FINAL REPORT

Trial: #552-0553-93B-002

Title: The effect of different Clostridial Vaccines on Feed Consumption and Performance of Feedlot Calves

Investigator: N. K. Chirase, Ph.D.

Co-investigators: G. B. Thompson, Ph.D.
M. D. Cravey, Ph.D.
Texas A&M Research Center
6500 Amarillo Boulevard West
Amarillo, Texas 79106

Monitor: Dr. Dudley Smith
Boerhinger Ingelheim Animal Health, Inc.
P. O. Box 8454
Amarillo, Texas 79118

Sponsor: Dr. Ivan Nicholson
Boerhinger Ingelheim Animal Health, Inc.
2621 North Belt Highway
St. Joseph, Missouri 64506

Dates: On test: 11-19-93
Off test: 12-17-93

Introduction

Several clostridial vaccines are currently being used in the beef cattle industry. Of most concern are the effects of vaccine and injection site on the seroconversion , performance and feed consumption rates of feedlot steers.

Objectives

Part I

1) To determine the effect of vaccination with three (3) Clostridial vaccines in two (2) different injection sites on feed intake and performance of feedlot steers using computerized pinpointers.

Part II

2) To compare by serological evaluation, the seroconversion accomplished with the products used.

Materials

Test and Reference articles

Name of test, type of formulation, batch, assay purity, size and source of supplier are all contained in company reference manuals.

The steers were fed a feedlot receiving diet (Table 1a), containing a commercial protein supplement (Table 1b) for fourteen (14) days before initiating the experiment. The diet was formulated to meet the nutrient requirements of growing cattle (NRC, 1984).

Test System

Eighty (80) crossbred steers (avg wt 237 kg) were purchased via the normal commercial cattle order buyer system. All steers were weighed and randomly tagged in the ear with individual identification numbers (Form RD015). All steers were selected randomly from a group of one hundred and twenty (120) steers by ranking them according to weight and excluding twenty from the top and bottom. This provided a uniform group yielding no significance difference ($P > .05$) in initial weight among treatment groups.

Management of test animals

All steers were housed in feedlot pens equipped with individual feed intake monitoring devices (pinpointers) linked to a central computer in the office (facility plan and description attached). The diet fed to all steers is shown in Table 1a. Water was available on an *ad libitum* basis. The feed was sampled daily and composited every 7 days for analysis (Tables 1a & 1b).

During the course of the study, sick animals were treated with Micotil® when first pulled and then Erythromycin® second pull. All drugs were used according to labeled directions. All treatments were recorded on Individual Animal Health Record (Attachment #3) at the time of treatment.

Challenge System

The source, genus, species, numbers or concentrations and the method of challenge are contained in company records and manuals.

Procedures/Methods/Observations

A completely randomized block design was used in this study. Cattle were allotted to blocks on the basis of initial weight. There were sixteen (16) head per pen. Steers were ranked by weight from the heaviest to lightest. The lightest and heaviest animals were randomly assigned to block one. The next heaviest and lightest animals were assigned to the second block. Then the process was continued in the following block sequence: 3-4-5-5-4-3-2-1-1-2-3-4-5 until all 80 steers were randomly assigned to each pen in a block. The treatments were randomly assigned to the pen within each block. Animal assignments were recorded on form RD022 (Randomized complete Block Worksheet).

Individual body weights were recorded in the beginning (day 0) and final day (day 28) of the study. Weights were determined on the scales as described in attachment I. Daily individual feed intake was determined by pinpointers (attachment I). Performance data were calculated from feed intake and weight data.

Methods of Data Analysis

The data were analyzed using the GLM procedure of SAS (1982). Analysis of variance was performed using steers as both a sampling and experimental units. The model specified for this analysis is given below:

$$Y_{ijklm} = U_i + T_j + B_k + B_k(T_j) + ID(T_j) + D_m(T_j) + E_{ijklm}$$

where

Y_{ijklm} = Feed intake, average daily gain, feed to gain ratio.
U_i is the overall mean.
T_j is the treatment effect.
B_k is the block effect.
D_m is the day of the trial.
$ID(T_j)$ is animal within treatment.
$B_k(T_j)$ is treatment within block.
$D_m(T_j)$ is treatment within day of trial.
E_{ijklm} is the experimental error.

When there were main effects of vaccine or injection site, the means were separated by Duncan's multiple range test (Steel and Torrie, 1980). The error term used in testing for statistical differences between means was that of the interaction where the interaction was significant ($P < .05$); where the interaction was not significant ($P > .05$), the experimental error term was used.

Results and Discussion

Table 1 shows the performance data for steers as summarized by vaccine and injection site. Steers in all treatment groups had similar (P > .05) final weights. All steers averaged 8.7 kg of daily feed consumption (Figure 1a) except steers vaccinated with Alpha-7 (sub-Q ear; A7SE) and Ultra-7 (sub-Q, prescapula; U7SP) had significantly lower (P < .05) feed intake (7.4 kg/hd/day). The control steers had total feedlot gains similar (P > .05) to steers vaccinated with A7SE and Alpha-7 (sub-Q, prescapula; A7SP). However, steers vaccinated with Vision (sub-Q, prescapula; VSP) and U7SP had significantly lower (P < .05) gains than the control steers (Figure 1b). The average daily gain of steers vaccinated with A7SE and A7SP were similar to those of the controls but higher than steers vaccinated with VSP (Figure 1c). Similarly, these steers also had lower (P <. 05) feed conversion ratios than those vaccinated with VSP (Figure 1d).

Table 2 indicates the effect of clostridial vaccines on the size and consistency of lesion of injection site of feedlot steers. Steers vaccinated with A7SE, A7SP and U7SP exhibited similar (P > .05) size lesions at the injection site (Figure 1e). However, steers vaccinated with VSP had lower (P <. 05) lesions when compared to A7SP. Steers vaccinated with A7SE and U7SP scored higher (P < .05) in consistency of lesion than the A7SP and VSP (Figure 1f). However, all lesions were scored as hard and not draining (Table 2).

Table 3 shows the Pearson correlation coefficients of several variables. Feed intake, ADG and total gain correlated negatively (R = -.26; P < .05) with size of the lesion. Also the size of the lesion was highly (R = .87; P < .001) correlated with its consistency. Table 3 also contain some prediction equations obtained by regressing various factors on size and consistency.

Figure 1 indicates the daily feed consumption pattern of all steers. The pattern indicates that steers vaccinated with U7SP and A7SE decreased their feed intake 6 days after clostridial vaccination. However the rest of the treatment groups did show appreciable drop in their feed consumption when compared to the controls.

Figure 2 shows the frequency of visits made by steers after vaccination. Steers vaccinated with A7SE exhibited a significant drop in frequency of visits 10 days after vaccination. By day 29, this group had increased the number of visits up to the rest of the other groups. It is important to note that this group also scored higher in both size and consistency of lesion (Table 2).

Figure 3 is a summary of the total daily time (minutes) spent eating by each treatment group. The pattern of time spent eating mimics that of frequency of visits. Steers vaccinated with A7SE showed a slight decrease in time spent eating 10 days after vaccination. The significant decrease in feed consumption (Table 1) in this group could be attributed to the decrease in number of visits and time spent eating.

