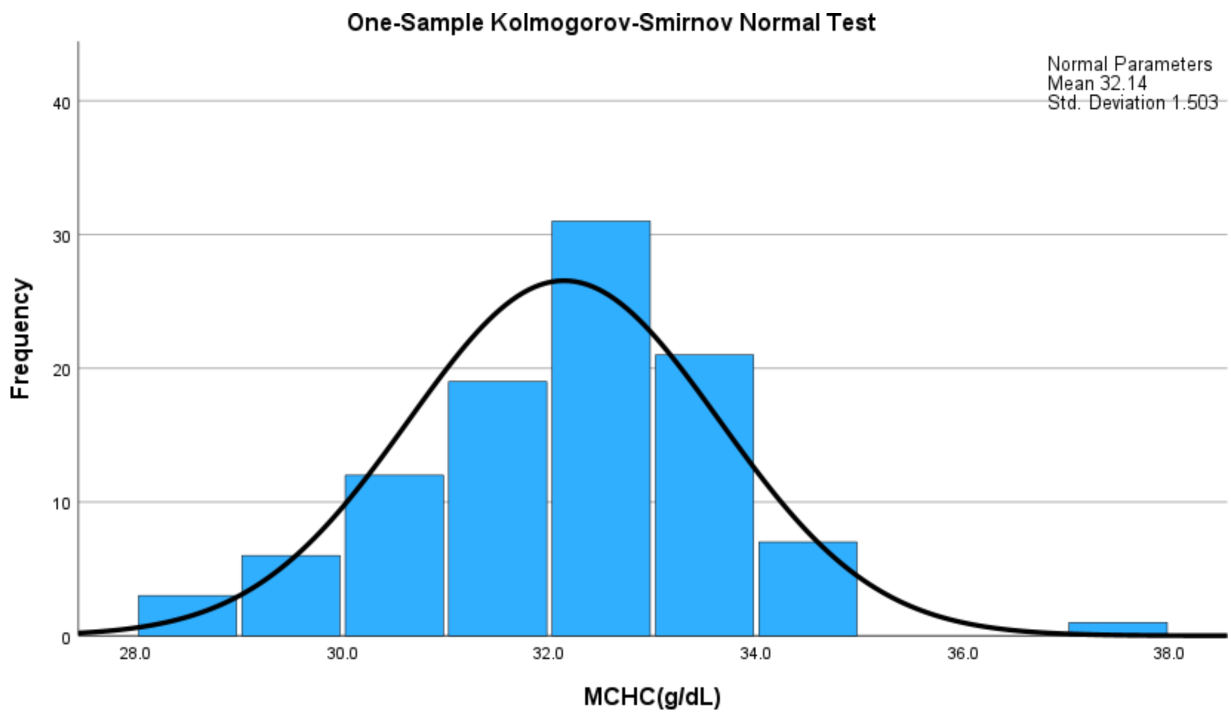
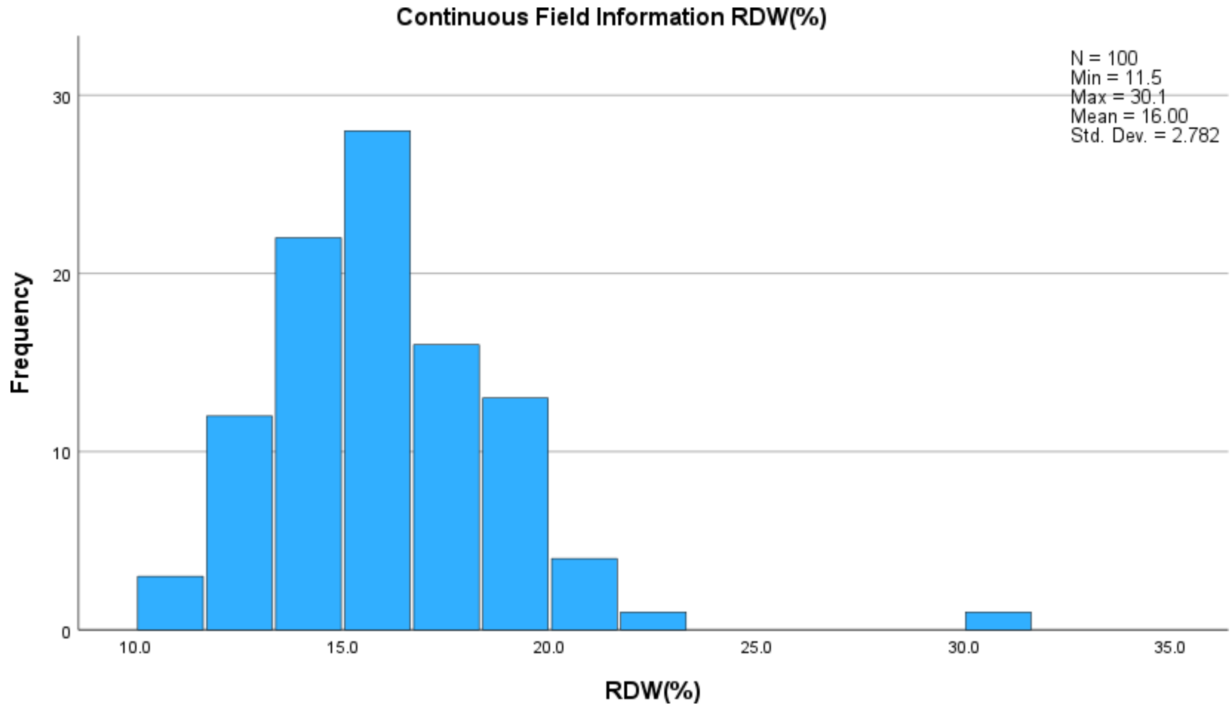


