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Research Article

EFFECT OF CASTRATION ON R.B.C., W.B.C., HAEMOGLOBIN AND BODY WEIGHT IN ALBINO SWISS MICE, *Mus musculus*

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A B S T R A C T

Repeated experiments examined the effect of castration on number of RBC, WBC, haemoglobin concentration and body weight in mice, Mus musculus. Castrations in general have been reported to lower the RBC, WBC and haemoglobin concentration but increase in body weight. The body weight of the castrated mice showed an increase tendency in comparison to the normal mice with a percentage of 28.51. In the castrated mice the number of RBC, WBC and haemoglobin concentration per 100ml of blood were found less than the normal intact mice. Thus, it appears that the male sex hormone (testosterone) exert influence on bodyweight, RBC, WBC, and haemoglobin concentration in a significant manner.

INTRODUCTION

Castration is any action, surgical, chemical, or otherwise, by which an individual loses use of the testicles. Surgical castration is bilateral orchiectomy and chemical castration uses pharmaceutical drugs to deactivate the testes. Castration causes sterilization; it also greatly reduces the production of certain hormones, such as testosterone. Surgical castration in animals is often called neutering. The term "castration" is sometimes also used to refer to the removal of the ovaries in the female, otherwise known as an oophorectomy or, in animals, spaying. Estrogen levels drop precipitously following oophorectomy, and long-term effects of the reduction of sex hormones are significant throughout the body (Shuster et al; 2008).

Castration has a significant effect in animals. Various voluminous literatures are available on the blood of different mammalian species. Blood is a parameter, quickly influenced by even the slightest change in external and internal environmental hazards.

Reports which are available state that haematological data are influenced by the various changes in climatic condition, food, nature of sex, age and size in different vertebrate species (Haws & Good Night Preston, 1960; Beunett, 1964; Banerjee, 1966; Choubey, 1971; Dube & Datta Munsi, 1973; Fasihuddin & Choubey, 1973; Choubey & Singh, 1977).

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Humans commonly castrate domestic animals not intended for breeding. Domestic animals are usually castrated to avoid unwanted or uncontrolled reproduction; to reduce or prevent other manifestations of sexual behavior such as defending the herd from humans and other threats, or intra-herd aggression; or to reduce other consequences of sexual behavior that may make animal husbandry more difficult, such as boundary/fence/enclosure destruction when attempting to get to nearby females of the species.

Castrations of male in general have been reported to lower the RBC, WBC, Haemoglobin concentration but increase in body weight. Androgen administration returns them to precastration level (Nalbandov, 1964).

In veterinary practice an "open" castration refers to a castration in which the inguinal tunic is incised and not sutured. A "closed" castration refers to when the procedure is performed so that the inguinal tunic is sutured together after incision. Castration of non human animal is intended for favoring a desired development of the animal or of his habits, or preventing overpopulation.

Methods of veterinary castration include instant surgical removal, the use of an elastrator tool to secure a band around the testicles that disrupts the blood supply, the use of a Burdizzo tool or emasculators to crush the spermatic cords and disrupt the blood supply, pharmacological injections and implants and immunological techniques to inoculate the animal against its own sexual hormones. The practice of castration has its roots before recorded human history. Castration was frequently used for religious or social reasons

in certain cultures mainly South Asia, Africa, and East Asia. After battles in some cases, winners castrated their captives or the corpses of the defeated to symbolize their victory and seize their "power". Castration in humans has been proposed, and sometimes used, as a method of birth control in certain poorer regions.

MATERIALS AND METHODS

Materials

1. Albino Swiss male mice *Mus musculus*
2. Analgesics
3. Anaesthetic: isoflurane
4. Sterile ophthalmic ointment
5. Electric clipper or depilatory cream
6. Gauze (sterile and non-sterile)
7. 70% Alcohol
8. Chlorhexidine 2% solution or povidone-iodine solution
9. Sterile isotonic saline solution
10. Sterile cotton-tipped swabs
11. Sterile surgical instruments
12. Dry bead sterilizer
13. Surgical tissue glue or absorbable suture.
14. Heating disc/pad, red heat lamp or incubator.
15. Haemocytometer.
16. Weighing balance.

Methods: Standard Operating Procedure

Albino Swiss male mice *Mus musculus* were procured from the departmental animal house. These mice were divided into two groups i.e. normal (intact) and experimental (castrated). Animals were weighed before castration. The experimental mice were administrated analgesic and anesthetized by using isoflurane. Hair over the scrotum of the mouse was removed using a clipper or depilatory cream and loose hair with gauze. The skin surface was wiped with 70% alcohol followed by 2% Chlorhexidine solution or povidone-iodine solution. The experimental animals were castrated. The fat surrounding the vas deferens and spermatic blood vessels was gently removed using dry sterile gauze to facilitate cauterization. The instruments were disinfected between each animal by dipping them in a hot glass bead sterilizer for approximately 30 seconds after removing any blood and debris (let cool completely). Animals were allowed to recover in a clean cage. Provided supplemental heat (use a heating disc or pad, heating lamp or incubator) for approximately 30 minutes and were monitored until they have fully recovered prior to returning them to their housing room. Both normal and castrated mice were given the same diet; milk, bread, spinach etc. Weights of the normal and castrated animals were taken.

