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A comparative study to estimate the liver and kidney functions of smoker and non smoker serum blood samples

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***Abstract*---**A comparative study was conducted on serum blood samples collected from smoker and non smoker of some Libyan population. Different liver and Kidney functions were estimated included: GOT,GPT,Total bilirubin and ALK.PH of liver functions beside creatinine and urea of Kidney functions. The results recorded that the contents of: Total bilirubin in the smokers blood samples were ranged between (0.3 – 1.8), GOT (6 – 36), GPT (8 – 37) and ALK.PH contents were ranged between (76 – 226). On other hand the same parameters in the blood of non smokers samples were ranged as following: (0.3 – 1.1) , (15 – 27) , (12 – 22) and (122 – 226), respectively. Also effect of cigarette smoking on renal functions was indicated by serum creatinine and urea ,where the contents of serum creatinine and urea in smoker people showed high values of urea. The contents of urea of smoker samples were (29.8 ± 7.62) comparing with non smoker blood samples of (25 .05 ± 4.37).

***Keywords*---**smoker, non smoker, liver functions, kidney function.

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Introduction

The effects of cigarette smoking on human health are serious and in many cases, deadly. Cigarette smoking carries higher risks for most of the chronic diseases. It also has chronic and acute effects on the hematologic system. Smoking is the most important public health problem. Many studies performed have proved its deleterious effects on many organ systems mainly respiratory, and cardiovascular systems. With 6000 chemical substance it contains, it exerts pharmacological, mutagenic, carcinogenic, toxic, and inflammatory effects . Evidence collected during the past four decades have unanimously demonstrated that both active and passive tobacco cigarette smoking increase morbidity and the risk for premature death and generate adverse acute and long-term health effects in nearly all systems of the human organism (Flouris *et al.*, 2010). Despite the global initiatives and the implementation of smoke-free measures, smoking still kills nearly 6 million people every year (Flouris, 2009).

There are a lot number of chemicals found in cigarette smoke (Green and Rodgman , 1996), and a cigarette smoker is exposed to a number of harmful substances including nicotine, free radicals, carbon monoxide and other gaseous products (Gitte , 2011). It is widely known that smokers have higher risk for cardiovascular diseases, hypertension, inflammation, stroke, clotting disorder, and respiratory disease (Abel *et al.,* 2005). Moreover, cigarette smoking accelerates pathogenesis in different type of cancers such as lung, pancreas, breast, liver and kidney (Islam *et al.*, 2007). Similarly, it also enhances pH in stomach that resulted in peptic ulcers and gastric diseases (Kume *et al.*, 2009). Many studies were constructed to evaluate the relationship between cigarette smoking and the biochemical state of the liver throughout investigating the effect of cigarette smoking on liver function test. (Butkiewicz et al., 2006) studied the effect of smoking on platelet activation and some morphological parameters including MPV for smoker blood samples and they concluded that no any effect of smoking on MPV , but recorded relative effect on the platelets count.

(Nordenberg *et al.,* 1990) studied the effect of smoking on CBC parameters for smokers and non smokers blood samples , they confirmed that hemoglobin levels were significantly higher for smokers than non smokers. There are a lot number of chemicals found in cigarette smoke (Green and Rodgman , 1996), and a cigarette smoker is exposed to a number of harmful substances including nicotine, free radicals, carbon monoxide and other gaseous products (Gitte , 2011). It is widely known that smokers have higher risk for cardiovascular diseases, hypertension, inflammation, stroke, clotting disorder, and respiratory disease (Abel *et al.,* 2005). Moreover, cigarette smoking accelerates pathogenesis in different type of cancers such as lung, pancreas, breast, liver and kidney (Islam *et al.*, 2007). Similarly, it also enhances pH in stomach that resulted in peptic ulcers and gastric diseases (Kume *et al.*, 2009).

Experimental part

Sampling:

The study was carried out at El-beida city (Libya),A total of seventy blood samples were collected from male , enrolled in this study with different ages and different periods of cigarette smoking . Fifty samples of smokers and twenty samples for non smokers. Blood samples with drawn from veins into blood tubes,then the serum was separated from the cells by centrifugation at 3000 rpm for few minutes and stored in the freezer. The enrolled subjects did not have any serious health problem .The clinical data, medical history and other relevant information were collected from subjects by personal interview.

Laboratory tests

Liver functions provided Plasma levels of alkaline phosphatase (ALP), GOT and GPT.

