The Study of Body Weight, Haematological and Serum Biochemical Parameters, Liver and Kidney Texture in Rats Fed Corn Oil

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1. INTRODUCTION

Corn is the small hard seed of any of the cereal grasses, it is edible and therefore is used in the preparation of food items. It can be used as antidote to prevent some oxidative stress related diseases and a complication is advocated (Orhun, 2013).

It has been suggested that C.O. is highly digestible and provides energy and essential fatty acids. Linoleic acid is a dietary essential that is necessary for integrity of the skin, cell membranes, the immune system, and for synthesis of eicosanoids. Eicosanoids are necessary for reproductive, cardiovascular, renal, and gastrointestinal functions and resistance to disease (Dupont et al., 1990). Dietary supplemented with fats have a dual role in the human and animal physiology; as a source of energy and structural components of cells. As a regulator of gene expression that impacts lipid, carbohydrate and protein metabolisms, as well as cell growth and differentiation (Jump, 2004). It approved a highly effective for lowering serum cholesterol, primarily LDL cholesterol (Giacometti et al., 2005). In addition, C.O. owns high level antioxidant potential (Nwadiogbu and Afam,}

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ABSTRACT

The present study aimed to investigate the effect of Afia corn oil (C.O.) 0.3 ml/rat on animals body weight (B.W.), foodintake, organs weight of liver, and kidney, some haematological and serum biochemical parameters, liver and kidney sections, orally by gavage in adult male rats for 4 weeks. Serum total cholesterol, Serum triglyceride (TG) and Low density lipoprotein (LDL) were decreased significantly from control group. While non significant change occurred in animals B.W., foodintake, organs weight, haematological parameters, and high density lipoprotein (HDL), also histological sections of liver and kidney were similar to those of control group. The results of the present study indicating that Afia C.O. offering health benefits through decreasing of cholesterol, TG, and LDL concentrations.
It also used as a carrier for drug molecules in pharmaceutical preparations (Katragadda et al., 2010).

It has been shown that mice were treated with C.O. and chloroform slows the rate of chloroform absorption from the gastrointestinal tract were they used together (Withey et al., 1983). In another study rats were administrated by acute oral C.O. caused capillary venous congestion, necrosis and many droplets in at the proximal and distal tubules (Andrade et al., 2007). Furthermore, Tan et al. (2011) suggested that a combination of poly and mono-unsaturated fatty acids in C.O. is protective against alcohol and iron induced liver injury. In the light and importance of information above, the research plan was established to study the influence of C.O. on body weight, food intake, weight of liver and kidney, haematological parameters, serum biochemicals, liver and kidney sections in male albino rats.

2. Materials and methods

2.1. Experimental animals

Male adult albino rats Rattus norvegicus (Suckow et al., 2006) weighing 250-350 gm were obtained from the laboratory animal house, College of Education, Salahaddin University-Erbil- Iraq. The animals were kept in an environmentally controlled room at constant temperature 22 ± 2 °C, on a lighting schedule 12 hours light and 12 hours darkness, they were maintained at free access to tap water ad libitum and were fed a standard pelleted feed. During the experiment the cages were cleaned and washed with detergents and sterilized with Dettol once a week.

2.2. Experimental design

Adult male rats were divided randomly and equally into two groups. The first group were fed with standard rodent diet and tap water ad libitum. The second group were fed standard rodent diet and tap water ad libitum, and they exposed to orally administration of 0.3 ml /rat /day of C.O. (Afia oil company, Saudi Arabia) for four weeks.

2.3. Body weight and food intake

At the beginning of the experiment and the end of each week, the weight of animals was recorded in gm, and at the end of the first three weeks the weights of diet also were recorded in gm/rat.