Figure 4 shows the amount of feed consumed by each group per visit. All groups tended to exhibit significantly higher amount of feed consumed per visit during the first 10 days after vaccination. However, there was a gradual decrease in all groups throughout the rest of the study except the A7SE which increased its feed consumption per visit from day 11 to 17, after which there was a gradual drop to baseline.

Figure 5 shows the feed consumption rate (lb/min) of all treatment groups. Initial observations following vaccination indicated irregular pattern of feed consumption rate for the A7SE and U7SP groups. However, by day 10, all treatment groups exhibited a gradual drop in rate of intake except the A7SE group.

Figure 6 shows the daily amount of time spent per visit by each group. The time spent per visit pattern was variable for all treatment groups.

Conclusion

These data indicate that steers vaccinated with A7SE and A7SP had similar total feedlot gains, ADG and feed to ratios as the controls. However these groups also had greater total gain and ADG when compared to the steers vaccinated with VSP. Although a decrease in frequency of visit and total time spent eating was observed in the the A7SE vaccinated group, that did not significantly alter their total feedlot gain and feed conversion ratios when compared to the controls.

Table 1a. Basal diet fed to cattle vaccinated with different Clostridial vaccines.

Ingredient	Percent
Corn	55
Cottonseed hulls	25
Alfalfa pellets	10
Starter supplement	10

Table 1b. Ingredients and chemical composition of starter supplement fed to cattle vaccinated with different Clostridial vaccines.

Ingredient	Percent
Corn steep	27.87
Cane molasses	13.87
Feather meal	10.0
Blood meal	10.0
Animal fat	10.0
Standardi	9.5
Europe CMS	7.5
Fine lime	7.3
Suspension agent	2.0
Salt	.56
Anhydrous Ammonium	.35
Ammonium polyphosphate	.22
Trace mineral	.20
Potassium chloride	.10
Potassium sorbate	.01
Vitamin A	.0125
Vitamin E	.0110
Chemical Analysis	
Dry matter	65.0
Crude protein[a]	27.0
Crude fat	10.5
Crdue fiber	0.1
Calcium	4.0
Phosphorus	0.5
Salt	2.0
TSI[b]	8.5

[a]Not more than 8.0% equivalent protein from non-protein nitrogen.
[b]Total sugars as invert.

Table 1. Performance of feedlot steers vaccinated with different clostridial vaccines at different sites.

Item	Vaccine					
	Control	A7SE[a]	A7SP[b]	VSP[c]	U7SP[d]	SE[e]
Initial Wt (kg)	238	232	235	244	240	
Final Wt (kg)	278	267	271	273	272	
Feed intake, kg	8.8[f]	7.6[g]	8.7[f]	8.6[f]	7.2[g]	.32
Gain (kg)	40.3[f]	35.3[fg]	36.0[fg]	29.7[g]	32.2[g]	2.30
ADG (kg/d)	1.4[f]	1.3[fg]	1.3[fg]	1.1[g]	1.2[g]	.09
Feed:gain	6.3[f]	6.5[f]	7.1[fg]	9.0[g]	6.8[f]	.62

[a]Alpha-7, subcutaneous-ear; [b]Alpha-7, subcutaneous-prescapula; [c]Vision, subcutaneous-prescapula; [d]Ultra-7, subcutaneous-prescapula;
[e]Standard error of the mean (n=15).
[fg]Means within the same row with different superscripts differ ($P < .05$).

Table 2. Effect of different clostridial vaccines on the size of injection site and consistency of lesions of feedlot steers.

	Lesion	
Vaccine	Size (in.)[a]	Consistency[b]
Control	0.00[c]	0.00[c]
Alpha-7 (Subcu ear)	2.50[d]	0.88[d]
Alpha-7 (Subcu. PS[f])	1.77[de]	0.46[e]
Vision (Subcu. PS[f])	1.57[e]	0.43[e]
Ultra-7 (Subcu. PS[f])	2.07[de]	0.80[d]
SE[g]	0.17	0.10

[a]0=No lesion; 1=1-2"; 2=2-4"; 3=4-6"; 4 > 6".
[b]1=Hard, not draining; 2=Soft, not draining; 3=Draining; 4=Healed.
[cde]Column means differ ($P < .05$).
[f]Subcutaneous prescapula injection.
[g]Standard error of the mean ($n = 15$).

Table 3. Pearson correlation coefficients of total gain, average daily gain and size and consistency of injection site of steers treated with different clostridial vaccines.

Item	Size	Consistency
Feed intake, kg/hd/d	-0.35[a]	-0.37[a]
Total gain	-0.24[b]	-0.21[c]
ADG, kg	-0.24[b]	-0.21[c]
Feed:gain	-0.02	-0.02
Size (in)	-	0.87[d]
Consistency	0.87[d]	-

[a] $P < .01$
[b] $P < .05$
[c] $P < .07$
[d] $P < .001$

Prediction equations:

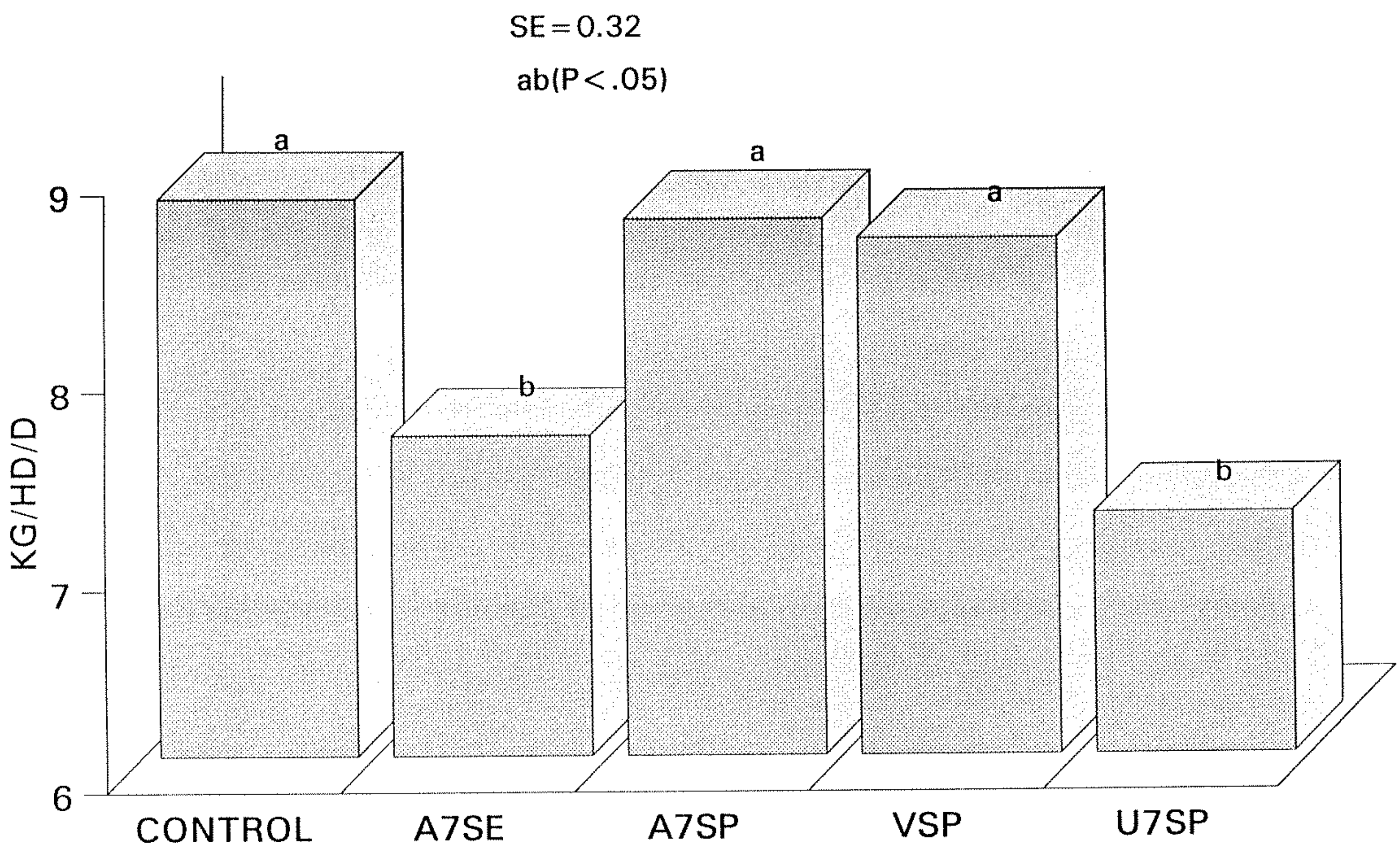
Total gain (kg) = 38.13 -2.17(size) + 0.03(consistency score).

