

Original Research Article

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Effect of Non Enzymatic Antioxidants on Serum Glucose Level in Magra Rams in Arid Region of Rajasthan, India

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ABSTRACT

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The study was designed to evaluate the effect of combination of vitamin E with selenium (Se) and vitamin C injections on serum glucose concentration in Magra rams. Twenty one Magra rams were randomly divided in three groups. The 1st group (n=7, C) was administered injection of normal saline 1ml SC once in a week as a placebo and was considered as a control. The rams of group 2nd (n=7, VES) were given injections of selenium and vitamin E (1.5 mg sodium selenite and tocopherol 50mg/ml) 1ml SC per animal once in a week. The rams of group 3rd (n=7) were given vitamin C (250mg sodium ascorbate/ml), 8 ml SC per animal on alternate days. All the rams received the treatments for 45 days. The overall mean serum glucose concentration (mg/dL) was 52.59±0.62, 61.18±0.91 and 57.69±1.12 in group C, VES and VC, respectively which was significantly (P<0.05) higher in group VES followed by VC than group C. The results of this experiment inferred that injections of vitamin E with Se and vitamin C during breeding season improved the level of serum glucose in Magra rams of arid region of Rajasthan.

Introduction

The biochemical parameters are important for several reproductive functions and their deficiency impaired these functions as well as causes nutritional disorders (Mcdowell, 1992). Glucose, also called dextrose, one of the group of carbohydrates known as most abundant monosaccharide (Domb *et al.*, 1998) which is main source of energy for animal cells. Through a series of complex biochemical reactions, the breakdown of glucose yields high-energy molecules

called adenosine triphosphate (ATP). Vitamins and minerals play an important role in the physiology of animals. Vitamin E, the principal lipid-soluble antioxidant (Chow, 1991) combined with selenium increased serum glucose level probably by improving feed efficiency or the improvement in the overall animal health (Balicka-Ramisz *et al.*, 2006; Mahmoud *et al.*, 2014). Although, vitamin E and Se directly affect the metabolism of carbohydrates, it is not clear whether increased glucose level directly or indirectly through increasing thyroxin and

triiodothyronine hormones in supplemented animals (Mohri *et al.*, 2011). Vitamin C is a water-soluble vitamin essential for the metabolism of many mammals (Padilla *et al.*, 2007), who can synthesize ascorbic acid from glucose in liver (Combs, 2008). An increase in glucose concentration due to vitamin C acid supplementation has been reported by Abd-Allah and Zounouy (2014) probably due to decrease in glucose utilization.

Although both vitamins serve as free radical scavengers in biological system, vitamin C is hydrophilic and exerts its effect in the extracellular space, trapping radicals in the aqueous phase (Sulak *et al.*, 2005), while vitamin E is a lipid soluble antioxidant within the cells, where the reactive metabolites are actually produced (Durak *et al.*, 2009). This protective activity of vitamin E depends on vitamin C to recycle oxidized vitamin E (Gey, 1998). However, studies related to affecting serum concentration by vitamins and minerals in blood are limited (Mahmoud *et al.*, 2013; Jafaroghli *et al.*, 2014) in rams. Therefore, the present study was aimed to evaluate the effects of vitamin E with Se and vitamin C on serum glucose levels in Magra rams in arid region of Rajasthan.

Materials and Methods

The present study was undertaken in the department of Veterinary Gynaecology and Obstetrics, College of Veterinary and Animal Science, RAJUVAS and ICAR-CSWRI, ARC, Beechhwal, Bikaner during year 2017-2018.

Housing and feeding management

All the twenty one Magra rams were fed on the standard diet, formulated according to the requirement for mature ram suggested by Indian Council of Agricultural Research, New Delhi (ICAR, 2013). All the rams were

maintained in identical nutritional and managerial condition. All rams were provided pasture grazing, free access to water and were remained separated from ewes throughout the period of study. During the experimental period, all rams were housed in separate groups in well ventilated sheds and were maintained under proper hygienic conditions. A general management program for deworming, disease prevention were followed during the experiment as prescribed by the health calendar of the institute to ensure that animals were remained in a healthy condition throughout the study.