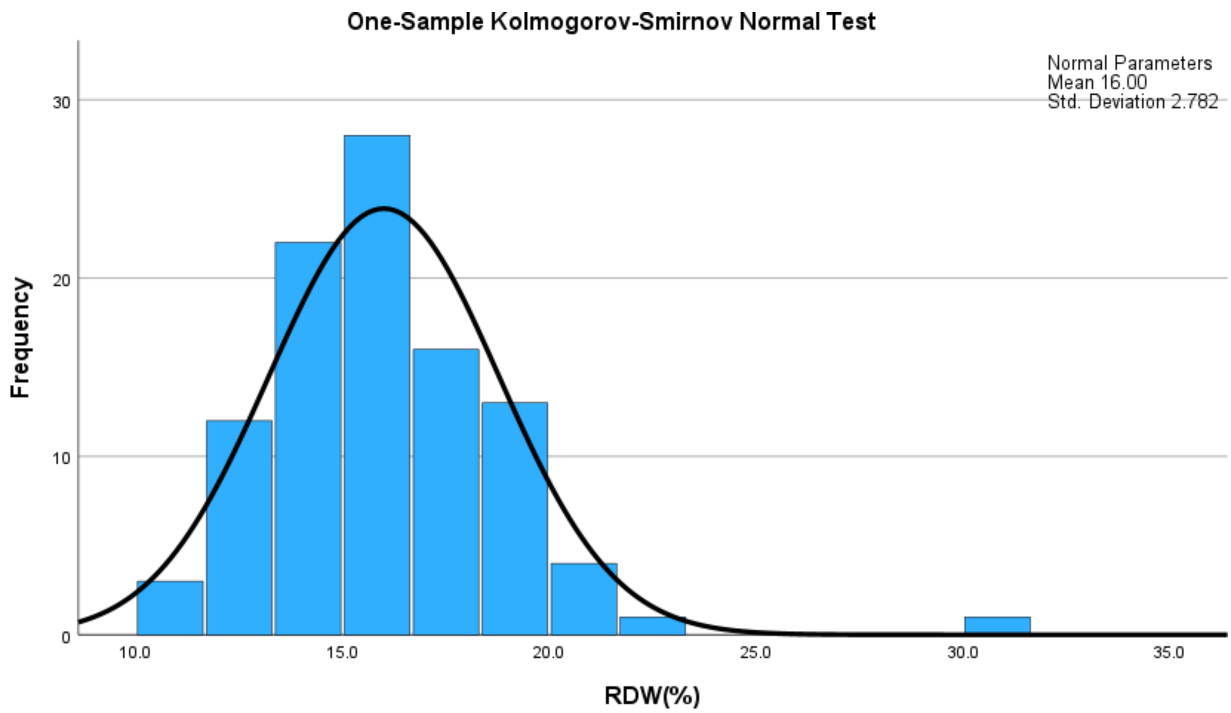
Chart(20):

asymptotic significance (2-sided test)=0.162

The RDW Values(%):



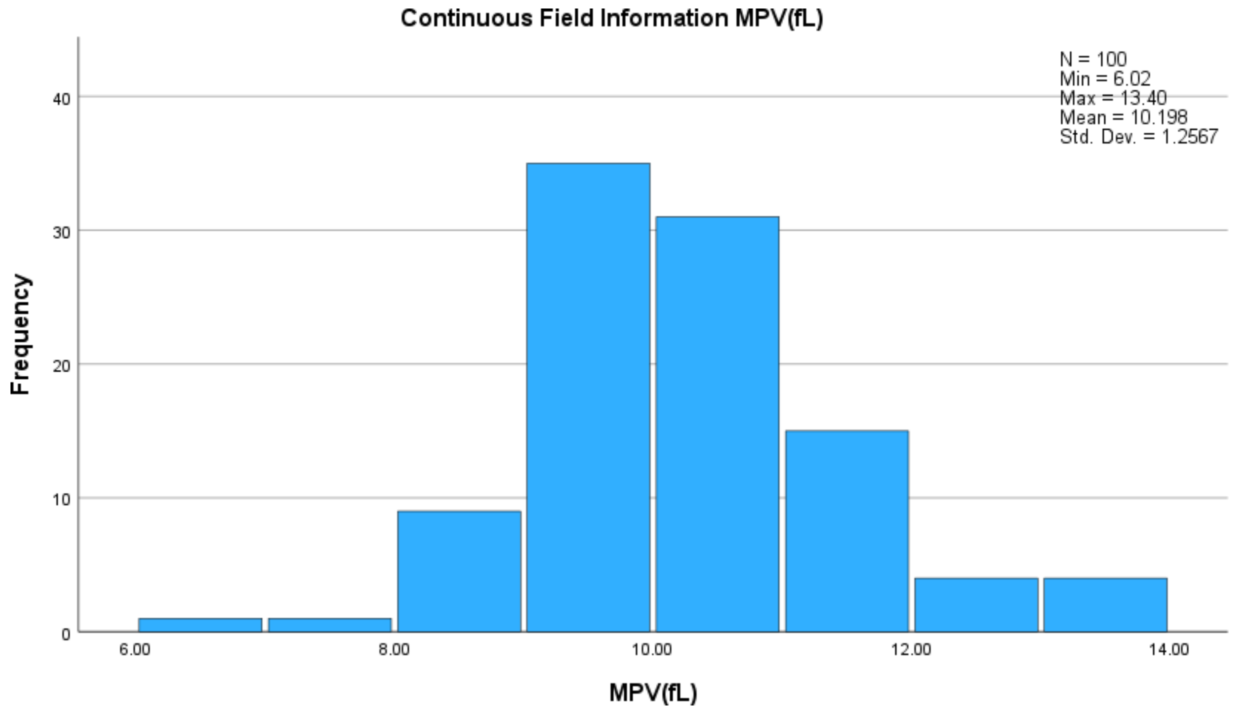
Chart(21)



