Int.J.Curr.Microbiol.App.Sci (2018) *7*(10): 507-511

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 7 Number 10 (2018)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2018.710.055

Leptin, Insulin and Estradiol Profile in Bannur Female Sheep

M.P. Veena*, M. Naryana Swamy, S. Yathiraj, P.T. Ramesh, Suguna Rao, N.B. Shridhar, G.P. Kalmath and H.S. Shwetha

Department of Veterinary Physiology, Veterinary College, KVAFSU, Hebbal, Bangalore, Karnataka, India

**Corresponding author*

Keywords

Leptin, Insulin, Estradiol, Hormonal indicators, Bannur female sheep

Article Info

Accepted:
06 September 2018
Available Online:
10 October 2018

A B S T R A C T

The present study was conducted to determine the profile of leptin, insulin and estradiol in Bannur female sheep in different age groups maintained under iso-nutritional and iso-managemental conditions at Bandur Breeding Farm, Danagur Village, Malavalli Taluk, Mandya District, Karnataka. A total of 24 randomly selected female sheep as per age were divided in to four groups comprising of six animals in each group. The groups were Group I (>3 to 5 months), Group II (>5 to 7 months), Group III (>7 to 9 months) and Group IV (>9 to 11 months) having uniform body weight in each group. The blood samples collected from jugular vein at 15th, 30th, 45th and 60th day in each group were processed to obtain the serum samples. Leptin, insulin and estradiol in serum levels were estimated by ELISA method. The levels of all the hormones increased as the age advanced and it was proportional to the gain in body weight. It was concluded that the differences in these metabolic hormonal profile during different age of growth could be due to the variation in metabolic activity and level of nutrition. The levels of these hormones could be used as physiological indicators of growth in Bannur female sheep.

Introduction

The total sheep population in India is 65.06 million as per the 20th livestock census. India stands second after China whereas, Karnataka state stands second after Andhra Pradesh (undivided) in sheep population (Anon., 2017).

Growth and development are the continuous and dynamic processes that require integration of numerous factors such as plane of nutrition, efficiency of metabolism, hormonal levels, immune responses, physiological status and maintenance of homeostasis. The majority of metabolic hormonal levels in young animals differ from normal values of adults and they change as per age of the animals (Jezek *et al.*, 2006). The level of certain hormones can be used as physiological indicators of growth.

The metabolism of energy in farm animals is controlled by important hormonal factors like leptin and insulin. In lambs, the correlation between blood leptin and insulin concentrations increases with the age. Insulin is most important anabolic hormone with respect to all the three major nutrients

(Dimitriadis *et al.,* 2011). The raising circulating estrogen level could increase the sensitivity of growing bone to mechanical signals (Devlin and Lieberman, 2006) that could finally result in growth of the animal.

Bannur breed of sheep is known for its tasty meat. Better growth and weight gain could help in sheep production. There is paucity of information on hormonal indicators of growth in Bannur sheep. Therefore, a study was designed with the aim of determining the levels of leptin, insulin and estradiol from 3 to 11 months of age in Bannur female sheep.

Materials and Methods

The present study was conducted to determine the profile of leptin, insulin and estradiol during different stages of growth in Bannur female sheep maintained at Bandur Breeding Farm, Dhanagur Village, Malavalli Taluk, Mandya District, Karnataka, India. Twenty four female sheep randomly selected as per age and body weight were divided into four groups, *viz*., Group I (>3 to 5 months), Group II (>5 to 7 months), Group III (>7 to 9 months) and Group IV (>9 to 11 months), with six animals in each group. The animals were maintained under standard feeding and managemental conditions. The blood samples collected from jugular vein in to the clot activator coated vacutainers were allowed to clot for 30 minutes at room temperature to obtain the serum samples. The samples were collected at fortnightly intervals for two months in each group, *i.e.*, 15^{th}, 30^{th}, 45^{th} and 60^{th} day. Before each blood sampling, the animals were individually weighed on a digital scale to record the body weight in kilograms. The serum leptin, insulin and estradiol levels were determined using ELISA kits.

GraphPad Prism version 5.01 (2007), a computerized statistical software, was used to analyze the data. One-way ANOVA with Tukey's posttest was employed to know the differences between various groups. The values were expressed as Mean ± Standard Error and the level of significance or non-significance was determined at P value of 0.05.

Results and Discussion

The serum leptin levels were significantly higher in advanced age groups (Group III and IV) compared to younger age groups (Group I and II) (Table 1). The results of the present study were in accordance with the findings of Delvaud *et al.,* (2000) in sheep, Chilliard *et al.,* (2001) in ruminants, Tokuda *et al.,* (2001) in sheep, Bispham *et al.,* (2002) in sheep, Cestnik *et al.,* (2004) in Jezersko-Solcava lambs and Antunovic *et al.,* (2010) in sheep.

They have reported that the plasma leptin levels are closely correlated with body condition score and nutritional status of the animal and increase in leptin concentration in blood plasma was correlated to the progress in the fattening of the lambs as the age of the animal advanced.

