

Effects of Noise on Rabbit's Blood

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To cite this article:

Khitam Elwasife, Ismail Abdel Aziz, Mhammad Shabat, Osama Shahwan, Al Monther El Hamidi. Effects of Noise on Rabbit's Blood.

International Journal of Economics, Finance and Management Sciences. Vol. 3, No. 2, 2015, pp. 10-13. doi: 10.11648/j.ejb.20150302.11

Abstract: Experiments are described in which domestic rabbits were deliberately subjected to a daily 3-4 hours noise regime (65 dB) for 18, 28, 40 and 50 days, to determine its effects on the blood. Noise exposure to rabbits caused a general increase in its biochemical parameters such as urea, uric acid, creatinine, cholesterol, and triglycerides, while glucose level decreased significantly. Our results indicate a general decrease of total protein, albumin and globulin levels. The results indicated that noise exposure at split dose could be harmful. It found that recovery period were able to alleviate some of those harmful changes.

Keywords: Noise, Recovery Period, Blood Indices Domestic Rabbits

1. Introduction

Noise, defined as disturbing and unwanted sound, is perceived as an environmental stressor and nuisance. Noise is a pervasive aspect of many modern communities, work environments. Its damaging effects particularly the productions of free radicals are not limited to the auditory organ. The response to noise may depend on characteristics of the sound, including intensity, frequency, and complexity of sound, duration and the meaning of the noise [1]. Exposure to noise causes many health problems such as hearing loss, sleep disturbance, and impairs performance as well as effecting cognitive performance. It also increases aggression and reduce the processing of social cues seen as irrelevant to task performance as well as leading to coronary heart disease, hypertension, higher blood pressure, increased mortality risk, serious psychological effects, headache, anxiety, and nausea [2-4]. Reha et al have been investigate the effect of noise on oxidative stress parameters in rat [5]. Several studies have shown that noise in animal care facilities can reach as high as 90 – 100 dB [6]. Such levels of noise can induce physiological and behavioral responses in laboratory rodents such as increased plasma corticosterone levels, reduction in body weight, decrease in gastric secretion, changes in immune response and tumor resistance, and a decrease in reproductive function. Behavioral responses include increases in total activity, grooming themselves and

their cage-mates, and rearing onto their hind legs [7-12]. These changes are similar to those seen in rodents exposed to other stressful situations [13, 14]. In spite of the evidence that noise levels in animal facilities are often high enough to produce uncontrolled physiological and psychological responses, the acoustic levels continue to be not as monitored as other environmental factors (lighting, temperature, humidity, etc). Cynthia Hohmann et al have been evaluated the association between chronic noise exposure during pregnancy and birth outcomes and the health of fetuses and infants and the association between chronic noise exposure and stress indicators, cardiovascular risk factors and immune-mediated diseases such as asthma and allergy in children [15]. The effect of noise exposure on blood pressure and heart rate of steel industry workers have been investigated by Zahra Zamanian [16]. Materials and methods in the study were, 50 workers were selected from a steel company in Fars province, Iran, and exposed to 85, 95, and 105 dB noise levels for 5 minutes. The participants' blood pressure and heart rate were measured using Beurer BC16 pulse meter both before and after the exposure. The Results has been showed no significant difference in blood pressure and heart rate before and after the exposure. However, the workers' systolic blood pressure had increased compared to before the exposure; of course, the difference was not statistically significant (0.05). Besides, although the subjects' heart rate had reduced in comparison to before the exposure,

the difference was not statistically significant (>0.05). No significant change was observed in blood pressure and heart rate after acute exposure to 85, 95, and 105 dB noise levels. Thus, the present study aims to investigate the hematological and biomedical effects of noise in adult rabbits.

