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A comparison of via of administration of the injection of vitamin E in newly received feedlot calves

Comparación de la vía de administración de la inyección de vitamina E en becerros recién llegados a la engorda

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Resumen

Cincuenta becerros Holstein (121 ± 4 kg) se utilizaron con el objetivo de determinar la eficacia de la vía de administración de la vitamina E al tiempo de llegada de los becerros al corral de engorda sobre los niveles de concentración plasmática de alfa-tocoferol durante los primeros 16 días de su llegada al corral. Diez becerros se utilizaron como testigos y los 40 restantes (20 becerros por tratamiento) fueron inyectados con 1500 IU de vitamina E (d-alfa tocoferol) ya sea por vía intramuscular (IM) o por vía subcutánea (SC). Los tratamientos de vitamina E se administraron al primer día y al día 8 de la llegada, mientras que las muestras de sangre se obtuvieron en los días 1, 4, 8, 12 y 16. Los sitios de inyección se examinaron visualmente en el día 16 para determinar si la vía de administración afectaba la incidencia de la inflamación. Los becerros fueron alimentados con una dieta de recepción conteniendo una proporción concentrado: forraje de 72:28. La concentración plasmática de alfa-tocoferol permaneció baja (rango de 0.06 a 0.10 mg/dL) en el grupo testigo durante los 16 días. La inyección de vitamina E incrementó ($P<0.01$) 4 veces la concentración de alfa-tocoferol en plasma. La vía de administración de vitamina E no influyó ($P> 0.10$) la incidencia de la inflamación en el lugar de la inyección promediando 17,5% ($\chi 2$, $P> 0,05$). Las concentraciones de alfa-tocoferol en plasma no se vieron afectados ($P> 0.30$) por la presencia de inflamación en el lugar de inyección. La administración subcutánea de vitamina E inyectable es una alternativa práctica a la tradicional ruta de administración intramuscular.

Palabras clave: Tocoferol, ganado, plasma, vía de administración

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Abstract

Fifty Holstein steers calves (121 ± 4 kg) were used in order to determine the effects of route of administration of vitamin E at the time of arrival of feedlot cattle on levels of plasma alpha-tocopherol concentrations during the initial 16 days following their arrival into the feedlot. Ten steers served as controls, the remaining 40 steers (20 steers/treatment) were injected either

intramuscular (IM) or subcutaneous (SQ) with 1500 IU of vitamin E (d-alpha tocopherol). Vitamin E treatments were administered on days 1 and 8 of the arrival, while blood samples were obtained on days 1, 4, 8, 12 and 16. Injection sites were examined visually on day 16 to determine if route of administration affected incidence of injection-site inflammation. Steers were fed a steam-flaked corn based receiving diet with a 72:28 concentrate-to-forage ratio. Plasma alpha-tocopherol concentrations of control steers remained low (range from 0.06 to 0.10 mg/dL) throughout the 16-d period. Vitamin E injection increased ($P<0.01$) 4-fold the plasma alpha-tocopherol concentration. Route of vitamin E administration did not influence ($P > 0.10$) the incidence of injection site inflammation, averaging 17.5% (χ^2, $P>0.05$). Plasma alpha-tocopherol concentrations were not affected ($P > 0.30$) by the presence of injection site inflammation. Since the risk of lesions in meat are considerably higher with intramuscular application and plasma alpha-tocopherol concentrations were not different between routes of application, it is concluded that subcutaneous administration is a practical alternative to the traditional intramuscular of administration of injectable vitamin E for feedlot cattle.

Keywords: Tocopherol, cattle, plasma, route of administration

Introduction

Because calves entering the feedlot are often vitamin E deficient (Mass *et al.*, 2008), administration of vitamin E during receiving is recommended (Secrist *et al*., 1997). Previous work (Hidiroglou and Batra, 1996; McDowell *et al*., 1996) demonstrates that plasma tocopherol concentrations are affected by dosage level, frequency of administration, and chemical form of vitamin E and its carrier. Traditionally, vitamin E is administered via intramuscular (IM) injection. It has been maintained that, compared to IM administration, the subcutaneous (SQ) administration of vitamin E result in lower rate of uptake to appreciably increase plasma and tissue alpha-tocopherol concentrations (Judson *et al*., 1991). However, direct comparisons between IM and SQ routes of administration have not been conducted. Thus, there is no conclusive experimental basis for this recommendation. With increased interest in reduction of injection-site blemishes resulting by IM injections in feedlot industry (Roeber *et al*., 2001), it is preferable that, where feasible, injection treatments be applied SQ.

