SUMMARY

5. Summary

The present study aimed to determine the chemical composition, physiochemical properties of oils and to evaluate the effects of some dietary proteins, dietary oils and propolis ethanol extract on biochemical, biological and histopathological changes to prevent the development of atherosclerosis in the experimental animals at the adult age.

The obtained data could be summarized as follows:

5.1. Chemical composition of raw materials:

5.1.1. Crude protein content showed in the highest value for protein isolate of sweet lupine (93.72%) while the lowest value was in fenugreek seeds (30.25%).

5.1.2. Crude lipids ranged from 1.13% for sweet lupine protein isolate to 11.24% for sweet lupine seeds, while it ranged from 1.41% for fenugreek isolate to 8.90% for fenugreek seeds.

5.1.3. Crude fiber recorded the highest value 14.52% for sweet lupine flour while the lowest value was in protein isolate of fenugreek seeds (1.63%).

5.1.4. Ash content ranged between 1.60% - 3.93% for lupine protein isolate and defatted lupine flour

5.1.5. Total carbohydrates gave the highest value 50.9% for defatted fenugreek flour , while lupine protein isolate showed the lowest value.

5.1.6. Moisture content ranged from 2.53% for lupine protein isolate to 9.25%for defatted lupine flour.

5.2. Physical and chemical properties of dietary oils :

5.2.1. Refractive index (at 25°C) of cottonseed oil was 1.464, corn oil 1.471, olive oil 1.465 and sunflower oil 1.468.

5.2.2. The acid value recorded the highest value 2.44 for olive oil, while the lowest value 0.560 was in cottonseed oil.

5.2.3. The peroxide value ranged between 9.27 -2% for olive oil and corn oil , respectively.

5.2.4. The data showed that the thiobarbaturic acid value were relatively small.

5.3. Fatty acid composition of dietary oils:

Fatty acids of cottonseed oil, corn oil, olive oil and sunflower oil were fractionated by GLC. The results showed that, olive oil characterized by the highest amount of monounsaturated fatty acids, 60.43% and the lowest amount of polyunsaturated fatty acids 17.34%, while corn oil characterized by the highest amount of polyunsaturated fatty acid 57.44%. Total saturated fatty acids ranged from 10.99% for sunflower oil to 45.02% for cottonseed oil. Palmitic acid ranged between 8.44% (sunflower oil) and 42.51% (cottonseed oil).

5.4. Biological evaluation

The obtained results showed that body weight gain was the highest significant decrease in group fed on hypercholes - terolemic diet containing defatted fenugreek flour, while the lowest significant increase of weight gain were found in group fed on defatted lupine flour. On the other hand, rats fed on olive oil with 1% cholesterol showed that weight gain was significantly increased, food efficiency ratio was increased for rats fed on dietary oils and propolis ethanol extract, but reduced for rats fed on plant proteins. The lowest value recorded for rats fed on defatted fenugreek flour.

5.4.1. organs weight:

5.4.1.1. liver :

The highly value of liver weight was in rats fed on sunflower oil containing diet, while the lowest value found in rats fed on a basal diet 3.01%

5.4.1.2. Heart:

The highly value of heart weight was in group fed on defatted fenugreek flour (0.430%), while the lowest value found in negative control diet (0.283%). All rats fed on diet with 1% cholesterol the values of heart weight were increased.

5.4.1.3. Spleen :

The highly value of spleen found in rats fed on sunflower oil, (0.270%) while the lowest value was in rats fed on negative control diet (0.167%).

5.4.1.4. Kidney:

It could be observed that rats fed in defatted fenugreek flour have higher in kidney weight/ body weight ratio(0.700), while rats fed on a basal diet, the kidney weight/body weight ratio was (0.523%).

5.4.1.5. Brain:

The highly value of Brain weight ratio was in rats fed on defatted fenugreek containing diet (0.960%), while the lowest value was (0.570%) for rats fed on negative control diet.

5.4.1.6. Lung:

The results showed that lung weight/ body weight ratio was the highest (0.597%) in rats fed on defatted fenugreek

5.4.1.7. Testes:

Testes weight /body weight ratio ranged from (0.857%) for negative control to (1.407%) for groups fed on defatted fenugreek flour.

5.5. Biochemical parameters:

5.5.1. Total lipid ranged from 0.593 an gm/dL to 0.632gm/dL and 0.667 gm/dL to 1.204 gm /dL for negative and positive control groups during of experimental period. The best effect in reducing total lipid found due to feeding on defatted lupine flour, corn oil and propolis ethanol extract.

5.5.2. The lowest value of triglycerides, were obtained by feeding on defatted lupin flour (43.68mg/dL), corn oil (62.07mg/dL) and propolies ethanol extract (70.41 mg/dL)

compared with positive control which raised gradually to reach a maximum level (121.82 mg/dL) at the end of experimental period (10 weeks).

5.5.3. Serum total cholesterol ranged from 72.59 mg/dl to 78.32 mg/dL and 128.72 mg/dL to 225.47 mg/dL for negative and positive control. The lowest values of total cholesterol were in rats fed on defatted lupine flour (77.28 mg/dL), corn oil (151.54 mg/dL) and propolis ethanol extract (102.20 mg/dL).

