4-RESULTS AND DISCUSSION

4.1. Chemical composition of potato chips with different flavors:

Table (2) shows the chemical composition of potato chips flavored with cheese, turkey, chili & lemon or kabab compared with unflavored potato chips (made home). The data revealed that the crude protein ranged between 6.17-6.68%, total lipid 35.54 – 36.22%, total carbohydrates 41.68- 42.33%, crude fiber 11.61 – 11.80 and total ash 3.37- 4% for the above mentioned flavored chips, respectively. The data show a slight variation between flavored chips concerning all chemical composition and this means that the flavors had no effect on the chemical composition. The data were in the line with the finding of **Abd Elrahman (2002).**

Table (2) :Chemical composition of potato chips with different flavors.(on dry basis)

Potato chips flavored with:	Chemical composition %				
	Crude protein	Total lipids	Total carbohydrate	Crude fiber	Total ash
Cheese flavor	6.36	35.66	42.33	11.66	3.99
Turkey flavor	6.68	36.08	42.26	11.61	3.37
Chili & lemon flavor	6.41	36.22	41.68	11.69	4.00
Kabab flavor	6.54	35.54	42.21	11.80	3.91
Home potato chips	6.17	35.64	42.33	11.78	3.99

4.3. Fatty acid composition of sunflower oil before and after frying potato chips and oil separated from flavored potato chips:

Table (4) shows the fatty acid composition of fresh sunflower oil and that extracted from the potato chips after frying. The fresh oil was characterized with high unsaturation which was about 83.13%. Sunflower oil after frying showed an unsaturation percentage of 76.65 and slight increase in saturated fatty acid. The fatty acids extracted from the potato chips after frying resulted in high level of monosaturated more than the fresh or fried oils and vice versa concerning the polyunsaturated in slight decrease and increase compared with the fresh oil. Some short chain fatty acids increased as a result of frying process. The obtained data were in parallel with that of physical and chemical properties of the extracted oils (table 3). The data were in the line with the findings of **Pantzaris (1998), Tyagi *et al.* (1998)** and **Abd Elrahman *et al.* (2002).**

Table (4): Fatty acid composition of sunflower oil before and after frying potato chips and oil separated from flavored potato chips.

Fatty acids	RRT	Sunflower oil		Potato chips flavored with			
		Before frying	After frying	Cheese	Turkey	Chili& lemon	Kabab
8:0	0.12	1.20	—	—	0.70	0.82	0.53
10:0	0.34	—	0.10	—	0.11	—	—
12:0	0.40	2.41	3.81	—	2.20	4.10	3.63
14:0	0.53	0.22	0.87	1.60	1.80	2.62	1.77
15:0	0.56	—	—	5.22	2.16	1.11	1.52
16:0	0.65	12.94	13.86	7.20	8.77	10.18	8.93
16:1	0.73	0.10	—	1.40	—	1.70	0.90
17:0	0.77	—	—	—	2.16	0.70	—
18:0	0.89	2.00	4.10	3.21	5.82	7.11	5.66
18:1	1.00	33.30	37.22	51.54	41.51	41.22	43.28
18:2	1.07	49.83	39.43	29.83	34.77	30.44	33.78
Saturated F.A.	----	16.77	23.35	17.23	23.72	26.64	22.04
Unsaturated F.A.	----	83.23	76.65	82.77	76.28	73.36	77.96

4-5 Identification and determination of cheese, turkey, chili & lemon and kabab flavors by GC/ MS chromatography:

Table (6) shows the cheese flavor compounds fractionated by GC/MS. The data revealed that 3 major compounds namely Decanoic acid, tetradecanoic acid Bis (2- hydroxyl ethyl) lauramide which amounted in 24.08, 22.69% and 13.25%, respectively. These major compounds may be responsible for the cheese flavor.

Table (7) shows the turkey flavor compounds fractionated by GC/MS. The data revealed that there were three compounds composed about 73.5% of the total compounds. Meanwhile there were seven compounds composed about 25% of the total. The main compounds found in the amount of 41.06%, 24.94% and 8.24% namely 1,2,3- propantriol triacetate, Neopentyl glycol acetate and 1,2,3,4- Butanetetrol tetraacetate, respectively. It is worth to mention that the presence of acetate in the main compounds may explain that there compounds with acetate.

Table (8) shows the chili & lemon flavor compounds fractionated by GC/MS. The data revealed that there was one major compound namely benzaldehyde, 4-(1-methylester) which amounted 68.16%. There are also some essential oils such as citral, linalool, Thujanol genaniol and α- caryophellene in small amounts. The responsibility of chili & lemon flavor may be due to the major compound besides the essential ones.

Table (9) shows the kabab flavor compounds. The data revealed that five compounds consisted about 58% of the flavor compounds, namely Enzactin (15.66%), Neopently glycol diacetate (12.32%), 4,5- dimethyl tetrahydro,1,3- oxazine-2-thione (10.11%), 4,6- dimethyltetrahydro, 1,3- oxazine- 2- thione (9.44%) and 1,2,3,4- Butanetetral, tetraacetate (10.3%). There are ten compounds consisted about 40.98% of the flavor compounds ranged from 1.74 to 6.52. The other compounds found in the range of 0.03 – 0.44%. From the afore mentioned data, it could be concluded that the main components may be responsible for the kabab flavor.

Table (6) : Identification and determination of cheese flavor by GC/ MS chromatography.

Compound	%
1- propanol	0.12
1,2- propandiene, 1,3- dione	1.71
Valeric acid	0.27
Caproic acid	5.92
n- caprylic acid	5.11
Hexanoic acid	4.22
2- Hydroxyethylacetylene	0.45
Furandione	0.07
N- nitropiperidine	0.31
Decanoic acid	24.08
Octoic acid	3.90
Nonanoic acid	3.86
Bis (hydroxy methyl) acetylene	1.66
Butylated hydroxyl toluene (BHT)	3.05
Pentanmide, 5- hydroxy	1.26
Bis (2-hydroxy ethyl) lauramide	13.25
Heptyl thiovinyl ether	4.09
2,3,5- trimethyl heptaine	1.93
Propine	0.49
Furazan	0.91
Tetradecanoic acid	22.69
2,4 (1H, 3H)- Pyrimidine dione, 5-nitro	0.66

Table (7) : Identification and determination of turkey flavor by GC/ MS chromatography.

Compound	%
Acetic acid ethenyl ester	2.45
1,2,3 propanetrial monoacetate	0.16
1,2 ethanediol diacetate	3.13
1,2,3 propanetrial diacetate	5.39
Triacetin	1.82
Acetoglyceride	2.21
Propyl thioglycolate	0.29
1,2,3 propanetriol triacetate	41.06
Neopentyl glycol acetate	24.94
1,2,3,4- Butanetetrol tetraacetate	8.24
Diacetyl glycol	6.02
3- Buten-2-one, 3- methyl-, dimmer	1.75
α- Cubebene	0.29
α- Farnesene	2.08
2,6- Octadien-1- ol, 3,7-dimethyl acetate	0.16

Table (8) : Identification and determination of chili & lemon flavor by GC/ MS chromatography.

Compound	%
Benzene, 1-ethyl-2- methyl	0.95
B-linalool	6.17
3-cyclohexene-1- carboxaldehyde, 1,2,3,4,	7.25
Benzaldehyde, 4-(1-methyl ester)	68.16
Citral	0.71
3-Nonen-5-yne,4-ethyl	7.48
1,2- propandiene	0.06
Trisulfide, di -2- propenyl	0.73
2,5- furandione, dihydro-3-methylene	0.14
4- Thujanol	0.41
Beta farnesene	0.63
Furazan	0.15
Geraniol	0.55
α- Caryophellene	0.60
Methyl acetylene	0.16
1,2- Benenedicarboxylic acid, butyl 2- ethyl hexyl	0.12
Hexadecanoic acid	4.37
11- dodecynoic acid methylester	1.21
11- tetradecen-1- ol- acetate	0.14

Table (9) : Identification and determination of kabab flavor by GC/ MS chromatography.

Compound	%
2- Butanone, 4- phenyl	0.09
2- Cyclohexan-1- one, 2 methyl-5-(1-methyl)	0.36
1.2.3- Propentriol diacetate	1.74
1.2- Ethanediol diacetate	0.44
Cyclohexyl ethyl acetate	0.07
Enzactin	15.66
Diacetin	3.01
Triacetin	3.84
1 3- Di- O- acetyl- α-ß- D- ribo pyranose	3.48
Neopentyl glycol diacetate	12.32
4-5- Dimethyl tetrahydro. 1.3- oxazine-2- thione	10.11
1,3 – Di isobutyrin trimethyl silyl	3.61
4.6- dimethyl tetrahydro. 1.3- oxazine- 2- thione	9.44
Diacetyl glycerol	6.52
Fugacetin	4.17
2.2 dimeth	4.74
1.2.3.4- Butanetetrol. tetraacetate	10.30
Butane. 2- propoxy	3.83
Propanamide. N- acetyl	5.68
2.3 Pentadione	0.06
1.2- propadiene. 1.3- dione	0.08
3-Butyn-1- ol	0.03
Pineridine. 1- nitro	0.03
Cyclobutan.1.1- dimethyl-2- octyl	0.04

4.6. Effect of the different treatments on body weight gain, food intake and food efficiency ratio of the excremental rats:

Table (10) shows that the body weight gain of the control was 23.2 g, meanwhile it showed a value of 37.6 g for the animal groups fed sunflower oil after frying potato chips. Feeding flavored potato chips with cheese, turkey, chili & lemon or kabab showed values of 142.8, 157.2, 157.8 and 165.2 g, respectively which showed an increase than that of freshly chips fried at home (150.8g) except that of cheese flavor. Feeding potato chips flavored with different flavors revealed an acceptability and enhance the appetite of the experimental animals to consume more diet than the control or other treatments except that of cheese flavor. Feeding flavor with bulking agent only showed a reduction in food intake to about 50%, 62.6 %, 34.6% and 23.5% as that of potato chips flavored with cheese, turkey, chili & lemon or kabab, respectively, meanwhile it decreased also by about similar amounts compared with home chips. On the contrary, these values were about 3, 4.2, 2.3 and 1.67 times as highs as that of control. Feeding flavors without bulking agent (extracted flavor) resulted in almost the same value as that of animals fed on sunflower oil after firing potato chips, meanwhile it showed an increase ranged between 1.37 and 1.8 times as that of control. On the other hand, the extracted flavors rustled in decreasing food intake than bulking and processed potato chips. This may be due to the composition or the structure of the flavor itself which showed less acceptability or may be reflected by a reduced efficiency of

energy metabolism, **Jackson *et al.* (1987)**. Meanwhile, bulking agent considered a diet material and preference more than the flavor itself. On the other hand, flavored potato chips revealed more acceptability more than the bulking agent and extracted flavor. The obtained data were in the line with those obtained by **Gad (2000)** who found that feeding 5% and 10% of kabab flavor was increased the body weight gain. A decrease in body weight gain might be due to a toxic effect of the flavor which disturbed the metabolism process pathway. **(Friedman and Gumman 1984, 1988).**

Food efficiency ratio is the ratio between the daily weight gain and daily food intake (Table 2). The food efficiency ratio showed a value of 6.58% for the control. Feeding sunflower oil after frying potato chips increased to 8.78%. Feeding unflavored or flavored potato chips showed a food efficiency ratio ranged between 24.66 and 30.29%. Meanwhile feeding flavor with bulking agent or the extracted flavors resulted food efficiency ratio ranged from 9.63 to 19.46 and 7.85 – 14.43%, respectively. Increasing in food efficiency ratio explained more growth due to food intake. These results agree with **Ghozlan (1983)** and **Gad (2000).**

The statistical analysis for body weight gain and feed efficiency ratio showed non-significant differences ($P > 0.05$) between control and groups fed on sunflower oil after frying potato chips, kabab flavor with bulking agent, extracted turkey and chili & lemon flavor, but showed a significant difference ($P < 0.05$) between control and other treatments.

Table (10): Effect of the different treatments on body weight gain, food intake and food efficiency ratio

Treatments		Initial body weight (gm)	Final body weight (gm)	Body weight gain (gm)	Food intake g/day	Food efficiency ratio
Control (G1)		66.2^{a} ± 8.26	89.4^{a} ±10.43	23.2^{a} ±4.3	11.7	6.58^{a} ±1.2
Sunflower oil after frying potato chips (G2)		66.2^{a} ±7.65	103.8^{ab} ±14.95	37.6^{ab} ±8.2	14.27	8.76^{ab} ±1.9
Home potato chips (G3)		66.2^{a} ±10.57	217.0^{e} ±29.51	150.8^{fg} ±19.7	19.97	25.18^{f} ±3.29
Flavored processed chips	Cheese flavor (G4)	66.2^{a} ±11.07	209.0^{e} ±32.47	142.8^{f} ±8.03	19.30	24.66^{f} ±1.37
	Turkey flavor (G5)	66.4^{a} ±6.62	223.6^{e} ±18.18	157.2^{fg}±12.68	17.33	30.29^{g} ±2.44
	Chili & lemon flavor (G6)	66.4^{a} ±9.45	224.2^{e} ±23.73	157.8^{fg}±14.95	18.00	29.22^{g} ±2.76
	Kabab flavor (G7)	66.2^{a} ±8.68	231.4^{e} ±18.17	165.2^{g} ±10.37	18.66	29.53^{g} ±2.17
flavor with bulking agent	Cheese flavor (G8)	66.4^{a} ±8.78	137.0^{c} ±16.95	70.6^{d} ±9.38	12.8	18.43^{e} ±2.44
	Turkey flavor (G9)	66.4^{a} ±7.36	164.0^{d} ±15.06	97.6^{e} ±8.74	16.8	19.46^{e} ± 1.73
	Chili & lemon flavor(G10)	66.2^{a} ±8.97	120.8^{bc} ±10.38	54.6^{cd} ±3.7	13.46	13.52^{d} ±0.91
	Kabab flavor (G11)	66.2^{a} ± 7.79	105.0^{ab} ±13.14	38.8^{abc} ±7.0	13.40	9.63^{abc} ±1.74
Extracted flavors	Cheese flavor (G12)	66.2^{a} ±9.18	106.0^{ab} ±13.09	39.8±^{bc} 4.565	10.00	13.3^{cd} ±1.5
	Turkey flavor (G13)	66.2^{a} ±7.82	98.0^{ab} ±17.36	31.8^{ab} ±9.96	13.50	7.85^{ab} ±2.45
	Chili & lemon flavor (G14)	66.4^{a} ±9.66	103.2^{ab} ±10.16	36.8^{ab} ±2.59	11.06	11.03^{bcd} ±0.78
	Kabab flavor (G15)	66.4^{a} ±9.99	108.4^{ab} ±19.03	42.0^{bc} ±12.7	9.70	14.43^{d} ±4.36
LSD at 5%		14.00	26.55	16.06	----	3.5864

a,b,c,... Any two means within the same column, have the same latter are not significantly different (P> 0.05)

4.7. Effect of the different treatments on the ratio between some organs to body weight:

Table (11) shows the effect of flavored and unflavored potato chips on the ratio between liver, kidney, heart, spleen and brain to the body weight. The ratio showed values of 4.25, 1.2, 0.33, 0.27 and 1.6%, respectively for these organs to the body weight for the control. A slight increase was found concerning liver ratio as a result of all treatments except that of potato chips flavored with chili & lemon which showed a slight decrease compared with all treatments. Regarding kidney, potato chips either flavored or unflavored resulted in remarkable decrease followed by flavor with bulking agent and extracted flavor which showed a range of 0.75 – 0.87 < 0.98 – 1.19 <1.1 – 1.33, respectively. A slight increase was found due to extracted turkey flavor. Heart showed a ratio of 0.33 which resulted in decrease compared with sunflower oil (0.44). Other treatments resulted in an increase in the heart ratio compared with control and can be arranged in the following ascending order as fallow: potato chips (0.38–0.43%)> flavor with bulking agent (0.39-0.46%)> extracted flavor (0.48– 0.54%). Spleen showed to be almost the same as that of control due to all treatments except that of feeding sunflower oil after frying potato chips, chips with turkey, chili & lemon flavors, flavor with bulking agent of turkey or kabab and extracted turkey flavor which showed values of about 1.88, 1.48, 1.48, 1.25, 1.25 and 1.25 times as high as that of control, respectively. Brain showed a ratio of 1.6%for the control which showed a slight increase due to feeding extracted flavors, flavored by chili & lemon or kabab flavor with bulking agent,

meanwhile cheese or turkey flavor showed a decrease in the ratio to 0.85 and 0.95% to body weight. Feeding potato chips either flavored or unflavored resulted in maximum decrease in brain ratio to body weight. It can be arranged in the following ascending order: chili and lemon (0.73) > kabab (0.72) > freshly potato chips without flavor (home made) (0.702) > cheese (0.69) > turkey (0.63). For the afore mentioned data, it could be concluded that potato chips increased the ratio between liver to body weight and heart meanwhile spleen showed almost the same ratio as that of control except that of chips flavored with turkey. On the contrary, brain showed a maximum decreasing ratio and showed to be the most affected organs. Feeding flavor with bulking agent showed similar trend as that of chips except that of kidney and brain which showed a slight increase than that of chips. Extracted flavor resulted in slight increase in spleen, heart and liver, remarkable increase in kidney while brain showed almost the same ratio as that of control. In conclusion, the most affected organs were brain followed by kidney which showed a decreasing ratio, meanwhile liver and heart resulted in an increasing ratio compared with the control may be due to occurrence of toxic damage in the beginning of phathological process **Khalil (1999)** and **Ahmed (1994)** or may be due to a dramatic increase in the size and of hepatocyte peroxisomes **Bellei (1992)**. Spleen showed was slightly affected or not affected due to chips feeding either flavored or unflavored. This can explain the effect of the interaction between the flavor material, aldehydes, ketones and hydrocarbons produced as a result of frying in oil which can be explained from the results of feeding sunflower oil after frying potato chips, and also the

of the potato itself as carbohydrates and proteins. The obtained data were in agreement with **(Robinson (1977); Ghozlan (1983)** and **Ismail (1989)** who found that increase or reduction in the organs relative weight due to the consumption of different flavors. However, liver, brain, kidney, spleen were the most sensitive organs to the ingestion of the flavor.

