South Dakota State University

Department of Animal Science | SDSU Extension

Animal Science Research and Extension Report - Sheep

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Statistics in the South Dakota State University Animal Science Report

The purpose of research at SDSU is to provide reference information that represents the various populations of livestock production. Since the researcher cannot apply treatments to every member of a population, he/she must sample the population. The use of statistics allows the researcher and readers the opportunity to evaluate separation of random occurrences and real biological effects of a treatment. The following is a brief description of the major statistics used in these proceedings.

- **Mean:** Data for individual experimental units (cows, pens of cattle, steers, steaks) exposed to the same treatment are generally averaged and reported in the text, tables, and figures. The statistical term representing the average of a group of data points is mean.
- **Variability:** The inconsistency among the individual experimental units used to calculate a mean for the item measured is the variance. For example, if the ADG for all the steers used to calculate the mean for a treatment is 3.5 lb then the variance is zero. However, if ADG for individual steers is used to calculate the mean for a treatment range from 1.0 lb to 5.0 lb, then the variance is large. The variance may be reported as standard deviation (square root of the variance) or as standard error of the mean. The standard error is the standard deviation of the mean as if we had done repeated samplings of data to calculate multiple means for a given treatment. In most cases, treatment means and their measure of variability will be expressed as follows: 3.50 ± 0.150. This would be a mean of 3.5 followed by the standard error of the mean of 0.150. A helpful step combining both the mean and the variability from an experiment to conclude whether the treatment results in a real biological effect is to calculate a 95% confidence interval. This interval would be twice the standard error added to and subtracted from the mean. In the example above, this interval is 3.20 to 3.80 lb. If in an experiment, these intervals calculated for treatments of interest overlap, the experiment does not provide satisfactory evidence to conclude that treatments effects are different.
- ***P*-value:** Probability (*P*-value) refers to the likelihood the observed differences among treatment means are due to chance. For example, if the author reports $P \leq 0.05$ as the significance level for a test of the differences between treatments as they affect ADG, the reader may conclude there is less than a 5% chance the differences observed between the means are a random occurrence (or 95% sure that the difference was not due to random chance). Due to this small probability of chance, there must be a difference between the treatments in their effect on ADG. Authors may discuss tendencies in data when P values are between 0.06 and 0.15, because they are not confident the differences among treatment means are real treatment effects. With *P*-values of 0.06 and 0.15 the chance random sampling caused the observed differences is 1 in 16.7 and 1 in 6.7, respectively.
- **Linear & Quadratic Contrasts:** Some articles contain linear (L) and quadratic (Q) responses to treatments. These parameters are used when the research involves increasing amounts of a factor as treatments. Examples are increasing amounts of a ration ingredient (corn, by- product, or feed additive) or increasing amounts of a nutrient (protein, calcium, or vitamin E). The L and Q contrasts provide information regarding the shape of the response. Linear indicates a straight-line response and quadratic indicates a curved response. P-values for these contrasts have the same interpretation as described above.
- **Correlation (r):** Correlation indicates amount of linear relationship of two measurements. The correlation coefficient can range from -1 to 1. Values near zero indicate a weak relationship, values near 1 indicate a strong positive relationship, and a value of -1 indicates a strong negative relationship.

- **Chi square (χ^2):** A statistical test used to compare observed results with expected results. The purpose of this test is to determine if a difference between observed data and expected data is due to chance, or if it is due to a relationship between the variables being studied. This is a nonparametric test used for data that do not follow the assumption of a normal distribution. The null hypothesis is that there are no differences between the variables. A $\chi^2 \leq 0.05$ is considered statistically significant, thus, the null hypothesis should be rejected in favor of the alternative hypothesis.

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Effects of Steam Flaked Corn on Growth Performance, Carcass Characteristics, and Gastrointestinal Health in Feedlot Lambs

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Rationale and Approach

Feeding steam-flaked corn to cattle has been shown to increased feed efficiency and average daily gain (ADG). Steam flaked corn has recently become available as an affordable option to sheep producers in eastern South Dakota. However, there has been little research done to determine if the same performance effects observed in cattle are mimicked in sheep. The objective of this study was to evaluate the growth performance, carcass characteristics, and gastrointestinal health of feedlot wethers fed a TMR containing steam flaked corn. Polypay wethers (n = 32) were allocated by body weight to 16 pens (2 lambs/pen, 8 pens/treatment). Two treatments were applied: 1) TMR containing steam flaked corn (SFC) and 2) TMR containing rolled corn (RC). Lambs were fed for 63 days and received a booster vaccination of clostridium types C&D and tetanus on d -3. Ad Libitum intake was achieved by offering 10% more diet dry matter (DM) than the previous day's dry matter intake (DMI).