2. Materials and Methods

The study was conducted in 36 male rabbits (w 1000 - 1200 g). During the course of the study the animals were housed in pairs in the animal house with food and water and kept under standard environmental conditions for light (12: 12 h light: dark cycle) temperature (27°C) and noise levels (60-70 dB) On the days of the test the rabbits were brought to the laboratory. The experiment was conducted at

Gaza strip laboratory. The use of these experimental animals was approved by Veterinary Service of the Municipality of Gaza-Palestine

The animals divided into six groups

The first group consists of ten rabbits and it acts as control

The second, third, fourth and fifth group were exposed to the noise for (18,28,40 and 50) days respectively, while the sixth group are exposed to the noise for 50 days and left untreated for one month to recovery. The animals were exposed to noise product from generator with 1KW and dimension of 1200mmx1100mmx1300mm. They exposure for 3-4 hour in each day. At the end of the experiment, animals from both control and experimental groups were decapitated. After wards, the blood samples were collected between 6–7 mL from each rabbit depending on the rabbit body weight. For the hematological tests, approximately 2–3 mL of blood sample was received at a tube containing dipotassium ethylene diaminetetra acetate (EDTA). In addition, about 2–3 mL of blood was collected into a centrifuge tube without any anticoagulant for the biochemical tests [17]. Blood samples were collected in 10 ml plain tubes for serum preparation. Clear serum samples were separated by centrifugation at 3000 r.p.m for 20 min. Serum glucose, triglycerides and total cholesterol were determined using the method described by Trinder(18), Fossati and Prencipe(19) and Allain etal(20). Serum total protein was determined according to the Biuret reaction as described by Bellossi et al. [21]. The kits were purchased from Biotech laboratories, U.K. Serum albumin was determined using Randox reagent kits

and following their instruction manual according to the method of Doumas et al. [22]. The concentrations of globulin were calculated by the following equation: Concentration of globulins (gm/dl) = Total protein - Albumin [23-25].

2.1. Hematological Parameters

Determination of hematological parameters was carried out using an 18 automated parameter hematology analyzer. ABX Micros 60 from Horiba ABX. France.

2.2. Data Analysis

Data were computer analyzed using SPSS version 11.0 for windows (Statistical Package for the Social Sciences Inc. Chicago, Illinois, USA). Means were compared by independent-samples test, $p < 0.05$ was considered as significant. Percentage change was also calculated.

3. Results

Serum glucose, triglycerides and total cholesterol, mean values of rabbits affected by noise exposure with/ without recovery are summarized in table (1). The data revealed that noise exposure for 50 days decreased serum glucose level by -36.73% compared the control level. But after in recovery group decrement of serum glucose to -5.39%, compared to the control level, on the other hand triglycerides increased gradually and non-significantly from the first ten days treatment till 50 days ($p < 0.05$). On the other hand, mean values of serum cholesterol was significantly increased by 13.5% in noise treated rabbit for 50 days compared to the control. in general, noise exposure increased urea, uric acid, and creatinine compared to control level. the noise exposure was more pronounced on urea. However in recovery period were able to lowered the elevated values as illustrated in table (2). Total protein values were decrease exhibiting percentage decreased of 5.39% and 11.03% in 40 and 50 days respectively compared to control levels (table3). Albumin concentration rabbit's blood serum under the influence of noise for 28, 40, 50 days decreased by 3.5%, 7.07% and 16.67% respectively. on the other and results in table (3) indicated in significant decrease in globulin concentration after noise exposure treatment for 18,28,40 and 50 days.

Table (1). Glucose, Cholesterol, Triglycerides, Urea, Uric acid, and creatinine in rabbits after noise exposure.

Parameters	Experimental Period					
	Control N=10	18 days N=6	28 days N=6	40 days N=6	50 days N=6	Recovery (30 days) N=6
Glucose(mg/dl)		80.21 \pm 0.39	69.36 \pm 0.50	62.8 \pm 0.41	60.30 \pm 0.32	90.16 \pm 0.36
%change	95.30 \pm 0.61	15.83-	-27.22	-34.10	-36.73	-5.39
P value		<0.01	<0.01	<0.01	<0.01	0.05>
Triglycerides(mg/dl)		115.50 \pm 0.30	116.10 \pm 0.25	118.80 \pm 0.31	119.90 \pm 0.39	110 \pm 0.26
%change	100.20 \pm 0.29	15.27	15.87	18.56	19.66	10
P value		<0.01	<0.01	<0.01	<0.01	<0.05
Cholesterol(mg/dl)		175.0 \pm 0.36	180.10 \pm 0.33	189.61 \pm 0.37	195.11 \pm 0.30	188.0 \pm 0.31
%change	171.90 \pm 0.55	1.8	4.77	10.30	13.5	9.37
P value		0.05>	>0.05	<0.05	<0.05	0.05>

All values were expressed as mean \pm S.E; $P < 0.05$ significant; $P < 0.01$ highly significant

Table (2). Urea, Uric acid ,and Creatinine in rabbits after noise exposure.