The objective of this trial was to compare IM vs SQ routes of vitamin E administration on plasma alpha-tocopherol concentrations and incidence of injection site inflammation in the first 56 days of the arrival of newly received calves.

Materials and Methodology

All animals care, handling, and surgical techniques followed protocols that have been approved by the University of California, Davis, Animal Use and Care Committee.

Fifty Holstein steer calves (121 ± 4 kg) were used to evaluate the influence of SQ versus IM injection of vitamin E on plasma alpha-tocopherol concentrations and incidence of injection site inflammation during the initial 16 days following their arrival into the feedlot. Calves were purchased as steers (previously castrated via elastration). Upon arrival, steers were vaccinated for bovine rhinotracheitis parainfluenza3 (TSV-2, Zoetis, Florham Park, NJ), Clostridials (Fortress 8, Zoetis, Florham Park, NJ), and *Pasteurella haemolytica* (One Shot, Zoetis, Florham Park, NJ), were treated for parasites (Dectomax Injectable, Zoetis, Florham Park, NJ), and randomly assigned to three treatment groups. Steers were group-fed a steam-flaked corn-based receiving diet with an expected concentration of 22 mg/kg vitamin E (NRC, 1996). The formulation of receiving diet is shown in Table 1.

Table 1. Ingredients and composition of receiving diet.

Item	% of dry matter
Ingredient composition (%)	
Steam-flaked corn	63.10
Alfalfa hay	19.00
Sudan grass hay	9.00
Molasses cane	6.00
Yellow grease	1.00
Limestone	1.00
Urea	0.50
Trace mineral salt	0.40
Chemical composition (DM basis)	
Crude protein (%)	13.90
Ether extract (%)	3.40
NDF (%)	20.20
Ca	0.86
P	0.28
Calculated net energy (Mcal/kg)	
Maintenance	1.93
Gain	1.29

Trace mineral salt contained: $CoSO_4$, .068%; $CuSO_4$, 1.04%; $FeSO_4$, 3.57%; ZnO, 1.24%; $MnSO_4$, 1.07%, KI 0.052%; and NaCl, 92.96%, Chemical composition and calculated net energy are based on tabular concentration of nutrients and net energy (NE) values for individual feed ingredients (NRC, 1996).

Ten steers served as controls, receiving no vitamin E injections. The remaining 40 steers (20 steers/treatment) were injected either IM or SQ with 1500 IU of d-alpha tocopherol (5 mL of Vital E-A+D_3, Stuart Products Inc., Bedford, TX). Site of injection was located in front of the shoulder and midway of the neck in the "injection triangle" below the nuchal ligament and above the jugular furrow. Vitamin E treatments were administered on days 1 and 8. Blood samples were obtained from all steers (controls and treated with vitamin E) on days 1 (before administration of vitamin E treatments), 4, 8, 12 and 16. Blood samples were collected via jugular puncture into heparinized tubes. Immediately, blood was centrifuges at 1070×*g* for 10 min. Plasma alpha-tocopherol analyses was conducted by the Veterinary Diagnostic Laboratory (College of

Veterinary Medicine, Iowa State University, Ames, IA) according to procedures described by Stahr (1991). On the final day of the study (day 16), incidence of injection site inflammation was recorded based on presence of absence of visible swelling. The trial was analyzed as a completely randomized design. Data were analyzed by repeated-measures analysis of variance using the MIXED procedure of SAS version 9.1 (Cary, NC. USA). The means were compared by the Tukey test at 5% of probability.Treatment effects on proportion of steers with injection-site inflammation was analyzed using the Mantel-Haenszel chi-square analysis. Differences were considered significant when the P-value was ≤ 0.05.

Results and discussion

Treatment effects on plasma tocopherol concentrations is shown in Table 2. Plasma alpha-tocopherol concentrations of control steers remained low throughout the 16-day period of the study, averaging 0,06, 0,06, 0,06, 0,11, and 0,10 mg/dL for days 1, 4, 8, 12, and 16, respectively.