The statistical analysis for the ratio between liver to body weight showed non-significant difference ($P>0.05$) between control and groups fed on flavored potato chips with turkey and chili & lemon flavors, but showed a significant difference ($P< 0.05$) between control and other treatments.

On the other hand, the ratio between kidney to body weight showed non-significant differences between control and groups fed on turkey and kabab flavors with bulking agent and extracted cheese and chili & lemon flavors, but decreased significantly for other treatments except groups fed on extracted kabab flavor and sunflower oil after frying potato chips which showed a significant increase compared with control.

The statistical analysis for the ratio between heart to body weight showed non-significant differences between control and groups fed on potato chips home made and flavored potato chips with chili & lemon. Meanwhile, their are significant differences between control and other treatments.

The ratio between spleen to body weight showed significant differences between control and groups fed on sunflower oil after frying potato chips, flavored potato chips with turkey flavor and extracted chili & lemon flavor. Meanwhile,

non-significant differences between control and other treatments was found.

Brain showed non-significant differences between control and groups fed on kabab flavor with bulking agent and extracted flavors with cheese, turkey, chili & lemon and kabab. Meanwhile, significant decrease for the brain weight to body for the other treatments compared with control was found.

4.8. Effect of the different treatments on aspartate aminotransferase (AST) and alanine amino transferase (ALT):

Table (12) shows the effect of flavored, unflavored chips, flavor with bulking agent, extracted flavor and sunflower oil used in frying potato chips on the aspartate transaminase (AST) activity.

AST activity showed to be constant through the experimental period (51.35 -51.69 IU/L). Feeding sunflower oil after frying potato chips showed a value of 51.39 IU/L at zero time and increased to 63.73 and 111.56 IU/L after 15 and 30 days, respectively. Feeding freshly potato chips (home made), potato chips flavored with cheese, turkey, chili & lemon and Kabab showed AST values at zero time of 52.00, 51.48, 52.59, 52.23 and 51.73 IU/L, respectively. The activity after 15 days of the experiment was about 1.46, 1.56, 1.77 and 1.99 times as that of corresponding treatments at zero time while it showed a values of 2.18, 2.14, 1.97 and 1.37 fold compared with those at

Table (11): Effect of the different treatments on the ratio between some organs to body weight.

Treatments			Relative weight percentage (%)				
			Liver	Kidney	Heart	Spleen	Brain
Control		(G1)	$4.25^{ab} \pm 0.18$	$1.2^{f} \pm 0.14$	$0.33^{a} \pm 0.01$	$0.27^{a} \pm 0.02$	$1.61^{e} \pm 0.17$
Sunflower oil after frying potato chips		(G2)	$5.37^{fg} \pm 0.38$	$1.25^{gh} \pm 0.06$	$0.44^{cdef} \pm 0.03$	$0.48^{c} \pm 0.10$	$1.45^{d} \pm 0.20$
Potato chips home made		(G3)	$4.51^{bcd} \pm 0.25$	$0.82^{ab} \pm 0.03$	$0.38^{ab} \pm 0.02$	$0.26^{a} \pm 0.03$	$0.70^{a} \pm 0.03$
Flavored processed chips	Cheese flavor	(G4)	$5.37^{fg} \pm 0.53$	$0.87^{bc} \pm 0.01$	$0.43^{bcdef} \pm 0.02$	$0.27^{a} \pm 0.02$	$0.69^{a} \pm 0.06$
	Turkey flavor	(G5)	$4.20^{ab} \pm 0.15$	$0.77^{ab} \pm 0.03$	$0.40^{bcd} \pm 0.03$	$0.37^{b} \pm 0.05$	$0.63^{a} \pm 0.06$
	Chili & lemon flavor	(G6)	$3.90^{a} \pm 0.29$	$0.75^{a} \pm 0.02$	$0.38^{ab} \pm 0.02$	$0.25^{a} \pm 0.02$	$0.73^{ab} \pm 0.06$
	Kabab flavor	(G7)	$4.41^{bc} \pm 0.25$	$0.84^{ab} \pm 0.04$	$0.39^{bc} \pm 0.01$	$0.27^{a} \pm 0.05$	$0.71^{a} \pm 0.06$
Flavors with bulking agent	Cheese flavor	(G8)	$5.21^{ef} \pm 0.28$	$0.98^{cd} \pm 0.04$	$0.45^{defg} \pm 0.02$	$0.26^{a} \pm 0.01$	$1.04^{c} \pm 0.09$
	Turkey flavor	(G9)	$4.39^{bc} \pm 0.26$	$1.09^{def} \pm 0.03$	$0.39^{bc} \pm 0.01$	$0.32^{ab} \pm 0.02$	$0.94^{c} \pm 0.04$
	Chili & lemon flavor	(G10)	$4.90^{def} \pm 0.21$	$0.99^{de} \pm 0.02$	$0.42^{bcde} \pm 0.02$	$0.28^{a} \pm 0.01$	$1.31^{d} \pm 0.10$
	Kabab flavor	(G11)	$4.83^{cde} \pm 0.17$	$1.19^{fg} \pm 0.05$	$0.46^{efg} \pm 0.04$	$0.31^{ab} \pm 0.03$	$1.49^{de} \pm 0.15$
Extracted flavors	Cheese flavor	(G12)	$4.51^{bcd} \pm 0.39$	$1.10^{ef} \pm 0.07$	$0.50^{ghi} \pm 0.04$	$0.26^{a} \pm 0.03$	$1.40^{de} \pm 0.12$
	Turkey flavor	(G13)	$5.26^{efg} \pm 0.25$	$1.33^{h} \pm 0.11$	$0.48^{fgh} \pm 0.02$	$0.32^{ab} \pm 0.05$	$1.56^{e} \pm 0.19$
	Chili & lemon flavor	(G14)	$5.63^{g} \pm 0.29$	$1.16^{fg} \pm 0.01$	$0.54^{i} \pm 0.01$	$0.37^{b} \pm 0.05$	$1.58^{e} \pm 0.16$
	Kabab flavor	(G15)	$4.79^{cde} \pm 0.31$	$1.25^{gh} \pm 0.14$	$0.53^{hi} \pm 0.07$	$0.29^{a} \pm 0.07$	$1.49^{de} \pm 0.24$
L.S.D. at 5 %			**0.47**	**0.11**	**0.05**	**0.08**	**0.22**

a,b,c,... Any two means within the same column, have the same latter are not significantly different (P> 0.05)

zero time, respectively after 30 days. Feeding flavors with bulking agents, i.e., cheese, turkey, chili & lemon and kabab resulted in amounts of 43.87, 52.72, 51.5 and 51.43 IU/L, respectively. After 15 days of the experiment, the values were about 1.6, 0.96, 1.5 and 1.3 meanwhile after 30 days, it showed values 2.45, 1.84,1.7 and 1.64 times as that at zero time for the corresponding treatments, respectively. Feeding extracted flavor resulted in AST values of 55.58, 55.60, 54.27 and 54.44 IU/L at zero time for cheese, turkey, chili & lemon and kabab, respectively. After 15 days an increase was found by about 1.16, 0.95, 1.53and 1.23 fold as that at zero time while it recorded 1.58, 1.57, 1.99 and 2.57 fold after 30 days for the above mentioned data, it could be observed that the most effective treatments were extracted kabab flavor, cheese flavor with bulking agent, processed potato chips with cheese flavor and sunflower oil used in frying potato chips when compared with the corresponding treatment at zero time.

On the other hand, all treatments resulted in an increase in AST value compared with control at the end of the experiment. It showed to be 2.17, 2.8, 1.37 -2.19, 1.64-2.1 and 1.70 – 2.72 fold as that of control for sunflower oil used in frying potato chips, freshly potato (home made), flavored potato chips, flavor with bulking agent and extracted flavor, respectively. It is worth to mention that the normal value of AST ranged from 42.9±10.1 IU/L as reported by **Jiro (1987).** Increasing AST values may reflect the increase in the ratio between the liver and body weight (Table 3). This also may be explained by the beginning of hepatic cirrhosis.

The statistical analysis for AST showed non-significant differences ($P>0.05$) between control and treatments at zero time. Meanwhile significant increase for all treatments compared with control after 30 day was found.

Table (13) shows the effect of all treatments on the Alanine amino transferase (ALT) activity of the experimental animals. At zero time, ALT showed a value of 3.33 increased to 3.75 and 11.54 IU/L after 15 and 30 days for the control. Feeding sunflower oil after frying potato chips resulted in ALT amounts of 3.73 increased to about 1.45 and 15.1 fold as that of zero time after 15 and 30 days, respectively. Fed unflavored potato chips (home made) showed an ALT value of 3.96 which increased to about 2.1 and 1.75 fold after two period of experiment. Feeding potato chips with cheese, turkey, chili & lemon and kabab flavors showed a value ranged between 3.35 and 5.82 IU/L which increased by about 2.39 – 4.17 and 3.32 – 5.36 fold as that of zero time after 15, 30 days of the corresponding treatments. Feeding flavor with bulking agent resulted in ALT range of 3.03 – 6.82 IU/L which increased by about 1.3 -1.7 and 3.28 -8.04 fold as that of zero time for the afore mentioned treatments. Feeding extracted flavor showed a value of 4.54, 3.14, 5.07 and 3.47 IU/L for the cheese, turkey, chili & lemon and kabab, respectively at zero time. It increased by about 1.39 – 1.78 and 6.81 – 10.42 fold as that of zero time after 15 and 30 day of experiment. On the other hand, the increasing compared by control after 15 days was 1.44 and 2.22 for the sunflower oil after frying chips in it and chips home made, respectively. Meanwhile the increase ranged between 2.93

and 5.48, 1.04 – 3.15 and 1.22 – 2.35 fold as that of control for flavored chips, flavor with bulking agent and extracted flavor, respectively. At the end of the experiment (30days), ALT increased by about 4.88 ; 1.55 – 1.68 ; 0.8 – 3.2 and 1.89 – 4.58 fold as that of control for the sunflower oil after frying potato chips, processed chips with different flavors, flavor with bulking agent and extracted flavor, respectively. Meanwhile, freshly potato chips (home made) showed a decrease in the amount of ALT after 30 days of experiment by about 40%. From the above mentioned data, it could be concluded that sunflower oil after frying potato chips in it, and chili & lemon flavor showed to be the most effective on the increasing ALT followed by cheese flavor and kabab flavor with bulking agent, extracted cheese and kabab flavor and chili & lemon flavor with bulking agent. Meanwhile freshly processed chips with different flavors resulted in moderate increase compared with control. On the contrary, home made potato chips, and turkey flavor with bulking agent resulted in the lowest ALT activity being 40% and 14%, respectively. In this respect, the ALT amounts ranged between 35.1±13.3 IU/L for the healthy subject as reported by **Jiro (1987)**. Increasing its activity is considered an alarm for hepatic disease and must be taken into consideration. The obtained data are in agreement with those of **Abd Elrahim (1989)** found that the synthetic flavor induced elevation in plasma activity of GOT and GPT, or the extensive destruction occurred in liver tissue, and **Ghozlan (1983)** found that increased the GOT and GPT level in serum may be due to injurous effect or necrosis effect on liver cells.

The statistical analysis for ALT after 15 day from feeding period showed non-significant differences ($P>0.05$) between control and groups fed on sunflower oil after frying potato chips, turkey and kabab flavors with bulking agent, extracted cheese, turkey and kabab flavors, meanwhile significant differences was found between control and other treatments. After 30 day serum ALT showed non-significant differences between control and groups fed on potato chips home made, turkey flavor with bulking agent, but showed significant differences ($P<0.05$) between control and other treatments.

Table (12) : Effect of the different treatments on aspartate aminotransferase (AST).

Treatments		Serum AST (U/L)			
		Feeding period (days)			
		Zero time	15	30	Mean of all
Control	(G1)	51.69 ^{b} ±5.79	51.32 ^{a} ±6.37	51.32 ^{a} ±6.39	51.45 ^{a} ±3.09
Sunflower oil after frying potato chips	(G2)	51.39 ^{b} ±4.82	63.73 ^{abcd} ±7.43	111.56 ^{f} ±15.0	75.56 ^{bc} ±10.46
Potato chips home made	(G3)	52.00 ^{b} ±2.37	110.36 ^{h}±31.18	143.75 ^{g}±12.47	102.04 ^{d} ±16.56
Flavored processed chips	Cheese flavor (G4)	51.48 ^{b} ±4.63	75.28 ^{cdef} ±11.55	112.01 ^{f}±6.06	79.59 ^{bc} ±9.67
	Turkey flavor (G5)	52.59 ^{b} ±3.49	82.15 ^{ef} ±9.07	91.15 ^{bcdef} ±14.08	75.29 ^{bc} ±7.64
	Chili & lemon flavor (G6)	52.23 ^{b} ±2.14	92.54 ^{g} ±3.70	103.18 ^{def} ±3.63	82.65 ^{bcd} ±7.92
	Kabab flavor (G7)	51.73 ^{b} ±3.29	61.48 ^{ab} ±12.49	70.76 ^{ab} ±13.49	61.29 ^{ab} ±6.04
Flavor with bulking agent	Cheese flavor (G8)	43.79 ^{a} ±7.78	70.78 ^{cdef}±15.14	107.64 ^{ef} ±23.97	74.13 ^{bc} ±12.54
	Turkey flavor (G9)	52.72 ^{b} ±1.41	50.62 ^{a} ±12.09	96.96 ^{cde} ±21.84	66.77 ^{abc} ±10.45
	Chili & lemon flavor (G10)	51.50 ^{b} ±1.75	77.30 ^{defg} ±7.93	87.81 ^{bcde} ±8.69	72.21 ^{abc} ±6.39
	Kabab flavor (G11)	51.43 ^{b} ±2.28	67.04 ^{bcde} ±11.33	84.21 ^{bcd} ±4.29	67.57 ^{abc} ±5.92
Extracted flavor	Cheese flavor (G12)	55.58 ^{b} ±0.91	64.64 ^{abcd} ±8.01	87.95 ^{bcde}±19.26	69.39 ^{abc} ±7.72
	Turkey flavor (G13)	55.60 ^{b} ±8.83	52.87 ^{ab} ±6.16	87.33 ^{bcde}±20.86	65.27 ^{ab} ±8.75
	Chili & lemon flavor (G14)	54.27 ^{b} ±2.45	83.11 ^{f}±12.12	108.49 ^{ef} ±27.73	81.96 ^{bcd} ±11.75
	Kabab flavor (G15)	54.44 ^{b} ±5.04	67.17 ^{bcde} ±13.52	139.75 ^{g} ±30.86	87.12 ^{cd} ±16.53
L.S.D. at 5 %		5.41	15.66	21.27	21.45

a,b,c,... Any two means within the same column, have the same latter are not significantly different (P> 0.05)

Table (13) : Effect of the different treatments on alanine amino transferase (ALT).

Treatments			Serum ALT (U/L)			
			Feeding period (days)			
			Zero time	15	30	Mean of all time
	Control	(G1)	$3.33^{ab} \pm 1.27$	$3.75^{a} \pm 1.39$	$11.54^{a} \pm 2.01$	$6.21^{a} \pm 1.55$
	Sunflower oil after frying potato chips	(G2)	$3.73^{abc} \pm 0.35$	$5.40^{ab} \pm 0.76$	$56.29^{e} \pm 2.29$	$21.81^{c} \pm 10.43$
	Potato chips home made	(G3)	$3.96^{abc} \pm 0.85$	$8.31^{bcd} \pm .93$	$6.93^{a} \pm 1.76$	$6.40^{a} \pm 0.89$
Flavored processed chips	Cheese flavor	(G4)	$3.78^{abc} \pm 0.38$	$15.42^{g} \pm 3.28$	$19.29^{bc} \pm 3.74$	$12.83^{abc} \pm 2.74$
	Turkey flavor	(G5)	$3.35^{ab} \pm 0.63$	$10.98^{def} \pm 2.21$	$17.96^{bc} \pm 2.69$	$10.77^{ab} \pm 2.34$
	Chili & lemon flavor	(G6)	$5.82^{ef} \pm 1.77$	$13.92^{fg} \pm 4.51$	$19.38^{bc} \pm 2.55$	$13.04^{abc} \pm 2.53$
	Kabab flavor	(G7)	$4.93^{cde} \pm 0.89$	$20.55^{h} \pm 2.61$	$18.07^{bc} \pm 1.16$	$14.52^{abc} \pm 2.57$
Flavors with bulking agent	Cheese flavor	(G8)	$6.82^{f} \pm 1.61$	$11.82^{ef} \pm 5.16$	$36.97^{d} \pm 8.27$	$18.54^{bc} \pm 5.47$
	Turkey flavor	(G9)	$3.03^{ab} \pm 0.63$	$3.96^{a} \pm 0.12$	$9.92^{abc} \pm 4.26$	$5.64^{a} \pm 1.65$
	Chili & lemon flavor	(G10)	$5.55^{def} \pm 1.54$	$9.20^{cde} \pm 2.32$	$32.85^{d} \pm 6.86$	$15.87^{abc} \pm 4.78$
	Kabab flavor	(G11)	$4.30^{bcd} \pm 2.11$	$6.15^{abc} \pm 3.11$	$34.61^{d} \pm 6.74$	$15.02^{abc} \pm 5.39$
Extracted flavors	Cheese flavor	(G12)	$4.54^{bcde} \pm 2.07$	$6.34^{abc} \pm 2.94$	$33.34^{d} \pm 13.43$	$14.74^{abc} \pm 6.15$
	Turkey flavor	(G13)	$3.14^{ab} \pm 0.37$	$4.59^{a} \pm 1.42$	$21.36^{c} \pm 3.05$	$9.70^{ab} \pm 3.08$
	Chili & lemon flavor	(G14)	$5.07^{cde} \pm 1.09$	$8.82^{cde} \pm 2.02$	$52.82^{e} \pm 8.98$	$22.24^{c} \pm 8.12$
	Kabab flavor	(G15)	$2.46^{a} \pm 0.67$	$6.17^{abc} \pm 3.14$	$32.13^{d} \pm 2.51$	$13.59^{abc} \pm 4.81$
	L.S.D. at 5 %		**1.51**	**3.36**	**9.51**	**10.38**

a,b,c,... Any two means within the same column, have the same latter are not significantly different (P> 0.05)

4.9. Effect of the different treatments on the serum alkaline phosphatase:

Table (14) shows the effect of all treatments on the activity of serum alkaline phosphatase after 15 and 30 days of experiment. At zero time, the enzyme found in the range of 122.58 to 126.99 IU/L for all treatments. Control treatments showed an increase by about 1.4 and 1.5 fold after 15 and 30 days, respectively. Feeding sunflower oil after frying potato chips resulted in an increase by about 2.6 and 4.5 fold as that of zero time. Feeding freshly unflavored potato chips (home made) showed an increase by about 1.8 and 4.8 times as that of zero time. Flavored chips result alkaline phophatase in the amounts more than that of zero time by about 2.46 – 1.68 and 4.0 – 2.3 times after 15 and 30 days, respectively. Meanwhile the increase ranged between 1.95 – 5.56 and 4.12 – 6.0 times for the flavor with bulking agents and 2.7 – 4.24 and 4.92 – 5.92 times for the extracted flavors compared with zero time. Comparing with the control, the treatments understudy showed an increase by about 1.8, 1.2, 1.2 – 1.7 ; 1.37 – 3.84 and 1.9 – 3.03 times as that of control after 15 days due to feeding sunflower oil after frying potato chips, unflavored potato chips, freshly processed chips with different flavors, flavors with bulking agents and extracted flavors, respectively. Meanwhile the increase was 2.97, 3.15, 1.5 – 2.6, 2.74 – 3.96 and 3.3 – 3.9 times after 30 days of feeding with the above mentioned diets, respectively. It could be concluded that feeding with the extracted flavor resulted the maximum alkaline phophatase followed by flavor with bulking agent, unflavored chips, sunflower oil and flavored chips,

Table (14): Effect of the different treatments on the serum alkaline phosphatase.