Chart(22):

asymptotic significance (2-sided test)=0.087

The MPV Values(fL):



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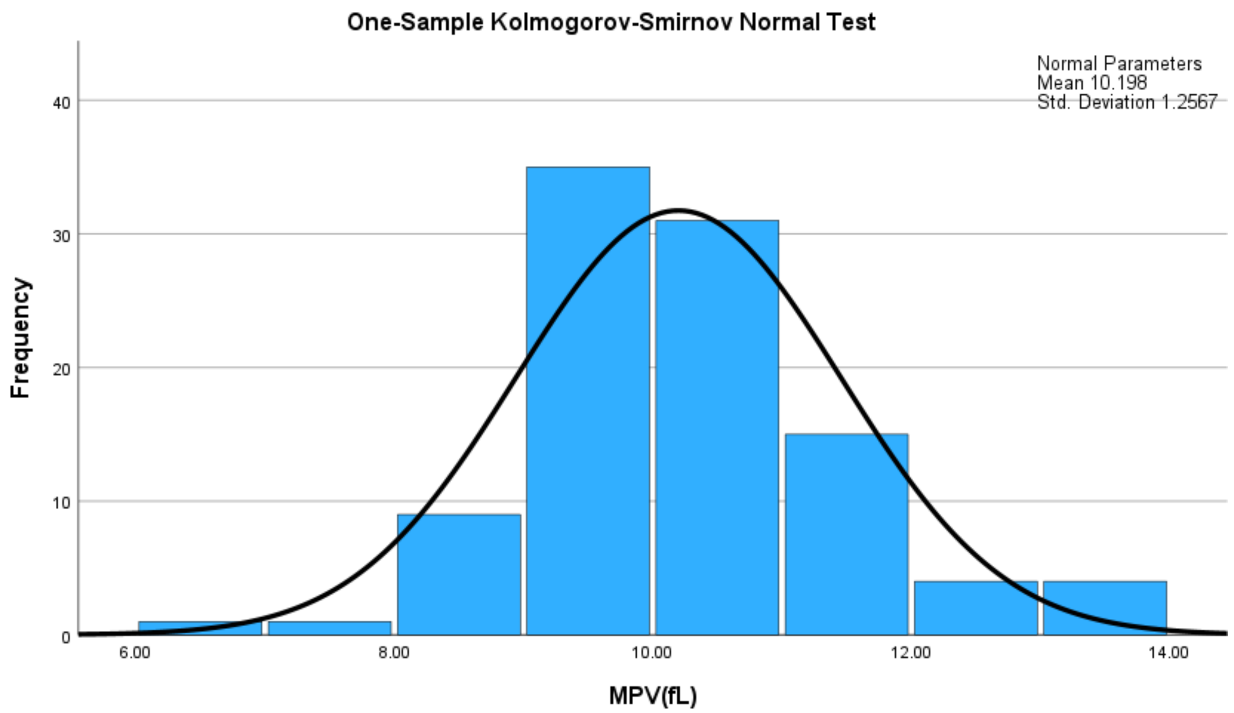
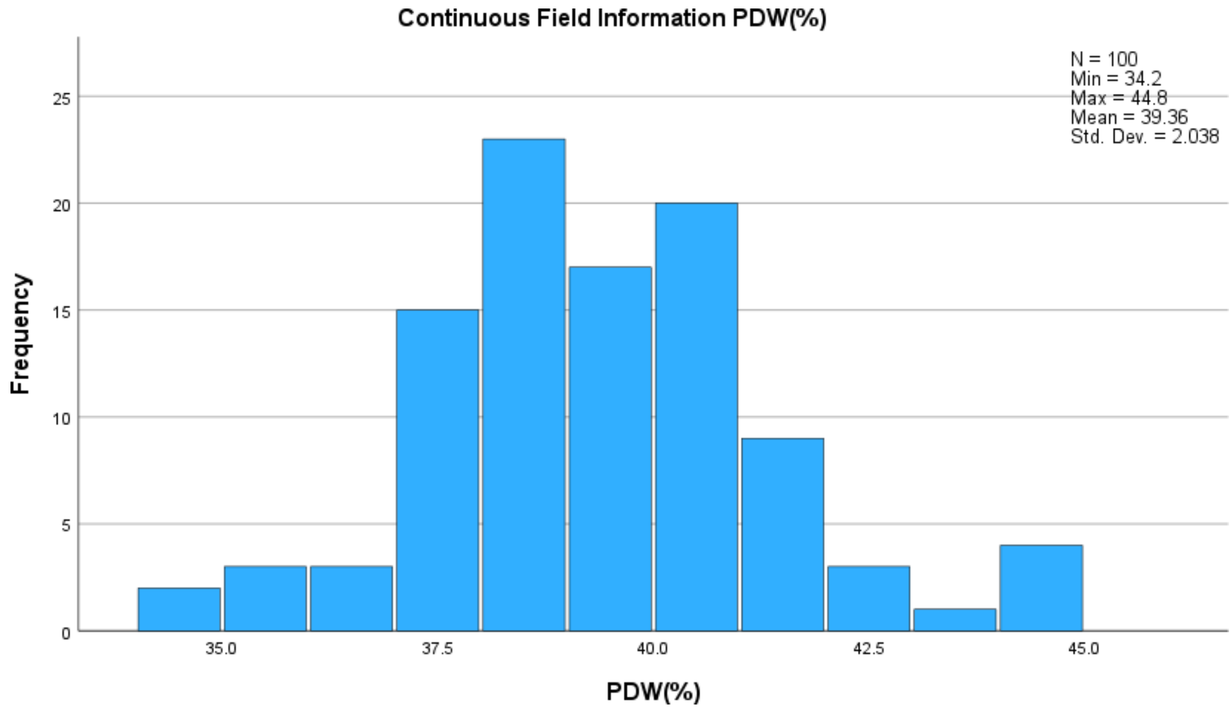