Average daily gain (kg) = 1.36 -0.08(size) + 0.001(consistency score).

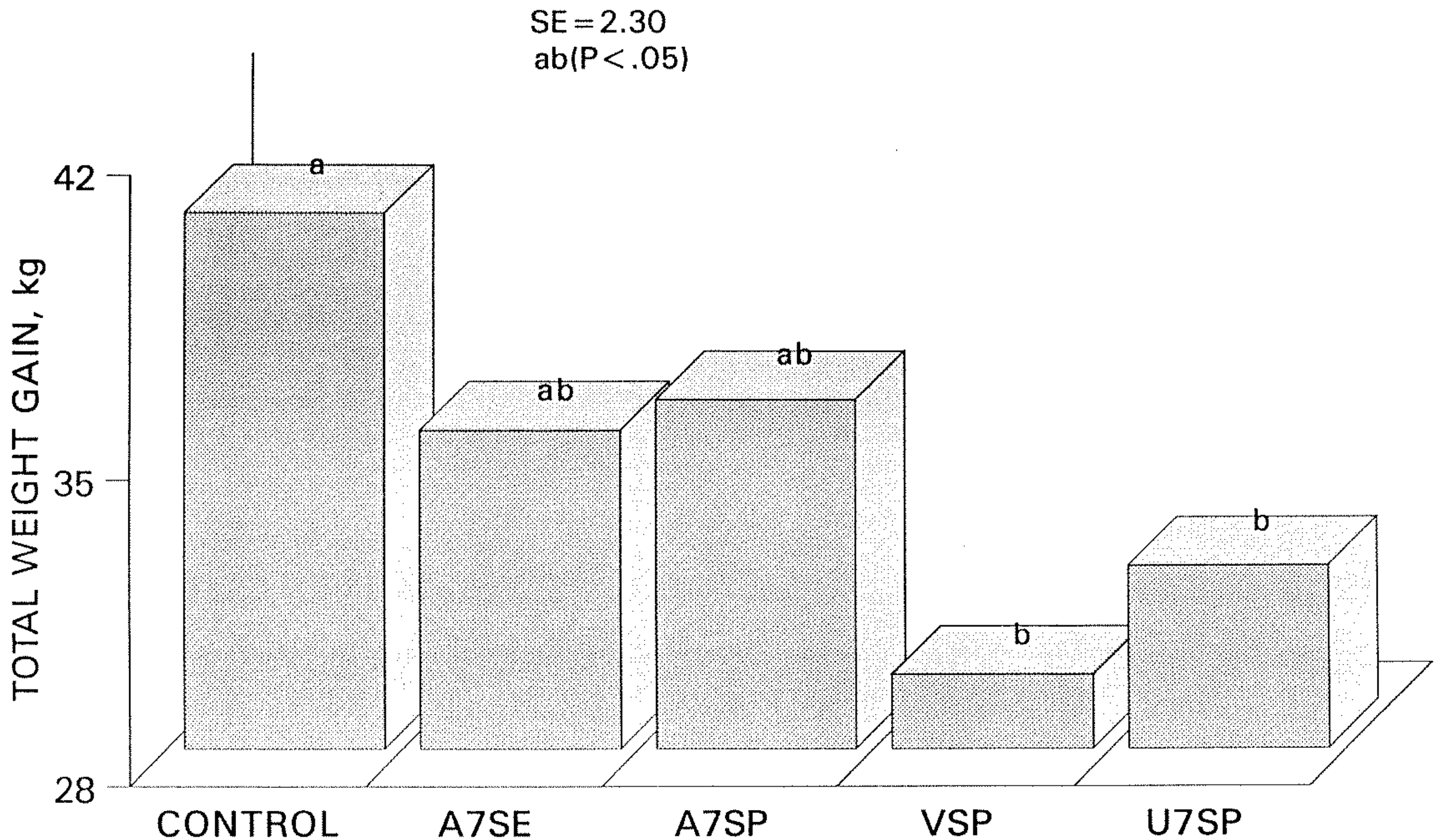
Daily feed intake (kg) = 8.74 - 0.11(size) -0.81(consistency).

Feed efficiency = 6.97 + 0.34(size) - 0.74(consistency).