Treatments			Serum alkaline phosphatase(U/L)			
			Feeding period (days)			
			Zero	15	30	Mean of all time
Control		(G1)	123.58 ^{a} ±3.75	177.56 ^{a} ±3.43	188.46 ^{a} ±3.57	163.21 ^{a} ±10.18
Sunflower oil after frying Potato chips		(G2)	123.36 ^{a} ±3.76	321.34 ^{e} ±3.45	558.60 ^{de} ±5.57	334.44 ^{bc} ±62.94
Potato chips home made		(G3)	123.51 ^{a} ±6.15	215.83 ^{b} ±4.17	593.06 ^{ef} ±5.31	310.80 ^{bc} ±71.86
Flavored processed chips	Cheese flavor	(G4)	122.58 ^{a} ±6.77	301.43 ^{d} ±4.07	489.05 ^{c} ±5.95	304.35 ^{abc} ±52.98
	Turkey flavor	(G5)	124.92 ^{a} ±4.87	227.51 ^{bc} ±12.09	288.70 ^{b} ±3.33	213.71 ^{ab} ±24.20
	Chili & lemon flavor	(G6)	124.42 ^{a} ±7.24	286.61 ^{d} ±7.39	312.47 ^{b} ±40.27	241.17 ^{ab} ±31.78
	Kabab flavor	(G7)	126.07 ^{a} ±5.19	212.16 ^{b} ±28.88	357.55 ^{b} ±18.18	231.93 ^{ab} ±35.21
Flavors with bulking agent	Cheese flavor	(G8)	124.72 ^{a} ±5.28	242.82 ^{b} ±13.72	620.66 ^{f} ±7.16	329.40 ^{bc} ±74.93
	Turkey flavor	(G9)	124.95 ^{a} ±2.97	378.81 ^{f} ±14.85	515.48 ^{cd} ±27.12	339.75 ^{bc} ±57.90
	Chili & lemon flavor	(G10)	122.06 ^{a} ±5.71	682.09 ^{k} ±5.68	745.24 ^{g} ±16.54	516.46 ^{d} ±99.16
	Kabab flavor	(G11)	123.65 ^{a} ±5.94	657.67 ^{j} ±24.25	733.91 ^{g} ±7.60	505.08 ^{d} ±96.28
Extracted flavors	Cheese flavor	(G12)	123.73 ^{a} ±3.85	335.06 ^{e} ±12.33	731.72 ^{g} ±11.54	396.84 ^{cd} ±89.25
	Turkey flavor	(G13)	126.99 ^{a} ±7.42	538.20 ^{i} ±9.75	624.86 ^{f} ±3.87	430.02 ^{cd} ±76.87
	Chili & lemon flavor	(G14)	125.61 ^{a} ±6.56	519.98 ^{h} ±7.82	654.61 ^{f} ±20.59	433.40 ^{cd} ±79.64
	Kabab flavor	(G15)	123.68 ^{a} ±3.37	400.63 ^{g} ±5.17	485.58 ^{c} ±21.39	336.63 ^{bc} ±81.71
L.S.D. at 5 %			6.67	15.68	69.30	144.75

a.b.c.... Any two means within the same column, have the same latter are not significantly different (P> 0.05)

respectively. This may be due to the bulking agent which prevent the absorption of the aldehydes, ketons and free fatty acids resulted from frying oil and release the flavor due to heating surface of potato chips. The obtained data were in the lines with those of **Walmsley and White (1994)** who found that the high increase in serum alkaline phosphatase activity were found in extra hepatic biliary obstruction.

The statistical analysis for ALP after 15 and 30 day from feeding period showed significant differences ($P<0.05$) between control and all treatments was found.

4-10 Effect of the different treatments on the serum albumin:

Table (15) shows the effect of all treatments on serum albumin. The data showed that serum albumin amounted in 3.74 mg/dl at zero time. A very slight increase was found after 15 and 30 days of the experiment for the control. Feeding sunflower oil after frying potato chips resulted in an increase of serum albumin by about 1.11 and 1.26 fold as that of control after 15 and 30 days. Unflavored potato chips (home made) showed an increase by about 1.22 and 1.25 fold for the above mentioned periods. Processed potato chips with flavor resulted serum albumin ranged from 1.09 – 1.22 and 1.03 – 1.15 fold while feeding flavor with bulking agent resulted in range of 1.12 – 1.26 and 1.19 – 1.29, extracted flavor 1.04 – 1.2 and 1.13 – 1.30 after 15 and 30 days compared with zero time.

Comparing with control after 15 days feeding sunflower oil after frying potato chips, unflavored freshly potato chips (home made), flavored chips, flavor with bulking agent and extracted flavor resulted in an increase by about 1.06, 1.16, 1.03 – 1.15, 1.07 – 1.19 and 0.99 – 1.15 fold as that of control while it was 1.19, 1.17, 0.97 – 1.09, 1.12 – 1.22 and 1.07 – 1.23 fold as that of control after 30 days of the experiment for the aforementioned treatments. From the above mentioned data, it could be concluded that there was no effect on serum albumin because the standard amounts ranged between 3.5 and 5.5 mg/dl (**Jiro, 1987**).

The statistical analysis of serum albumin after 15 day showed non-significant differences ($P > 0.05$) between control and groups fed on sunflower oil after frying potato chips, flavored potato chips with chili & lemon and kabab, but showed significant differences ($P < 0.05$) between control and other treatments. After 30 day, serum albumin showed significant differences between control and groups fed on sunflower oil after frying potato chips, extracted cheese and kabab flavors, meanwhile non-significant differences was found between control and other treatments.

Table (15): Effect of the different treatments on the serum albumin.

Treatments		Serum albumin (mg/dl.)			
		Feeding period (days)			
		Zero time	15	30	Mean of all time
Control	(G1)	3.74 ^{a} ±0.07	3.95 ^{a} ±0.003	3.98 ^{ab} ±0.15	3.89 ^{a} ±0.06
Sunflower oil after frying potato chips	(G2)	3.74 ^{a} ±0.07	4.19 ^{ab} ±0.08	4.72 ^{cd} ±0.55	4.22 ^{abc} ±0.21
Potato chips home made	(G3)	3.74 ^{a} ±0.07	4.59 ^{ef} ±0.19	4.68 ^{bcd} ±0.46	4.34 ^{c}±0.21
Flavored processed chips	Cheese flavor (G4)	3.74 ^{a} ±0.07	4.56 ^{ef} ±0.06	4.22 ^{a} ±0.17	4.17^{abc} ±0.13
	Turkey flavor (G5)	3.74 ^{a} ±0.07	4.25 ^{bcd} ±0.20	4.33^{b} ±0.28	4.11 ^{abc} ±0.14
	Chili & lemon flavor (G6)	3.74 ^{a} ±0.07	4.14 ^{abc} ±0.02	3.86 ^{a} ±0.49	3.92 ^{ab}±0.15
	Kabab flavor (G7)	3.74 ^{a} ±0.07	4.09 ^{ab} ±0.15	3.93 ^{a} ±0.30	3.92 ^{ab}±0.11
Flavors with bulking agent	Cheese flavor (G8)	3.74 ^{a} ±0.07	4.72 ^{f}±0.26	4.59 ^{bcd} ±0.29	4.35 ^{c}±0.19
	Turkey flavor (G9)	3.74 ^{a} ±0.07	4.40 ^{cde} ±0.12	4.60 ^{bcd} ±0.26	4.25 ^{bc} ±0.15
	Chili & lemon flavor (G10)	3.74 ^{a} ±0.07	4.24 ^{bcd} ±0.22	4.83^{de} ±0.08	4.27 ^{bc} ±0.17
	Kabab flavor (G11)	3.74 ^{a} ±0.07	4.44 ^{def} ±0.11	4.48 ^{bcd} ±0.11	4.22 ^{abc} ±0.13
Extracted flavors	Cheese flavor (G12)	3.74 ^{a} ±0.07	3.92 ^{a} ±0.46	4.83^{d}±0.12	4.16 ^{abc}±0.22
	Turkey flavor (G13)	3.74 ^{a} ±0.07	4.55 ^{ef} ±0.12	4.25 ^{b} ±0.35	4.18^{abc}±0.16
	Chili & lemon flavor (G14)	3.74 ^{a} ±0.07	4.50 ^{def} ±0.49	4.37 ^{bc} ±0.14	4.20 ^{abc}±0.19
	Kabab flavor (G15)	3.74 ^{a} ±0.07	4.55 ^{ef} ±0.19	4.87 ^{e}±0.14	4.39 ^{c}±0.18
	L.S.D. at 5 %	**0.09**	**0.28**	**0.37**	**0.35**

a,b,c,.... Any two means within the same column, have the same latter are not significantly different (P> 0.05)

4.11. Effect of the different treatments on the serum total protein:

Table (16) shows the effect of all treatments on the serum total protein of the experimental animals. At zero time, total protein ranged between 6.94 and 7.5 mg/dl. After 15 day of the experiment, no variable changes was observed regarding control. Feeding sunflower oil after frying potato chips resulted in an increasing serum total protein by about 24% compared with zero time. Feeding home made potato chips (without flavor) showed an increase by about 43.3%, while flavored potato chips resulted in an increase ranged from 0.4 to 53.4% according to the flavor of while the maximum increase was found due to turkey flavor while the minimum resulted due to kabab flavor when compared with that of zero time. Feeding flavor with bulking agent resulted in an increase ranged between 11 and 46.5% meanwhile extracted flavor showed a range of 8 to 18.9% according to the flavor compared with that zero time. After 30 day of the experiment, all treatments resulted in a decrease in serum total protein compared with that of 15 day of experiment but slightly increased than that of zero time. In comparison with the control, after 15 day serum total protein showed an increase by about 19.5%, 35.5%, 1.7 – 47.3%, 9.6 – 48.1% and 3.1 – 14.7% for the feeding with sunflower oil after frying potato chips, unflavored potato chips (home made), processed potato chips with different flavors, flavors with bulking agent and extracted flavors, receptively. After 30 day the increase was about 0.9%, 28.5%,-16.4 – 39.5%, 5.7 – 50.2% and -5.3 – 14.4%, for the above mentioned treatments, respectively. From the obtained data it

could be concluded that the serum protein decreased due to treatments with prolonged periods while it slightly increased compared with control. This may be due to the effect of flavors which affected the appetite of the animals to consume more chips as noticed in food intake (Table 10) compared with control. The obtained data were in the line with those of **Abd-Elrahim *et al.* (1989), Khalil (1999)** and **Weibel and Harson (1989)** who found that the decrease in serum total protein may be due to the aromatic compounds which are metabolized in the body to aldehydes, the aldehydes groups conjugated with protein or with amino group in the body from food.

The statistical analysis for serum total protein after 15 days from feeding period showed non-significant differences ($P > 0.05$) between control and groups fed on flavored potato chips with kabab flavor, chili & lemon, kabab flavors with bulking agent and all extracted flavors, but resulted in significant differences ($P < 0.05$) between control and other treatments. Meanwhile, after 30 day, serum total protein showed non-significant differences between control and groups fed on sunflower oil after frying potato chips, flavored potato chips with turkey and extracted turkey and chili and lemon flavors, but showed significant differences between control and other treatments.

Table (16): Effect of different treatments on the serum total protein.

Treatments			Serum total protein (mg/dl.) Feeding period (days)			
			Zero time	15	30	Mean of all time
Control		(G1)	7.22 ^{bcd} ±0.144	7.40 ^{a} ±0.76	6.45 ^{abc} ±1.01	7.02 ^{a} ±0.39
Sunflower oil after frying potato chips		(G2)	7.13 ^{abc} ±0.120	8.83 ^{cd} ±0.36	6.52 ^{abc} ±1.00	7.49 ^{abcd} ±0.46
Potato chips home made		(G3)	7.11 ^{abc} ±0.542	10.03 ^{ef} ±1.64	8.31 ^{efgh} ±1.08	8.48 ^{cde} ±0.72
Flavored processed chips	Cheese flavor	(G4)	7.04 ^{abc} ±0.145	8.95 ^{de} ±0.59	9.16 ^{hi} ±1.56	8.38 ^{bcde} ±0.59
	Turkey flavor	(G5)	7.12 ^{abc} ±0.338	10.54 ^{f} ±0.89	5.71 ^{a} ±0.53	7.79 ^{abcd} ±0.78
	Chili & lemon flavor	(G6)	7.13 ^{abc} ±0.120	10.53 ^{f} ±2.44	7.56 ^{def} ±0.94	8.41 ^{cde} ±0.92
	Kabab flavor	(G7)	7.50 ^{e} ±0.116	7.52 ^{ab} ±0.61	8.58 ^{fgh} ±0.16	7.87 ^{abcd} ±0.25
Flavors with bulking agent	Cheese flavor	(G8)	7.48 ^{de} ±0.182	10.96 ^{f} ±0.92	8.66 ^{gh} ±0.83	9.03 ^{c} ±0.62
	Turkey flavor	(G9)	7.16 ^{abc} ±0.021	8.57 ^{bcd} ±0.69	9.78 ^{i} ±0.68	8.50 ^{de} ±0.47
	Chili & lemon flavor	(G10)	7.33 ^{cde} ±0.088	8.22 ^{abcd} ±0.46	7.91 ^{defg} ±0.61	7.82 ^{abcd} ±0.26
	Kabab flavor	(G11)	7.22 ^{bcd} ±0.144	7.73 ^{abc} ±0.16	7.29 ^{cde} ±072	7.41 ^{abc} ±0.23
Extracted flavors	Cheese flavor	(G12)	6.94 ^{a} ±0.141	7.62 ^{ab} ±021	7.63 ^{defg} ±0.51	7.40 ^{abc} ±0.20
	Turkey flavor	(G13)	7.14 ^{abc} ±0.144	8.26 ^{abcd} ±0.37	6.50 ^{abc} ±0.83	7.30 ^{ab} ±0.37
	Chili & lemon flavor	(G14)	7.26 ^{bcdde} ±0.233	7.77 ^{abc} ±0.57	6.12 ^{ab} ±0.77	7.05 ^{a} ±0.37
	Kabab flavor	(G15)	7.13 ^{abc} ±0.192	8.49 ^{abcd} ±0.21	7.11 ^{bcd} ±0.44	7.58 ^{abcd} ±0.27
L.S.D. at 5 %			**0.26**	**1.14**	**1.03**	**1.08**

a,b,c,... Any two means within the same column, have the same latter are not significantly different (P> 0.05)

4.12. Effect of the different treatments on the serum total lipids:

Table (17) shows the effect of all treatments on the serum total lipids. Total lipids were in a range of 0.32 to 0.38 g/dl at zero time. After 15 day of experiment, control, sunflower oil, flavors with bulking agent except turkey, and extracted cheese flavor resulted in decrease in serum total lipids to 0.23, 0.29, 0.14 – 0.26 and 0.29 g/dl, respectively, while turkey flavor either used in processing or with bulking agent resulted in highest total lipids being 0.53 and 0.5 g/dl, respectively. Meanwhile other treatments resulted in similar amounts as that of zero time. At the end of the experiment (30 day), total lipids showed a slight increase than that of 15 day but still decreased than that of zero time. Feeding sunflower oil after frying potato chips or unflavored potato chips showed a value amount the same as that of zero time. Processed potato chips flavored with cheese or turkey had values similar to that of zero time while chili & lemon and kabab resulted in an increase of total lipids to 0.41 and 0.62 mg/dl, respectively. No variable changes were found due to feeding flavor with bulking agent except that of cheese which still decreased than that of zero time. Similar trend was found due to the extracted flavors except of turkey and kabab which showed an increase compared with other experimental periods. In comparison with the control, the data revealed that all treatments showed an increase by about 26%, 43.5%, 65.2- 130%, 39.1- 117.41% and 26-43.3% after 15 days while it was 50%, 34.6%, 19.2 – 138.5%, 3.8 – 26.9% and 19.2 – 111.5% after 30 day for the sunflower oil after frying potato chips,

unflavored potato chips (home made), processed chips with different flavors, flavors with bulking agent and extracted flavors, respectively. This fluctuation in serum total lipids reflect the effect of flavor which affected the animals appetite. It is worth to mention that normal serum total lipids ranged from 0.4 to 1.0 g/dl and the present data showed to be safe for all the treatments. The obtained data were in agreement with those of **Truswell (1997)** and **Abd-Elrahim *et al.* (1988)**.