Results and Discussion

Lambs fed the RC diet had a greater average daily gain than the SFC fed lambs (0.47 and 0.58 lb., $P = 0.03$). There was no difference in body weight, DMI, or feed efficiency between treatments ($P \geq 0.29$). No difference in carcass characteristics was observed between treatments ($P = 0.15$). Wethers fed the SFC ration tended to have more severe rumen lesions than the RC treatment ($P = 0.09$, 12.4 and 2.7%, respectively). Lambs in the RC treatment tended to have a larger absorptive surface area (ASA) and papillae area as a percentage of ASA ($P = 0.07$ and $P = 0.09$). There was no difference between number of papillae (NOP) or mean papillae area (MPA) between treatments ($P \geq 0.11$).

Implications

Lambs fed the RC ration performed better with a 19% increase in ADG and tended to have better gastrointestinal tract health. On average, the processing cost of rolling corn costs producers up to $7.00/ ton ($0.196/ bu.). The processing cost of steam flaked corn is more costly at $14.00/ ton ($0.39/ bu.). The results of this study suggest steam flaking corn in replacement of rolled corn offers no additional benefits and is more costly to producers raising feeder lambs. Future research should further explore the impact of chewing behavior in lambs, which often results in smaller particles compared to cattle mastication. Additionally, steam flaking corn is a precise process that may need more research before the same performance effects observed in feedlot cattle are seen in feedlot lambs.

References

Pereira, I.; Costa, C.; Martins, C.; Pereira, M.; Squizatti, M.; Owens, F.; Cruz, G.; Millen, D.; Arrigoni, M. Voluntary daily fluctuation in dry matter intake is associated to feedlot performance, feeding behavior and rumen morphometrics in beef cattle. Livest. Sci. 2021, 250, 104565.

Table 1. Growth performance, carcass characteristics, and rumen morphometric responses through d 63. Two treatments were applied: 1) TMR containing steam flaked corn (SFC) and 2) TMR containing rolled corn (RC).[1]

Item	SFC	RC	SEM	*P*-value
Body Weight				
Initial BW, lb.	67.3	63.0	4.69	0.32
Final BW, lb.	101.2	104.1	3.81	0.31
Growth performance				
ADG, lb.	0.47	0.58	0.029	0.03
DMI, lb.	3.46	3.58	0.138	0.53
G:F	0.14	0.17	0.013	0.12
Dietary Energetics[2]				
O:E NEm	0.69	0.77	0.022	0.06
O:E NEg	0.62	0.72	0.028	0.07
MQ, Mcal/MBS	0.140	0.120	0.0070	0.13
Carcass Traits				
EBW, lb.	88.4	90.0	3.38	0.58
HCW, lb.	54.7	56.7	2.08	0.21
DP, %[3]	53.99	54.51	0.267	0.22
RF, in.	0.17	0.20	0.017	0.15
REA, in. sq.	2.01	2.03	0.059	0.78
Rumen Morphometrics				
Rumen papillae count	89.50	98.37	0.038	0.11
Mean papillae area, cm sq.	0.117	0.138	0.0118	0.24
Absorptive Surface Area, cm sq./ cm sq. of rumen wall	11.09	14.07	0.906	0.07
Papillae area % of ASA	92.64	94.35	0.601	0.09
Rumen Scores				
Healthy, %	23.11	60.66	-	0.09
Mild, %	44.24	30.71		
Moderate, %	20.22	5.94		
Severe, %	12.43	2.69		

[1]A 4% pencil shrink was applied to all BW measures to account for digestive tract fill.
[2]Calculated according to Zinn and Shen, 1998 using live-basis growth performance.
[3]Calculated as: (HCW/Final BW) × 100.

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