



A COMPARATIVE STUDY ON BIOCHEMICAL PARAMETERS FOR MATURE CALIFORNIA AND CHINCHILLA RABBITS IN SOHAG GOVERNORATE.

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ABSTRACT

Rabbit as homeothermic species is able to keep its core body temperature within $\pm 1^\circ\text{C}$ regulatory range. In Upper Egypt where high ambient temperature particularly at summer months, rabbit breeding ceases, by virtue of its fur, there is certain inability to dissipate excess body heat. Under uncontrolled ambient environment, most of the observed mortality at summer is due to heat stasis. In this study, we compared white (California) to black (Chinchilla) mature breeds of rabbits. Blood picture and serum hormonal profiles were assessed. The results showed many similarities between the two breeds in terms of blood picture, the serum concentration of tri-iodothyronine (T3) and thyroxine (T4), but T3/T4 ratio was higher and corticosterone was lower in California than Chinchilla rabbits ($P < 0.5$). Heat loss was higher in male California than other rabbits. The overall results referred to the higher ability of California breed to withstand heat stress compared to Chinchilla rabbits.

Keywords: California, Chinchilla Rabbits, blood picture, corticosterone, T₄, T₃.

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INTRODUCTION

Rabbit breeding is gaining importance as a producer of meat, wool, and fur because of its prolificacy and higher feed conversion efficiency. Firstly New Zealand White rabbit was imported to Egypt, followed by import of Grey Giant, White Giant, and Soviet Chinchilla to breed them in temperate and sub-temperate conditions of the country. Crossbreeding has been established as breeding systems to exploit the heterosis in animal breeding and it could be fruitfully employed in rabbit breeding for increased productivity. However, in Upper Egypt high ambient temperature in summer months is considered the main threat to the industry. Besides the inability to reproduce, high mortalities are annually recorded.

Rabbit as mammalian species is able to keep its body temperature within a narrow balance range ($\pm 1^\circ\text{C}$) even when exposed to a vast range of external temperatures (Romanovsky, 2007). At high ambient temperature, heat production decreases while heat dissipation kept high. The resultant level of skin temperature depends on the rate of heat loss and the rate of gain from warm blood flows to the skin.

Therefore, the skin temperature could give an indication to the response of thermoregulation (Nääs *et al.*, 2010).

Biochemical and hematological examinations provide valuable information on an objective assessment of health status, in order to detect health disorders and monitoring stress factors already at the preclinical stage (Hinton *et al.*, 1982). Changes in physiological biochemical and hematological values can also be used as indicators of welfare in rabbit breeding (Hoy and Verga 2006). Biochemical and hematological values may be influenced by a number of environmental factors, such as feed components and animal management. Differences between rabbit genotypes in biochemical and hematological values were studied in details in Watanabe heritable hyperlipaemic rabbits (Kurosawa *et al.*, 1995).

In vertebrates, a central component of the stress response is the activation of the hypothalamic-pituitary-adrenal (HPA) axis. The main glucocorticoid in humans is cortisol and corticosterone in birds and rabbit (Lewis *et al.*, 2005). Thyroid hormones are hormones produced and released by the thyroid gland,

namely triiodothyronine (T₃) and thyroxine (T₄). Although, the major form of thyroid hormone in the blood is thyroxine (T₄), which has a longer half-life than T₃. (Pilo *et al.*, 1990), T₃ is the active form (3-4 times more potent than T₄). The most common method for quantification of hormones such as corticosterone is enzyme-linked immunosorbent assay (ELISA) (Abelson *et al.*, 2016). The work aimed to investigate and compare blood biochemical parameters in two divergent strains of rabbits (black and white) after inbreeding to the 5th generation.

MATERIALS AND METHODS

1. Animals

This study applied on the 6th generation of two breeds of rabbits; Chinchilla and California. Twenty-eight mature rabbits (male and female), their age (16-18 months) used for breeding at the experimental farm of Department of Animal Behavior and Husbandry, Veterinary Hospital, Faculty of Veterinary medicine, Sohag University. Each breed was kept in an isolated battery under a specific managemental program. e.g. Feeding, watering, utensils disinfection and vaccination.

2. Environmental condition

Ambient Temperature and relative humidity were measured by mini data-logger (testo 174 H; Germany) which record data every 30 min /6000

reading. Heat loss index was calculated from the measurement of ambient (Ta), skin (Ts) and body temperature (Tb) according to formula; $HLI = Tsk - (Ta)/(Tb) - (Ta)$. (Mahmoud *et al.*, 2011) HLI value ranges theoretically from zero equivalents to the state of complete vasoconstriction to one (state of complete vasodilatation, Steiner and Branco, 2002).

