Pharmacological Effects of Dexamethasone in Rats

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Abstract

Dexamethasone is one of the most widely used glucocorticoids which has a prominent glucocorticoid with slight mineralocorticoid property. This study was performed on twenty four adult Sprague Dawley rats to evaluate the proposed effects of dexamethasone offering as intraperitoneal injection. The animals were allocated randomly into three groups of eight rats to each. The protocol of experiment was: the control group; animals are injected intraperitoneally with 2ml of distilled water, the dexamethasone 1 group; animals are injected intraperitoneally with dexamethasone 2mg/kg, and the dexamethasone 2 group; animals are injected intraperitoneally with dexamethasone 4mg/kg. The injection period extended for one month. The results illustrate that dexamethasone cause significant declination in RBC, PCV, Hb, HDL, and neutrophils besides significant elevations in WBC, eosinophils, monocytes, LDL, TC, TG, VLDL, AST, ALT, and creatinine on a direct positive proportion with the increase in dexamethasone dose comparing with control group at ($P \leq 0.05$).

Key words: *Dexamethasone, Rats, intraperitoneally.*

Introduction

Dexamethasone is one of the most widely used artificial glucocorticoids which has many properties like anti-inflammatory, immune suppressant and others [1; 2]. It is associated with vast range of diseases related to metabolism [3]. Many studies have reported the effects of dexamethasone on different body functions and systems like dexamethasone effects on rat`s body weight [4], on the embryonic development of rat [5], the dexamethasone effects on bone related diseases [6], on the blood electrolytes of rats [7], the effect on musculoskeletal system [8]. It`s effect on liver by causing steatosis [9], on the eye retinal neurons and optic nerve [3], and others. Extended use of dexamethasone has been associated with increasing its adverse effects so we focus in our study on the proposed effects of dexamethasone on blood lipids, electrolytes, red cells parameters, leukocytes parameters and liver enzymes of rats for one month.

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Materials and Method

Animals of the experiment

Twenty four adult male Sprague - Dawley rats (*Rattus norvegicus*) of 175 - 180 grams weights were adopted. The animals were bought from the Iraqi Center for Genetics and Cancer Research in Baghdad. The animals were housed in standard opened cages made of plastic with a stainless steel roof. The temperature of the room was set on 24±1C° and the lighting was fit on a pattern of 12 hours dark/light cycle. The animals lived two weeks of acclimatization prior to the experiment.

Diet of animals

Animals were fed a standard rat diet recommended by the subcommittee on laboratory animal nutrition (Nutrient requirements of laboratory Animals, 1995) along the experiment period which continued for three months. Rats were given free access to food and water *ad libitum* along the period of experiment.

Experimental protocol

The allocation of the animals into groups was on a random pattern as below:

1- Control group, comprises 8 male rats. They were being dosed intraperitoneally with 2ml of normal saline NaCl 0.9% daily for one month.

2- Dexamethasone 1 group (DEXA1), comprises 8 male rats. The rats of this group were being dosed intraperitoneally with 2ml solution containing dexamethasone as 2mg/kg daily for one month.

3- Dexamethasone 2 group (DEXA2), comprises 8 male rats. The rats of the second treatment group were dosed intraperitoneally with 2ml solution containing dexamethasone as 4mg/kg daily for one month. The dose of dexamethasone was chosen according to [10; 11]. Dexamethasone was given for 1 month according to [12]. Dexamethasone was purchased from local veterinary bureau supplier (trademark of Merck, Germany).

Specimens' collection

Blood samples were collected from the animals of all groups at the end of the one month period of the experiment. Syringes with needles of 25 gauge were used to collect 2.5 ml of blood from the saphenous (lateral tarsal) veins of rats. The collected 2.5 ml of blood were being divided as 1 ml to be poured into anticoagulant tubes to perform the hematological exam and 1.5 ml to be poured into a gel tube to obtain serum to perform the serological tests. The handling of the rats, intraperitoneal injection and the blood sampling technique were applied respecting the recommendations of [13].

Results

Blood Parameters Changes: The effects of dexamethasone were very clear from the results, where it causes significant declination in the number of red blood cells (RBC), hemoglobin (Hb) and packed cells volume (PCV) and the declination was more prominent in direct proportion with increase in dose of dexamethasone comparing with control group as it is seen in table (1). Dexamethasone also causes leukocytosis representing by increased total white cells count (WBC), eosinophilia, and monocytosis beside declination in number of neutrophils (neutropenia) significantly and positively directional with increase of dexamethasone dose as it is obvious in table (2).