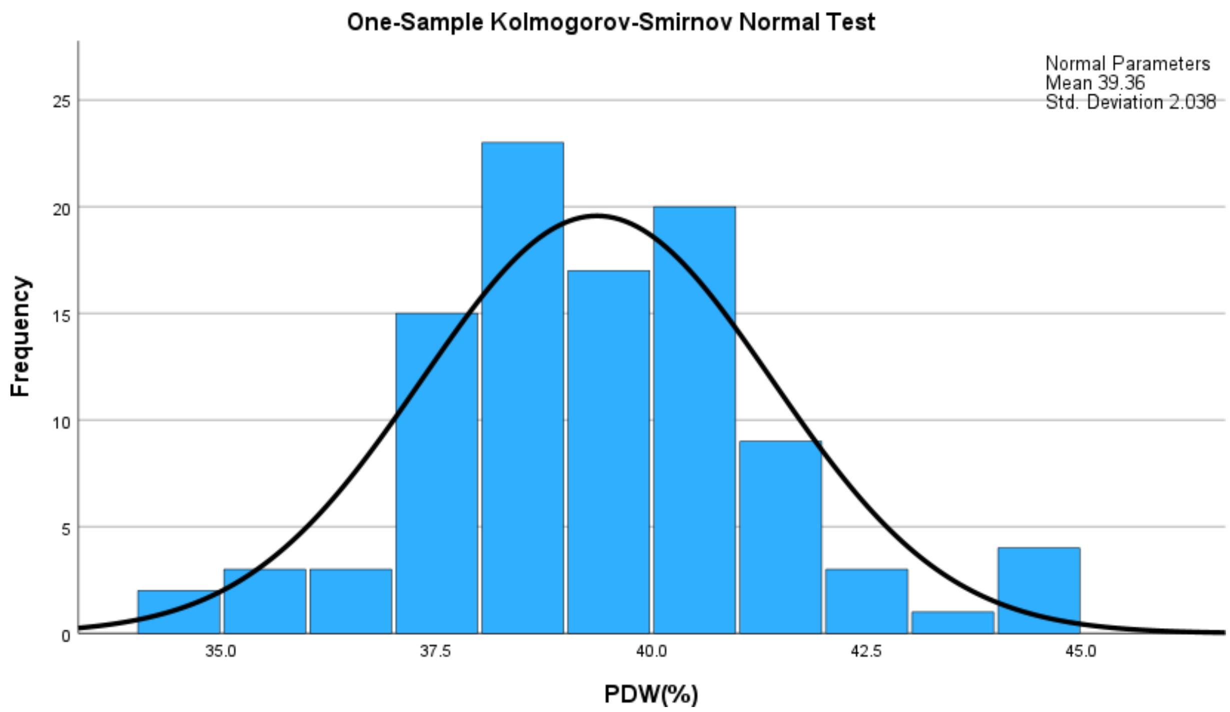
Chaer(24)

asymptotic significance (2-sided test)=0.122

The PDW Values(%):



Chart(25)



Chart(26)

asymptotic significance (2-sided test)=0.2

The Effect Of The Gender Of The Patients On The Result:

Independent Samples T Test:

		Levene's Test for Equality of Variances							
		F	Sig.	t	df	Significance		Mean Difference	Std. Error Difference
						One-Sided p	Two-Sided p		
RBC(×10^6/uL)	Equal variances assumed	6.132	.015	.461	98	.323	.646	.08079	.17527
	Equal variances not assumed			.590	76.263	.279	.557	.08079	.13705
WBC(×10^3/uL)	Equal variances assumed	.056	.813	1.324	98	.094	.189	1.34905	1.01900
	Equal variances not assumed			1.390	48.089	.085	.171	1.34905	.97033
PLT(×10^3/uL)	Equal variances assumed	.509	.477	-.143	98	.443	.887	-2.7564	19.2774
	Equal variances not assumed			-.129	37.136	.449	.898	-2.7564	21.3459
HGB(g/dL)	Equal variances assumed	3.222	.076	1.099	98	.137	.274	.5065	.4607
	Equal variances not assumed			1.251	57.197	.108	.216	.5065	.4050
HCT(%)	Equal variances assumed	3.389	.069	1.147	98	.127	.254	1.58189	1.37956
	Equal variances not assumed			1.335	60.452	.093	.187	1.58189	1.18460
MCV(fL)	Equal variances assumed	.022	.883	1.302	98	.098	.196	2.3397	1.7964
	Equal variances not assumed			1.311	44.333	.098	.197	2.3397	1.7846
MCH(pg)	Equal variances assumed	.048	.827	1.263	98	.105	.210	.8115	.6426
	Equal variances not assumed			1.261	43.707	.107	.214	.8115	.6434
MCHC(g/dL)	Equal variances assumed	.146	.703	.267	98	.395	.790	.0918	.3442
	Equal variances not assumed			.266	43.515	.396	.792	.0918	.3455
RDW(%)	Equal variances assumed	.510	.477	-1.760	98	.041	.082	-1.1046	.6277
	Equal variances not assumed			-1.780	44.743	.041	.082	-1.1046	.6205
MPV(fL)	Equal variances assumed	.007	.934	-.368	98	.357	.714	-.10318	.28038
	Equal variances not assumed			-.382	47.053	.352	.704	-.10318	.26993
PDW(%)	Equal variances assumed	.127	.723	-.180	98	.429	.858	-.0839	.4670
	Equal variances not assumed			-.191	49.487	.425	.849	-.0839	.4385

Table(1)

As we see in the result of independent samples t test, all P values of our categories is larger than 0.05(alpha level) so, we will accept the null hypothesis that there is probably no significant association between the gender of the patients and the CBC variables values in this sample of heart failure patients.

The Effect Of The Age Of The Patients On The Result:

1- For RBC values:

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	3168.542[a]	3200	.650
Likelihood Ratio	641.503	3200	1.000
Linear-by-Linear Association	6.797	1	.009
N of Valid Cases	100		

Table(2)

The P value is larger than 0.05(alpha level) so, The null hypothesis will be accepted (that there is no significant association between the age of the patient and RBC value in this sample of heart failure patients).

2- For WBC values:

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	3893.690[a]	3840	.268
Likelihood Ratio	691.777	3840	1.000
Linear-by-Linear Association	.002	1	.967
N of Valid Cases	100		

Table(3)

The P value is larger than 0.05(alpha level) so, The null hypothesis will be accepted (that there is no significant association between the age of the patient and WBC value in this sample of heart failure patients).

3- For PLT values:

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	3353.770[a]	3280	.181
Likelihood Ratio	649.821	3280	1.000
Linear-by-Linear Association	.010	1	.922
N of Valid Cases	100		

Table(4)

The P value is larger than 0.05(alpha level) so, The null hypothesis will be accepted (that there is no significant association between the age of the patient and PLT value in this sample of heart failure patients).

4- For HGB values:

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2264.595[a]	2120	.015
Likelihood Ratio	558.133	2120	1.000
Linear-by-Linear Association	7.171	1	.007
N of Valid Cases	100		

Table(5)

The P value is smaller than 0.05(alpha level) so, The null hypothesis will be rejected (that there is significant association between the age of the patient and HGB value in this sample of heart failure patients).

Symmetric Measures			
		Value	Approximate Significance
Nominal by Nominal	Cramer's V	.752	.015
N of Valid Cases		100	

Table(6)

As we have a high cramer's value(>0.5), there is strong association between the age of the patient and HGB value in this sample of heart failure patients.

5- For HCT values:

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	3650.079[a]	3600	.276
Likelihood Ratio	674.095	3600	1.000
Linear-by-Linear Association	7.744	1	.005
N of Valid Cases	100		

Table(7)

The P value is larger than 0.05(alpha level) so, The null hypothesis will be accepted (that there is no significant association between the age of the patient and HCT value in this sample of heart failure patients).

6- For MCV value:

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2365.249[a]	2200	.007
Likelihood Ratio	542.038	2200	1.000
Linear-by-Linear Association	.087	1	.768
N of Valid Cases	100		

Table(8)

The P value is smaller than 0.05(alpha level) so, The null hypothesis will be rejected (that there is significant association between the age of the patient and MCV value in this sample of heart failure patients).

Symmetric Measures			
		Value	Approximate Significance
Nominal by Nominal	Cramer's V	.769	.007
N of Valid Cases		100	

Table(9)

As we have a high cramer's value(>0.5), there is strong association between the age of the patient and MCV value in this sample of heart failure patients.

7- The MCH values:

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2595.417[a]	2520	.144
Likelihood Ratio	585.684	2520	1.000
Linear-by-Linear Association	.139	1	.709
N of Valid Cases	100		

Table(10)

The P value is larger than 0.05(alpha level) so, The null hypothesis will be accepted (that there is no significant association between the age of the patient and MCH value in this sample of heart failure patients).

