5- SUMMARY

The present study was designed to determine the biological effect of feeding rats on some flavors added to potato chips as cheese, turkey, chili & lemon or kabab with bulking agent and extracted its flavors from bulking agent and compared with feeding flavored and unflavored (home made) potato chips and sunflower oil after frying potato chips on body weight, liver and kidney function, and its effect on some organs tissue using weanling male albino rats.

I - Chemical analysis

1- Chemical composition of potato chips with different flavors:

The data show a slight variation between flavors concerning all chemical composition and this means that the flavors had no effect on the chemical composition.

2- Physical and chemical properties of sunflower oil before and after frying potato chips and oil separated from flavored potato chips:

Sunflower oil after frying deteriorated in physical and chemical properties while other oils showed to be in the range specified by the **Egyptian standard (49/ 1993)**.

3- Fatty acid composition of sunflower oil and oil extracted from flavored chips after frying:-

The fresh oil was characterized with high unsaturation which reached about 83.13%. Sunflower oil after used in frying showed an unsaturation percentage of 76.65 and slight increase in saturated fatty acid. The fatty acids extracted from the potato chips resulted in high level of monounsaturated 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 appeared as a result of frying process.

4- Effect of sunflower oil and potato chips on the unsaponifiable matter composition after oil extraction:-

During the frying process, some hydrocarbons disappeared and others appeared due to the destruction and condensation.

II- Biological examination

The effect of the different treatments on:-

1- on body weight gain, food intake and food efficiency ratio of the excremental rats :-

Rats fed on control diet showed that the body weight gain was 23.2 g, meanwhile it was 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, 157.4, 157.8 and 165.2 g, respectively, showed increase than that of freshly chips fried at home (150.8 g) except that of cheese flavor.

The food efficiency ratio showed value of 6.58% for the control. Feeding sunflower oil after frying potato chips showed an increase 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 in food efficiency ratio ranged from 9.63 to 19.46 and 7.85 – 14.43%, respectively.

2- The ratio between some organs to body weight:

Feeding potato chips increased the ratio between liver and heart to body weight 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 spleen, heart and liver, remarkable increase in kidney while brain showed almost the same ratio as that of control. In conclusion, the most affect organs were brain followed by kidney which showed a decreasing ratio, meanwhile liver and heart resulted in an increasing ratio compared with the control. Spleen showed a slight effect or not effected due to chips feeding either flavored or unflavored.

3- Aspartate aminotransferase (AST):-

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 after frying potato chips, freshly potato (home made), freshly flavored potato chips, flavor with bulking agent and extracted flavor, respectively.

4- Alanine amino transferase(ALT) :

Feeding sunflower oil after frying potato chips, and chili & lemon flavor were the most effective on increasing ALT followed by cheese and kabab flavors with bulking agent, extracted cheese, kabab and chili & lemon flavors with bulking agent. Meanwhile 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.

5- The serum alkaline phosphatase:

Feeding with the extracted flavor resulted the maximum alkaline phophatase followed by flavor with bulking agent, unflavored chips, sunflower oil and flavored chips, respectively.

6- The serum albumin:

There was no effect on serum albumin because the stander amounts ranged between 3.5 and 5.5 mg/dl

7- The serum total protein:

The serum protein decreased due to treatments with prolonged periods while it slightly increased compared with control.

8- The serum total lipids:

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 days for the sunflower oil after frying potato chips, unflavored potato chips (home made), chips with different flavors, flavors with bulking agent and extracted flavors, respectively.

9- The serum triglycerides:

Feeding on 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.

10- The serum creatinene:

All potato chips flavored with different flavors resulted in the highest serum creatinene followed by flavor with bulking agent, extracted flavors, sunflower oil and unflavored potato chips (home made).

11- The serum uric acid:

All treatments under study resulted in maximum decrease due to sunflower oil followed by unflavored chips, extracted flavor, freshly flavored chips and flavors with bulking agent.

12- Thyroid hormones:

Feeding on processed potato chips with kabab flavor resulted in maximum T_4 amounts followed by chips with cheese flavor and unflavored chips. Meanwhile, Feeding flavored chips processed with cheese, turkey, chili & lemon, kabab, flavors with bulking agent of cheese and turkey resulted in T_3 amount being 1.59, 2.0, 1.41, 1.32, 1.82, 1.15 and 1.23 fold as the control, respectively.

13- Superoxide dismutase enzyme (SOD):

Blood contained dismutase more 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.

14- The blood picture:-

Feeding the diets under study affected the WBC, HGB, HCT, MCV, MCH, by decreasing its amounts than the control or the normal amounts while some treatments increased PLT amount.

III- Histopathological effect of the different treatments on some organs:

Group (1): fed on basal diet. The organs showed no significant changes in their structure.

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.

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

(c) Brain: Demyeliation of some nerve fibers of cerebral cortex. Endotheliosis of meningeal blood vessels and meningeal edema and hemonlage.

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

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.

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

(c) Brain : The brain appeared apparently normal.

(d) Spleen : The splenic tissue was normal.

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

(a) Liver: Fatty changes of some hepatocytes.

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

(c) Brain : Normal structure of brain tissue.

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

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.

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

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

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

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

(a) Liver: Focal fatty changes of hepatocytes.

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

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

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

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

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

(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.

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

(d) Spleen : Lymphoid depletion of white pulps.

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

(a) Liver: Sever fatty changes of all hepatocytes.

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

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

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

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

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

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

(c) **Brain :** Congestion of chorioid plexus.

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

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.

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

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

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

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

(a) **Liver:** Very cellular fibroblastic proliferation.

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

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

(d) Spleen : Lymphoid depletion of white pulps.

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.

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.

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

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

(d) Spleen : Mild shrinkage of lymphoid tissue.

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

(a) Liver: Vacuolar and hydropic degeneration of blood vessels and individualization of the hepatic cells with pericellular fibroblastic proliferation.

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

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

(d) **Spleen :** The splenic tissue was normal.

Group (15): Fed on extracted kabab flavor:

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

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

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

(d) **Spleen:** The splenic tissue was normal.