IGURE 1a. EFFECT OF DIFFERENT CLOSTRIDIAL VACCINES AND INJECTION SITE ON FEED CONSUMPTION (kg) OF FEEDLOT STEERS



IGURE 1b. EFFECT OF DIFFERENT CLOSTRIDIAL VACCINES AND INJECTION SITE ON TOTAL WEIGHT GAIN (kg) OF FEEDLOT STEERS



IGURE 1c. EFFECT OF DIFFERENT CLOSTRIDIAL VACCINES AND INJECTION SITE ON AVERAGE DAILY GAIN (kg) OF FEEDLOT STEERS

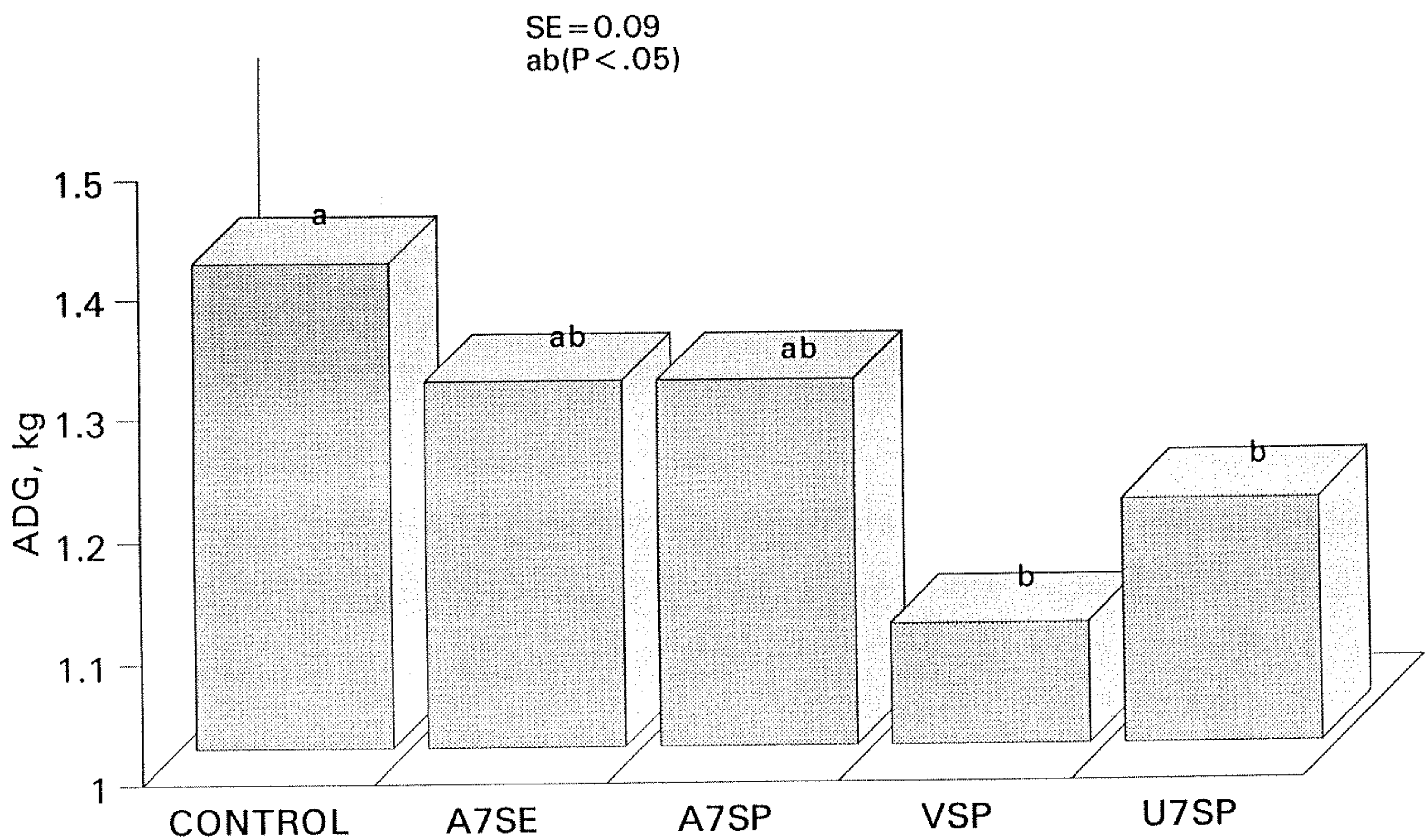
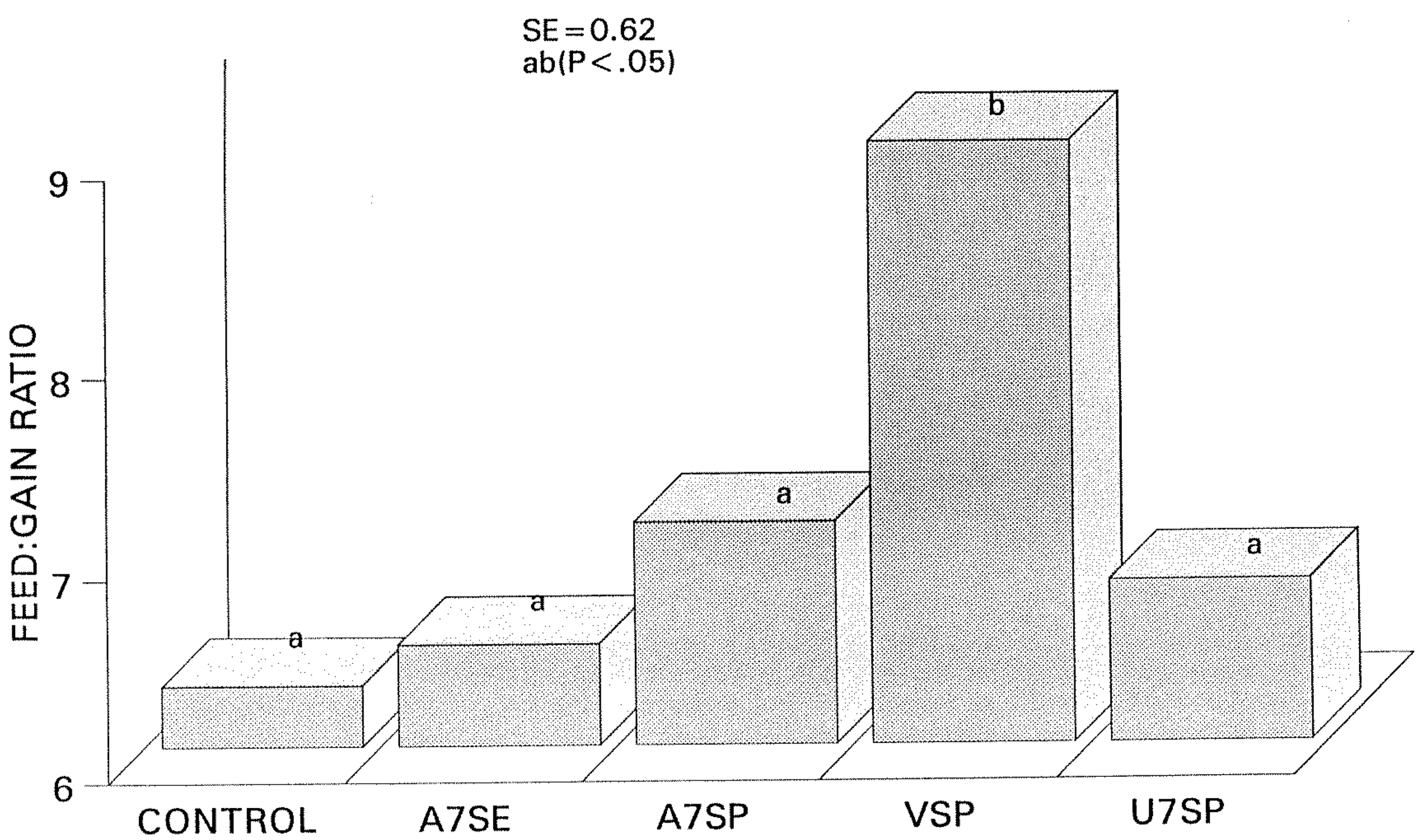
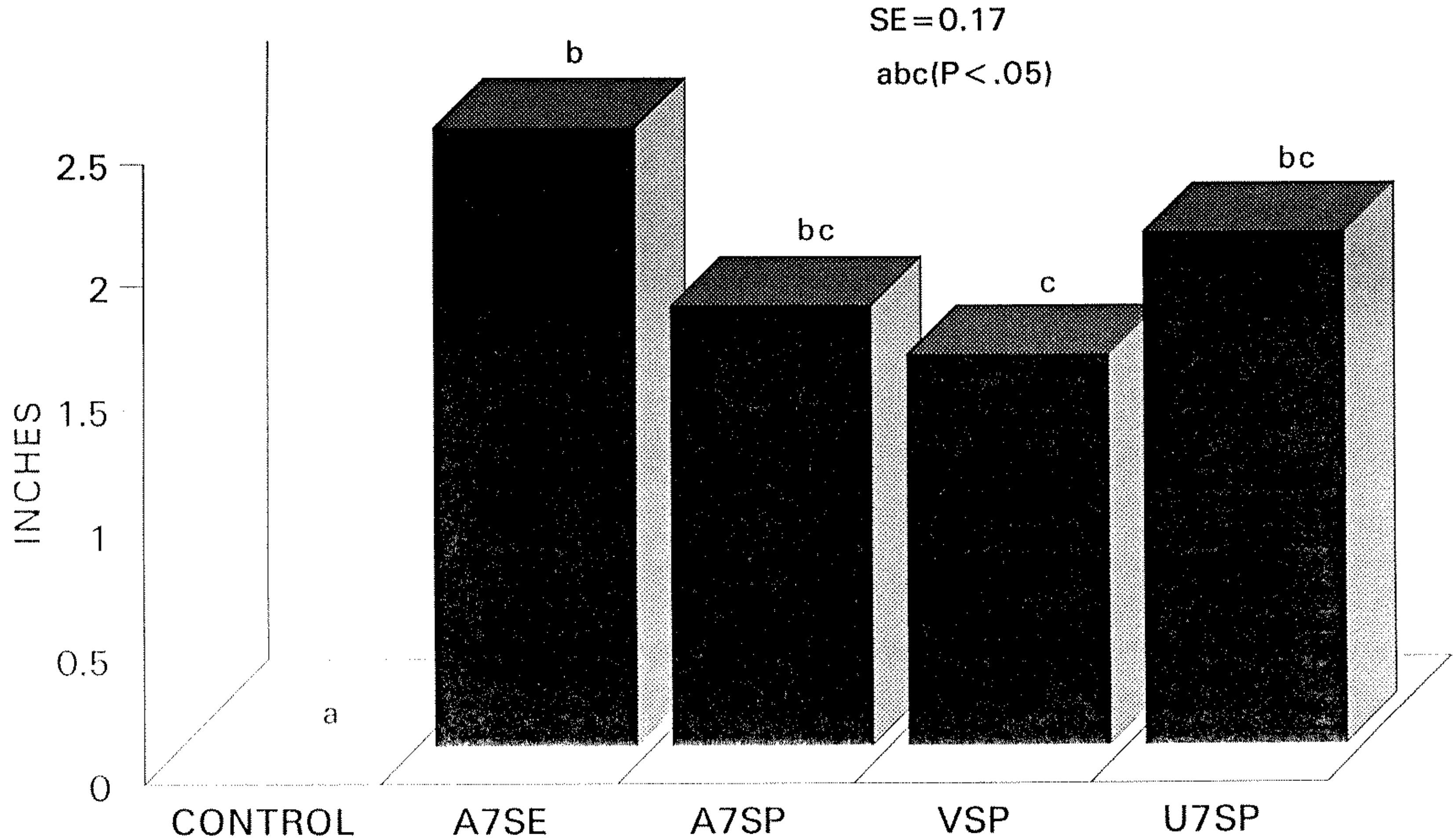