2.4. Collection of blood samples

After fasting for 24 hours at the end of treatment period the rats were anesthetized by a combination of ketamine (Rotexmedica and Tritta Germany) and xylazine (Xyla Ject Holland). Ketamine and xylazine were injected intraperitoneally in a dose of 90 mg/kg and 10 mg/kg B.W. respectively (Keane et al., 1999). The blood samples were collected by a non-heparinized syringe-5ml (Momingside, UK) from all anesthetized rats of both groups through cardiac puncture by identifying the position of the heart in a careful palpation before puncturing process, finally the needle was pushed slowly between the ribs and across thoracic cavity (Archer and Jeffcott, 1977). In which the collected blood samples were immediately placed into two types of separate test tubes, one of them was chilled tube with ethylene diamine tetraacetic acid (k2EDTA) (Sun-Vague, Jordan) for hematological parameters and the other one was chilled tube with gel and clot activator (Ayset, Turkey) for serum collection, later centrifuged at 3000 revolutions per min (rpm) for 20 min at 4°C (Sorvall RC-5B Refrigerated Superspeed Centrifuge ) then the sera were stored in three eppendorfs 1.5 ml at -80°C (Sanyo-Ultra-Low Temperature, Japan) until they assayed (Drury and Wallington, 1980a).

2.5. Dissection and removal of the organs

After withdrawal of blood samples, animals were dissected, the liver and right kidney were removed, and their weights were recorded by high-precision electronic balances (BL-220H, Shimadzu, Japan) then fixed in 10% formalsaline.
2.6. Histological sectioning

Preserved tissue samples in fixative solution exposed to serial processes began with dehydration, clearing and impregnation using a series of graded ethanol in ascending concentrations then immersed in xylene. Finally embedded in paraffin wax and cooled (Drury and Wallington, 1980a). Paraffin sections were cut by rotary microtome (QPJ-1,) (Drury and Wallington, 1980b). Then stained with haematoxylin and eosin (Bancroft and Gamble, 2008). Finally photos taken by novel digital microscope (XZS-N107T, China). Sections were magnified 100X and 400X.

2.7. Measurement of haematological parameters

Haematological parameters including haemoglobin (Hb), packed cell volume (PCV), red blood cells (RBC), white blood cells (WBC), platelets (PLT), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), Mean corpuscular hemoglobin concentration (MCHC), lymphocytes (LY), monocytes (MO) and Granulocytes (GR) were measured for each group by coulter counter (Nihon Kohden, MEK-6410K, Japan) (El Hendy et al., 2001).

2.8. Determination of serum lipid profile

Serum total cholesterol and TG were estimated by the enzymatic colorimetric test – CHOD-PAP Method according to the laboratory kit obtained from (Centronic GmbH, Germany), and HDL-C was measured according to the laboratory kit obtained from (Centronic GmbH, Germany). LDL was estimated using the formula of Friedewald (Friedewald et al., 1972).

2.9. Statistical analysis

Data were analyzed statistically by t-test using SPSS program version 16.0 with significant level fixed at p<0.05. Data are expressed as mean ± standard error (mean ± S.E.).

3. Results and discussion

3.1. Body weight

Non significant change was occurred in B.W. of rats treated with C.O. during experimental period as compared to control (Table 1). The non significant change in B.W. is supported by the findings of Hill et al. (1993) who reported that male wister rats were fed diet contained C.O. on showed non significant change in their body weight. Besides that it is agreed with the finding of Naji, (2013) in female rats who showed that ten immature female rats treated with C.O. by subcutaneous injection from postnatal day (PND) 21, for 3 or 7 days caused no significant differences in their B.W. Whereas our results disagree with the findings of Haseman and Rao, (1992) who reported that C.O. administration in long term appears to increase B.W. in male rats. Furthermore, another study showed that male rats were treated with diet of 10% C.O. cause gain their weight (Kiitchevsky et al., 1988).
Table 1. Effect of corn oil on body weight in male rats

| Parameters     | Control (A) (n=7) | C.O. (B) (n=7) | t-test A vs B |
|----------------|-------------------|----------------|---------------|
| Before treatment | 300.000±11.353 | 308.290±11.9317 | N.S |
| Week 1 (gm) | 313.860±15.564 | 314.290±11.571 | N.S |
| Week 2 (gm) | 332.710±14.453 | 333.140±11.568 | N.S |
| Week 3 (gm) | 339.860±14.965 | 339.860±10.280 | N.S |
| Week 4 (gm) | 350.430±13.534 | 348.710±12.027 | N.S |