5.5.4. Serum HDL-C ranged from 46.01 mg/dLto 56.67 mg/dL and 19.64 mg/dL to 43.68 mg/dL for negative and positive control. Significant increased in serum HDL-C for groups fed on diets containing defatted lupine flour, corn oil and propolis ethanol extract with 1% cholesterol

5.5.5. Serum LDL -C ranged from 10.16 mg/dLto 24.73 mg/dL and 64.23 mg/dL to 184.89 mg/dl for negative and positive control. The lowest values of LDL-C were obtained by feeding on diet containing defatted lupine flour, corn oil and propolis ethanol extract with 1% cholesterol compared with positive control. While the highest value was in rats fed on olive oil.

5.5.6. Serum VLDL-C ranged from 7.31 mg/dL to 8.52 mg/dL and 19.03 mg/dL to 25.14 mg/dL for negative and positive control. Feeding on defatted lupine flour containing diet led to non significant differences in VLDL-C level compared with negative diet.

5.5.7. Atherogenic index (LDL /HDL ratio) was (0.236) in negative control compared with positive control (9.24). Atherogenic index in rats fed in defatted lupine flour, corn oil and propolis ethanol extract 0.438, 4.979 and 2.276, respectively.

5.5.8. Serum glucose in negative control ranged from 59.60 mg/dL to 66.85 mg/dL compared with positive control which ranged from 79.24mg/dL to 180.19 mg/dL. All treated groups decreased serum glucose after 10 weeks. Defatted lupine flour, corn oil and propolis ethanol extract were the best of treatments.

5.5.9. Serum AST level in negative control ranged between (32.40 IU/L - 38.37 Iu/L) compared with positive control (36.72 IU /L - 85.07 Iu/L) feeding defatted lupine flour led to reduced AST level to reach 52.29 Iu/L after 10 weeks, corn oil 68.25 Iu/L. the highest value was by feeding on olive oil diet (141.58 Iu/L) compared with positive diet.

5.5.10. The highest value of ALT was 49.39 Iu/L for rats fed on olive oil while the lowest value was 21.1 Iu/L for rats fed on defatted lupine flour.

5.5.11. Non significant increases in serum creatinin in all groups except rats fed on olive oil which have significant increased.

5.5.12. Serum uric acid ranged from 3.08mg/dL to 3.90 mg/dL in negative control compared with positive control which reached to 9.97mg/dL after 10 week, feeding on propolis ethanol extract led to reduced serum uric acid level.

5.6. Histopathological changes :-

- **Group (A)**: fed on basal diet without cholesterol (Negative control). The organs showed no significant changes in their structure.
- **Group (B):** fed on basal diet with 1% cholesterol (positive control).

1- **Aorta:** Thickening in the endothelial cells of the tunica intema with some desqumation of few cells.

2- **Liver:** Hepatocyte including vacular and hydrobic degeneration. Fatty changes that appeared in the liver.

3- **Heart:** Hyalinization in the wall of the heart(myocardium) and loss of structure in cardiac muscle.

4- **Kidney:** Destructive changes lead to obscure most structure and massive lymphocytic infiltration.

5- **Brain:** Hammorrhage in the brain artery and gliosis in the cells of the brain.

6- **Lung:** Active hypermia arround the wall of the small artery.

- **Group (C):** fed on defatted lupine flour with 1% cholesterol. The wall of the aorta appeared without characteristic changes and the other organs showed no significant changes in their structure.

- **Group (D):** Fed on corn oil with 1% cholesterol.

  Cross section of the wall of the aorta appeared very small foci intimal thickening and the other organs showed very mild changes only includes congestion in their blood vessles.

- **Group (E):** Fed on olive oil with 1% cholesterol. Thickening in the endothelial cells of the aorta with desquamation in the cells of the tunica intema and destruction of the cells of the tunica adventitia. And the other organs changes likes the changes in group (B).

- **Group (F):** Fed on sunflower oil with 1% cholesterol.

  Mild thickening in the endothelial cells in the tunica intema in the aorta. The other organ showed very mild changes only includes congestion in their blood vessles.

5.7. Sensory evaluation of biscuits:-

The produced biscuit were organoleptically evaluated by ten panelists. The data revealed that non significant difference between biscuits made from control for sensory characteristics. Defatted lupine meal, corn oil and ethanolic extract of propolis were suitable for the production of hard biscuits with high acceptability.

Recommendations

The obtained data exhibited that defatted lupine meal, come oil and the ethanol extract of propolis could be suggested as substituted materials in producing baked products such as biscuits. This suggestion could be applied as a therapeutic nutrition foe the hypercholestero -lemic patients and these who suffered from atherosclerosis as well as coronary heart disease. This may be due to the protein content (quantity and quality) its therapeutic effect besides the presence of unsaturated fatty acids. The presence of the ethanolic extract of propolis gave also a therapeutic effect due to the presence of some chemical constituents which act as antioxidants, precursors of some vitamins and hormones.

The product must have a large announce program to give a good idea for its importance. The announcement must take place in the mass media. i.e. T. V., Radio, news paper magazines.