Experimental design

Magra rams, aged between 1.5-2.5 years having weight around 40 kg reared at CSWRI, ARC, Beechhwal, Bikaner were randomly divided in three groups. The 1st group (n=7) was administered injection of normal saline (without antioxidant administration) 1ml SC as a placebo and was considered as a control (C). The rams of group 2nd (n=7) were given injections of selenium and vitamin E (1.5 mg sodium selenite and tocopherol 50mg/ml, Inj.Repronol, Cadila pharmaceuticals limited, Ahmedabad, India) 1ml SC per animal once in a week (Deori *et al.*, 2014) and considered as group VES. The rams of group 3rd (n=7) were given vitamin C (250mg sodium ascorbate/ml, Inj.ALPA- C, Alpa vet, Indore, India), 8 ml SC per animal on alternate days (Al-saab, 2015) and considered as group VC. The rams received the treatments for 45 days.

Collection of blood samples and analysis

Blood was collected twice in a week in sterilized 10ml tubes one month post treatment for 5 weeks from treated and untreated rams by jugular vein puncture. The serum was separated at 1000g for 20 minutes. Serum samples were analyzed to estimate

glucose level by VetTest biochemistry analyser (IDEXX Laboratories, US) as per the manufacturer's subscribed procedure.

Statistical analysis

Data obtained were analyzed statistically by three way analysis of variance using 3×5 factorial design and correlation were obtained using the SPSS computer programme (version 25.0), based on the standard procedures outlined by Snedecor and Cochran (1994). The mean values were compared by using Duncan's multiple range test (DMRT) described by Duncan (1955).

Results and Discussion

The overall mean serum glucose concentration (mg/dL) was 52.59 ± 0.62 , 61.18 ± 0.91 and 57.69 ± 1.12 in group C, VES and VC, respectively which was significantly ($P < 0.05$) higher in group VES followed by VC than group C (Table 1; Fig. 1). The overall mean serum glucose concentration (mg/dL) was 58.96 ± 1.15 , 61.2 ± 1.46 , 57.03 ± 1.4 , 54.24 ± 0.94 and 54.34 ± 1.13 during the 1st, 2nd, 3rd, 4th and 5th week, respectively which differed significantly ($P < 0.05$) between the weeks. During 2nd week, overall mean serum glucose concentration was significantly ($P < 0.05$) higher than rest of the weeks. The overall mean serum glucose concentration was significantly ($P < 0.05$) higher during 1st week than 4th and 5th week. The overall mean serum glucose concentration differed non significantly between 1st and 3rd week as well as between 3rd, 4th and 5th week. Analysis of variance revealed significant ($P < 0.05$) interaction between treatment groups and weeks (Table 1; Fig. 1).

The mean serum glucose concentration was significantly ($P < 0.05$) higher in group VES followed by VC than group C. The overall mean serum glucose concentration was

significantly ($P < 0.05$) different between the weeks whereas interaction between treatment groups and weeks also differed significantly ($P < 0.05$). The significant increase in serum glucose concentration in Magra rams of VES group was coincided with finding of Mahmoud *et al.*, (2013) who reported significantly increased serum glucose level treated after vitamin E plus Se injections in Ossimi rams. Similarly, vitamin E and Se supplementation resulted in higher level of glucose than control lambs and ewes (Avci *et al.*, 2000; Pisek *et al.*, 2008). This result stand with findings of Babe (2011) who showed significant increase in serum glucose level in vitamin C treated heat stressed sheep compared with untreated control. In accordance to the present findings, an increase in glucose concentration due to ascorbic acid supplementation has been reported by Abd-Allah and Zanouny (2014) probably due to the decrease in glucose utilization. In contrast of present findings, vitamin E plus Se administration didn't affect serum glucose concentration in lambs (Soliman, 2015; Ibrahim, 2017) and buffalo calves (Shinde *et al.*, 2008). Contrastingly, Konwar *et al.*, (2017) observed significantly reduced serum glucose level in vitamin C treated swamp buffaloes.

Increased glucose concentration may be due to reduction of oxidative stress produced by heat stress (Bruno *et al.*, 2006). The decrease in serum glucose level in the ascorbic acid supplemented groups could be due to effect of ascorbic acid in increasing insulin concentration and decreasing corticosterone level as reported by Sahin *et al.*, (2003) and Gursu *et al.*, (2004). The effect of co-administration of vitamin E and Se on carbohydrate metabolism is not clear though if the increase levels of thyroxin and triiodothyronine hormones in supplemented animals could result to higher levels of glucose.