FIGURE 1d. EFFECT OF DIFFERENT CLOSTRIDIAL VACCINES AND INJECTION SITE ON FEED EFFICIENCY OF FEEDLOT STEERS



IGURE 1e. EFFECT OF DIFFERENT CLOSTRIDIAL VACCINES AND INJECTION SITE ON SIZE OF INJECTION SITE (inches) OF FEEDLOT STEERS



IGURE 1f. EFFECT OF DIFFERENT CLOSTRIDIAL VACCINES AND INJECTION SITE ON CONSISTENCY OF INJECTION SITE OF FEEDLOT STEERS

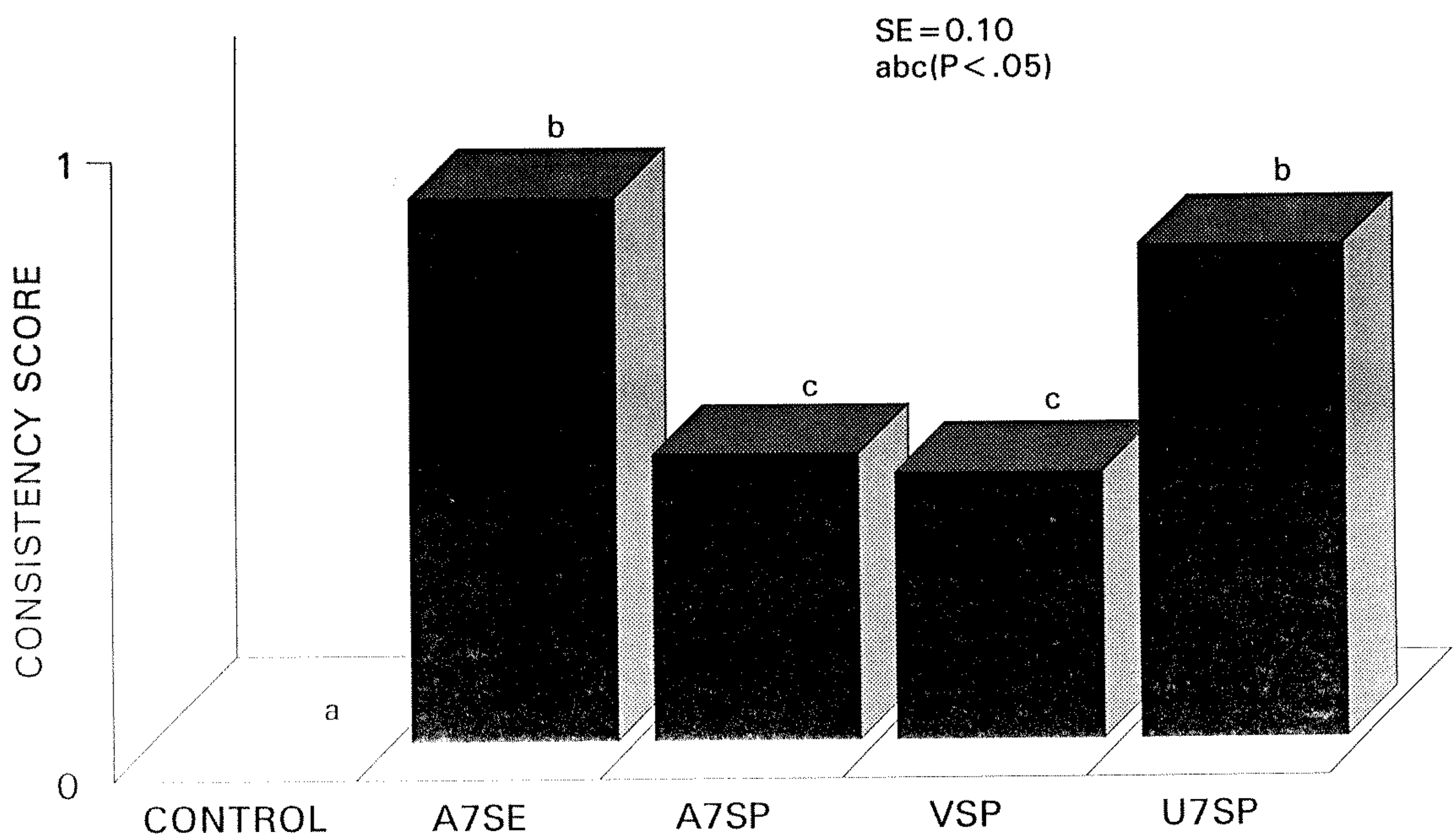