Data presented as mean ± S.E, p<0.05 mean significant change and N.S mean non-significant change

3.2. Food intake

During the experiment the non-significant change was occurred in food intake of rats treated with C.O. as compared to control (Table 2). The results of the present study are supported by the findings of Si et al. (2014) who reported that rats treated with C.O. revealed non-significant in food consumption. Also it was confirmed by the study of Zaniboni et al. (2006) who demonstrated that birds treated with C.O. showed non-significant differences in food intake and B.W.

Table 2. Effect of corn oil on food intake in male rats.

| Parameters     | Control (A) (n=7) | C.O. (B) (n=7) | t-test A vs B |
|----------------|-------------------|----------------|---------------|
| Week 1 (gm) | 87.575±3.490 | 90.500±2.997 | N.S |
| Week 2 (gm) | 109.144±6.231 | 118.003±11.509 | N.S |
| Week 3 (gm) | 111.864±2.175 | 114.005±4.250 | N.S |

Data presented as mean ± S.E, p<0.05 mean significant change and N.S mean non-significant change

3.3. Absolute and relative weight of liver and kidney

The non-significant change were occurred in absolute and relative weight of liver and kidney (Table 3 and Table 4 respectively) in C.O. group from control. The non significant change in these organs weight is supported by the findings of Nesaretnam et al. (1992) who reported that male sprague dawley rats were fed semipurified diets containing 20% C.O. for 15 weeks showed no difference in their organs weight, whereas the study of Boyd and Boulanger, (1969) showed that male rats treated with 70-80 ml/kg C.O. caused loss in dry organ weight.
Table 3. Effect of corn oil on absolute organs weight in male rats

| Parameters | Control (A) (n=7) | C.O.(B) (n=7) | t – test A vs B |
|------------|-------------------|---------------|-----------------|
| Liver (gm) | 10.641± 0.683     | 9.125± 0.469  | N.S             |
| Right kidney (gm) | 1.212± 0.057      | 1.185± 0.070  | N.S             |

Data presented as mean ± S.E, p<0.05 mean significant change and N.S mean non-significant change

Table 4. Effect of corn oil on relative organs weight in male rats

| Parameters | Control (A) (n=7) | C.O. (B) (n=7) | t – test A vs B |
|------------|-------------------|---------------|-----------------|
| Liver (gm) | 3.143± 0.126      | 2.849± 0.134  | N.S             |
| Right kidney (gm) | 0.369± 0.017      | 0.364± 0.015  | N.S             |

Data presented as mean ± S.E, p<0.05 mean significant change and N.S mean non-significant change

3.4. Haematological parameters

Table 5 shows the non- significant decrease in hematological parameters of rats treated with C.O. as compared to control. The present study is supported by the findings of Alexander et al. (1987) who showed that male weanling rats were provided purified diets containing 75% by weight of either fresh or laboratory-heated C.O. caused non-significant change in the hematological parameters.
Table 5. Effect of corn oil on haematological parameters in male rats

| Parameters | Control (A) (n=7) | C.O. (B) (n=7) | t-test A vs B |
|------------|-------------------|----------------|---------------|
| WBC \(10^3/\mu\text{L}\) | 10.814± | 9.630± | N.S |
| RBC \(10^6/\mu\text{L}\) | 7.652± | 7.657± | N.S |
| Hb* \(g/dL\) | 14.657± | 14.657± | N.S |
| PCV* % | 42.900± | 42.457± | N.S |
| MCV* fl | 56.214± | 55.442± | N.S |
| MCH pg | 19.171± | 19.142± | N.S |
| MCHC g/dL | 34.157± | 34.542± | N.S |
| PLT \(10^3/\mu\text{L}\) | 508.142± | 525.142± | N.S |
| LY % | 71.480± | 67.620± | N.S |
| MO % | 16.783± | 15.340± | N.S |
| GR % | 12.666± | 17.040± | N.S |