Table 2 Influence of subcutaneous versus intramuscular administration of vitamin E on plasma alpha-tocopherol concentrations (mg/dL) in newly arrival feedlot calves.

					P-value	
	Treatment				Control vs.	
Item	Control	SQ	IM	SE	IM, SQ	IM *vs* SQ
d 1	0.062	0.082	0.072	0.004	0.17	0.32
d 4	0.063	0.401	0.421	0.035	<0.01	0.81
d 8	0.062	0.275	0.273	0.012	<0.01	0.94
d 12	0.107	0.523	0.614	0.041	<0.01	0.33
d 16	0.105	0.376	0.360	0.019	<0.01	0.70

Vitamin E treatments were administered on day 1 and day 8 immediately following blood collection; SQ = subcutaneous injection; IM = Intramuscular injection.

As expected (Batra *et al*., 1995), tocopherol injection increased ($P < 0.01$) plasma alpha-tocopherol concentrations. However, plasma alpha-tocopherol concentrations were not different ($P > 0.10$) for IM and SQ routes of administration, averaging 0.41 ± 0.29, 0.28 ± 0.12, 0.56 ± 0.31 and 0.37 ± 0.13 mg/dL for days 4, 8, 12, and 16, respectively. The similarities in plasma

alpha-tocopherol between IM and SQ suggest that the rates of uptake or mobilization are similar. This contrasts with Judson *et al.* (1991) who did not observed a significant increased plasma tocopherol following SQ administration during the first four days following administration of 120 mg/kg of dl-alpha tocopheryl acetate to sheep.

Route of vitamin E administration did not influence ($P > 0.10$) the incidence of injection site inflammation, averaging 17.5% (χ^2, $P>0.05$). Furthermore, plasma alpha-tocopherol concentrations were not affected ($P > 0.30$) by the presence or absence of injection site inflammation, averaging 0.40 ± 0.11 and 0.36 ± 0.14 mg/dL, respectively.

Since the risk of lesions in meat are considerably higher with intramuscular application (Li et al., 2012) and plasma alpha-tocopherol concentrations were not different between routes of application, it is concluded that subcutaneous administration is a practical alternative to the traditional intramuscular of administration of injectable vitamin E for feedlot cattle.

References

Batra, T. R., Hidiroglou, M., Menard, L. (1995). Effects of vitamin E injection on body temperature and plasma alpha-tocopherol concentrations in pigs, lambs and calves. Vet. Res.26: 68-72.

Hidiroglou M., Batra, T.R. (1996) Plasma and tissu cocentration of vitamine E following supplemenattion of two forms of vitamin E in sheep. Small. Rum. Res.21:83-87.

Judson, G. J., Babidge, P. J., Babidge, W. J. (1991). Plasma, liver and fat alpha-tocopherol concentrations in sheep given various oral and subcutaneous doses of vitamin E. Aus. J. Experimental Agric. 31:45-50.

Li, W., Yin, Y., Wang, F., Miau, S. (2012). Beef Quality Assurance Injection Sites and Techniques. J. Agr. Sci.4:91-96.

Mass, J., Bruce, R.H., Myers, D. M., Tindall, J., Puschner, B. (2008).Vitamin E and selenium concentration in month-old beef cattle. J. Vet. Diagnostic Invest. 20:86-89.

McDowell, L. R., Williams, S.N., Hidiroglou, N., Njeru, C.A., G. M. Hill, G.M., Ochoa, L., Wilkinson, N.S. (1996). Vitamin E supplementation for the ruminant. Anim. Feed Sci. Technol. 60: 273-296.

NRC. (1996). Nutrient Requirement of Beef Cattle.7 ed. National Academy of Sciences. Washington, D.C.

Roeber, D.L., Cannel, R.S., Belk, K.E., Scanga, J.A., Cowman, G.L., Smith, G.C. (2001). Incidence of injection-site lesions in beef top sirloin butts. J. Anim. Sci. 79: 2615-2618.

SAS Institute Inc (2007). SAS/STAT user's guide. SAS, Cary, NC, USA.

Secrist, D. S., Owens, F. N., Gill, D. R. (1997). Effects of vitamin E on performance of feedlot cattle: A review. The Prof. Anim. Sci.13: 47-54.

Stahr, H. M. (1991). Analytical methods in toxicology. John Wiley & Sons, Inc.: New York, NY.