Journal of Animal and Vetarinary Advances 5 (8): 659-661, 2006


# Effect of Vandyl Sulphate on Blood Glucose Utilization in Sheep

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**Abstract:** Intramuscular administration of vandyl sulphate at a dose of 10 and 20 mg $kg^{-1}$ body weight for 6 days in sheep serum glucose levels at 50-53 mg $dL^{-1}$, compared to 60-71 mg $dL^{-1}$in their respective controls. Performance of glucose tolerance test indicated that total amount of glucose administered got utilized in 3 h in vandyl treated animals compared to 6 h in control. Vandyl sulphate used in the above specified doses was well tolerated in sheep.

**Key words:** Glucose, vandyl sulphate, tolerance, serum and sheep

## INTRODUCTION

The sheep from late pregnancy till weaning of the kids pass through a series of physiological profile and available plane of nutrition. Nutritionational requirement may shift abruptly because of added requirement of full term fetus. If these requirements are not met, then spontaneous negative energy balance may develop (Blache *et al*.,[1].

Glucose has long been a favoured candidate as metabolic link between nutrition and reproduction (Schillo[2]). In female sheep, insulin-induced hypoglycaemia inhibits luteinizing hormone secretion and administration of glucose reverse the effect (Funston *et al*.,[3]).

Vandium has been shown to have an insulin-like effect such as stimulation of glucose uptake[4-6], glycogen synthesis (Strout *et al*.,[7]) and glycolysis[8,4]. Therefore, this experiment was conducted to investigate the effect of vanadium on blood glucose concentration in sheep.

## MATERIALS AND METHODS

**Animals and treatments:** Fifteen apparently healthy sheep (male) at 2-3 years of age were used in the study. Animals were housed in separate pens under natural day length and temperature. They were allowed to rest for certain time to make sure none of them had received any medication for at least 8 weeks prior vandyl sulphate administration. Water, hay and concentrate supplements were provided *ad libitum*. Animals were equally divided into three groups. Group 1 animals were injected intramusculary (i. m.) with saline. Groups 2 and 3 animals were injected i. m. with vandyl sulphate (Wako chemicals, Japan) at 10 and 20 mg $kg^{-1}$ body weight, respectively for 6 days. Glucose tolerance test was performed on day 3 of the experiment. All animals were fasted for 24 h and were given intravenous injection of 50% dextrose at a dose of 1g $kg^{-1}$ body weight.

**Collection of blood samples and assays of metabolites:** Blood samples were collected daily for 10 days by venipuncture. Blood samples were also collected after dextrose administration at 0, 1, 2, 3, 4, 5 and 6 h into chilled tubes, placed in ice and centrifuged at 800 × g for 3 min. Serum glucose was assayed one day after experiment using Trinder assay kit (Sigma Chemical Corporation, Italy). Serum aspartate aminotransferase (AST), lactic dehydrogenase, (LDH) were determined by clinical chemistry analyzer (Roche Products, Herts, UK) using specific kits. Results were statistically analysed using Student's t-test () with a significance level of $p<0.05$.

## RESULTS AND DISCUSSION

Serum glucose level in group 2 and 3 during the 10 days of experiment of injection of vandyl sulphate is shown in Fig. 1. Serum glucose decreased from 64.1±1.9 mg± and 70.1±1.4 mg± to about 52-53 mg± in group 2 and 3, respectively from day 2 to day 6 but returned to 65-71 mg $dL^{-1}$on day 7 and thereafter up to day 10 of the experiment. Serum glucose levels in group 1 fluctuated between 54-72 mg $dL^{-1}$during the experiment period.

Similar effects were observed in rats Meyerovitchz[9-11]. The mode of vandate action *in vivo* in inducing normoglycemia involves stimulation of basal rates of glucose uptake and presumed metabolism by various tissues such as liver and muscle[9]. Furthermore, when added to intact cells, vandate was reported to stimulate glucose oxidation[4] and transport (Dubyai and Kleinzeller,[8]), in adipocytes and skeletal muscle, mimic the effect of insulin on glycogen synthatase in adipocytes