Renal (Kidneyfunction tests)

Renal functions provided plasma levels of blood urea and Creatinine.

Statistical treatments

All the statistical measurements, Histograms and Figures were obtained by using (R program , version 2013). All of the liver functions and ,kidney functions were estimated in all subjects by a kit method on automatic analyzer (Spectrophotometer 4040 V5).

Results and Discussion

The liver functions parameters analysis results:

The values of liver functions are given in Table (1), and representative in box plots Figures of (1 ,2 ,3 and 4), the results showed that the contents of Total bilirubin in the smokers blood samples were ranged between (0.3 – 1.8) , GOT (6 – 36), GPT (8 – 37) and ALK.PH contents were ranged between (76 – 226). On other hand the parameters in the blood of non smokers samples were ranged as following: (0.3 – 1.1) , (15 – 27) , (12 – 22) and (122 – 226), respectively , Table (2).

Effect of cigarette smoking on liver functions:

Liver function tests (LFT) are useful tools in clinical practice to assess potential liver diseases, to monitor treatment responses, and to predict prognosis of the patients with liver diseases. In this study the results recorded relative increase in ALP and total bilirubin (TB) in smokers blood samples with values (0.56 ± 0.25) and (168 ± 43.1), respectively, comparing with values of non smokers blood samples (0. 40 ± 0.07) and (137 ± 26.5) .On the side nearly no change was recorded in GPT of smokers and non smokers blood samples values in the

studied samples, (Tables 1 and 2) , Those results are agreements with some studies which recorded increase in some liver functions in blood smoker samples (Gordon ., 1993) .

In a study found the smoking increased serum ALP levels . However, it still not clear whether smoking is related to each component of liver functions test. Therefore, liver functions test changes in real clinical situations need to be interpreted carefully in the context of the interaction between various life style factors. It was reported that the cigarette smoke contains a large number of chemical substances with hepatic toxic potential including nicotine(Yuen et al .,1995) cigarette smoke propagates the lipid per oxidation, which damage the biological cell membrane of the liver and serum amino transferases are enzymes that act as sensitive indicators of hepatic cellular damage (Rochling, 2001). Some investigators claimed ALP and Tb increased by cigarette smoking (Chan-Yeung *et al.*, 1981) , in the present study the nicotine is relative positive correlated with ALP ,GOT and GPT (0.08 , 0.05 and 0.29 , respectively) as our results support, other studies argued that smoking influence ALP and total Tb (Suriyaprom *et al.*, 2007; Whitehead *et al.*, 1996; Tajima *et al.*, 1988). ALP was strongly influenced by smoking, consistent with other studies (Cheung *et al.*, 2009; Wannamethee *et al.*, 2005) concerning osteoporosis have documented increased serum ALP levels in current smokers, as a mainly marker of the liver .The obtained data recorded positive correlation between ALK with (GPT , GOT and TB) with values (0.26 , 0.40 and 0.11), GOT and GPT are highly correlated together (0.70) suggested that those parameters are mainly effecting by the smoking. (Figures 5 and 6).The results showed that there was statistically relative significant difference in ALP between smokers and non smokers.

It was stated that the liver tissue damage may be due to the production of reactive oxygen species (oxygen free radicals) which was probably induced by smokeless tobacco and this agrees with the work of (Bagchi et al., 1995) and (Bagchi *et al.*, 1996) who reported that oral cells, peritoneal macrophages, and hepatic mitochondria and microsomes, produce reactive oxygen species (oxygen free radicals) following in vitro incubation with an aqueous extract of smokeless tobacco may causes most of the cellular degeneration in vivo. Furthermore, Hoffmann *et al.,* (1977) discovered that serum ALP activity had an important role in characterizing bone and hepatic disorders, when obstruction of the duct system occurs at any level. Hepatic fibrosis also induces increased in serum activity of hepatic ALP, but the more common occurrence is its increase in association with hepatic lipidosis and severe starvation. Therefore the continues non-statistically significant increase on plasma ALP level in all the groups rules out the possibility of bone disease since liver and bone are the two main sources of ALP, although there were increase in ALP level at some stages when the test groups were compared with the control but are not statistically significant and this potentiates possible biliary duct problems.