8- The MCHC values:

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2012.165[a]	1960	.201
Likelihood Ratio	534.906	1960	1.000
Linear-by-Linear Association	.245	1	.621
N of Valid Cases	100		

Table(11)

The P value is larger than 0.05(alpha level) so, The null hypothesis will be accepted (that there is no significant association between the age of the patient and MCHC value in this sample of heart failure patients).

9- The RDW values:

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2475.575[a]	2400	.138
Likelihood Ratio	578.046	2400	1.000
Linear-by-Linear Association	1.673	1	.196
N of Valid Cases	100		

Table(12)

The P value is larger than 0.05(alpha level) so, The null hypothesis will be accepted (that there is no significant association between the age of the patient and RDW value in this sample of heart failure patients).

10- The MPV values:

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1763.556[a]	1680	.076
Likelihood Ratio	506.249	1680	1.000
Linear-by-Linear Association	1.393	1	.238
N of Valid Cases	100		

Table(13)

The P value is larger than 0.05(alpha level) so, The null hypothesis will be accepted (that there is no significant association between the age of the patient and RDW value in this sample of heart failure patients).

11- The PDW values:

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2321.272[a]	2200	.035
Likelihood Ratio	555.901	2200	1.000
Linear-by-Linear Association	.246	1	.620
N of Valid Cases	100		

Table(14)

The P value is smaller than 0.05(alpha level) so, The null hypothesis will be rejected (that there is significant association between the age of the patient and PDW value in our sample of heart failure patients).

Symmetric Measures			
		Value	Approximate Significance
Nominal by Nominal	Cramer's V	.762	.035
N of Valid Cases		100	

Table(15)

As we have a high cramer's value(>0.5), there is strong association between the age of the patient and PDW value in this sample of heart failure patients.

The Effect Of Heart Failure On CBC Values:

1- The RBC value:

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
RBC(×10^6/uL)	100	4.6344	.76571	.07657

Table(16)

One-Sample Test					
	Test Value = 4.8				
	t	df	Significance		Mean Difference
			One-Sided p	Two-Sided p	
RBC(×10^6/uL)	-2.163	99	.016	.033	-.16560

Table(17)

As we see P value <0.05(alpha value) and mean difference is negative, that mean there is significant decrease in RBC count in this sample of heart failure patient.

2- The WBC value:

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
WBC(×10^3/uL)	100	10.4383	4.48664	.44866

Table(18)

One-Sample Test					
	Test Value = 7.5				
	t	df	Significance		Mean Difference
			One-Sided p	Two-Sided p	
WBC(×10^3/uL)	6.549	99	<.001	<.001	2.93830

Table(19)

As we see P value <0.05(alpha value) and mean difference is positive, that mean there is significant increase in WBC count in this sample of heart failure patient.

3-The PLT value:

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
PLT(×10^3/uL)	100	231.691	84.1380	8.4138

Table(20)

One-Sample Test					
	Test Value = 275				
	t	df	Significance		Mean Difference
			One-Sided p	Two-Sided p	
PLT(×10^3/uL)	-5.147	99	<.001	<.001	-43.3090

Table(21)

As we see P value <0.05(alpha value) and mean difference is negative, that mean there is significant decrease in PLT in this sample of heart failure patient.

4- The HGB value:

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
HGB(g/dL)	100	12.671	2.0230	.2023

Table(22)

One-Sample Test					
	Test Value = 14.5				
	t	df	Significance		Mean Difference
			One-Sided p	Two-Sided p	
HGB(g/dL)	-9.041	99	<.001	<.001	-1.8290

Table(23)

As we see P value <0.05(alpha value) and mean difference is negative, that mean there is significant decrease in HGB in this sample of heart failure patient.

The result may be not totally accurate due to the effect of the age of the patient on this value.

5- The HCT value:

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
HCT(%)	100	39.4806	6.06082	.60608

Table(24)

One-Sample Test					
	Test Value = 42.5				
	t	df	Significance		Mean Difference
			One-Sided p	Two-Sided p	
HCT(%)	-4.982	99	<.001	<.001	-3.01940

Table(25)

As we see P value <0.05(alpha value) and mean difference is negative, that mean there is significant decrease in HCT in this sample of heart failure patient.

6- The MCV value:

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
MCV(fL)	100	85.766	7.9073	.7907

Table(26)

One-Sample Test					
	Test Value = 91				
	t	df	Significance		Mean Difference
			One-Sided p	Two-Sided p	
MCV(fL)	-6.619	99	<.001	<.001	-5.2340

Table(27)

As we see P value <0.05(alpha value) and mean difference is negative, that mean there is significant decrease in MCV in this sample of heart failure patient.

The result may be not totally accurate due to the effect of the age of the patient on this value.

7- The MCH value:

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
MCH(pg)	100	27.539	2.8273	.2827

Table(28)

One-Sample Test					
	Test Value = 30.5				
	t	df	Significance		Mean Difference
			One-Sided p	Two-Sided p	
MCH(pg)	-10.473	99	<.001	<.001	-2.9610

Table(29)

As we see P value <0.05(alpha value) and mean difference is negative, that mean there is significant decrease in MCH in this sample of heart failure patient.