3. Sampling and analysis

About 2 ml of blood samples were collected from rabbits (from marginal and central ear vein) and divided to two portions; one part on EDTA tubes for blood picture and examined by eos vet analyzer (CBC Analyzer, Domnarvsgatan 4, SE-163 53 Spanga, Sweden). The other portion serum samples were obtained by centrifugation of blood samples at 5000 rpm for 15 min and then plasma transferred to clean Eppendorf tubes and kept in -20C until hormonal analysis. Serum corticosterone, T₃ and T₄ assays were performed according to Manufacturer Company (Assay pro LLC 3400 Harry S Truman Blvd St. Charles, USA).

4. Statistical Analysis

All analyses were performed by one way-ANOVA and Tukey's post hoc tests using GraphPad Prism software (*P* was significant if <0.05). All data were represented as mean ± SD

RESULTS

Instrument Name: Sohag University		10:57:53 04/04/2019	
Start time: 03/01/2019 08:30:00 PM		Minimum	Maximum
End time: 04/04/2019 11:00:00 AM	Tempreture [°C]	9.7	31.3
Measurement channels: 2	Humidity [%rH]	23.3	74.4

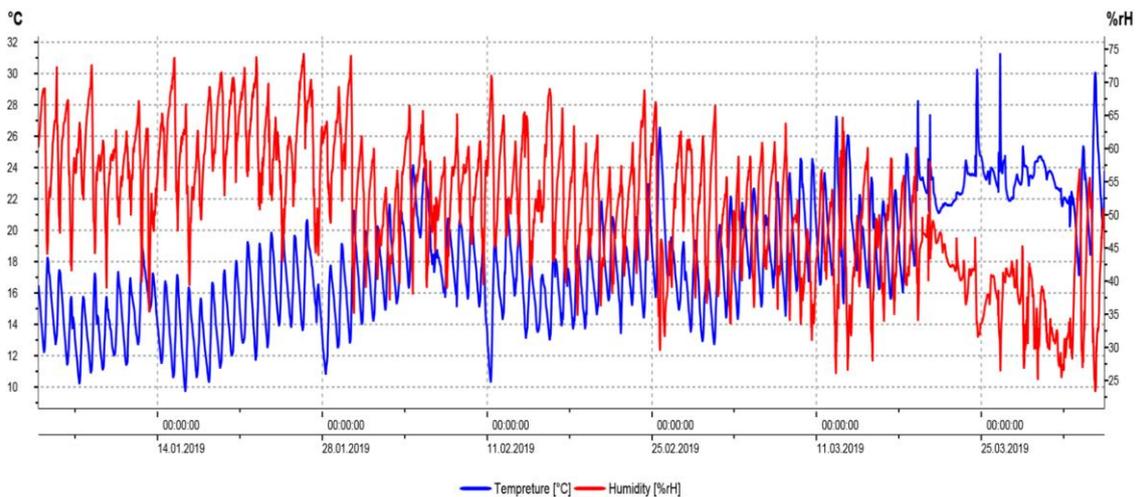


Fig. 1. Continuous measurement of temperature and relative humidity (from Jan. to March 2019). data logger was adjusted for taking the readings at 30 min interval

Table1. Physiological parameters for California and Chinchilla rabbits (body weight, respiratory rate, and temperature):

Parameter	California Female	California Male	Chinchilla Female	Chinchilla Male	P
Weight (kg)	2.75 ± 0.1	2.7 ± 0.2	3.0 ± 0.4	3.0 ± 0.5	0.03
Respiratory rate (n/15 Sec)	23.8 ± 1.6	23.2 ± 1.2	19.0 ± 1.1	20.8 ± 1.4	0.07
Rectal temperature (°C)	39.0 ± 0.5 a	39.0 ± 0.5 a	39.3 ± 0.4 a	39.9 ± 0.4 b	0.68
HLI at neck	0.82 ± 0.04 a	1.0 ± 0.03 b	0.85 ± 0.05 a	0.81 ± 0.04 a	0.02
HLI at ear	0.96 ± 0.06	0.93 ± 0.04	1.0 ± 0.04	0.92 ± 0.08	0.29

HLI= heat loss index. Data were represented as mean±SD. Values with different letters were significant.

Table 2: Blood picture for California and Chinchilla rabbits

Parameter	California Female	California Male	Chinchilla Female	Chinchilla Male
RBC (10¹²/L)	4.67 ± 0.1	4.77 ± 0.1	4.5 ± 0.2	4.5 ± 0.2
WBC (10⁹/L)	5.8 ± 1.0	5.67 ± 0.3	6.4 ± 0.8	5.68 ± 0.8
PLT (10⁹/L)	467 ± 55.2	551.33±46.3	508.78 ± 80.9	426.6 ± 96
HGB (g/dl)	10.8 ± 0.4	11.23±0.4	10.3 ± 0.5	10.32 ± 0.5
LYM (10⁹/L)	2.5 ± 0.3	2.23 ± 0.2	2.87 ± 0.5	2.32 ± 0.4
MONO (10⁹/L)	0.47 ± 0.1	0.4 ± 0.04	0.47 ± 0.09	0.34 ± 0.1
GRAN (10⁹/L)	2.9 ± 0.6	3.03 ± 0.1	3.1 ± 0.4	3.02 ± 0.3
HCT (%)	32.57 ± 1.5	29.35 ± 0.9	29.35 ± 1.8	28.76 ± 0.9

Data were represented as mean ± SD. Values with different letters were significant.