Table (1): The liver functions parameters of the collected blood samples of smokers

Samples No:	The	Parameters			
		Total	GOT	GPT	ALK.PH

		bilirubin mg/dl	U/L	U/L	U/L
1	Few months	0.7	32	27	168
2	1	0.3	12	8	124
3	2	0.7	15	17	112
4	8	0.3	11	21	219
5	4	0.6	19	21	109
6	6	0.8	28	32	184
7	4	0.9	21	23	128
8	4	0.3	20	29	132
9	1	1.8	16	10	130
10	9	0.4	18	14	142
11	6	0.5	19	27	171
12	6	0.6	13	12	114
13	8	0.6	14	15	182
14	10	0.3	11	16	165
15	9	0.4	19	14	91
16	9	0.4	19	22	152
17	12	0.3	6	13	164
18	8	0.3	7	9	105
19	7	0.3	21	19	177
20	2	0.5	17	21	76
21	6	0.7	7	11	144
22	12	0.6	24	20	176
23	13	0.6	18	16	158
24	10	0.3	10	17	145
25	11	0.5	19	20	120
26	18	0.3	9	18	150
27	18	0.7	14	10	191
28	9	0.8	18	16	122
29	16	0.3	31	30	177
30	28	0.6	18	23	148
31	12	0.7	15	19	174
32	18	0.5	35	37	178
33	23	0.5	12	16	144
34	32	0.7	25	18	195
35	4	0.9	25	20	186
36	13	0.3	36	30	92
37	20	0.3	14	16	180
38	10	0.4	17	19	226
39	11	0.6	22	18	208
40	9	0.7	28	25	230
41	13	0.7	30	25	219
42	20	0.6	32	27	220
43	17	0.5	27	29	199

44	16	0.6	30	18	208
45	21	0.7	27	20	230
46	18	0.6	28	22	218
47	16	0.7	31	23	240
48	20	0.6	27	18	234
49	14	0,5	33	27	198
50	11	0.7	29	26	245
Average	-	0.56	20.5	20.08	168
ST.D	-	0.25	8.03	6.37	43.1

Table (2): The liver functions parameters of the collected blood samples of non smokers

Samples No:	Parameters			
	Total bilirubin Mg/dl	GOT U/L	GPT U/L	ALK.PH U/L
1	0.6	15	12	130
2	0.3	22	15	156
3	0.4	27	20	122
4	0.3	19	17	188
5	0.4	25	12	185
6	0.4	17	16	213
7	0.3	25	20	186
8	0.4	17	19	226
9	0.4	19	22	152
10	1.1	24	22	203
11	0.2	18	13	145
12	0.5	20	17	158
13	0.4	19	15	170
14	0.5	22	14	162
15	0.3	20	18	175
16	0.4	17	20	146
17	0.5	22	17	190
18	0.3	21	15	180
19	0.5	21	16	187
20	0.4	20	21	172
Average	0.92	20.5	17.05	172.3
ST.D	0.37	3.10	3.13	26.5

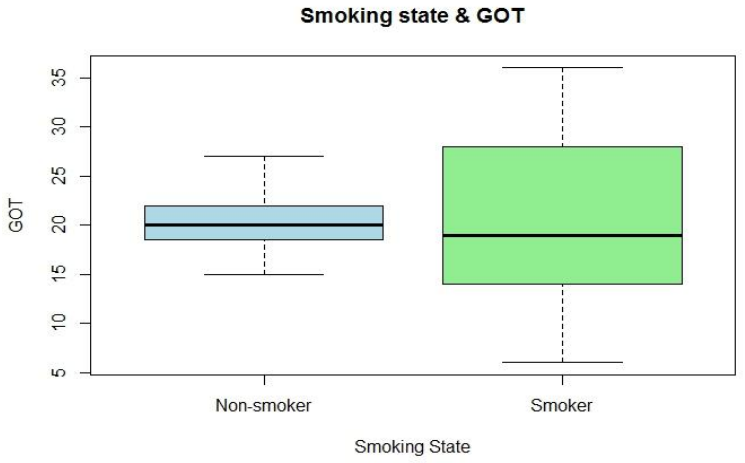

Figure (1) : The distribution of GOT contents for smokers and non smokers blood samples