8- The MCHC value:

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
MCHC(g/dL)	100	32.141	1.5027	.1503

Table(30)

One-Sample Test					
	Test Value = 33.5				
	t	df	Significance		Mean Difference
			One-Sided p	Two-Sided p	
MCHC(g/dL)	-9.044	99	<.001	<.001	-1.3590

Table(31)

As we see P value <0.05(alpha value) and mean difference is negative, that mean there is significant decrease in MCHC in this sample of heart failure patient.

9- The RDW value:

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
RDW(%)	100	15.998	2.7824	.2782

Table(32)

One-Sample Test					
	Test Value = 13.5				
	t	df	Significance		Mean Difference
			One-Sided p	Two-Sided p	
RDW(%)	8.978	99	<.001	<.001	2.4980

Table(33)

As we see P value <0.05(alpha value) and mean difference is positive, that mean there is significant increase in RDW in this sample of heart failure patient.

10- The MPV value:

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
MPV(fL)	100	10.1698	1.22445	.12244

Table(34)

One-Sample Test					
	Test Value = 9.25				
	t	df	Significance		Mean Difference
			One-Sided p	Two-Sided p	
MPV(fL)	7.512	99	<.001	<.001	.91980

Table(35)

As we see P value <0.05(alpha value) and mean difference is positive, that mean there is significant increase in MPV in this sample of heart failure patient.

11- The PDW value:

One-Sample Statistics				
	N	Mean	Std. Deviation	Std. Error Mean
PDW(%)	100	39.361	2.0385	.2038

Table(36)

One-Sample Test					
	Test Value = 40.7				
	t	df	Significance		Mean Difference
			One-Sided p	Two-Sided p	
PDW(%)	-6.569	99	<.001	<.001	-19.3390

Table(37)

As we see P value <0.05(alpha value) and mean difference is negative, that mean there is significant decrease in PDW in this sample of heart failure patient.

The result may be not totally accurate due to the effect of the age of the patient on this value.

The total result may be not totally accurate due to some limitations that we will discuss later.

Discussion:

In our study, HF patients males were more than female (74% versus 26%).
The predominance of HF in male may be attributed to high incidence of IHD in male and the effect of oestrogen protection against cardiovascular diseases in females **[6][8].**
But regarding the CBC of the patients there is no significant association between the gender and CBC variable values in this sample of heart failure patients. In regards to age of the patients, the mean age of the patients in our study was 59.9. In this study most of the patients with HF were the age groups of 50-60 years and > 65 years and this supports the high prevalence of this condition in the older population **[7].**
The effects of heart failure on CBC values were as follows:

1-<u>RBCs count and HGB concentration:</u>
As seen in the results, the mean difference is negative in both variables means there is a decrease in both of these variables in HF patients in this sample of heart failure patients. and this decrease is significant (p value is <0.05) . There are many causes of anaemia in HF patients and these are:

- Bone marrow depression from excessive cytokine production.
- Malnutrition (Missing certain vitamins or minerals in the diet because the patient is not eating enough) **[9].**
- Kidney disease (when kidneys are diseased they produce less erythropoietin, a hormone that signals the bone marrow to make RBCs) **[9].**
- Drug therapy (such as ACE inhibitors, antihypertensive drugs) **[9].**

The incidence of anemia is higher in women, diabetic patients, elderly and patients with chronic kidney diseases. This result agrees with Raed Odeh, M.B. Bdeir and Tara Conboy research (Prevalence of anemia in a Saudi population with chronic heart failure), In this study, the number of patients was 1256 and at admission, 27% (337) of patients were anaemic, with higher prevalence in females (33.4%) **[10].**

2-<u>hematocrit level HCT :</u>
As seen in the results, the mean difference is negative means there is decrease in HCT in this sample of HF patients. And the decreased HCT in HF patients is due to increased plasma volume (hemodilution) or from low RBCs count. This result agree with Maya Guglin research, University of South Florida (Relationship of Haemoglobin and Hematocrit to Systolic Function in Advanced Heart Failure), this study shows that there is correlation between HCT and HB, in this study Out of 433 patients , both HB and HCT were decreased in 37–43% of the HF population **[11].**

3-<u>mean cell volume MCV and mean cell hemoglobin MCH:</u>
As seen in the results the mean difference is negative in both of these variables means there is decreased MCV and MCH levels in this sample of HF patients. So the patients have microcytic hypochromic anemia. This condition may be caused by iron deficiency **[12].** And this result agree with Shimaa G. Mohammed, Abdel Hamead M. Mousa and Alaa M. Hashim research (Role of Hypochromia and Microcytosis in the prediction of iron deficiency anemia), this study shows that the serum iron levels in 60 cases (out of 90 patients) with hypochromia and microcytosis with normal haemoglobin were reduced it indicates an early sign of iron deficiency anemia **[13].**

4- red blood cell distribution width RDW:

As seen in the results the mean difference is positive means there is an increased RDW in this sample of HF patients. This increase is not significant (p value is < 0.05). Several pathophysiological mechanisms have been implicated in increasing RDW in HF patients such as ageing, oxidative stress,inflammation, kidney disease, iron deficiency and nutritional deficiencies **[14].** RDW is a powerful mortality predictor in elderly. Our result agree with Antoine Garnier, Julien Regamey, Olivier Hugli and David Martin clinical research (Red cell distribution width and mortality in acute heart failure patients with preserved and reduced ejection fraction), this result shows that patients with high RDW were older, had a higher incidence of previous HF-related hospitalizations. Patients in the high RDW had lower LVEF, lower systolic and diastolic blood pressure, and lower haemoglobin. Creatinine, C-reactive protein, and NT-proBNP levels were higher **[15].**