The statistical analysis for serum total lipids after 15 day from feeding period showed non-significant differences ($P > 0.05$) between control and groups fed on sunflower oil after frying potato chips, cheese and chili & lemon flavors with bulking agent, but group fed on kabab flavor with bulking agent showed significant decrease compared with control. On contrary, other treatments showed a significant increase compared with control. After 30 day, total lipids showed non-significant differences ($P > 0.05$) between control and groups fed on flavored potato chips with turkey flavor, all flavors with bulking agent and extracted cheese flavor.

Table (17): Effect of the different treatments on the serum total lipids.

Treatments		Serum total lipid (g/dl.)			
		Feeding period (days)			
		Zero time	15	30	Mean of all time
Control	(G1)	$0.34^{abc} \pm 0.02$	$0.23^{b} \pm 0.017$	$0.26^{a} \pm 0.018$	$0.27^{a} \pm 0.02$
Sunflower oil after frying potato chips	(G2)	$0.34^{abc} \pm 0.02$	$0.29^{bc} \pm 0.031$	$0.39^{cde} \pm 0.059$	$0.34^{abcde} \pm 0.02$
Potato chips made home	(G3)	$0.32^{a} \pm 0.02$	$0.33^{cd} \pm 0.05$	$0.35^{bcd} \pm 0.043$	$0.33^{abcde} \pm 0.02$
Flavored processed chips: Cheese flavor	(G4)	$0.37^{de} \pm 0.02$	$0.38^{d} \pm 0.032$	$0.37^{bcde} \pm 0.036$	$0.37^{cdef} \pm 0.01$
Flavored processed chips: Turkey flavor	(G5)	$0.34^{abc} \pm 0.01$	$0.53^{e} \pm 0.031$	$0.29^{ab} \pm 0.032$	$0.39^{defg} \pm 0.04$
Flavored processed chips: Chili & lemon flavor	(G6)	$0.35^{bcd} \pm 0.03$	$0.38^{d} \pm 0.04$	$0.41^{de} \pm 0.053$	$0.38^{cdefg} \pm 0.02$
Flavored processed chips: Kabab flavor	(G7)	$0.36^{cde} \pm 0.01$	$0.39^{d} \pm 0.07$	$0.62^{f} \pm 0.065$	$0.45^{g} \pm 0.05$
Flavors with bulking agent: Cheese flavor	(G8)	$0.38^{e} \pm 0.02$	$0.26^{b} \pm 0.027$	$0.25^{a} \pm 0.032$	$0.29^{ab} \pm 0.02$
Flavors with bulking agent: Turkey flavor	(G9)	$0.37^{de} \pm 0.03$	$0.53^{e} \pm 0.013$	$0.31^{abc} \pm 0.012$	$0.42^{fg} \pm 0.03$
Flavors with bulking agent: Chili & lemon flavor	(G10)	$0.35^{bcd} \pm 0.02$	$0.26^{b} \pm 0.06$	$0.32^{abc} \pm 0.071$	$0.31^{abc} \pm 0.03$
Flavors with bulking agent: Kabab flavor	(G11)	$0.34^{abc} \pm 0.01$	$0.14^{a} \pm 0.02$	$0.33^{abcd} \pm 0.02$	$0.27^{a} \pm 0.03$
Extracted flavors: Cheese flavor	(G12)	$0.35^{bcd} \pm 0.02$	$0.29^{bc} \pm 0.06$	$0.31^{abc} \pm 0.02$	$0.32^{abcd} \pm 0.02$
Extracted flavors: Turkey flavor	(G13)	$0.33^{ab} \pm 0.02$	$0.33^{cd} \pm 0.06$	$0.55^{f} \pm 0.052$	$0.40^{efg} \pm 0.04$
Extracted flavors: Chili & lemon flavor	(G14)	$0.36^{cde} \pm 0.02$	$0.33^{cd} \pm 0.08$	$0.37^{bcde} \pm 0.11$	$0.35^{bcdef} \pm 0.04$
Extracted flavors: Kabab flavor	(G15)	$0.32^{a} \pm 0.01$	$0.33^{cd} \pm 0.09$	$0.44^{e} \pm 0.15$	$0.36^{bcdef} \pm 0.05$
L.S.D. at 5%		**0.02**	**0.06**	**0.08**	**0.07**

a,b,c,... Any two means within the same column, have the same latter are not significantly different (P> 0.05)

4.13. Effect of the different treatments on the serum triglycerides :

Table (18) shows the effect of all treatments on the serum triglycerides. At zero time, triglycerides ranged from 40.38 to 43.91 mg/dl. After 15 and 30 day of feeding basal diet (control), a slight decrease in the amount of triglycerides was found. Feeding sunflower oil after frying potato chips showed an increase by about 16.3% and 25.84% after the above mentioned periods compared with that of zero time which was almost the same as that of feeding unflavored potato chips (home made). Feeding flavored processed potato chips increased the serum triglycerides by about 7.9 – 35.7% and 30.0 – 77.2% after 15 and 30 days, respectively. Feeding flavor with bulking agent or extracted flavors resulted in an increase by about 18.5 – 50.2%, 22.87 – 57.8% and 20.1 – 32.4%, 23.76 – 55.48% after 15 and 30 day, respectively. In comparison with the control, the increasing was about 13.4%, 18.7%, 4.9 – 36.7%, 15.9 – 41.8% and 15.6 – 27.1% after feeding sunflower oil after frying potato chips, unflavored chips (home made), processed chips with different flavors, flavors with bulking agent and extracted flavor for 15 day. Meanwhile, the increase was about 22.7%, 26.3%, 26.2 – 78.5%, 20.14-49.0% and 18.9 – 49.26% after 30 day of feeding the aforementioned formulas, respectively. From the obtained data, it could be concluded that processed potato chips with cheese resulted in triglycerides equal or almost the same as that of unflavored, sunflower oil after frying, chili & lemon or kabab flavors with bulking agent, all extracted flavors except that of chili & lemon flavors after 30 days. This means that the

flavors under study affected serum triglycerides. These results agree with **Grundy and Denke, 1990** who found that the elevation of serum triglycerides concentration in rats fed on oils rich in oleic acid may be due to a stimulatory effect of oleic acid upon very low density lipoprotein synthesis or on inhibitory effect of oleic acid upon very low density lipoprotein catabolism.

The statistical analysis for serum triglycerides after 15 day from the feeding period showed non-significant differences ($P > 0.05$) between control and group fed on potato chips with cheese flavor but other treatments showed a significant increase ($P<0.05$) compared with control. After 30 day, serum triglycerides showed an increased significantly for all treatments compared with control.

4.14. Effect of the different treatments on the serum creatinene :

Table (19) shows the effect of all treatments on serum creatinene after 15 and 30 day of the experiment. At zero time, creatinene ranged from 0.83 to 1.1 mg/dl. Feeding sunflower oil after frying potato chips, freshly unflavored chips (home made), and flavored chips resulted increasing serum creatinene by about 3– 4 fold as that of zero time after 15 and 30 days of experiment. Feeding flavors with bulking agent or extracted flavors showed an increase by about 1.6 – 1.5, 2.75 – 4.3 and 1.8, 2.8, 2.57 – 3.1 fold as that of zero time of the 15 and 30 day of experiment. It is worth to mention that all potato chips flavored with different flavors resulted in highest serum creatinene followed by flavor

Table (18): Effect of the different treatments on the serum triglycerides.

Treatments			Serum triglycerides (mg/dl.) Feeding period (days)			
			Zero time	15	30	Mean of all time
Control		(G1)	43.40 ^{c} ±0.98	42.74 ^{a} ±0.98	42.74 ^{a} ±0.98	42.96 ^{a} ±0.50
Sunflower oil after frying potato chips		(G2)	41.68 ^{a} ±1.65	48.48 ^{b} ±1.22	52.45 ^{bc} ±3.03	47.54 ^{abc} ±1.89
Potato chips home made		(G3)	43.91 ^{c} ±1.33	50.75 ^{bcd} ±1.64	53.66 ^{bc} ±1.20	49.44 ^{bcd} ±1.60
Flavored processed chips	Cheese flavor	(G4)	41.53 ^{a} ±3.17	44.83 ^{a} ±3.01	53.97 ^{bcd} ±3.14	46.77 ^{ab} ±2.42
	Turkey flavor	(G5)	43.06 ^{bc} ±1.74	58.42 ^{gh} ±2.21	66.31 ^{g} ±10.78	55.93 ^{e} ±4.69
	Chili & lemon flavor	(G6)	42.43 ^{a} ±1.16	54.26 ^{ef} ±2.52	56.39 ^{c} ±2.28	51.03 ^{bcde} ±2.40
	Kabab flavor	(G7)	41.27 ^{a} ±1.57	56.01 ^{fg} ±1.79	58.48 ^{de} ±5.30	51.92 ^{bcde} ±3.17
Flavors with bulking agent	Cheese flavor	(G8)	41.25 ^{a} ±1.20	50.46 ^{b} ±2.68	62.05 ^{ef} ±1.83	51.25 ^{bcde} ±3.17
	Turkey flavor	(G9)	40.38 ^{a} ±3.43	60.64 ^{h} ±1.69	63.71 ^{f} ±2.34	54.91 ^{de} ±3.88
	Chili & lemon flavor	(G10)	41.57 ^{a} ±0.70	51.89 ^{cde} ±2.21	54.38 ^{b} ±2.66	49.28 ^{bcd} ±2.21
	Kabab flavor	(G11)	41.81 ^{a} ±1.13	49.54 ^{bc} ±4.27	51.35 ^{b} ±4.29	47.57 ^{abc} ±2.30
Extracted flavors	Cheese flavor	(G12)	41.87 ^{a} ±1.93	53.51 ^{def} ±1.47	55.31 ^{b} ±2.36	50.23 ^{bcde} ±3.32
	Turkey flavor	(G13)	41.07 ^{a} ±1.13	49.85 ^{bc} ±4.52	50.81 ^{b} ±3.43	47.24 ^{ab} ±2.28
	Chili & lemon flavor	(G14)	41.04 ^{a} ±1.48	54.34 ^{ef} ±2.18	63.81 ^{f} ±2.08	53.06 ^{cde} ±3.44
	Kabab flavor	(G15)	41.15 ^{a} ±1.62	49.42 ^{bc} ±1.46	53.76 ^{bcd} ±0.71	48.11 ^{abc} ±1.96
L.S.D. at 5 %			2.18	3.02	4.77	5.79

a,b,c,... Any two means within the same column, have the same latter are not significantly different (P> 0.05)

with bulking agent, extracted flavors, sunflower oil and unflavored potato chips (home made). The normal amounts of creatinene ranged from 0.6 to1.59mg/dl. (**Jiro, 1987**). Increasing it to about four times as that of control led to renal failure and in the late status to renal serhosis.

The obtained data were in the line with those of **Anderson and Cockayne (1989) and Hood (1980)** found that an increase in serum creatinine may indicate that the kidneys are less active or in abnormal case.

The statistical analysis for serum creatinine after 15 day from the feeding period showed non-significant differences between control and groups fed on chili & lemon and kabab flavors with bulking agent, meanwhile other treatments showed significant increase compared with control. After 30 day, serum creatinine showed an increased significantly for all treatments compared with control.

Table (19): Effect of the different treatments on the serum creatinene.

Treatments		Serum creatinene (mg/dl.)			
		Feeding period (days)			
		Zero time	15	30	Mean of all time
Control	(G1)	0.84 ^{a} ±0.01	0.98 ^{a} ±0.28	1.12 ^{a} ±0.37	0.98 ^{a} ±0.14
Sunflower oil after frying potato chips	(G2)	1.04 ^{def} ±0.04	3.16 ^{d} ±0.16	3.6 ^{de} ±0.85	2.60 ^{def} ±0.47
Potato chips home made	(G3)	1.10 ^{f} ±0.12	3.49 ^{f} ±0.73	2.92 ^{bcd} ±0.22	2.50 ^{cdef} ±0.42
Flavored processed chips: Cheese flavor	(G4)	0.94 ^{abcd} ±0.07	2.13 ^{d} ±0.38	4.46 ^{f} ±0.53	2.51 ^{cdef} ±0.55
Flavored processed chips: Turkey flavor	(G5)	1.01 ^{cd} ±0.10	3.0 ^{e} ±0.33	4.60 ^{f} ±0.44	2.87 ^{f} ±0.54
Flavored processed chips: Chili & lemon flavor	(G6)	1.09 ^{ef} ±0.07	3.03 ^{e} ±0.24	4.11 ^{ef} ±0.94	2.74 ^{ef} ±0.52
Flavored processed chips: Kabab flavor	(G7)	1.04 ^{def} ±0.09	3.10 ^{e} ±0.26	3.08 ^{bcd} ±0.60	2.41 ^{bcdef} ±0.39
Flavors with bulking agent: Cheese flavor	(G8)	1.06 ^{def} ±0.06	1.68 ^{bcd} ±0.58	3.08 ^{bcd} ±0.37	1.94 ^{bcde} ±0.36
Flavors with bulking agent: Turkey flavor	(G9)	1.04 ^{def} ±0.19	1.74 ^{bcd} ±0.54	4.43 ^{ef} ±0.49	2.40 ^{bcdef} ±0.56
Flavors with bulking agent: Chili & lemon flavor	(G10)	0.87 ^{ab} ±0.14	1.33 ^{ab} ±0.10	2.40 ^{bc} ±0.91	1.53 ^{ab} ±0.35
Flavors with bulking agent: Kabab flavor	(G11)	0.85 ^{ab} ±0.07	1.35 ^{ab} ±0.36	3.08 ^{bc} ±0.98	1.76 ^{abcd} ±0.45
Extracted flavors: Cheese flavor	(G12)	0.82 ^{a} ±0.12	1.53 ^{bc} ±0.36	3.17 ^{cd} ±0.85	1.84 ^{abcde} ±0.44
Extracted flavors: Turkey flavor	(G13)	0.88 ^{ab} ±0.04	1.65 ^{cd} ±0.42	2.26 ^{b} ±0.83	1.59 ^{abc} ±0.33
Extracted flavors: Chili & lemon flavor	(G14)	1.04 ^{def} ±0.09	2.89 ^{e} ±0.40	3.21 ^{cd} ±0.84	2.38 ^{bcdef} ±0.43
Extracted flavors: Kabab flavor	(G15)	0.97 ^{bcde} ±0.8	2.03 ^{cd} ±0.82	2.67 ^{bc} ±0.27	1.89 ^{abcde} ±0.35
L.S.D. at 5 %		0.12	0.54	0.84	0.92

a,b,c,... Any two means within the same column, have the same latter are not significantly different (P> 0.05)

4.15. Effect of the different treatments on the serum uric acid:

Table (20) shows the effect of all treatments on the serum uric acid of the experimental animals after 15 and 30 day. At zero time serum uric acid showed a value of 3.34 mg/dl. After 15 day of experiment, control and sunflower oil resulted in slight increase in uric acid while all other treatments showed decrease in its amounts except that of kabab flavor either extracted or with bulking agent and extracted chili & lemon. After 30 day, control showed an increase in uric acid which amounted in 4.02 mg/dl. Meanwhile all treatments resulted in decreasing amounts compared with zero time. In comparison with the control, after 15 days, the decrease in uric acid was about 4.8%, 33.8%, 45.5 – 18.7% ; 34.8 – 12.5% and 47.3 – 1.5%, while after 30 days, it was 49.5% ; 45% ; 43.5 – 25.6% ; 30.0%-15.7% and 53.9 – 35.3%, for the sunflower oil after frying potato chips, unflavored chips (home made), processed potato chips with different flavors, flavors with bulking agents, and extracted flavors, respectively. From the above mentioned data, it could be concluded that all treatments under study resulted in maximum decrease for sunflower oil followed by unflavored chips, extracted flavor, processed chips and flavors with bulking agent. It is worth to mention that the normal uric acid amounts ranged from 3-7 mg/dl **Jiro (1987)** and decreasing its amounts may be due to the hepatic inflammotery (Histology).

The statistical analysis for serum uric acid after 15 day from the feeding period showed non-significant differences

between control and groups fed on sunflower oil after frying potato chips, kabab flavor with bulking agent, extracted chili & lemon and kabab flavors. But other treatments showed significant decrease compared with control. After 30 day, serum uric acid showed non- significant differences between control and groups fed on potato chips with chili & lemon and kabab flavors with bulking agent, but other treatments showed significant decrease between control and other treatments.

4.16. Effect of the different treatments on thyroid hormones:

Table (21) shows the effect of all treatments on thyroid hormones (thyroxine and triiodothyroxine) at the end of the experiment. Concerning thyroxine (T_4) it showed a value of 4.8 µg/dl. for the control which almost the same as that of processed chips with turkey (4.4µg/dl), chili & lemon (4.9 µg/dl) ; flavors with bulking agent as chili & lemon (4.6µg/dl) and kabab (4.6µg/dl), and extracted flavors as turkey (4.5µg/dl) and chili & lemon (4.4µg/dl). On the other hand, other treatments showed an increase in T_4 amounts by about 1.3, 1.5, 1.8, 2.0, 1.25, 1.42, 1.04 and 1.1 fold as that of control for sunflower oil after frying potato chips, unflavored chips (home made), processed chips with cheese, kabab, cheese flavor with bulking agent, turkey flavor with bulking agent, extracted cheese flavor and extracted kabab flavor, respectively. It could be observed that processed potato flavored with kabab resulted in maximum T_4 amounts followed by potato with cheese and unflavored chips. Normal T_4 ranged between 4.5 to 12.5 µg/dl **National**

Table (20): Effect of the different treatments on the serum uric acid.