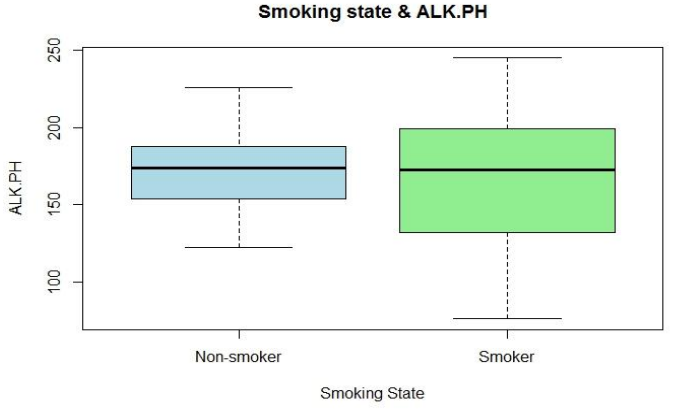

Figure (2): The distribution of ALK.PH contents for smokers and non smokers blood samples

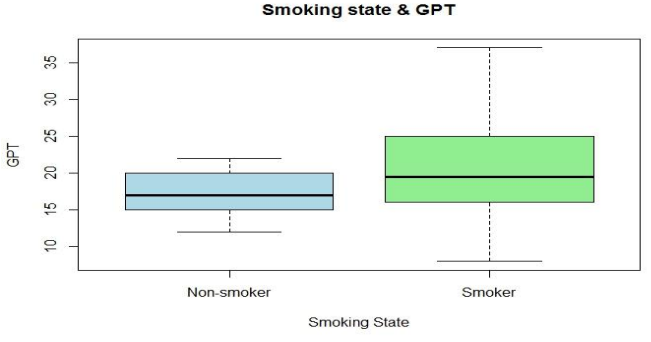

Figure (3): The distribution of GPT contents for smokers and non smokers blood samples

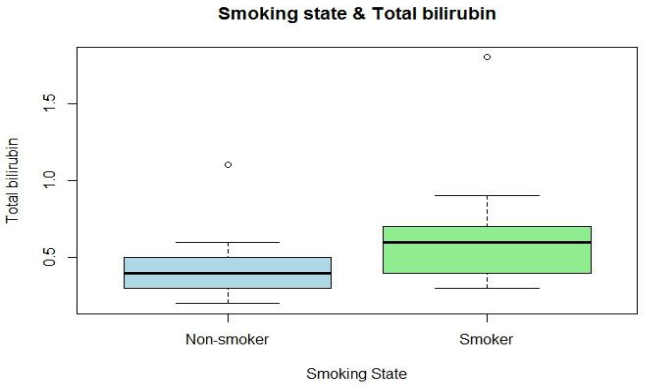

Figure (4): The distribution of Total Bilirubin contents for smokers and non smokers blood samples.

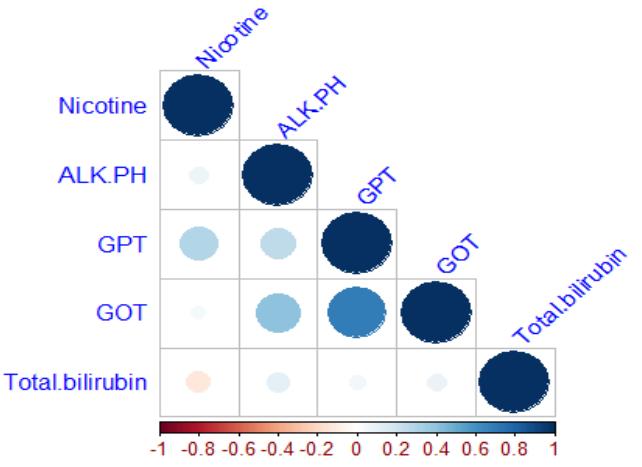

Figure (5) : The correlations matrix between nicotine and the studied liver functions parameters.

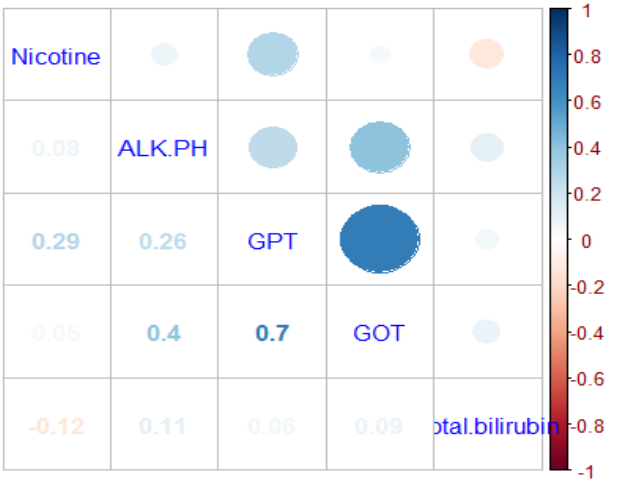

Figure (6): The correlations matrix between nicotine and the studied liver functions parameters.