FIGURE 1. EFFECT OF DIFFERENT CLOSTRIDIAL VACCINES AND INJECTION SITE ON FEED CONSUMPTION PATTERNS OF FEEDLOT STEERS

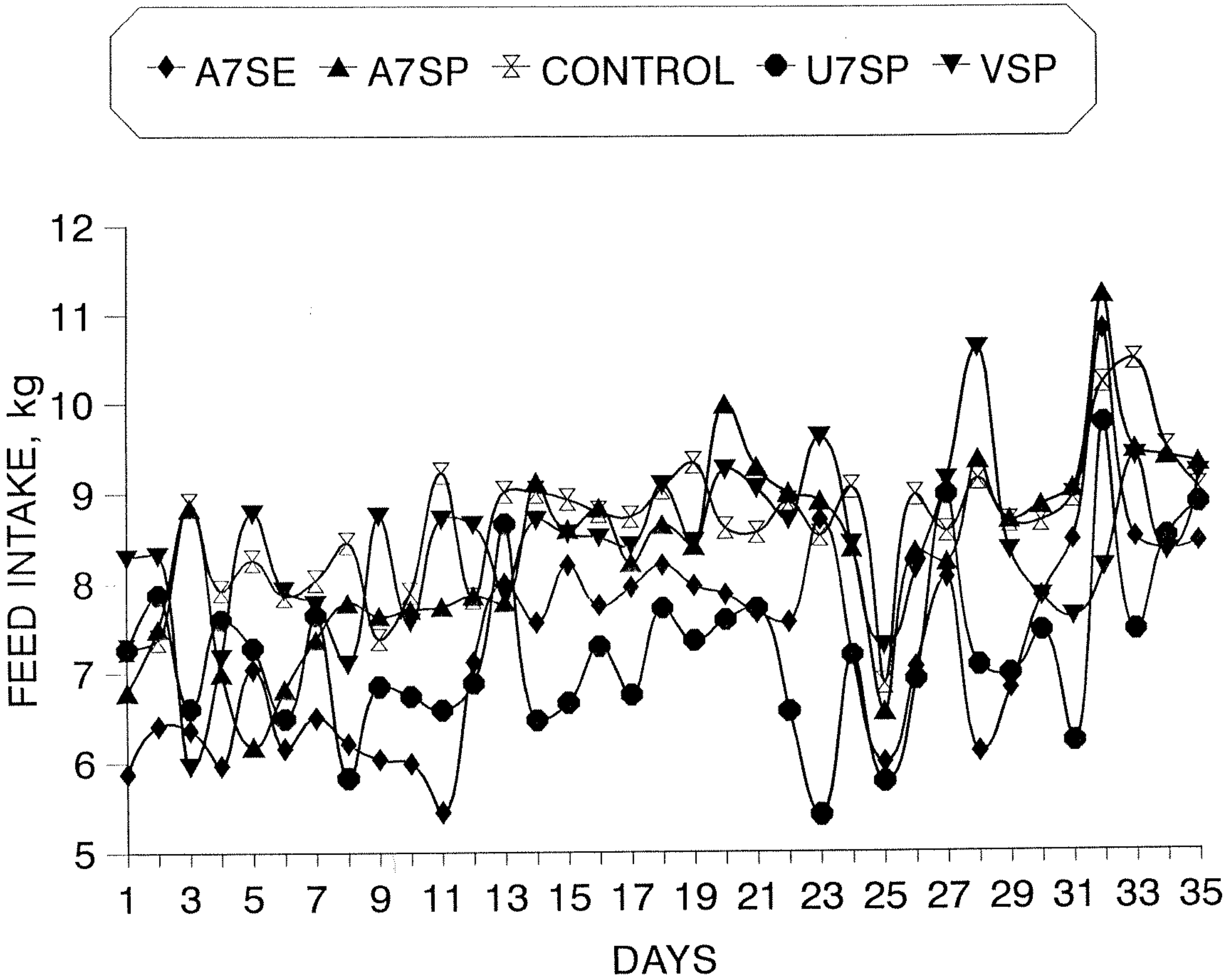


FIGURE 2. EFFECT OF DIFFERENT CLOSTRIDIAL VACCINES AND INJECTION SITE ON FREQUENCY OF VISITS OF FEEDLOT STEERS

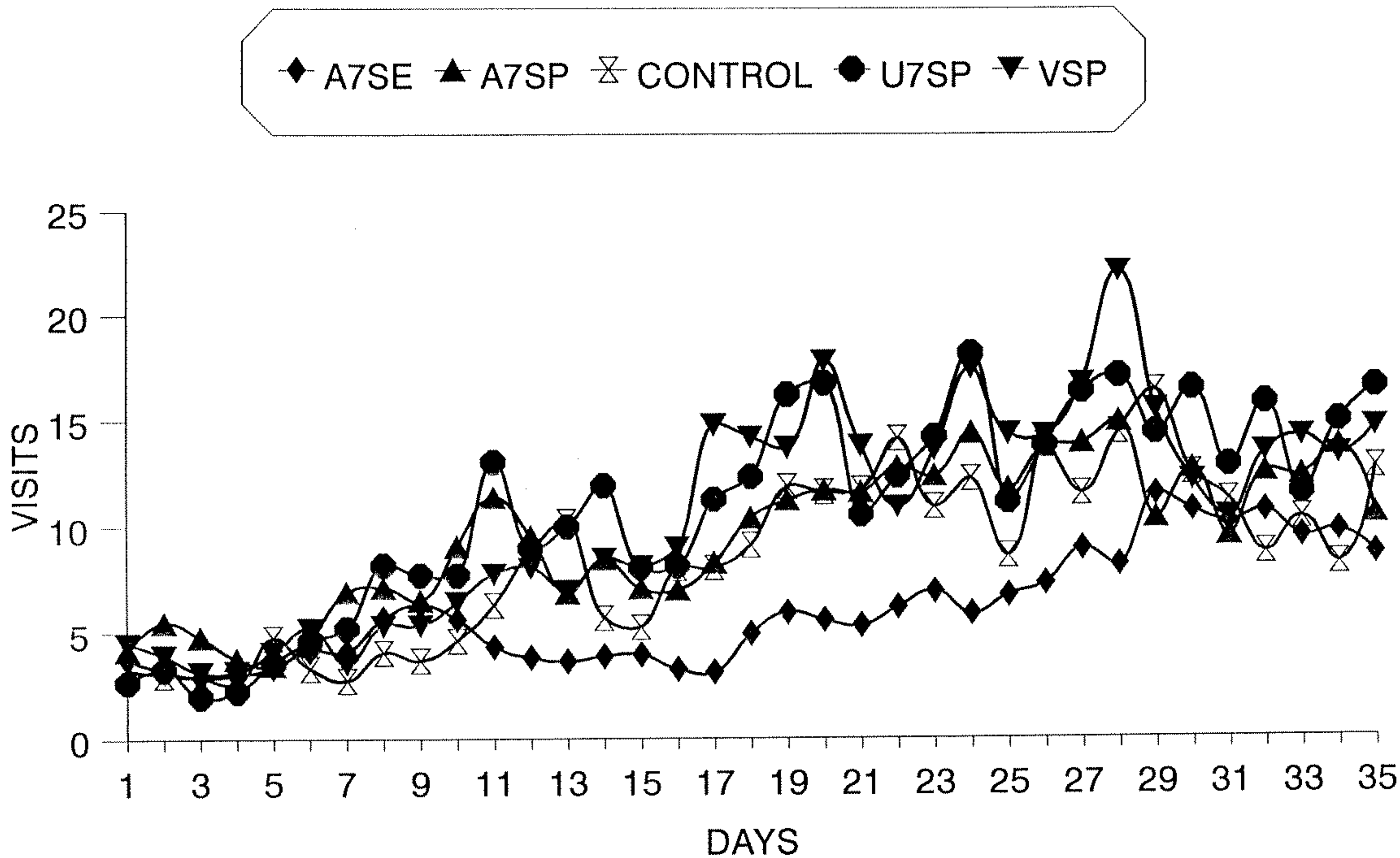


FIGURE 3. EFFECT OF DIFFERENT CLOSTRIDIAL VACCINES AND INJECTION SITE ON TIME SPENT EATING OF FEEDLOT STEERS

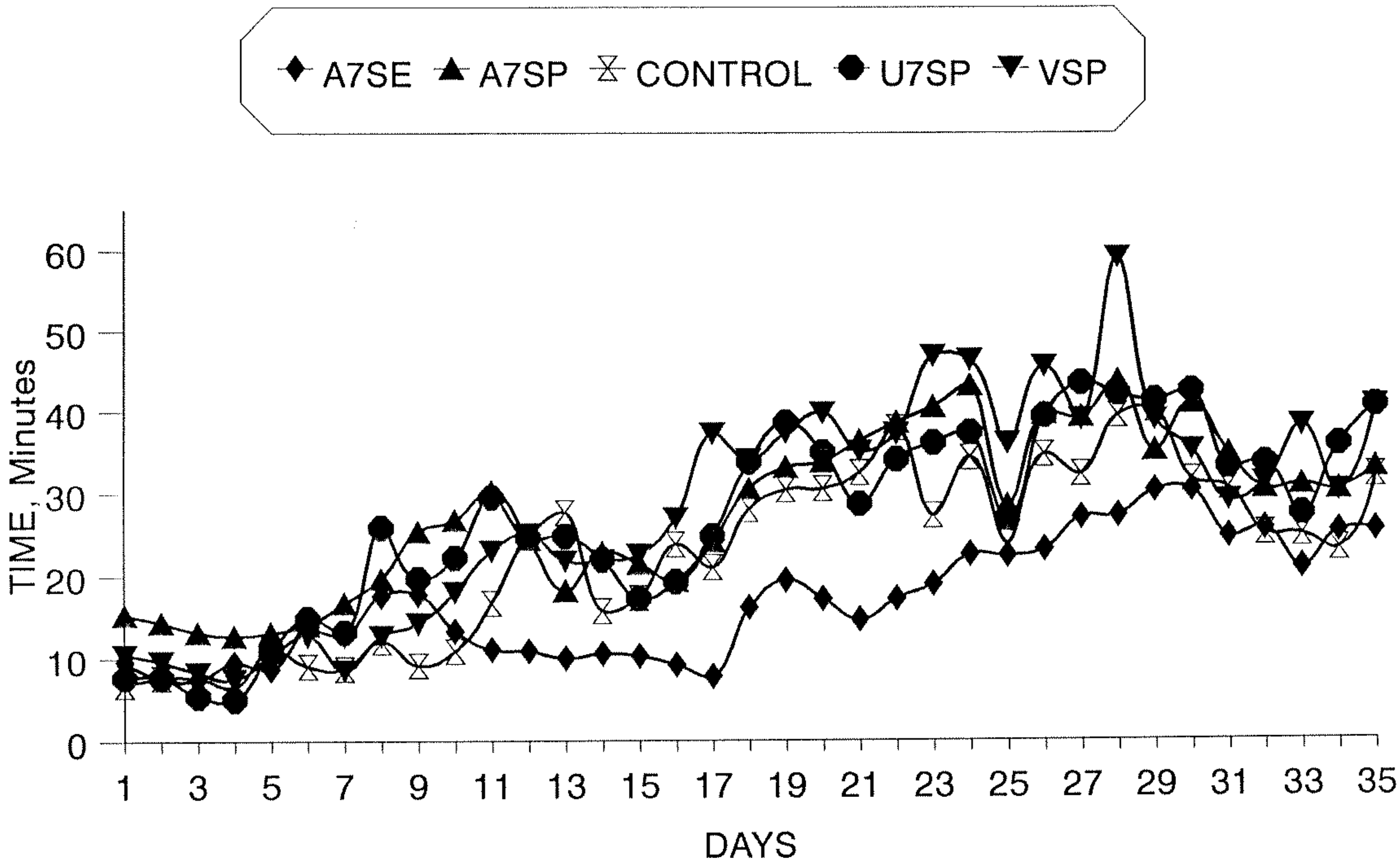