In the research of Altman *et al.,* (2004) feed deprivation in lambs reduced plasma leptin and insulin concentrations. The lowest plasma leptin concentration in Jezersko-Solchava lambs was determined at two months of age, followed by a significant increase till the 12^{th} month (Cebulj-Kadunc and Cestink, 2005). Ban-Tokuda (2008) reported that in lambs leptin and insulin concentrations changed significantly during fattening period.

The insulin levels increased as the age advanced indicating anabolic status during different stages of growth that finally could result in body weight gain (Table 2). The findings were in accordance with Erdhart *et al.,* (2003) in lambs, Gatfort *et al.,* (2004) in ewes, Sergio *et al.,* (2004) in sheep, Ban-

Tokuda *et al.*, (2008) in lambs and Antunovic *et al.*, (2010) lambs who opined that the increased insulin level in fattening lambs may be related to an increase in body weight and body fat accumulation. In lambs, the correlation between blood leptin and insulin concentrations increased with age. Insulin is most important anabolic hormone with respect to all the three major nutrients. Gatfort *et al.*, (2004) and Snoj *et al.*, (2014) found a gradual increase of insulin levels which was in parallel to body growth in ewes.

Table.1 Mean ± SE values of serum leptin (ng/mL) levels in growing Bannur female sheep

(n = 6)

Groups	15th day	30th day	45th day	60th day
Group I	1.36 ± 0.05^{a}	1.54 ± 0.12^{a}	1.45 ± 0.06^{a}	1.63 ± 0.06^{a}
Group II	1.58 ± 0.07^{b}	1.60 ± 0.13^{b}	1.65 ± 0.08^{a}	1.63 ± 0.10^{a}
Group III	1.80 ± 0.07^{b}	1.98 ± 0.03^{b}	2.19 ± 0.13^{b}	2.27 ± 0.13^{b}
Group IV	2.23 ± 0.11^{c}	2.25 ± 0.10^{b}	2.33 ± 0.10^{b}	2.35 ± 0.11^{b}

The values bearing different superscripts within a column differ significantly (P<0.05).

Table.2 Mean ± SE values of serum insulin (µU/mL) levels in growing Bannur female sheep

(n = 6)

Groups	15th day	30th days	45th day	60th day
Group I	08.21 ± 0.19^{a}	08.70 ± 0.07^{a}	09.49 ± 0.28^{a}	10.09 ± 0.29^{a}
Group II	10.95 ± 0.13^{b}	10.81 ± 0.09^{b}	10.08 ± 0.12^{b}	11.92 ± 0.42^{b}
Group III	12.64 ± 0.36^{c}	12.85 ± 0.04^{c}	13.16 ± 0.24^{c}	13.40 ± 0.21^{bc}
Group IV	14.28 ± 0.26^{d}	15.33 ± 0.67^{d}	14.85 ± 0.35^{d}	14.23 ± 0.52^{c}

The values bearing different superscripts within a column differ significantly (P<0.05).

Table.3 Mean ± SE values of serum estradiol (pg/mL) levels in growing Bannur female sheep

(n = 6)

Groups	15 days	30 days	45 days	60 days
Group I	0.57 ± 0.01^{a}	0.57 ± 0.01^{a}	0.57 ± 0.01^{a}	0.57 ± 0.03^{a}
Group II	0.58 ± 0.07^{a}	0.57 ± 0.05^{a}	0.68 ± 0.03^{b}	0.67 ± 0.03^{a}
Group III	0.64 ± 0.03^{a}	0.72 ± 0.03^{b}	0.76 ± 0.01^{c}	0.74 ± 0.01^{a}
Group IV	0.78 ± 0.04^{b}	0.83 ± 0.02^{c}	0.82 ± 0.02^{c}	1.56 ± 0.13^{b}

The values bearing different superscripts within a column differ significantly (P<0.05).

In the present study, significantly higher serum estradiol level was observed in Group IV which could be due to the age approaching attainment of puberty (Table 3).

The results were in accordance with Gonzalez-padilla *et al.*, (1975) in heifer. Estradiol showed tiny pulses and more fluctuations which was an indication of sheep reaching pubertal stage. The length of prepubertal age may be affected by various factors such as inherent characters of different breeds, body weight at birth, nutrition and photoperiod.

Similarly, a significant increase in estradiol 17-β levels was reported by Glencross (1984) in heifers. There was a close relationship between high levels of oestradiol 17-β, early puberty and number of follicles in ewe lambs (Yue *et al.*, 1996). Estrogen may possibly have a direct effect on growth hormone

secretion via binding to estrogen receptor-α due to its co-expression in growth hormone neurons in the medial preoptic area and arcuate nucleus. Estrogen may also have an indirect effect via reducing the insulin-like growth factor-1 feedback inhibition resulting in increased growth hormone secretion (Tilahun *et al.*, 2016).

It was concluded that the age influenced leptin, insulin and estradiol concentration in the growing female Bannur sheep and the findings could be used as metabolic indicators of growth.

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How to cite this article:

Veena, M.P., M. Naryana Swamy, S. Yathiraj, P.T. Ramesh, Suguna Rao, N.B. Shridhar, G.P. Kalmath and Shwetha, H.S. 2018. Leptin, Insulin and Estradiol Profile in Bannur Female Sheep. *Int.J.Curr.Microbiol.App.Sci.* 7(10): 507-511.
doi: https://doi.org/10.20546/ijcmas.2018.710.055