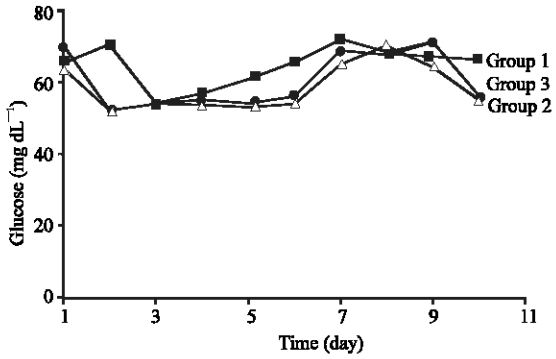


Fig. 1: Serum glucose level in sheep treated with vandyl sulphate at a dose of 10 mg $kg^{-1}$ (group 2) and 20 mg $kg^{-1}$ body weight (group 3), control (group 1) (n = 5 each)

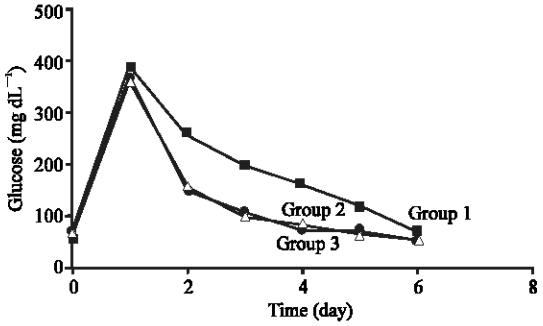


Fig. 2: Glucose utilization in sheep treated with vandyl sulphate at a dose of 10 mg $kg^{-1}$ (group 2) and 20 mg $kg^{-1}$ body weight (group 3), control (group 1) (n = 5 each)

Table 1: Serobiochemical values of sheep treated with vandyl sulphate at a dose 10 and 20 mg $kg^{-1}$ body weight (n = 5 each)

| Parameter | Group1 (control) | Group2 (10 mg $kg^{-1}$) | Group3 (20 mg $kg^{-1}$) |
|---|---|---|---|
| AST (μ/l) | 6.7±0.3 | 6.8±0.3 | 6.4±0.4 |
| LDH (μ/l) | 128±12 | 126±13 | 124±12 |
| CK (μ/l) | 66.3±4 | 63.4±3 | 67.5±3 |
| BUN (mg $dL^{-1}$) | 6.2±0.5 | 6.1±0.4 | 6.0±0.3 |

AST = aspartate aminotransferase, (LDH) = lactic dehydrogenase, (CK) = creatine kinase, (BUN) = blood urea nitrogen

(Tamura *et al.*,[12]) and regulate gene expression in a fashion similar to insulin (Johnson *et al.*,[13]). It is interesting that fluctuated levels of serum glucose concentrations were seen after stoppage of vandate administration suggesting that the effect of vandate on seum glucose was reversible. However, serum in streptozotocin rats serum glucose levels normalized by 3 weeks of vandyl sulphate treatment, remained normoglycemic after 13 weeks of withdrawal suggesting a prolonged effect of vanadium (Pederson *et al.*,[14]).

Results of glucose tolerance test in animals is presented in Fig. 2. Glucose utilization in animals of group 1 was such that its 38% amount was utilized by the body at 1h, up to 56% at 2h, up to 68% at 3h, up to 80% at 4h, up to 95% at 5h and up to 99% at 6h. The corresponding values in animals of group 2 and 3 were up to 77% and 73% ($p<0.01$) at 1h, up to 87% and 83% ($p<0.01$) at 2h, up to 93% and 98% ($p<0.01$) at 3h and up to 99% ($p<0.01$) at 4h in both groups. These results indicate that glucose was better utilized in animals treated with vandate compared to saline control (Sakurai *et al.*,[15]). Vandate may enhance glucose incorporation into peripheral cells and activates glycogen synthetase to 98% of the maximum activation by insulin (Tamura *et al.*,[12]),

Serobiochemical enzymes such as aspartate Aminotransferase (AST), Lactic Dehydrogenase (LDH), Creatine Kinase (CK) and blood urea nitrogen (BUN) were normal (Table 1), suggesting that vandyl sulphate was well tolerated by animals. Early reports have claimed that vandate is toxic to animals (Meyerovitch *et al.*,[9]), vandyl sulphate at the doses used in this study was without apparent signs of toxicity.

## ACKNOWLEDGEMENT

The author thanks the Deanship of Scientific Research, King Faisal University for financial support.

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