Initial body weight of normal/intact mice in gram: 25, 25.1, 25.2, 24.9, 24.8, 25, 25, 25.2, 25.3, 24.8, 25, 25, 24.4, 24.3, 24.9
Mean (x̄): 24.926666666667, Standard deviation (s): 0.27377432485934
Initial body weight of experimental/castrated mice in gram: 20,20.1,19.8,20,20.2,20,19.9,20,20.2,20.1,20,19.7,20,20.2,20
Mean (x̄): 20.013333333333, Standard deviation (s): 0.14074631010983
Final body weight of normal/intact mice in gram: 25.5,25.2,25.4,25.1,25.5,25.2,25.3,25.1,25.6,25.4,25.5,25.1,25.6,25.3,25.5
Mean (x̄): 25.353333333333, Standard deviation (s): 0.18073922282273
Final body weight of experimental/castrated mice in gram: 26.6,26.3,26.1,25.9,25.5,25.9,26.4,25.8,26.4,26,25.8,26.2,26,25.7,26.4
Mean (x̄): 26.066666666667, Standard deviation (s): 0.31091263510329

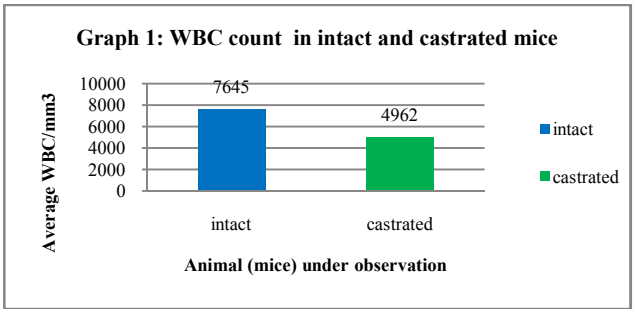
After a month of castration, RBC & WBC count were made with a nebular haemocytometer by diluting a known volume of blood with a fluid which is isotonic with blood and prevent its coagulation. The blood cells were then counted in known volume of blood in counting chamber and the number of RBC & WBC per mm^3 of the undiluted blood was determined by calculation. The haemoglobin concentration was determined by Sahli's haemometer. The experiments were repeated three times on 30 mice for six months in three sets of mice. Each set consisted of five normal and five experimental i.e. 10 mice.

RESULTS

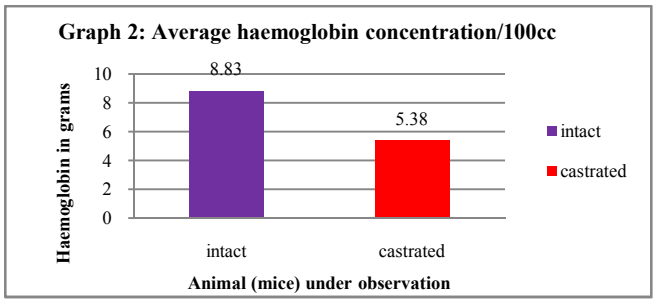
In this experiment it was observed that castration influenced the number of RBC, WBC, Haemoglobin concentration and Body weight of the animal. The body weight of the castrated mice showed an increasing tendency in comparison to the normal mice. In the castrated mice the number of RBC, WBC and Haemoglobin concentration per 100ml of blood were found less than the normal intact mice. The experimental observations are given below in a tabular form.

Table 1 The effect of castration on RBC, WBC, Haemoglobin concentration and Body weight in Albino Swiss mice Mus musculus.

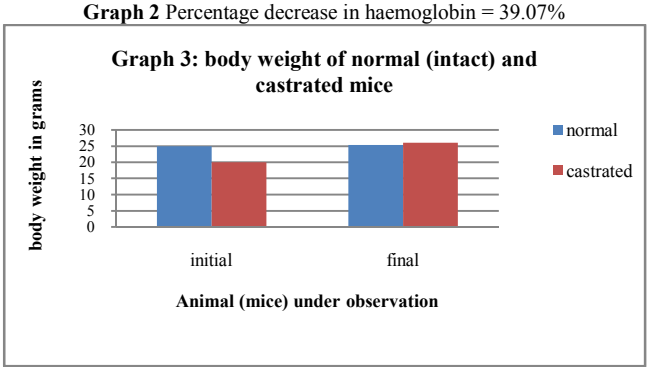
Status of animals	Total number of animals	Average body weight of each mice in gram		Average RBC/mm^3	Average WBC/mm^3	Average hemoglobin concentration/100cc
		Initial	Final			In gm.
Normal	15	24.92gm	25.35 gm	7.44 x 10^6	7645	8.83
Castrated	15	20.01gm	26.06 gm	5.49 x 10^6	4962	5.38