Effects Of Dexamethasone On Lipid Profile: Considering the lipid profile results in table 3 which reveal that dexamethasone causes significant elevations in total serum cholesterol (TC), triglycerides (TG), low density lipoprotein (LDL), very low density lipoprotein (VLDL), beside significant declination in high density lipoprotein (HDL) with a positive proportion with the dose of dexamethasone comparing with control group at ($P \leq 0.05$).

Effects Of Dexamethasone On Hepato-Renal Functions: Regarding the hepato-renal function, table 4 reveal that dexamethasone causes significant elevations in aminotransferases enzymes (AST and ALT), and creatinine with a positive correlation with the dose of dexamethasone comparing with control group at ($P \leq 0.05$).

Table 1. Dexamethasone effect on blood aspects

GROUPS	**R.B.C** **× 1012 /L**	**Hb** **g /dL**	**P.C.V.** **%**
CONTROL	a 9.33 ± 0.51	a 13.17 ± 0.40	a 42.5 ± 1.22
DEXA 1 (2mg)	b 8.17 ± 0.40	b 10.5 ± 0.54	b 36.76 ± 0.63
DEXA 2 (4mg)	c 7.33 ± 0.51	c 10 ± 0.6	c 33 ± 1.41
LSD	0.83	0.50	3.76

Numbers represent mean ± standard deviation. Different letters refer to significant differences.

Table 2. Dexamethasone effect on Leukocytes

Groups	W.B.C. (Cell/mm3)×103	Neutrophil %	Acidophil %	Lymphocyte %	Monocyte %
Control	c 3.69 ± 0.29	a 57.00 ± 1.69	c 1.25 ± 0.46	c 37.00 ± 1.69	b 4.00 ± 0.75
DEXA 1 (2mg)	b 17.38 ± 0.18	b 27.75 ± 0.88	b 3.25 ± 0.46	b 48.37 ± 2.13	a 14.87 ± 0.64
DEXA 2 (4mg)	a 17.57 ± 0.10	c 25.50 ± 0.75	a 4.25 ± 0.70	a 51.87 ± 2.58	a 15.00 ± 1.06
LSD	0.18	1.06	0.49	1.94	0.75

Numbers represent mean ± standard deviation. Different letters refer to significant differences.

Table 3. Dexamethasone effect on lipid profile

Groups	TC (mg/dl)	HDL (mg/dl)	TG (mg/dl)	LDL (mg/dl)	VLDL (mg/dl)
CONTROL	88.76 ± 2.49 c	40.30 ± 2.53 a	69.62 ± 2.68 b,c	34.53 ± 3.02 c	14.79 ± 0.88 b
DEXA 1 (2mg)	95.15 ± 4.09 b	32.28 ± 3.48 b	71.88 ± 2.37 b	48.49 ± 3.39 b	14.37 ± 0.47 b,c
DEXA 2 (4mg)	136.37 ± 3.86 a	25.60 ± 3.67 c	86.13 ± 3.00 a	93.54 ± 3.62 a	17.89 ± 1.16 a
LSD	6.39	6.68	14.25	13.96	3.1

The numbers represent the mean ± standard deviation. Different letters refer to significant differences.

Table 4. Dexamethasone effect on hepatic and renal enzymes

Groups	AST (U/l)	ALT (U/l)	Creatinine (mg/dl)
Control	59.87 ± 6.15 c	32.32 ± 2.75 c	0.37 ± 0.03 e
DEXA 1 (2mg)	75.35 ± 3.23 b	36.11 ± 3.88 b	1.06 ± 0.05 b
DEXA 2 (4mg)	83.34 ± 9.04 a	75.32 ± 3.20 a	2.23 ± 0.07 a
LSD	15.48	3.79	0.69

Numbers represent mean ± standard deviation. Different letters refer to significant differences.

Discussion

The present study has been conducted to study the pharmacological effects of two doses of dexamethasone on hematological parameters, leukocytes, lipid profile and finally its effect on liver and kidney functions. The effect of dexamethasone on red blood cells, hemoglobin, and packed cell volume in our study comes in line with the study of [14] who explained that consuming a constant amount of dexamethasone may cause suppression of the bone marrow. Dexamethasone was reported in our study to cause elevation in total leukocyte account and this agrees with the studies of [15, 16]. The hyperlipidemic effect of dexamethasone and its effects on hepatic-renal enzymes in our study agrees with the studies of [17, 9]. The mechanisms by which dexamethasone exerts its effects like hyperlipidemia are not fully recognized [18]. But, one is assured that the effects of dexamethasone are greatly depends on the dose of which, the period of treatment and the type of animal [19].

Ethical Clearance: The Research Ethical Committee at scientific research by ethical approval of both environmental and health and higher education and scientific research ministries in Iraq

Conflict of Interest: The authors declare that they have no conflict of interest.

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