Treatments			Serum uric acid (mg/dl.) Feeding period (days) Zero time	15	30	Mean of all time
Control		(G1)	$3.33^{a}\pm0.15$	$3.91^{g}\pm0.56$	$4.02^{i}\pm0.29$	$3.75^{d}\pm0.21$
Sunflower oil after frying potato chips		(G2)	$3.33^{a}\pm0.15$	$3.72^{fg}\pm0.22$	$2.03^{ab}\pm0.21$	$3.02^{abc}\pm0.27$
Potato chips made home		(G3)	$3.33^{a}\pm0.15$	$2.59^{abc}\pm0.22$	$2.21^{abc}\pm0.40$	$2.71^{ab}\pm0.21$
Flavored processed chips	Cheese flavor	(G4)	$3.33^{a}\pm0.15$	$2.32^{ab}\pm0.21$	$2.42^{bcd}\pm0.20$	$2.69^{ab}\pm0.18$
	Turkey flavor	(G5)	$3.33^{a}\pm0.15$	$3.18^{ef}\pm0.44$	$2.99^{efg}\pm0.54$	$3.17^{bc}\pm0.21$
	Chili & lemon flavor	(G6)	$3.33^{a}\pm0.15$	$2.61^{abcd}\pm0.42$	$4.27^{i}\pm0.42$	$2.73^{ab}\pm0.23$
	Kabab flavor	(G7)	$3.33^{a}\pm0.15$	$2.13^{a}\pm0.34$	$2.62^{cdefg}\pm0.44$	$2.69^{ab}\pm0.24$
Flavor with bulking agent	Cheese flavor	(G8)	$3.33^{a}\pm0.15$	$2.79^{bc}\pm0.32$	$3.09^{g}\pm0.43$	$3.07^{abc}\pm0.18$
	Turkey flavor	(G9)	$3.33^{a}\pm0.15$	$3.13^{ce}\pm0.48$	$2.80^{defg}\pm0.38$	$3.09^{abc}\pm0.19$
	Chili & lemon flavor	(G10)	$3.33^{a}\pm0.15$	$2.55^{ab}\pm0.39$	$3.08^{f}\pm0.33$	$2.98^{ab}\pm0.19$
	Kabab flavor	(G11)	$3.33^{a}\pm0.15$	$3.42^{efg}\pm0.49$	$3.72^{hi}\pm0.38$	$3.49^{cd}\pm0.19$
Extracted flavor	Cheese flavor	(G12)	$3.33^{a}\pm0.15$	$2.06^{a}\pm018$	$2.39^{bcd}\pm0.24$	$2.59^{a}\pm0.21$
	Turkey flavor	(G13)	$3.33^{a}\pm0.15$	$3.17^{def}\pm0.25$	$2.60^{cdef}\pm0.49$	$3.03^{abc}\pm0.20$
	Chili & lemon flavor	(G14)	$3.33^{a}\pm0.15$	$3.39^{efg}\pm0.35$	$2.60^{cdef}\pm0.49$	$3.11^{bc}\pm0.22$
	Kabab flavor	(G15)	$3.33^{a}\pm0.15$	$3.85^{g}\pm1.08$	$1.84^{a}\pm0.35$	$3.01^{abc}\pm0.44$
L.S.D. at 5%			0.18	0.56	0.48	0.50

a,b,c,... Any two means within the same column, have the same latter are not significantly different (P> 0.05)

Committee for Clinical Laboratory Standards. (NCCLS) 1998. The presence of T_4 in the normal range explained the healthy status of the animals under study.

The statistical analysis showed a significant differences ($P< 0.05$) was found between all treatments compared with control for thyroxine (T_4) except group fed on potato chips with chili & lemon showed non-significant differences ($P> 0.05$) between control.

Concerning triiodothyroxine (T_3), it amounted to 88 µg/dl for the control. Similar amounts or almost the same were found due to feeding sunflower oil after frying potato chips (88 µg/dl), chili & lemon flavor with bulking agent (94 µg/dl), kabab flavor with bulking agent (90 µg/dl), all extracted flavors which ranged from 84 to 94 µg/dl. Feeding unflavored chips, processed chips with cheese, turkey, chili & lemon, kabab, flavor with bulking agent of cheese and turkey resulted in T3 amount being 1.59, 2.0, 1.41, 1.32, 1.82, 1.15 and 1.23 fold as the control, respectively. The standard amounts of T3 ranged from 86 to 187 µg/dl **National Committee for Clinical Laboratory Standards. (NCCLS) 1998** and the data under study was in the standard range. The statistical analysis showed non-significant differences ($P> 0.05$) between control and groups fed on sunflower oil after frying potato chips and extracted cheese flavor. Meanwhile, a significant differences ($P< 0.05$) between other treatments compared with control for thiiodothyroxine (T_3) at the end of feeding period. The obtained data were in the line with those of **Abd Elrahim *et al.* (1988).**

Table (21): Effect of the different treatments on thyroid hormones.

Treatments			Thyroid hormones (µg /dl.)	
			Thyroxine T_4	Triiodothyroxine (T_3)
	Control	(G1)	4.80 ^{c} ±0.12	88.00 ^{c} ± 3.23
	Sunflower oil after frying potato chips	(G2)	6.40 ^{g} ±0.61	88.00 ^{c} ± 4.65
	Potato chips home made	(G3)	7.20 ^{h} ±0.51	140.0 ^{j} ± 4.36
Processed chips	Cheese flavor	(G4)	8.60 ^{j} ±0.52	176.00 ^{l} ±3.7
	Turkey flavor	(G5)	4.40 ^{a} ±0.23	124.00 ^{l} ± 4.63
	Chili & lemon flavor	(G6)	4.90 ^{cd} ±0.38	115.66 ^{h} ± 3.5
	Kabab flavor	(G7)	9.60 ^{k} ±0.55	160.00 ^{k} ± 3.83
Flavors with bulking agent	Cheese flavor	(G8)	6.00 ^{f} ±0.11	102.00 ^{f} ± 3.06
	Turkey flavor	(G9)	7.46 ^{i} ±0.24	108.00 ^{g} ± 3.79
	Chili & lemon flavor	(G10)	4.60 ^{b} ±0.28	94.00 ^{e} ± 3.78
	Kabab flavor	(G11)	4.60 ^{b} ±0.17	91.00 ^{d} ± 2.65
Extracted flavors	Cheese flavor	(G12)	5.00 ^{d} ±0.6	88.00 ^{c} ± 3.38
	Turkey flavor	(G13)	4.50 ^{ab} ±0.28	86.00 ^{b} ± 3.05
	Chili & lemon flavor	(G14)	4.40 ^{a} ±0.44	94.00 ^{e} ± 4.58
	Kabab flavor	(G15)	5.30 ^{e} ±0.47	84.00 ^{a} ± 3.06
L.S.D. at 5%			0.16	0.74

a,b,c,... Any two means within the same column, have the same latter are not significantly different (P> 0.05)

4.17. Effect of the different treatments on superoxide dismutase enzyme (SOD):

Aerobic organisms employ a battery of defense mechanisms such as antioxidant enzymes to prevent or mitigate oxidative tissue damage **Halliwell and Gutteridge (1989).** Among biological tissue anti-oxidants mostly studied, is superoxide dismutase (SOD) that constitutes the first line of defense against superoxide anion mediated injury **Fridovich (1978).**

Table (22) shows the superoxide dismutase enzyme of liver and blood as affected by feeding sunflower oil after frying potato chips, unflavored potato chips (home made), flavored chips with different flavors, i.e., cheese, turkey, chili & lemon and kabab ; flavor with bulking agent, extracted flavor. The enzyme amounted 257.27 U/g liver for control which was almost the same as that of unflavored chips (261.25), cheese flavored with chili & lemon (258.52), cheese and kabab flavor with bulking agent (255.96 and 258.87). All treatments resulted in an increasing dismutase amounts except chips flavored with cheese (217.53) and kabab (228.885). The maximum increase was found due to flavored chips with turkey flavor (286.68) followed by chili & lemon flavor with bulking agent (282.74) and sunflower oil (278.455) and extracted turkey flavor (278.57), meanwhile the minimum increase was found as a result of feeding extracted cheese flavor (268.14) followed by chili & lemon (272.18). Blood dismutase was found in the amount of 339.55 U/g Hb. for the control which almost the same as that of

sunflower oil (336.865). Feeding chili & lemon, kabab; or with bulking agent, and chips flavored with turkey resulted in decreasing amount in blood dismutase and amounted in 290.56, 315.35, 304.44, 305.43 and 328.76 U/g Hb., respectively. On the contrary, feeding chips flavored with chili & lemon, cheese, unflavored chips, chips flavored with kabab, extracted cheese flavor or turkey, cheese flavor with bulking agent and turkey flavor resulted in an increase in blood dismutase activity to the amounts of 439.63, 406.75, 404.27, 391.70, 388.89, 379.53, 357.67 and 347.42 U/g Hb., respectively. From the above mentioned data, it could be concluded that blood contained dismutase more active than liver and this enzyme is very important for free radical oxidation. This means that the enzyme transported by the blood stream to the sites containing oxides or superoxides produced from the diets. The obtained data were in the line with those of **Muthusamy- Raveendran *et al.* (1993)** and **Kanai and Okano (1998)** hypothesized that the reason for drastic decrease in hepatic SOD activity may be due to the protective effect of these substances on cell membranes rather than O_2 radical scavenging activities. The statistical analysis for liver SOD showed non-significant differences ($P > 0.05$) between control and groups fed on potato chips with chili & lemon and cheese, turkey and kabab flavors with bulking agent. But showed significant differences ($P < 0.05$) between control and other treatments. Blood SOD showed non-significant differences between control and group fed on sunflower oil after frying potato chips. Meanwhile, showed significant differences between control and other treatments.

Table (22): Effect the of different treatments on superoxide dismutase enzyme (SOD).

Treatments			Superoxide dismutasae enzyme(U/g)	
			Liver	Blood
	Control	(G1)	257.27 ^{cd} ± 3.83	336.55 ^{cde} ±21.27
	Sunflower oil after frying potato chips	(G2)	278.46 ^{gh} ± 2.89	333.04 ^{cd} ±9.76
	Potato chips made home	(G3)	261.25 ^{de} ± 2.14	404.27 ^{I} ±8.28
Processed chips	Cheese flavor	(G4)	217.54 ^{a} ±3.22	406.75 ^{I} ±29.58
Processed chips	Turkey flavor	(G5)	286.68 ^{I} ±4.57	362.09 ^{fg} ±15.07
Processed chips	Chili & lemon flavor	(G6)	258.53 ^{cd} ±1.8	439.63 ^{j} ±13.26
Processed chips	Kabab flavor	(G7)	228.88 ^{b} ±1.84	391.7 ^{hi} ±19.5
Flavors with bulking agent	Cheese flavor	(G8)	255.96 ^{c} ±6.13	357.67 ^{efg} ±17.48
Flavors with bulking agent	Turkey flavor	(G9)	251.55 ^{c} ± 22.17	347.42 ^{def} ±8.38
Flavors with bulking agent	Chili & lemon flavor	(G10)	282.74 ^{hi} ±3.82	304.44 ^{ab} ±38.84
Flavors with bulking agent	Kabab flavor	(G11)	258.87 ^{cd} ±0.15	305.43 ^{ab} ±7.55
Extracted flavors	Cheese flavor	(G12)	268.14 ^{ef} ±1.8	388.89 ^{hi} ±15.93
Extracted flavors	Turkey flavor	(G13)	278.75 ^{gh} ± 0.9	379.53 ^{gh} ±15.08
Extracted flavors	Chili & lemon flavor	(G14)	272.18 ^{fg} ±1.96	290.56 ^{a} ±8.83
Extracted flavors	Kabab flavor	(G15)	275.55 ^{fgh} ±1.55	315.35 ^{bc} ±2.18
L.S.D. at 5%			7.87	21.86

a,b,c,... Any two means within the same column, have the same latter are not significantly different (P> 0.05)

4.18. Effect of the different treatments on the blood picture:

Table (23) shows the blood picture of the experimental animals as a result of feeding basal diet (control), sunflower oil after frying potato chip, unflavored chips (home made), flavored chips with different flavors, i.e., cheese, turkey, chili & lemon and kabab; flavor with bulking agent, extracted flavor. The data showed that the white blood cells (WBC, $10^3/mm^3$) amounted in 9.3 for the control. The most affected treatment was that of flavored chips with cheese, cheese with bulking agent or extracted ones followed by extracted kabab meanwhile the other treatments resulted in almost the same as that of control. It is worth mentioning that the normal WBC ranged from 4 -11 $\times$ 10^3 cell/mm^3. The red blood cell (RBC, $10^6/mm^3$) resulted in slight variation due to treatments it ranged from 5-6 $\times$ $10^6/mm^3$ for the normal subjects. Hemoglobin (HGB, g/dl.) ranged from 10.93 to 16.13 g/dl for all treatments. The normal HGB ranged from 14-16 g/dl. All treatments resulted a slight decrease in hemoglobin amounts except that of chili & lemon and kabab with bulking agent and the same flavors without bulking agent which resulted in slight increase than the control. Heamatocrite (HCT) showed a slight decrease due to all treatments except that of chili & lemon and kabab either with bulking agent of extracted which showed a slight increase in HCT compared with control. The normal amounts of HCT ranged from 42 – 45%. The platelet counts (PLT) of the normal subjects ranged from 150 to 400 $\times$ $10^3/mm^3$. The data revealed that an increase in

PLT was found due to all treatments including control while kabab flavor either extracted or with bulking agent decreased slightly the PLT. Normal mean corpuscular volume (MCV) ranged from 80 to 97 µm3 which showed a decrease due to all treatments which mean corpuscular hemoglobin (MCH) amounted in 26.5 – 33.5 pg for the normal individuals. The present study resulted in lower MCH than the normal due to all treatments. On the other hand, mean corpuscular hemoglobin in cell (MCHC) found in the normal range (31.5 – 35.0 g/dl). From the afore mentioned data, it could be concluded that the diets under study affected the WBC, HGB, HCT, MCV and MCH by decreasing its amounts than the control or the normal amounts while some treatments increased PLT amount. Those data must be taken into consideration to make alarm for the child immunity.

The statistical analysis for white blood cells showed non-significant differences ($P > 0.05$) between control and groups fed on sunflower oil after frying potato chips, cheese, kabab flavors with bulking agent and extracted chili & lemon flavor, but showed significant differences ($P < 0.05$) between control and other treatments. Red blood cells showed non-significant differences between control and groups fed on sunflower oil after frying potato chips, cheese, turkey flavors with bulking agent and extracted cheese and turkey flavors, but showed significant differences between control and other treatments. Hemoglobin showed significant differences between control and all treatments. Heamatocrite showed non-significant differences between control and groups fed on kabab flavor with bulking

agent and extracted kabab flavor, but showed significant differences between control and other treatments. The platelet counts showed non-significant differences between control and group fed on extracted cheese flavor, meanwhile showed significant differences between control and other treatments.

Table (23): Effect of the different treatments on the blood picture.