Data presented as mean ± S.E, p<0.05 mean significant change and N.S mean non-significant change
3.5. Serum lipid profile

Table 6 shows the effect of C.O. on lipid profile in male rats. The administration of rats with C.O. showed significant p˂0.05 decrease of serum total cholesterol concentration, TG and LDL as compared to control. Meanwhile non-significant change was occurred in HDL in concentration as compared to control. The significant decrease in TG and cholesterol were supported by the findings of Nalbone et al. (1989) who reported that rats were treated with diet contain 17% C.O. decreased TG and cholesterol. Also another study showed that Rats fed a diet containing 20% C.O. have significantly lower concentrations of serum cholesterol (Avigan and Steinberg, 1958). It has been reported that Phytosterols comprising < 1% of commercial C.O. substantially reduced cholesterol absorption and may account for part of the cholesterol-lowering activity of C.O. previously attributed solely to unsaturated fatty acids (Ostlund Jr, 2002). The non-significant in HDL concentration is supported by the findings of Wardlaw and Snook, (1990) who reported that consuming 37-43% of energy as fat from diets based on C.O. lead to non-significant change in HDL.

| Parameters    | Control (A) | C.O. (B) | t – test | A vs B |
|---------------|-------------|----------|----------|--------|
| Total Cholesterol (mg/dL) | 73.461±5.685 | 50.000±7.246 | P < 0.05 |
| TG (mg/dL)    | 62.325±3.162 | 36.279±1.535 | P < 0.05 |
| HDL* (mg/dL)  | 23.546±3.131 | 24.707±1.720 | N.S     |
| LDL* (mg/dL)  | 36.905±2.530 | 16.346±4.995 | P < 0.05 |

Data presented as mean ± S.E, p<0.05 mean significant change and N.S mean non-significant change

3.6. Histological texture of liver and kidney

Histological sections of liver in rats treated with C.O. (plates 3 and 4) showed normal appearances included blood sinusoids spaces, central vein, normal hepatic cells and kupffer cells, also hepatic nuclei are shown in normal state as compared to control (plates 1 and 2). It has been reported that the hepatotoxicity ranks one the most frequent causes of acute liver failure (Andrade et al., 2007). Tan et al. (2011) suggested that a combination of poly and mono-unsaturated fatty acids in C.O. is protective against alcohol and iron induced liver injury.

The histological sections of the kidney in rats administrated with C.O. (plates 7 and 8) showed normal histological features, normal glomeruli, bowman’s capsule and tubules as compared to control (plates 5 and 6). It has been suggested that male albino rats were administrated by acute oral C.O. 70-80 ml/kg caused capillary venous congestion, necrosis and many droplet in at the proximal and distal tubules (Boyd and Boulanger, 1969). Furthermore it has been reported that female rats were administrated by 10ml/kg C.O. caused significant alteration in kidneys tubules (Sato et al., 2000).

In the light observations above, the controversy between the present study and
other investigators is attributed to dose differences.

Plate (1): Section in liver of control showing sinusoids and central vein. (Stain: H&E.100X).

Plate (2): Section in liver of control, showing hepatocytes, sinusoids and kupffer cells. (Stain: H&E.400X).

Plate (3): Section in liver of male rats treated with C.O. showing sinusoids and central vein. (Stain: H&E.100X).

Plate (4): Section in liver of male rats treated with C.O. showing hepatocytes, sinusoids and kupffer cells. (Stain: H&E.400X).
4. Conclusions

The results of this study revealed that administration of corn oil lowers serum cholesterol, LDL and TG, with non-significant change in B.W. and haematological parameters. Also no change occurred in liver and kidney texture.
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