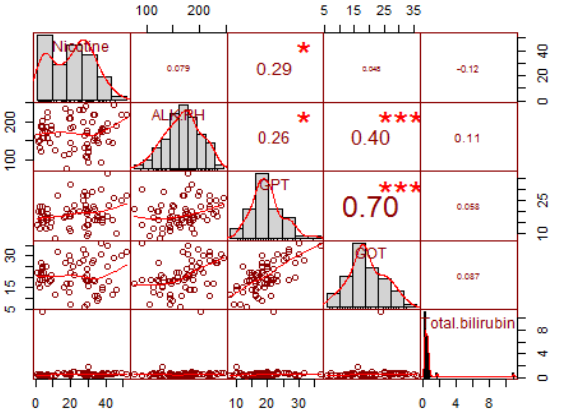

Figure (7): The histogram ,correlations and scatters values of liver functions.

The kidney functions parameters analysis results

The kidney functions data are given in Tables (3&4), and representative in box plots figures of (8&9) the results showed that the contents of blood urea in the smokers blood samples were ranged between (15 – 45), and creatinine contents were ranged between (0.5 –0.9). While the same parameters in the blood of non smokers samples were ranged as following: (19 – 36) and (0.5 – 0.7), respectively , Table (5).

Effect of cigarette smoking on kidney functions

The kidneys play a major role in the control of the consistency of the internal environment. The blood passing through the kidneys is first filtrated (glomerular

filtration) so that all the constituents, except blood cells and plasma proteins, go into the microtubular systems. In the kidneys the useful substances are quickly reabsorbed but unwanted substances escape filtration and are actively excreted in urine (*El Sayed et al.,2013*). renal function tests are important to identify renal dysfunction, to diagnose renal disease, to monitor disease progress, and to monitor response to treatment. In medicine (nephrology) renal function is an indication of the state of the kidney and its physiological role in the body. Most doctors use the concentration of creatinine , urea, to determine renal function.(*Munzir et al..*, *2015*).

This study showed the effect of cigarette smoking on renal function, as indicated by serum creatinine and urea It shows that there were an elevated values of serum creatinine, and urea in smoker people in comparison with the non smokers , where the high values of urea were recorded in smokers (29.8 ± 7.62) comparing with non smoker blood samples (25 .05 ± 4.37) these findings are agreement with the results of other studies (El Sayed *et al.*, 2013 and Yuka *et al.*, 2012). Moreover, these might be due to that the cigarette smoking increases renovascular resistance that lead to a significant fall in glomerular filtration rate (GFR), filtration fraction and renal plasma blood (Ritz *et al.*, 1998). The decrease in GFR will lead to a decrease in distal tubular flow rate which leads to increase of urea re absorption (Joann and Robert ., 2011). Several mechanisms may be operative in inducing renal vasoconstriction and vascular damage. Nicotine increases plasma levels of including vasoconstrictors catecholamines, arginine, vasopressin and endothelin1 (Ritz *et al.*, 1998; Gambaro *et al.*, 1998). Cigarette smoke damages endothelial cells, and nicotine induces smooth muscle cell proliferation (Pittilo *et al.*, 1990). Other study attributed the renovascular resistance to activation of the sympathetic nervous system(Black *et al.*, 1983).

In some studies smoker samples did not exhibit lower creatinine clearance than non smokers (where some samples recorded 0.7 mg/l of creatintine) .On the other side some of smoker blood samples recorded high levels of creatinine) 0.8 & 0.9 , this is associated with the period of smoking in many cases . . Creatinine clearance was even slightly higher in current smokers, at least in men, The effect of current smoking on creatinine clearance was reversible upon smoking discontinuation. (Orth , 2002) ..

Also many blood samples of smokers recorded high values of urea above of 30 mg/l and ranged (32 – 45) , Table (8) comparing with non smokes blood samples which they are not increasing on 30 mg/l (Table , 8) , this mainly due to the effect of smoking , according to many studies whish documenting a deleterious effect of smoking on renal function, several important aspects of smoking induced renal damage remain unclear,(Orth and Hallan ., 2008).