Graph 1 Percentage decrease in WBC = 35.09%



Graph 2 Percentage decrease in haemoglobin = 39.07%



Graph 3 Percentage increase in body weight = 28.51%

DISCUSSION AND CONCLUSION

Castration, removal of the *gonads* (testes in men, ovaries in women) in human beings or animals. Castration has been employed medically to combat some forms of cancer, but this use is declining. At one time castration was used in some countries as a means of eugenics. In China and the Middle East, selected male children were castrated to serve as guards (eunuchs) of women's quarters or as chamberlains, but this practice ceased in the 20th century. In Europe, between the 16th and 18th centuries, boys with fine voices were sometimes castrated to sing in church choirs as castrati because of the Roman Catholic ban on female singers. Earlier operas, the so-called *opera seria,* were frequently written for adult castrati. The practice ended in the 19th century.

Castration prevented the appearance of the flank gland but did not alter the development of aggression, dominance and marking. After the formation of intact-castrated pairs, the level of performance of the intact was significantly higher than the castrates only for marking behavior (Whitsett, 1975). In animal husbandry, castration of male animals is called *gelding* and castration of females is called *spaying.* It is used for such purposes as selective breeding, increased docility, and, for pet cats and dogs, sterility.

Blood acts as a reservoir of different physiological actions of the body. It regulates homeostasis in the body. It is thus, very sensitive to any change in the internal and the external environment. Any significant change in the body physiology and the external environment, change the morphological and biochemical constituent of the blood, Singh (1988) has reported in *Monopterus cuchia*_(Hum) that haemoglobin concentration was maximum during gonadal active phase i.e. during summer season. From winter onward haemoglobin concentration increased simultaneously with the increase of gonadal weight as well as temperature and photoperiod. At the gonadal peak month (May) the haemoglobin concentration and water temperature were observed to be maximum. It illustrate that gonadal hormone enhance the blood haemoglobin concentration for which higher temperature and photoperiod provided favourable conditions.

High hemoglobin in some fishes in the spawning period i.e. in the summer and low in the non breeding period i.e. in the winter, have been reported by Pandey(1975), Tiwary(1977), Tiwary(1979), Banerjee(1981) and Towheed et al (1986).

Luo (1983) has reported the RBC count varied with age and gonadal development, a juvenile's red blood cell count being higher than that of an adult. Towheed et al (1986) in *A. cuchia* reported that the temperature and photoperiod are not only directly involved in the regulation of the changes in the blood parameters (erythrocyte count, Haemoglobin) rather than internal factors (thyroid, gonadal and adrenal activity) might be important in the regulation of blood parameters. Guyton (1981) has reported that high production of cortisol during the spawning period might have increased erythrocyte count.

Singh (1988) has reported that total leucocytes count of female *Monopterus cuchia* showed higher during the summer (May/June) and lower during the winter (December/January).
The influences of the male hormone on the body weight vary with the species and also depend on the nutritional status of the animals. Nalbandov (1964) has reported that androgen stimulates protein anabolism and causes nitrogen retention which has been suggested to account for the rapid growth and greater weight of male.

In normal and castrated male low doses of androgen produce increase in bodyweight, but continued treatment, especially with higher doses prevents gain of the body weight. So the male mice after fifteen days of castration showed increasing tendency of bodyweight resulting from increased food intake and retardation in utilization of fat. So extensive deposition of fat in the absence of the male hormone increase the bodyweight in the castrated male mice. Androgens are responsible for fat catabolic effect in intact male mice (Turner, 1966).

Turner (1966) has reported that the male hormone causes storage of nitrogen in the form of tissue protein. The skeletal muscle of castrated male have been shown to grow less rapidly than those of intact male and by androgen administration, the number and thickness of muscle fibers were increased which has been suggested as a probable cause of increase in the bodyweight (Nalbandov, 1964).

Castration of mice in free running conditions causes a reduction of running wheel activity in the beginning of the active period and stimulates activity at the end (Daan et. al; 1975).

Nalbandov (1964) has reported that castration of male animals lowers the RBC, WBC and Haemoglobin Concentration and androgen administration returns them to precastration levels.
It was found that the body weight of intact mice increased by 1.72% while the body weight of castrated mice increased by 30.23%. So percentage increase in body weight of castrated mice in comparison to intact mice is 28.51%. Percentage decrease in RBC, WBC & haemoglobin were calculated and found 26.21%, 35.09% & 39.07% respectively. Thus, it appears that the male sex hormone exert influence on bodyweight, RBC, WBC, and Haemoglobin concentration in a significant manner, especially during higher and lower metabolic rates depending its physiological variable.

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