5-platelets count:

As seen in the results the mean difference is negative means there is decrease in platelets count in this sample of HF patients. platelet counts are used as a prognostic marker in the assessment of the patient with Heart failure. The causes of thrombocytopenia are: bone marrow depression, drug therapy particularly with intravenous blood heparin (heparin induced thrombocytopenia) and also the drugs that regulate the blood clotting (antiplatelet drugs) **[16].**

Our result agree with Mohammad Khalid Mojadidi research (Thrombocytopenia as a Prognostic Indicator in Heart Failure with Reduced Ejection Fraction), in this study 1907 patients with HF, overall one-year mortality was 17.2% with higher mortality among patients with moderate/severe thrombocytopenia compared to those with normal/mild thrombocytopenia (33.0% vs. 15.4%) **[17].**

6-mean platelet volume MPV:

As seen in the results MPV value is increased in this sample of HF patients (the mean difference is positive). MPV is also a useful prognostic biomarker in patients with cardiovascular diseases **[18].**

7-platelet distribution width PDW:

As seen in the results the PDW is decreased (mean difference is negative). PDW is a specific marker for platelet activation. The prognostic impact of PDW is unclear in patients with HF. Reduced PDW in this sample of HF patients may be due to bone marrow cells (including megakaryocytes) malfunctioning **[19].**

Conclusion:

- Anaemia is highly prevalent in patients with HF particularly, in the elderly and in females. Anaemic patients had worse symptoms and higher overall mortality than none anaemic.

- In patients with HF, higher degree of thrombocytopenia is associated with higher all-cause mortality. These findings may support the use of platelet counts as a prognostic marker in the assessment of the patient with heart failure.

- High RDW is associated with a high mortality rate in HF patients.

Limitations

1- The few heart failure patients that present in the hospital made a challenge to us so, we decided to get the information of heart failure patients form the patient's files in the archives of the hospital so, we can't anymore calculate the BMI of the patients in our research.

2-Some of CBC sheets have PDW-sd and do not have PDW-cv, others have PDW-cv and do not have PDW-sd.

Since we decide to use PDW-cv in our research , we have to switch PDW-sd values to PDW-cv but we do not have the standard deviation that is important to do this calculation by the formula [PDW-cv=(SD/MPV)×100%], so, we needed other solution.

For that reason we made other formula that do not need the standard deviation to do this calculation by the following mathematic theorem:

$\because$ PDW-sd = X

PDW-cv = Y

ng = Normal range

ngw = Normal range width

$\because X_{ng} = (9fL \text{ to } 17fL)$

$\therefore X_{ngw} = 17 - 9 = 8(fL)$

$\because Y_{ng} = (37.8\% \text{ to } 43.6\%)$

$\therefore Y_{ngw} = 37.8 - 43.6 = 5.8(\%)$

$\because Z = X_{ngw} \times Y_{ngw}$

$\therefore A - C/X_{ngw} = B - D/Y_{ngw}$

$\vee$ A $\in$ X, B $\in$ Y

C = Lower value of X_{ng}

D = Lower value of Y_{ng}

$\because$ X_{ngw} = 8(fL), Y_{ngw} = 5.8(%)

C = 9(fL), D = 37.8(%)

$\therefore$ A(Fl)-9(fL)/8(fL) = B(%)-37.8(%)/5.8(%)

■ B(%) = [(A(fL)-9)÷8]×5.8+37.8

3- We supposed to find the mean of CBC values of normal population that we need for our calculation, because we failed to get normal population CBC test, we made the formula[X_{mean}=[(A+B)÷2]+B] for this calculation by the following mathematic theorem:

$\because$ X= one of CBC values.

$\because$ X has known normal rang (ng).

$\because$ X value for most population (mp) is in the middle of (ng) according to bell curve.

$\therefore$ X_{mean}=X_{mp}

$\because$ X_{mp}=(X_{ng}÷2)+B

$\vee$ A = grater value of(ng)

B = smaller value of (ng)

$\because$$X_{ng}$= A-B

$\therefore$ X_{mp}=[(A-B)÷2]+B

■X_{mean}=[(A-B)÷2]+B

4-Most of the patients were unconscious, so we couldn’t take enough information from the patients.

5-The cases were few, so we had to go to more than one hospital to find cases.

Recommendations:

- Further studies among other hospitals and societies are needed about the effects of heart failure on kidney functions or lung functions.

- Further studies about the effect of heart failure on liver function tests are needed.

- Also studies about relationships of heart failure and hypertension.

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(questionnaire) :

1- sample no. :

2- Gender :

3- Age :

4- Height :

5- weight :

6- BMI :

7- CBC : -RBC (red blood cells) :

-WBC (white blood cells) :

-PLT (platlets) :

-HB (hemoglobin) :

-HCT (hematocrit) :

-MCV (mean cell volume) :

-MCH (mean cell hemoglobin) :

-MCHC (mean cell hemoglobin concentration) :

-RDW (red cell distribution width):

-MPV (mean platlets volume) :

-PDW (platlet distribution width) :