Treatments		WBC	RBC	HGB	HCT	PLT	MCV	MCH	MCHC
Control (G1)		9.3 ^{cd} ±1.0	7.22 ^{e} ±0.6	14.36 ^{c} ±.68	43.66 ^{c} ±1.2	579.0 ^{def} ±67.3	59.33 ^{abcde} ±4.91	19.30 ^{cdef} ±1.13	32.86 ^{ab} ±0.74
Oil after frying (G2)		9.26 ^{cf} ±0.77	6.99 ^{e} ±0.3	13.40 ^{cd} ±0.4	40.66 ^{d} ±1.93	472.66 ^{c} ±49.9	57.0 ^{a} ±00	18.83 ^{bcd} ±0.48	33.03 ^{ab} ±0.73
Potato made home(G3)		8.16 ^{cde} ±.85	5.65 ^{bcd} ±0.09	11.63 ^{ab} ±0.14	34.56 ^{bc} ±0.08	604.0 ^{efg} ±74.32	61.33 ^{bcde} ±0.88	20.60 ^{cde} ±0.50	33.73 ^{bc} ±0.46
Flavored processed chips	Cheese flavor (G4)	7.10 ^{bcd} ±0.88	5.10 ^{a} ±0.59	10.93 ^{a} ±0.73	31.80 ^{a} ±2.19	684.66 ^{ghij} ±9.40	63.0 ^{e} ±2.88	21.73 ^{g} ±1.13	34.43 ^{cd} ±0.13
	Turkey flavor (G5)	10.90 ^{gh} ±0.75	5.69 ^{cd} ±0.06	12.16 ^{b} ±0.03	35.10 ^{c} ±0.30	695.0 ^{hij} ±43.87	61.66 ^{cde} ±0.33	21.36 ^{g} ±0.26	34.63 ^{cd} ±0.33
	Chili & lemon (G6)	8.36 ^{de} ±1.64	5.77 ^{d} ±0.03	12.26 ^{b} ±0.3	35.70 ^{c} ±1.37	788.66 ^{k} ±44.84	62.0 ^{de} ±2.08	21.23 ^{g} ±0.51	34.43 ^{cd} ±0.87
	Kabab flavor (G7)	10.86 ^{fh} ±3.17	5.23 ^{ab} ±0.29	11.43 ^{a} ±0.61	32.70 ^{ab} ±1.52	749.0 ^{ijk} ±92.14	72.66 ^{f} ±10.66	21.80 ^{g} ±0.23	34.90 ^{d} ±0.41
flavor with bulking agent	Cheese flavor (G8)	5.60 ^{ab} ±0.70	6.89 ^{e} ±0.03	13.46 ^{c} ±0.1	40.73 ^{d} ±0.48	637.0 ^{fghi} ±29.31	59.0 ^{abcde} ±0.57	19.50 ^{def} ±0.17	33.03 ^{ab} ±029
	Turkey flavor (G9)	8.90 ^{e} ±0.25	6.93 ^{e} ±0.19	13.13 ^{c} ±0.2	40.10 ^{d} ±0.37	712.33 ^{ijk} ±59.12	57.66 ^{abc} ±1.33	18.93 ^{bcde} ±0.57	32.70 ^{ab} ±0.15
	Chili & lemon (G10)	5.86 ^{ab} ±.35	8.38 ^{g} ±0.73	16.13 ^{g} ±1.41	48.50 ^{g} ±3.52	473.0 ^{c} ±90.83	58.66 ^{abcd} ±0.66	19.53 ^{ef} ±0.54	33.20 ^{b} ±0.70
	Kabab flavor (G11)	8.93 ^{e} ±1.53	7.83 ^{f} ±0.1	15.06 ^{f} ±0.06	44.13 ^{e} ±0.4	335.66 ^{a} ±51.33	58.0 ^{abcd} ±00	19.70 ^{f} ±0.10	34.10 ^{c} ±0.10
Extracted flavor	Cheese flavor (G12)	6.90 ^{abcd} ±0.00	7.19 ^{e} ±0.27	13.76 ^{cde} ±0.6	41.56 ^{d} ±2.36	565.0 ^{def} ±51.00	56.33 ^{a} ±0.66	18.60 ^{b} ±0.50	33.20 ^{b} ±0.50
	Turkey flavor (G13)	11.46 ^{h} ±2.19	7.08 ^{e} ±0.35	13.90 ^{de} ±0.50	40.66 ^{d} ±1.89	441.33 ^{bc} ±119.7	57.0 ^{a} ±1.00	19.50 ^{def} ±0.47	34.16 ^{c} ±0.35
	Chili & lemon (G14)	9.46 ^{efg} ±0.93	7.95 ^{fg} ±0.33	15.06 ^{f} ±0.84	46.26 ^{f} ±2.39	498.3 ^{cd} ±79.68	57.33 ^{ab} ±0.33	18.73 ^{bc} ±0.26	32.50 ^{a} ±0.40
	Kabab flavor (G15)	5.40 ^{a} ±0.90	7.75 ^{f} ±0.2	15.10 ^{f} ±0.21	45.50 ^{ef} ±1.16	388.66 ^{ab} ±63.52	58.33 ^{abcd} ±4.84	17.76 ^{a} ±0.12	32.90 ^{ab} ±0.25
LSD at 5%		1.61	0.43	0.71	2.09	82.24	4.23	0.68	0.60

a,b,c,.. Any two means within the same column, have the same latter are not significantly different (P> 0.05)

WBC= white blood cells, RBC= red blood cell, HGB= Hemoglobin, HCT=Heamatocrite, PLT =platelet counts, MCV =mean corpuscular volume, MCH mean corpuscular hemoglobin, MCHC= mean corpuscular hemoglobin in cell.

4.19. Histopathological effect of different treatments on the some organs:

Group (1): Fed on basal diet:

(a) **Liver:** Cross section in the liver showed central vein surrounded by hepatic cords consists of hepatocytes contain central nucleus. (fig 16)

(b) **Kidney:** Cross section in the cortex and medulla of the kidney showed normal nephron and tubules with normal glomeruli and proximal and distal convoluted tubules. (fig 26)

(c) **Brain :** Cross section in the cerebrum showed normal structure and distribution of the pyramidal and nerve cells and fibers (fig 34).

(d) **Spleen :** Cross section in the splenic tissue was normal (fig 40).

Group (2): Fed on sunflower oil after frying after frying potato chips:

a) **Liver:** Peripherolobular fatty change with congested portal blood vessels. Fibroblastic proliferation and newly formed bile ductules were seen in portal areas (fig 17)

(b) **Kidney:** Cystic dilatation of some renal tubules and their lumina containing hyaline casts, lobulation of glomerular tufts could be seen (fig 27).

(c) Brain: Demyeliation of some nerve fibers of cerebral cortex could be seen (figs 35). Endotheliosis of meningeal blood vessels and meningeal edema and hemonlage, could be seen (fig 36).

(d) Spleen: Lymphoid depletion and necrosis were constent finding beside congested trabecular blood vessel and perivascular edema (fig 41).

Group (3): Fed on unflavored potato chips

(a) Liver: The hepatic parenchyma was apparently normal with presence of a few scattered vacuoles inside cytoplasm of the hepatic cells (fig 18).

(b) Kidney: The renal blood vessels and inter tubular capillaries were dilated and hyperemic (fig 28)

(c) Brain : The brain appeared apparently normal (fig 34).

(d) Spleen : The splenic tissue was normal (fig 40).

Group (4): Fed on potato chips with cheese flavor:

(a) Liver: Fatty changes of some hepatocytes. (fig 19)

(b) Kidney: Mild dilatation of glomerular spaces and mild dilation of renal blood vessels. (fig 29)

(c) Brain: Normal structure of brain tissue (fig 34).

(d) Spleen : Mild depletion and white of lymphocytes with showing hyperplasic (fig 42).

Group (5): Fed on potato chips with turkey flavor:

(a) Liver: The portal area appear edema infiltrated with lymphocytes and fibrosis hepatic cells suffered from vacuolar with hydropic degeneration and congestion of portal blood vessels. (fig 20)

(b) Kidney: Dilatation of glomerular spaces, contracted glomerular tufts and congestion of blood vessels. (fig 29)

(c) Brain : Normal structure and distribution of the pyramidal and nerve cells and fibers (fig 34).

(d) Spleen: Lymphoid necrosis depletion of white pulps (fig 43).

Group (6): Fed on potato chips with chili & lemon flavor:

(a) Liver: Focal fatty changes of hepatocytes. (fig 19)

(b) Kidney: Sever congestion of renal blood vessels interstitial fibrosis of medulla mild retrogression changes in renal tubules and hyalin casts of lumina (fig 30)

(c) Brain: Normal structure and distribution of the pyramidal and nerve cells and fibers (fig 34).

(d) Spleen : Lymphoid depletion of white pulps with extensive hemosiderosis (fig 44).

Group (7): Fed on potato chips with kabab flavor:

(a) Liver: Dilatation of hepatic sinusoids with atrophied hepatic cords (fig 21).

(b) Kidney: Focal fibrosis and congestion of renal cortex and renal medulla and cystic dilatation of some renal tubules interstitial lymphocytic aggregation of renal cortex and diffuse epithelial necrosis of renal tubules (fig 31).

(c) Brain: Congestion of meningeal, cerebral blood vessels submeningeal edema (fig 37).

(d) Spleen: Lymphoid depletion of white pulps.(fig 43)

Group (8): Fed on cheese flavor with bulking agent:

(a) Liver: Sever fatty changes of all hepatocytes (fig 19)

(b) Kidney: Congestion of blood vessels, edema of renal medulla (fig 28)

(c) Brain : Normal structure and distribution of the pyramidal and nerve cells and fibers (fig 34).

(d) Spleen : Depletion of lymphocytes and sever congestion of red pulps (fig 44).

Group (9): Fed on turkey flavor with bulking agent:

(a) Liver: Mild degenerative changes mainly vacuolar degeneration of hepatic cells (fig 24).

(b) Kidney: Dilatation of blood vessels and epithelial hyaline casts inside the renal tubules. (fig 30)

(c) Brain : Congestion of chorioid plexus (fig 37).

(d) Spleen : Extensive hemosiderosis depletion and necrosis of lymphocytes with replaced by fibrosis tissue (fig 44).

Group (10): Fed on chili & lemon flavor with bulking agent:

(a) Liver: Fatty changes with congestion of hepatic blood vessels and interstitial fibrosis and portal leukocytic aggregation (fig 22).

(b) Kidney: Interstitial nephritis, hemogenesis of renal medulla and corticomedullary and degeneration changes of renal tubules. (fig 29)

(c) Brain : Normal structure and distribution of the pyramidal and nerve cells and fibers (fig 34).

(d) Spleen: Hyper plastic of white pulps with lymphoid depletion (fig 42).

Group (11): Fed on kabab flavor with bulking agent:

(a) Liver: Very cellular fibroblastic proliferation. (fig 17)

(b) Kidney: Cystic dilatation of collecting tubules degeneration changes of tubular epithelial beside lymphositic aggregation. (fig 32)

(c) Brain: Normal structure and distribution of the pyramidal and nerve cells and fibers (fig 34).

(d) Spleen : Lymphoid depletion of white pulps (fig 43).

Group (12): Fed on extracted cheese flavor:

All organs showed normal structure except liver showed very mild changes only includes congestion in their blood vessels and hepatic sinusoids (fig 22).

Group (13): Fed on extracted turkey flavor:

(a) Liver: Focal destruction of the hepatocytes manifested by disassociated hepatic cords, and cell death and pericellular fibrosis.. (fig 23)

(b) Kidney: Mild dilatation of renal tubules and slight congestion of renal blood vessels (fig 29).

(c) Brain: Cross section in the cerebrum showed normal structure and distribution of the pyramidal and nerve cells and fibers (fig 34).

(d) Spleen : Mild shrinkage of lymphoid tissue (fig 43).

Group (14): Fed on extracted chili & lemon flavor:

(a) Liver: Vacuolar and hydropic degeneration or apoptosis of hepatic cells and individualization of the hepatic cells with pericellular fibroblastic proliferation (fig 24).

(b) Kidney: Cystic dilatation of some collecting tubules and congestion of blood vessels and conteraction of some glomeruli tufts. (fig 27).

(c) Brain: Cross section in the cerebrum showed normal structure and distribution of the pyramidal and nerve cells and fibers (fig 34).

(d) Spleen : The splenic tissue was normal. (fig 40)

Group (15): Fed on extracted kabab flavor:

(a) Liver: Portal fatty changes or fatty changes of periphery of hepatic lobules and portal leukocytic aggregation. . (fig 25).

(b) Kidney: Congestion of blood vessels with edema of renal medulla and necrosis in some tubular epitheliana. (fig 33).

(c) Brain: Congestion and hemogenesis of meninges of brain (fig 39).

(d) Spleen : The splenic tissue was normal (fig 40)

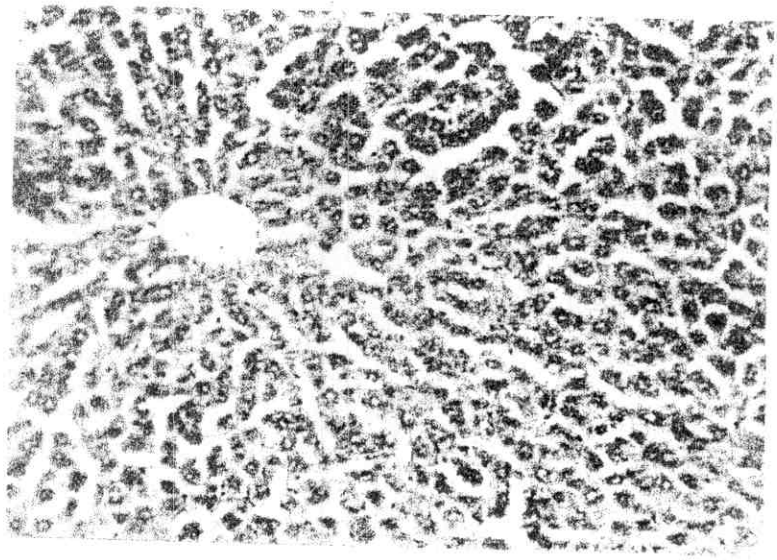

Fig (1): A Photomicrograph of liver healthy rats fed on control diet showing normal hepatic parenchyma (H&E.....X 300)

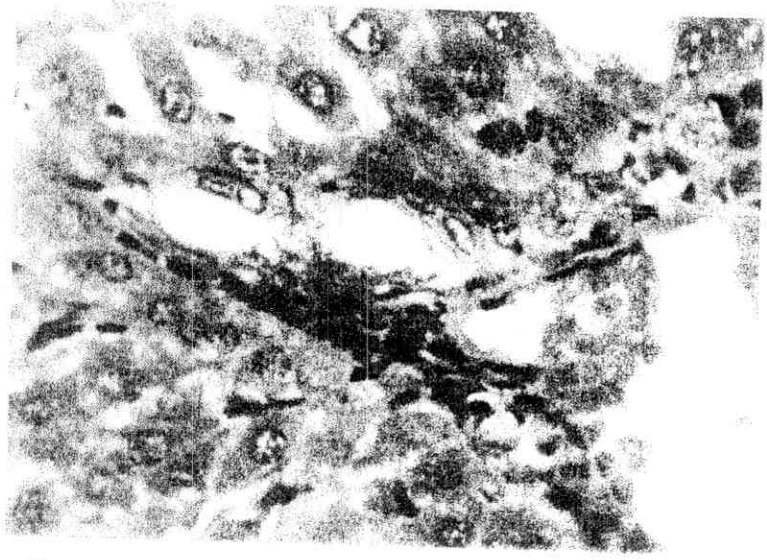

Fig (2): A Photomicrograph of liver of group (2, 11) showing fibroblast proliferation and proliferative bile ductules (H &E ..... X 1200)

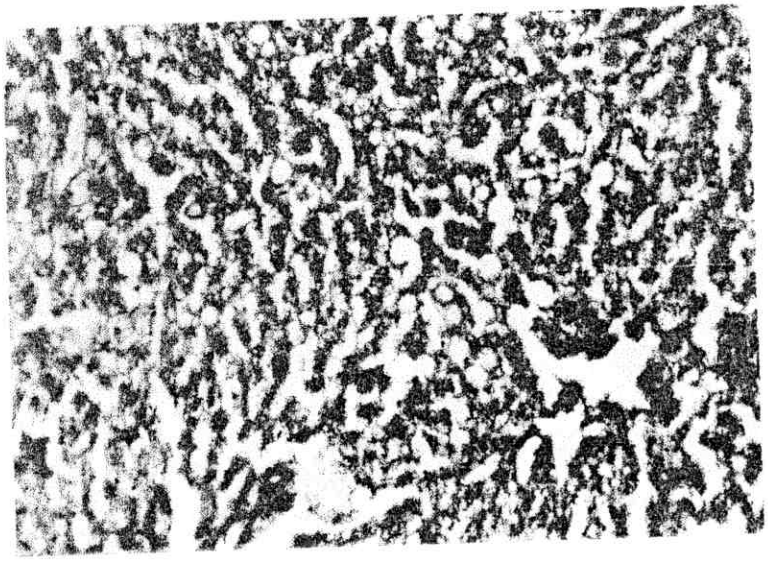

Fig (3): A Photomicrograph of liver of group (3, 9) showing vacuolar degeneration of hepatic cells (H&E.....X 300)

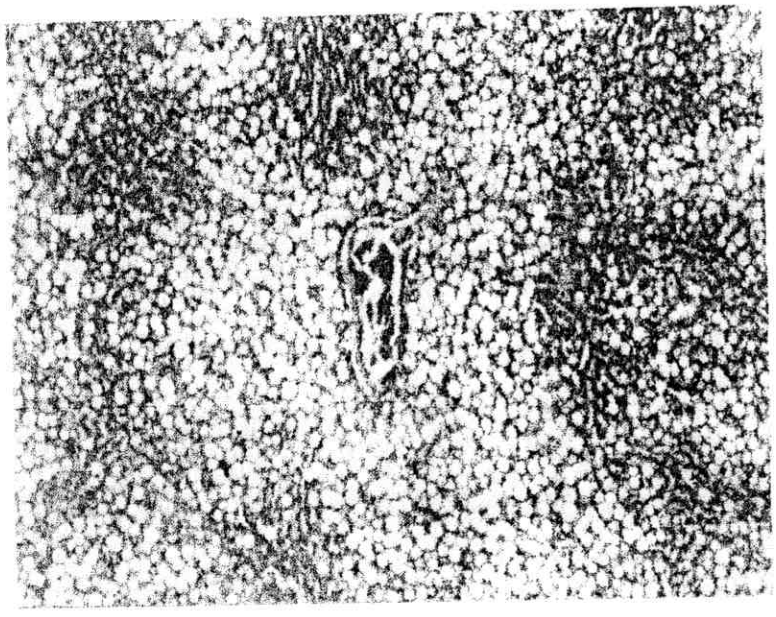

Fig (4): A Photomicrograph of liver of group (4,6,8) showing fatty change (H&E.....X 300)

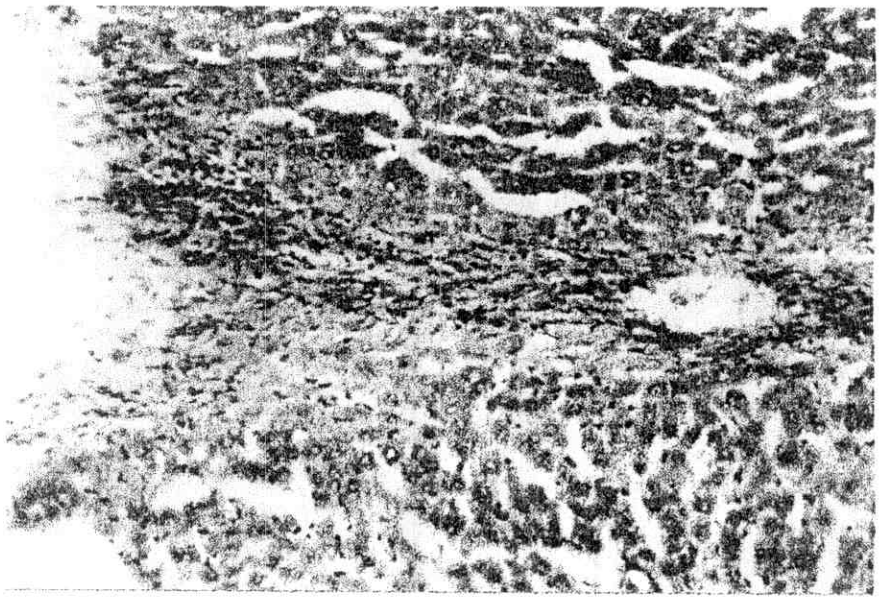

Fig (5): A Photomicrograph of liver of group (5) showing edema , hydrophpic degeneration and interstitial fibrosis (H&E.....X 300).