Table.1 Effect of vitamin E+Se and vitamin C on serum glucose concentration (mg/dl) in Magra rams (Mean±SE)

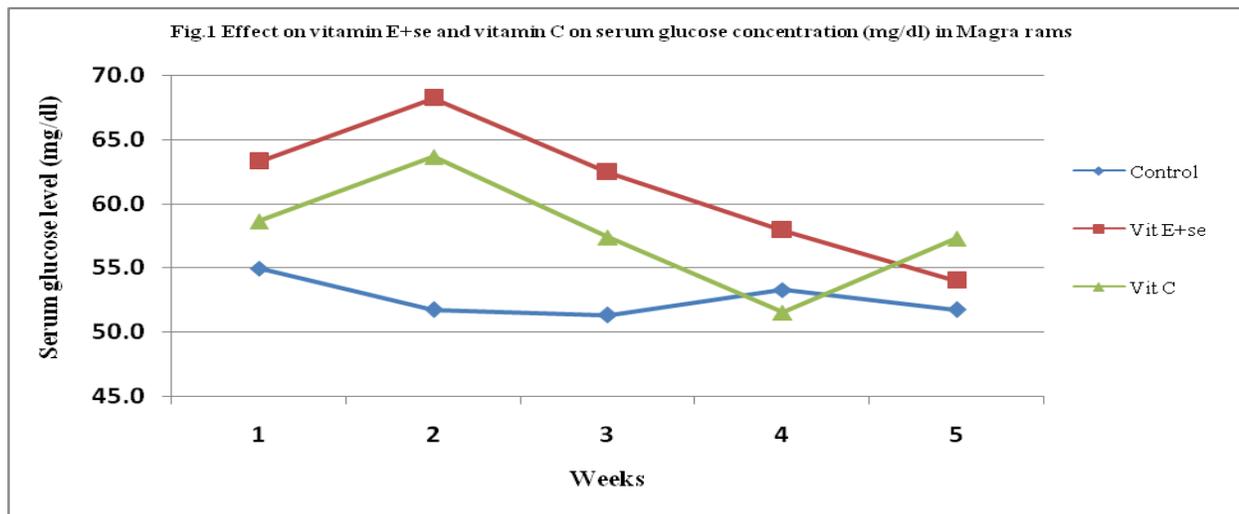
Groups	Serum glucose concentration (mg/dl) during weeks (n=10)					Over all
	1	2	3	4	5	
C	54.93±1.5 ^{aA}	51.72±1.53 ^{aA}	51.29±1.43 ^{aA}	53.29±1.13 ^{abA}	51.72±1.23 ^{Aa}	52.59±0.62 ^a
VES	63.29±1.6 ^{bC}	68.22±1.49 ^{bD}	62.43±2.28 ^{bBC}	57.93±1.49 ^{bAB}	54±0.96 ^{abA}	61.18±0.91 ^c
VC	58.64±2.21 ^{abB}	63.64±2.11 ^{bC}	57.36±2.54 ^{bb}	51.5±1.79 ^{aA}	57.29±2.91 ^{bb}	57.69±1.12 ^b
Over all	58.96±1.146 ^B	61.2±1.46 ^C	57.03±1.398 ^{AB}	54.24±0.943 ^A	54.34±1.133 ^A	

Means having different superscripts in a column (small letter) differ significantly (p<0.05)

Means having different superscripts in a row (capital letter) differ significantly (p<0.05)

Means carrying different superscripts (small and capital letter both) have significant interaction (p<0.05)

n=Number of serum samples



Mc Clure (1965) observed that variations in blood glucose were clearly linked to fertility as hypoglycemic condition has been found to depress the hypothalamic function leading to loss of gonadal activity due to failure of release of gonadotrophic hormone (Howland *et al.*, 1966; Arthur, 1975). Since FSH and LH are glycoprotein, glucose is essential for biological activity of these hormones (Hafez *et al.*, 2000). Therefore it can be inferred that administration of vitamin E with Se and ascorbic acid improve serum glucose concentration which is one of the essential metabolite in reproductive biology.

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