Although there are enough non renal reasons to not smoke, establishing smoking as an independent risk factor for kidney failure is important for improving focus and motivation for smoking cessation among CKD patients and to further increase awareness about this renal risk factor among nephrologists.(Orth and Hallan ., 2011) .

Although earlier reports had indicated that smoking may alter renal function, it was not until 1978 that additional information was published clearly indicating that smoking is a renal risk factor. Although large prospective studies are lacking, there is clear epidemiological evidence that smoking has to be considered as one of the most important renal risk factors. (Orth , 2008)

Table (3): The kidney function parameters of the collected blood samples of smokers

Samples No:	The smoking period	Parameters	
		Blood Urea Mg/dl	Serum Creatinine Mg/dl
1	Few Months	36	0.7
2	1	27	0.5
3	2	27	0.6
4	8	33	0.6
5	4	25	0.5
6	6	37	0.8
7	4	33	0.6
8	4	39	0.7
9	1	37	0.6
10	9	15	0.5
11	6	32	0.6
12	6	32	0.6
13	8	18	0.6
14	10	31	0.6
15	9	22	0.5
16	9	22	0.6
17	12	23	0.6
18	8	23	0.5
19	7	23	0.6
20	2	26	0.6
21	6	19	0.6
22	12	22	0.5
23	13	33	0.7
24	10	25	0.5
25	11	38	0.9
26	18	45	0.9
27	18	20	0.6
28	9	32	0.7
29	16	20	0.6
30	28	33	0.7
31	12	22	0.5
32	18	22	0.6
33	23	32	0.6

34	32	42	0.8
35	4	35	0.7
36	13	22	0.6
37	20	18	0.6
38	10	23	0.6
39	11	28	0.8
40	9	31	0.7
41	13	40	0.9
42	20	38	0.6
43	17	32	0.8
44	16	27	0.7
45	21	36	0.8
46	18	41	0.7
47	16	40	0.9
48	20	35	0.8
49	14	38	0.6
50	11	40	0.7
Average	-	29.8	0.65
ST.D	-	7.62	0.11

Table (4): The kidney function values of the collected blood samples of non smokers

Samples No:	**Parameters**	
	Blood Urea Mg/dl	Serum Creatinine Mg/dl
1	36	0.7
2	24	0.7
3	19	0.5
4	27	0.7
5	29	0.6
6	19	0.6
7	23	0.6
8	23	0.6
9	22	0.6
10	23	0.6
11	30	0.6
12	27	0.5
13	28	0.7
14	25	0.5
15	29	0.6
16	30	0.5
17	23	0.6
18	20	0.7
19	21	0.6
20	23	0.6

Average	25.05	0.60
ST.D	4.37	0.06

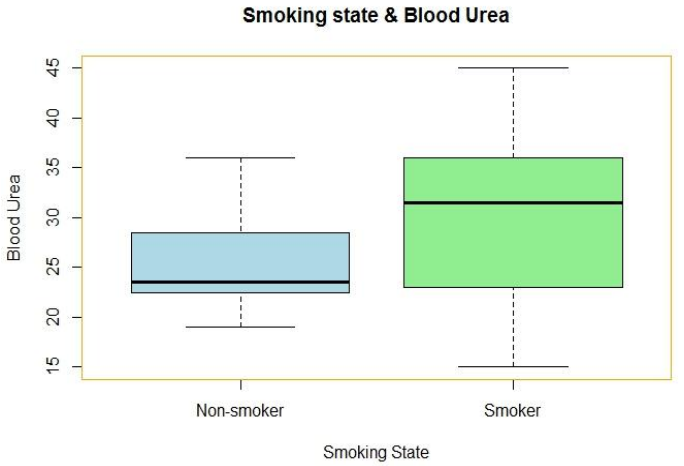

Figure (8) : The distribution of Blood Urea contents for smokers and non smokers blood samples

Conclusion

The obtained results showed relative decrease in the serum Bilirubin and ALP levels . The kidney function is adversely affected in smoker samples indicated that by the elevation of serum Urea and it's almost attributed to significant fall in glomerular filtration rate (GFR),on the other hand the serum Creatinine contents in smoker samples not recorded observation different comparing with non smokers creatinine levels. This study recorded slight increasing of Albumin in smokers samples , while the total protein contents not recorded wide differentiation in both cases .

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