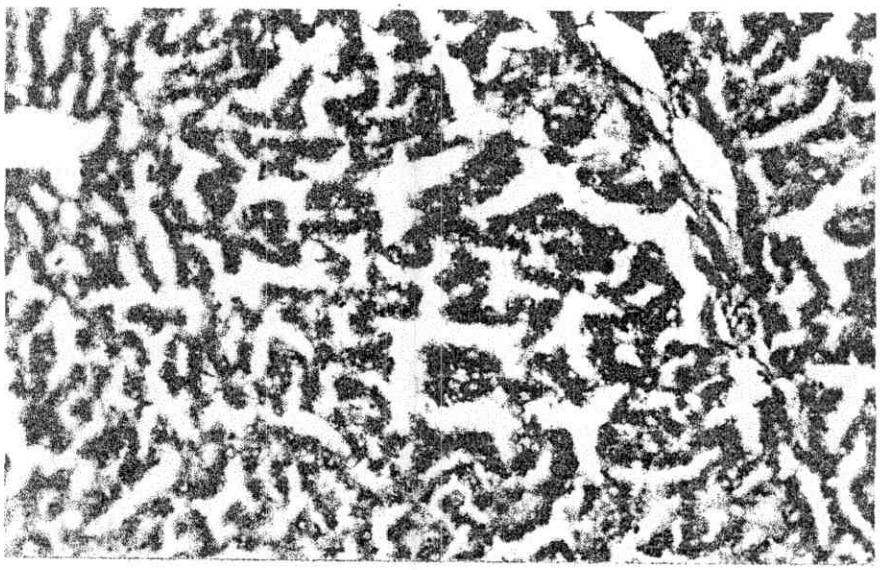

Fig (6): A Photomicrograph of liver of group (7, 12) showing atrophoid hepatic cords and dilated hepatic sinusoids (H&E.....X 300)

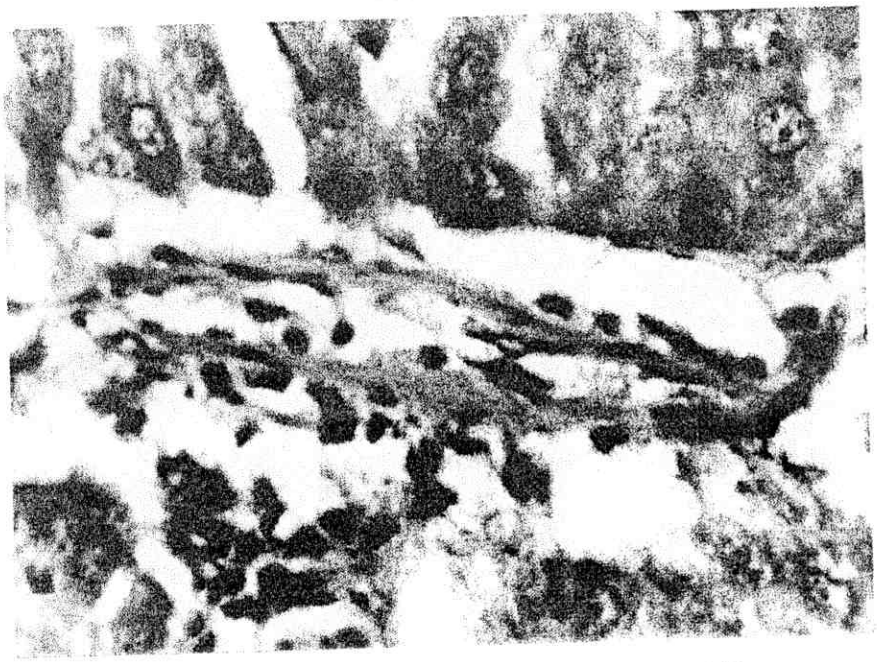

Fig (7): A Photomicrograph of liver of group (10) showing mild leukocytic infiltration in portal areas. (H&E.....X 1200)

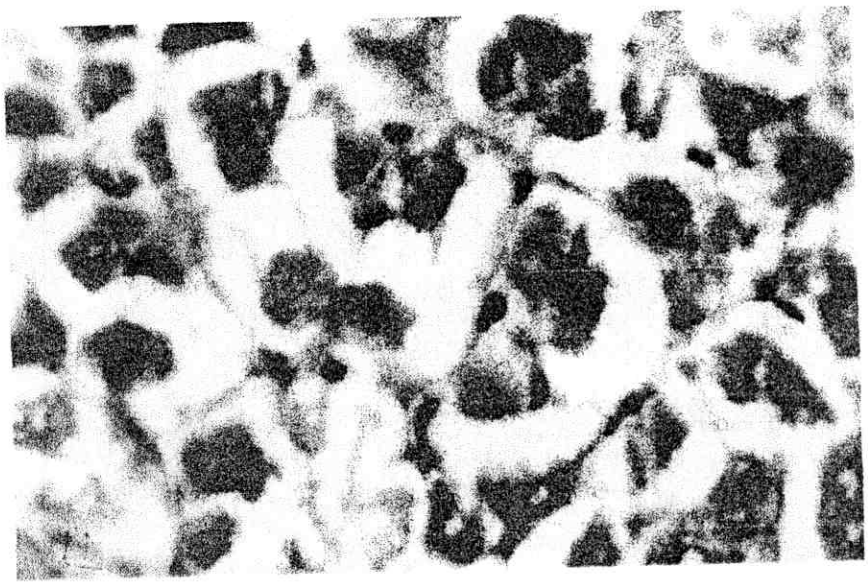

Fig (8): A Photomicrograph of liver of group (13) showing pericellular fibroblastic proliferation. (H&E.....X 1200)

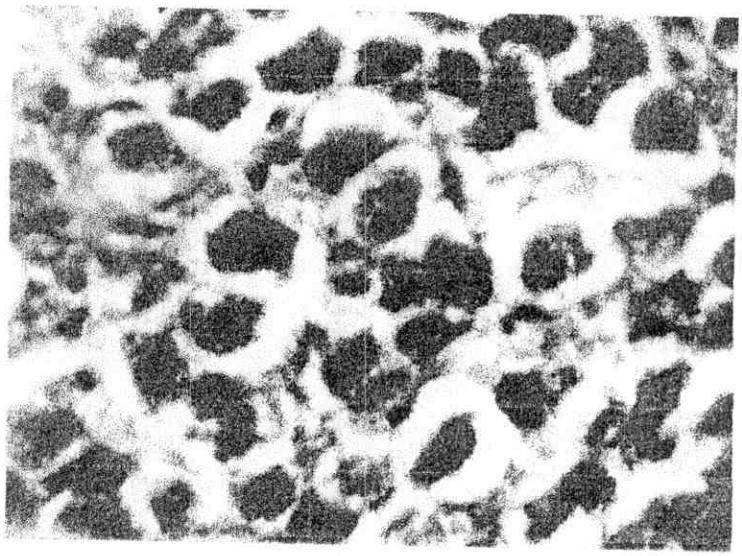

Fig (9): A Photomicrograph of liver of group (14) showing apoptosis of some hepatic cells (H&E.....X 1200)

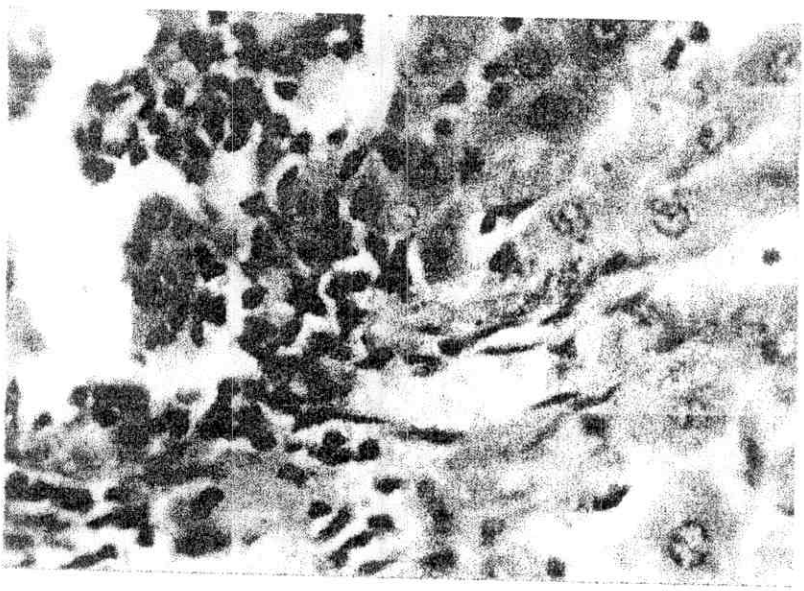

Fig (10): A Photomicrograph of liver of group (15) showing portal leukocytic aggregation mainly round cells (H&E.....X 1200)

Fig (11): A Photomicrograph of kidney healthy rats groups (1,12) showing normal renal parenchyma (H&E.....X 300)

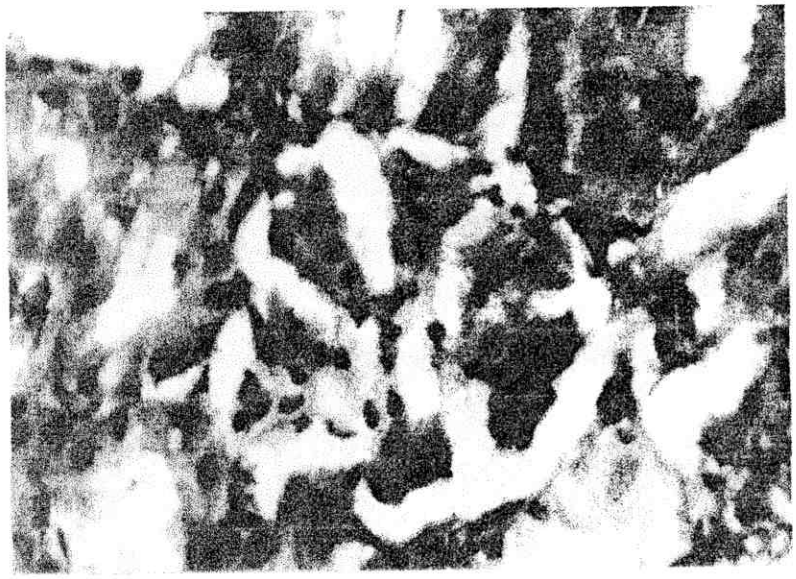

Fig (12): A Photomicrograph of kidney of group (2, 14) showing lobulation of glomerular tufts and hyaline costs. (H&E.....X 1200)

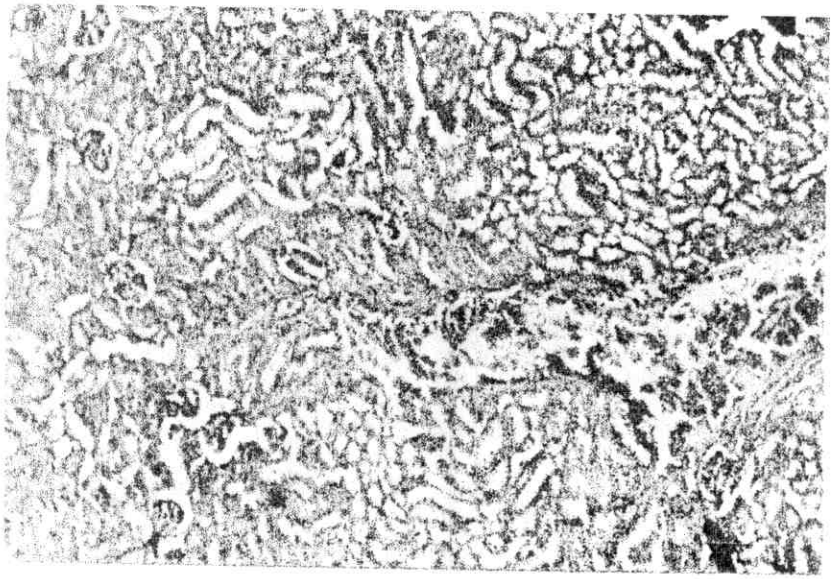

Fig (13): A Photomicrograph of kidney group (3,8) showing dilated and hyperemic of renal blood vessels. Congestion of blood vessels (H&E.....X 300)

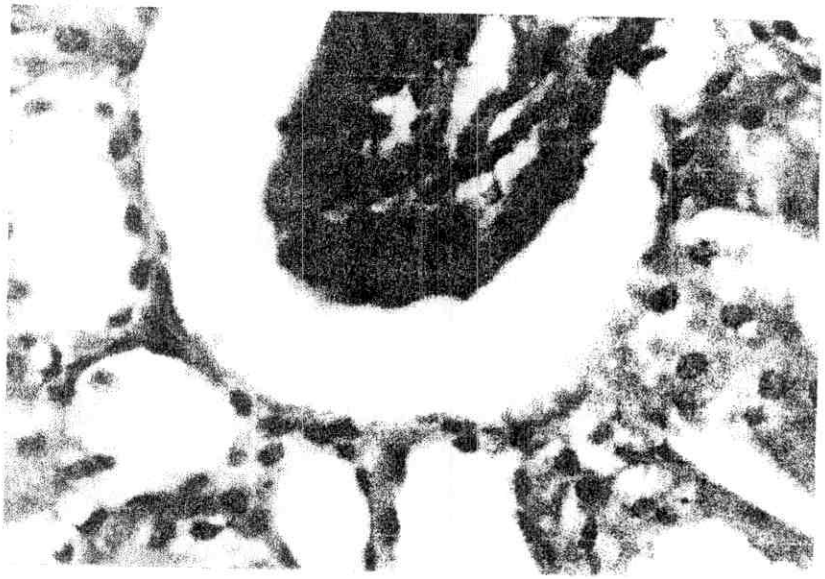

Fig (14): A Photomicrograph of kidney of groups (4,5,10, 13) showing dilation of glomerular space and congestion of renal blood vessels (H&E.....X 1200)

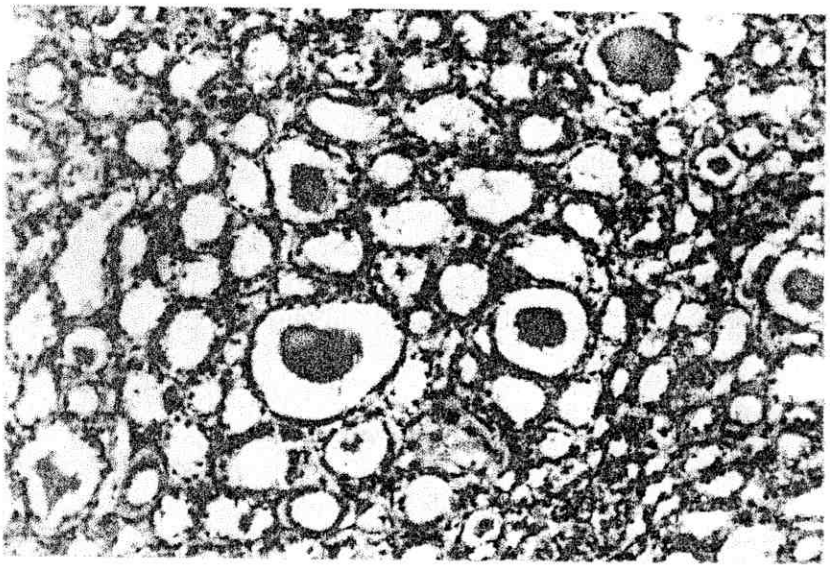

Fig (15): A Photomicrograph of kidney of groups (6,9,14) showing hyaline casts inside some renal lumina (H&E.....X 300)

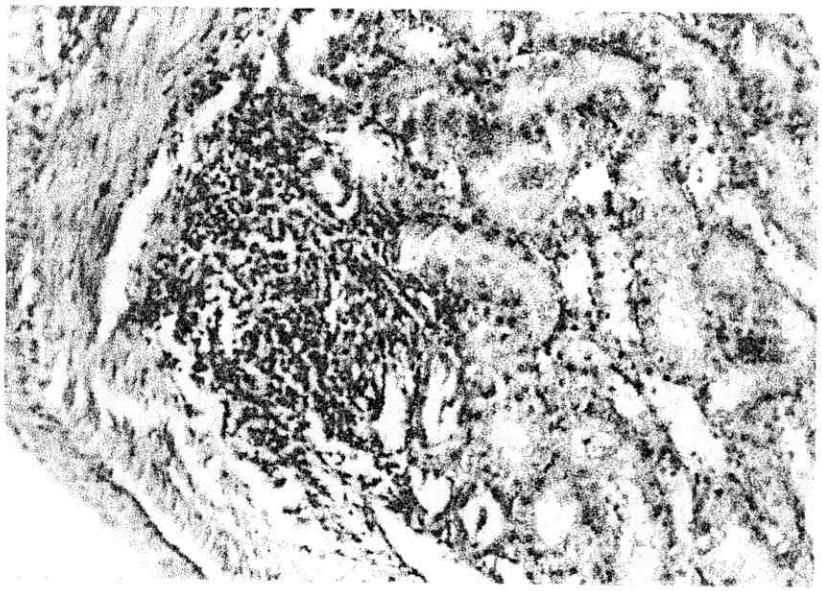

Fig (16): A Photomicrograph of kidney of group (7) showing interstitial lymphocytic aggregation and dilatation of renal tubules (H&E.....X 300)