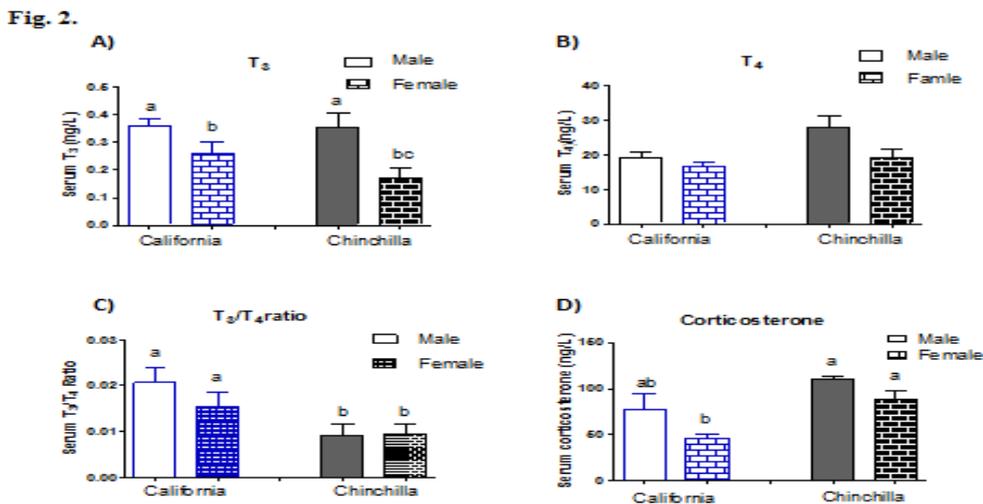


Fig. 2. Serum concentrations of tri-iodothyronine (T₃; A) and thyroxine (T₄; B), T₃/T₄ ratio (C) and corticosterone (D) in California and Chinchilla Rabbits. Data were represented as mean ± SD.

DISCUSSION

Rabbit industry is based on providing the community with valuable meat with good quality and unique characteristics. On the other hand, this industry has many threats in Upper Egypt. At the commercial level may breeders make haphazard crosses that may negatively influence heterosis. Under this condition, there is difficulty in starting up portfolios of rabbits records. In this study, we compared two divergent breeds of the rabbit under the environmental condition of Sohag governorate.

In this study, we measured the ambient temperature and relative humidity (RH) continuously by using computed data logger (Fig. 1). Changes in physiological biochemical and hematological values can also be used as indicators of welfare in rabbit breeding (Hoy and Verga, 2006). When fresh blood samples were analyzed by automated cell counter, the hemogram indicated non-significant differences between the two breeds in all measured variables (RBCs, WBCs, platelets, lymphocytes, monocytes and granulocytes and hematocrit values, Table 1). These data were in parallel with a study of Chineke *et al.*, (2006), in which all genotypes were similar in hemoglobin, erythrocyte number and mean cell volume (MCV). But in another study, some of the hematological variables were affected by the rabbit genotype (Martinec *et al.*, 2012). Our results indicated that there were no breed differences between California and Chinchilla rabbits.

Data of serum hormonal concentrations in both sexes of two breeds showed some within and interbreed variations (Fig. 2). There were sex differences in the serum active form of thyroid hormones tri-iodothyronine (T₃) and thyroxine (T₄). Serum T₃ concentrations were higher in male than female within two breeds ($P = 0.023$, Fig. 2A). Although such tendency for higher concentration in male the female was also lower in thyroxine level (T₄) but the differences was insignificant ($P > 0.5$, Fig. 2B). While calculated T₃/T₄ ratios showed distinct differences between breeds (Fig. 2C). California rabbits showed higher T₃/T₄ ratio compared to Chinchilla breed ($P = 0.026$). These data may indicate that the metabolic rate was generally higher in male than female; in addition, the conversion from T₄ to T₃ was higher in California rabbit when compared Chinchilla rabbit.

Corticosterone is the main glucocorticoid in many animal species and birds. It is involved in the regulation of energy, immune reactions, and stress responses (Lattin *et al.*, 2016). The stress hormone (corticosterone) concentrations showed distinct differences between the two breeds.

Corticosterone level was relatively lower in California than Chinchilla ($P < 0.001$, Fig. 2D). Our data showed higher concentrations of serum corticosterone than those measured in laboratory rabbits (Cristina *et al.*, 2013). Hence, California breed showed better indices for heat loss, higher metabolic rate, and lower stress hormone level when kept under the same environmental a condition. The overall results may indicate lowered stress level in such breed when compared to Chinchilla.

CONCLUSION

This study generally refer to the ability of California breed to withstand heat stress is higher than Chinchilla rabbits under the environmental condition of Sohag governorate.

CONFLICT OF INTEREST

All authors declare the absence of any type of conflict of interest

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