Parameters	Experimental Period					
	Control N=10	18 days N=6	28 days N=6	40 days N=6	50 days N=6	Recovery (30 days) N=6
Urea (mg/dl)		29.99 ± 0.51	30.86 ± 0.44	40.11± 0.39	46.67± 0.45	25.77± 0.36
%change	25.10± 0.6	19.48	46.85	59.80	88.94	14.62
P value		<0.01	<0.01	<0.01	<0.01	<0.01
Uric acid (mg/dl)		3.13 ± 0.18	3.89± 0.19	3.99± 0.17	4.73± 0.25	3.30± 0.22
%change	3.11± 0.11	0.64	5.43	28.30	52.09	6.11
P value		>0.05	>0.01	<0.01	<0.01	<0.05
Creatinine (mg/dl)		0.86± 0.08	0.89± 0.05	1.3± 0.06	1.50± 0.09	0.83±0.03
%change	0.80± 0.04	7.5	10.47	62.5	87.5	-33
P value		0.05>	<0.05	<0.01	<0.01	<0.01

Table (3). Total protein, albumin, and globulin in rabbits after noise exposure.

Parameters	Experimental Period					
	Control N=10	18 days N=6	28 days N=6	40 days N=6	P value50 days N=6	Recovery (30 days)N=6
Total protein(mg/dl)		7.87 ± 0.25	7.60 ± 0.21	7.55 ± 0.23	7.10 ± 0.20	7.93 ± 0.26
%change	7.98± 0.28	-1.38	4.76	-5.39	-11.03	-0.63
P value		0.05>	-0.05>	0.05>	<0.05	0.05>
Total Albumin(mg/dl)		3.91 ± 0.11	3.75 ± 0.13	3.68 ± 0.12	3.30 ± 0.15	3.93±0.17
%change	3.96 ± 0.41	-1.26	-5.30	-7.07	-16.67	-0.76
P value		0.05>	0.05>	0.05>	<0.01	0.05>
Total Globulin(mg/dl)		3.96± 0.13	3.85± 0.11	3.87± 0.14	3.80± 0.16	4.00± 0.21
%change	4.02 ± 0.10	-1.49	-4.22	-3.73	-5.47	- 0.50
P value		0.05>	0.05>	0.05>	0.05>	0.05>

All values were expressed as mean ±S.E; P<0.05 significant; P<0.01 highly significant.

4. Discussion

Data revealed highly significant decrease in serum glucose levels in rabbits in response to noise exposure. Noise exposure may indirectly, play a specific role in carbohydrate metabolism probably due to enhancing gluconeogenesis and glucose mobilization to the blood [24]. The change observed in serum triglycerides and cholesterol content in response to treatment by noise drug; take place in the liver due to imbalance between the normal rabbits of lipid synthesis, utilization and secretion [26]. The increment in cholesterol and triglyceride content agreed with that reported by Parker [27]. The possible explanation of these observed increments may be explained on indirect action of noise on lipid metabolism or lipid peroxidation [17]. The highly significant in blood urea is the principal end product of protein catabolism an accelerated amino acid deamination for gluconeogenesis is probably an acceptable postulate to interpret the elevated level of urea. The increment in blood urea, might be also due to the destruction of RBCs during the treatment. The presence of some toxic compounds might increase blood urea and decrease plasma protein [28]. On the other hand the elevation of blood urea might suggest that animals experienced hemoconcentration due to mild dehydration [29].

Moreover, the serum uric acid levels exhibited an increase in the treated rabbits for the experimental duration. This may be due to high degradation of purines or an increase of uric acid level by inability of its excretion by urinary system [30].

The non significant decreased levels of total protein in noise exposure rabbits could be attributed to an increase in

amino acids deamination. This decrease in serum total protein may be due to lowered synthesis of albumen and globulin in the liver in response to Noise exposure intake. It was reported that albumin levels are decreased in liver disease [31].

The decrease in these blood proteins of the rabbit may be due to usage of different amino acids in the production of antibodies in response to noise exposure.

5. Conclusion

We found that the noise exposure decreased the concentrations of serum glucose, total protein, globulin, and albumin. Consequently, we found that noise exposure at split dose could be harmful. We also found that recovery period were able to alleviate some of those harmful changes.

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