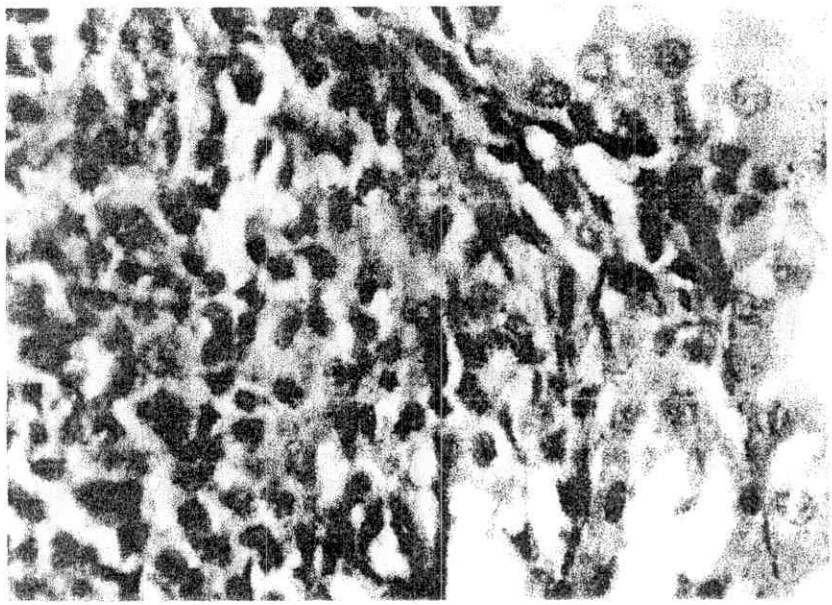

Fig (17): A Photomicrograph of kidney of group (11) showing lymphocytic aggregation and degeneration changes.(H&E.....X 300)

Fig (18): A Photomicrograph of kidney of group (15) showing necrosis in renal tubular epitheliana (H&E.....X 1200)

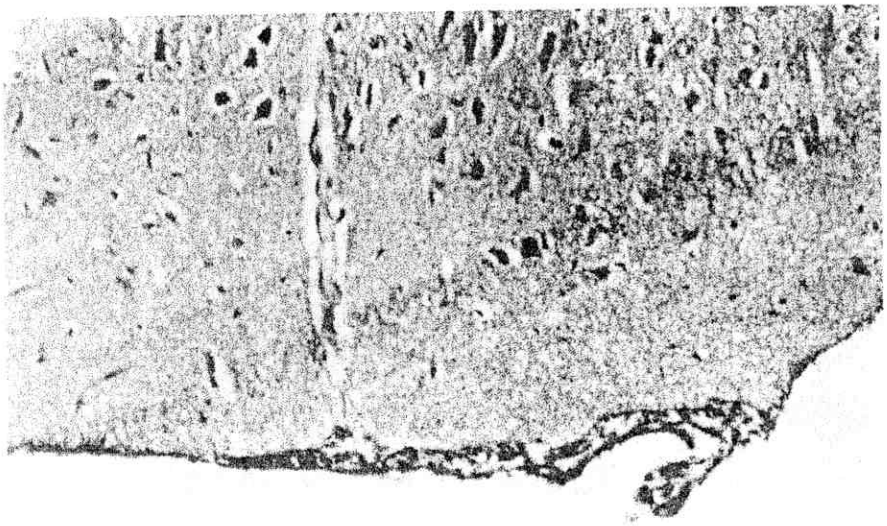

Fig (19): A Photomicrograph of brain of healthy groups (1, 3-6, 8, 10- 14) showing normal brain (H&E.....X 300)

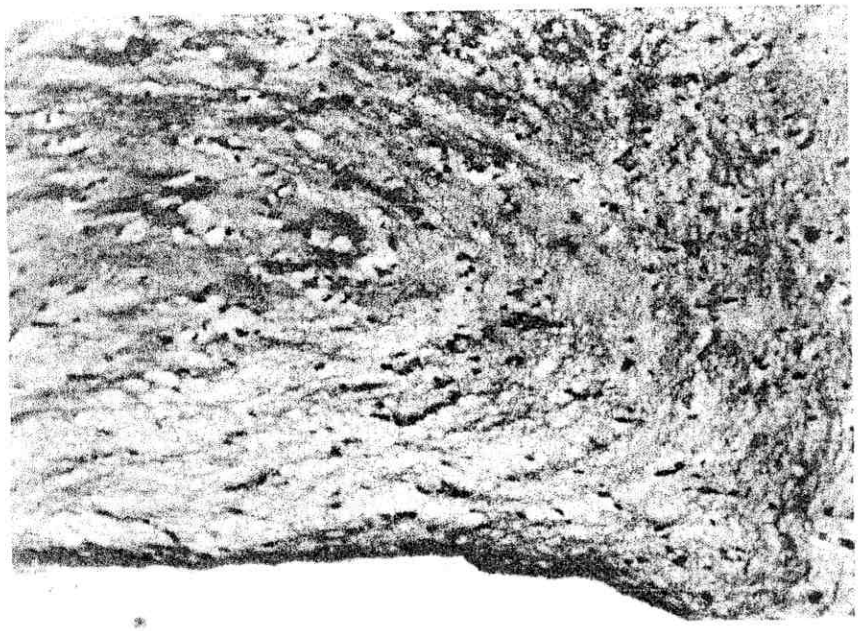

Fig (20): A Photomicrograph of brain of group (2) showing dymeliation of some nerve fibers (H&E.....X 300)

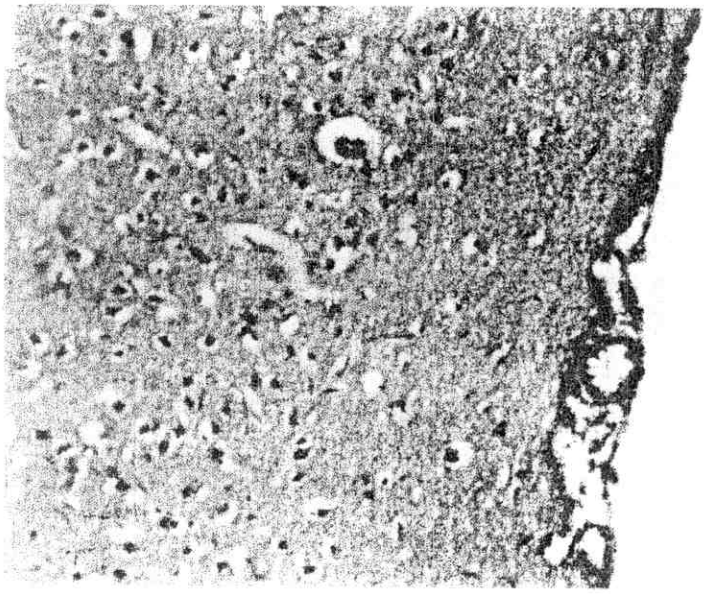

Fig (21): A Photomicrograph of brain of group (2) showing endotheliosis of some meningeal blood vessels. (H&E.....X 300)

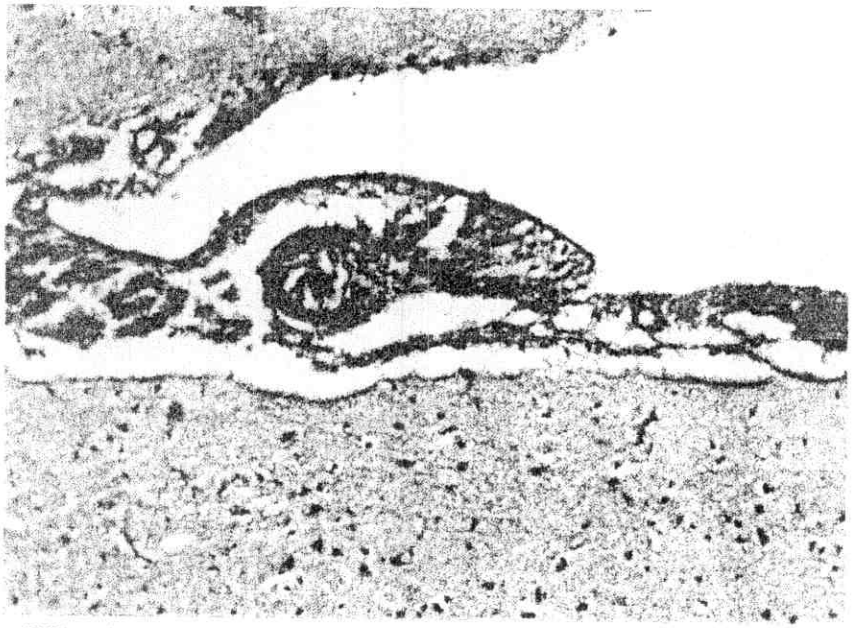

Fig (22): A Photomicrograph of brain of groups (7,9) showing congestion and hemonlage of meningeal and submeningeal edema (H&E.....X 300)

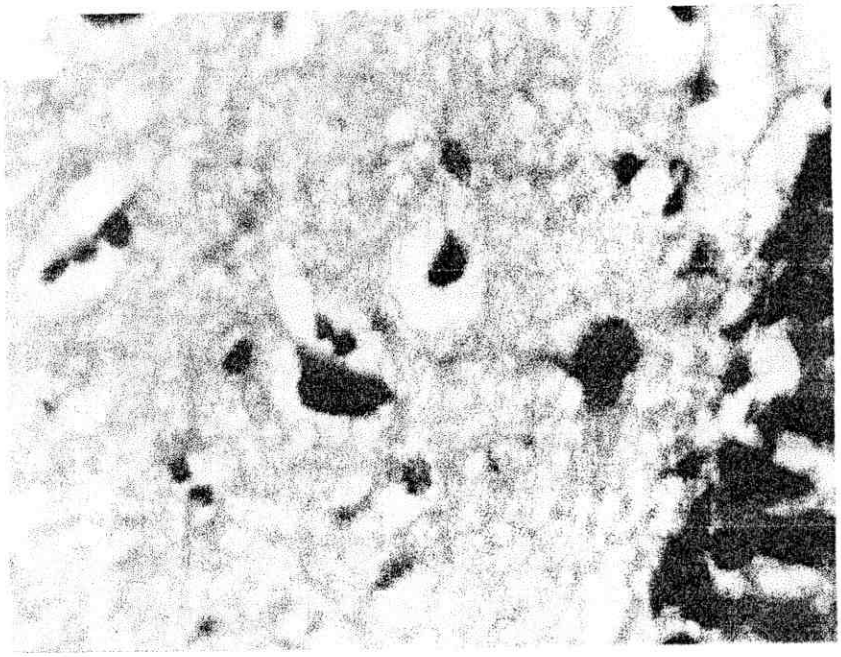

Fig (23): A Photomicrograph of brain of group (15) showing congestion and hemogenesis of meninges of brain (H&E.....X 1200)

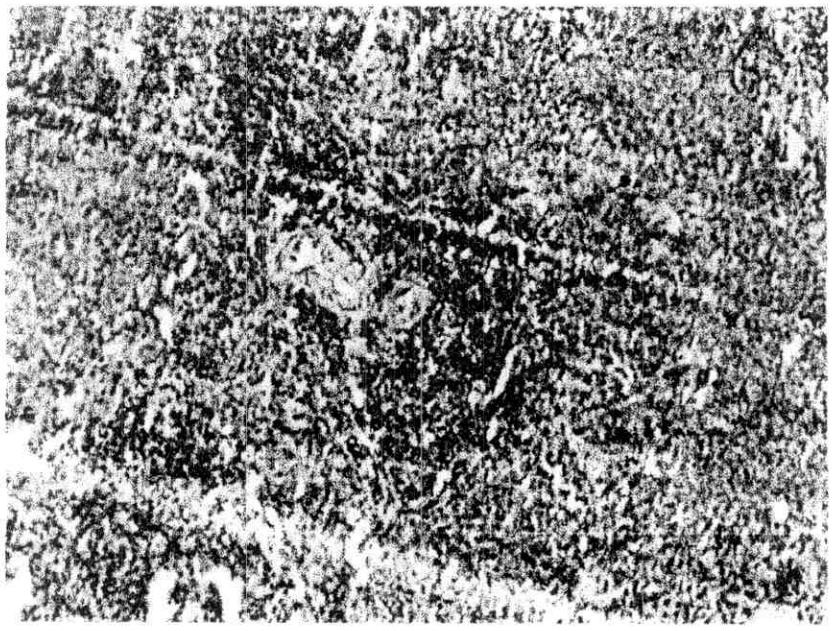

Fig (24): A Photomicrograph of spleen of groups (1,3,14,15) showing normal splenic tissue. (H&E.....X 300)

Fig (25): A Photomicrograph of spleen of group (2) showing congestion of blood vessels and edema (H&E.....X 300)

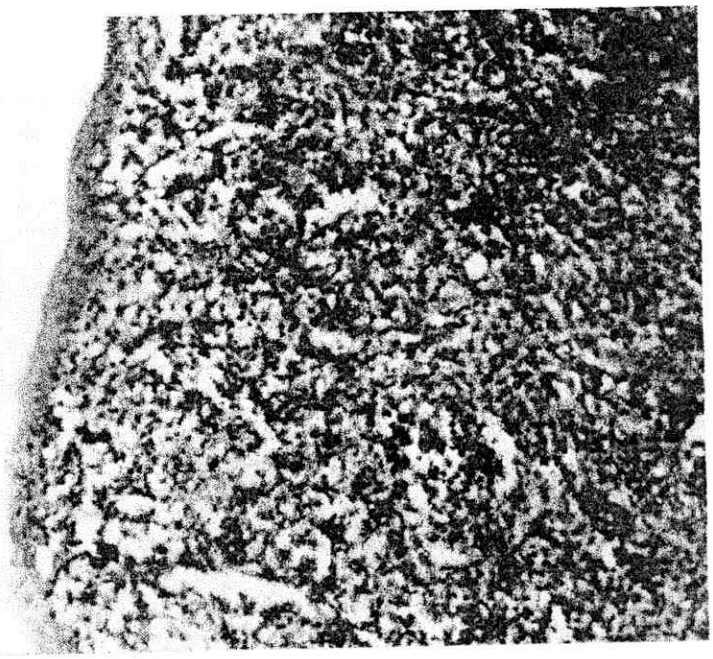

Fig (26): A Photomicrograph of spleen of groups (4,10,11) showing lymphoid depletion and hyperplastic (H&E.....X 300) .

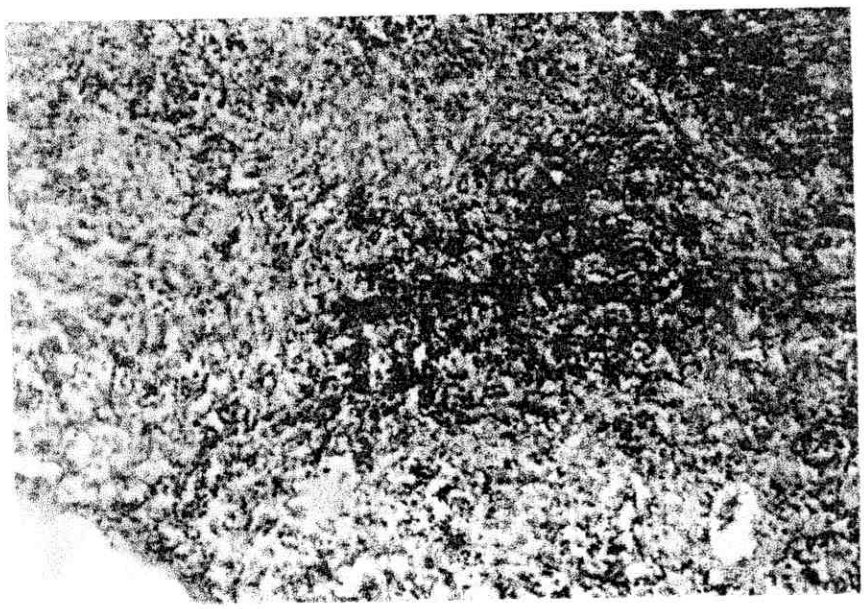

Fig (27): A Photomicrograph of spleen of groups (5,7,13) showing lymphoid necrosis and depletion (H&E.....X 300) .

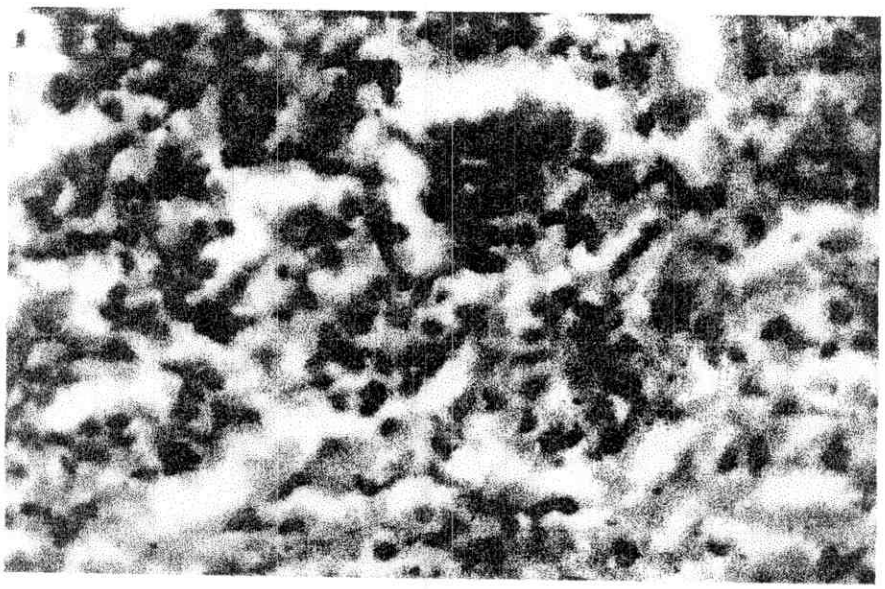

Fig (28): A Photomicrograph of spleen of groups (6,8,9) showing lymphoid depletion and hemosiderosis (H&E.....X 300) .