FIGURE 4. EFFECT OF DIFFERENT CLOSTRIDIAL VACCINES AND INJECTION SITE ON FEED CONSUMPTION PER VISIT OF FEEDLOT STEERS

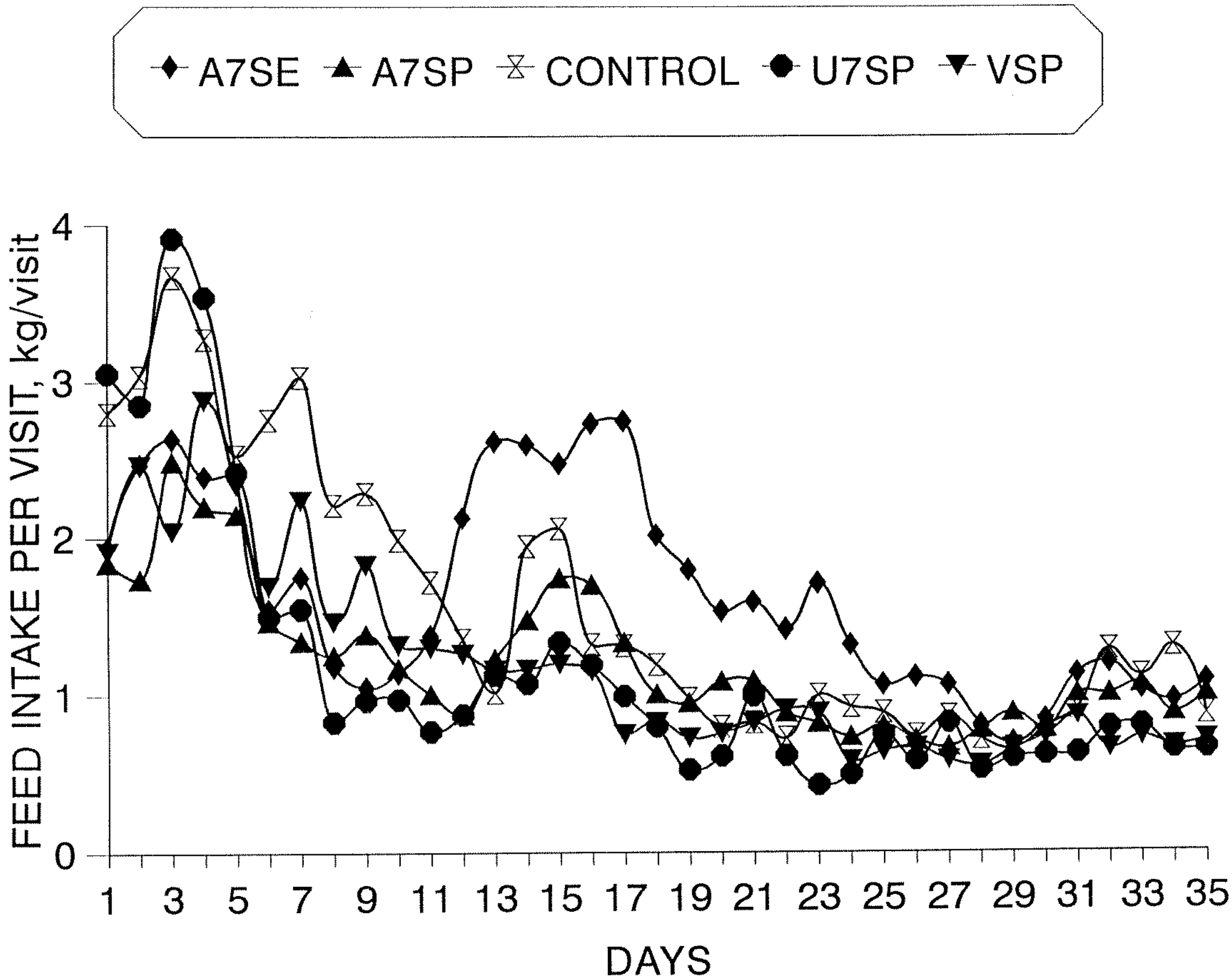


FIGURE 5. EFFECT OF DIFFERENT CLOSTRIDIAL VACCINES AND INJECTION SITE ON FEED CONSUMPTION RATE (kg/minute) OF FEEDLOT STEERS

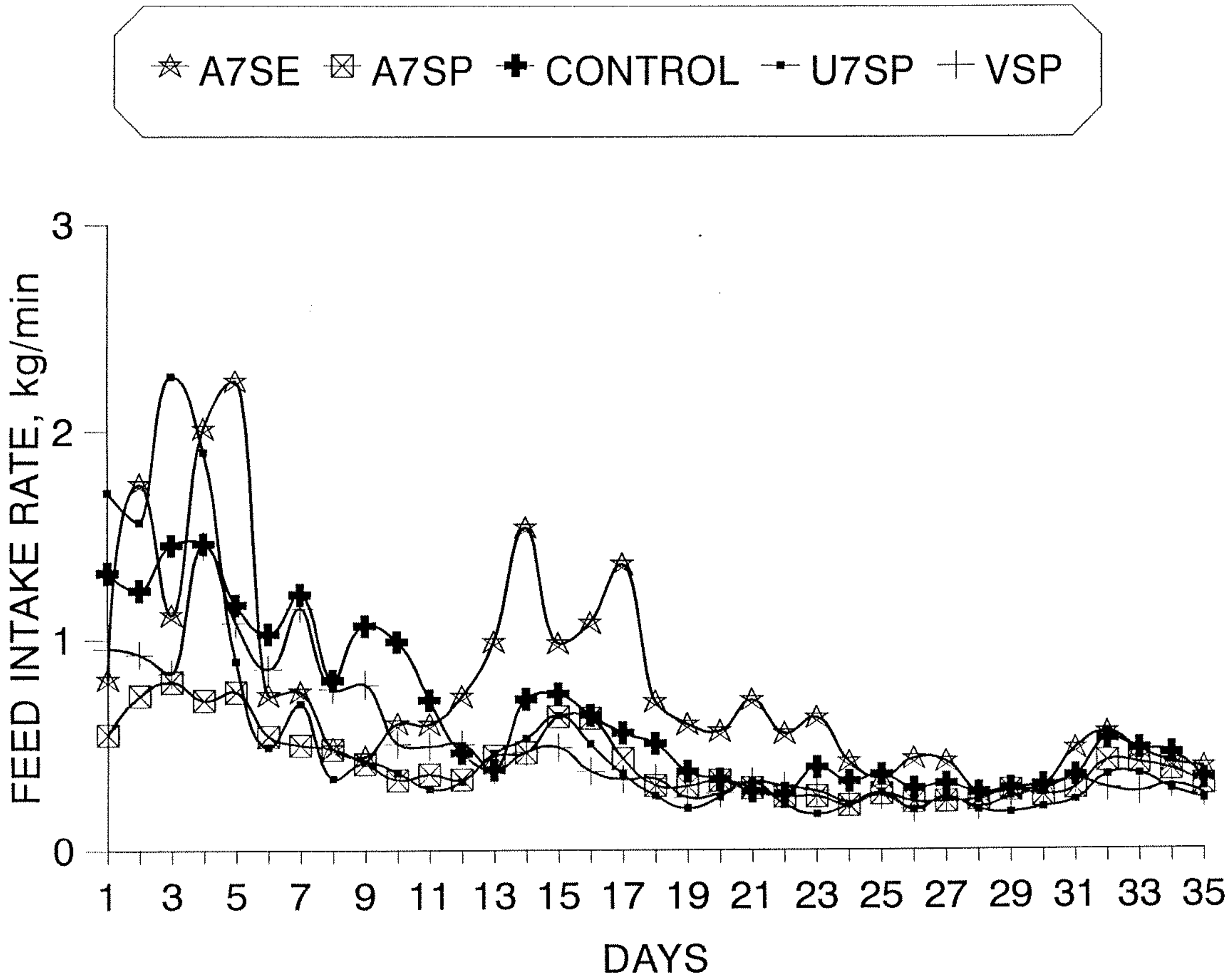


FIGURE 6. EFFECT OF DIFFERENT CLOSTRIDIAL VACCINES AND INJECTION SITE ON TIME SPENT PER VISIT OF FEEDLOT STEERS