Effects of nutritional plane before breeding on body condition score, mass indexes, and chemical composition of hair sheep

Raquel Lourencon, Lionel Dawson, Ryszard Puchala, Luana Ribeiro, Terry Gipson, Erick Loetz, Miguel Rojas, Mauricio Calle, Adaven Scronce, and Arthur L. Goetsch

American Institute for Goat Research, Langston University, Langston, Oklahoma, USA

INTRODUCTION

- Crop residues are often fed to ruminants, usually with a supplement.
  - It can be useful to periodically determine BW and evaluate indicators of body composition to assess the appropriateness of the level and composition of the supplement.
- One common means of assessing body composition is body condition score (BCS).
  - However, because BCS is subjective, there has been interest in use of more objective measures, including body mass indexes (BMI).
  - There has not been much attention given to relationships of various BMI to body composition.
  - A method such as urea dilution or urea space offers a relatively simple means of determining body composition.
- The three most common hair sheep breeds in the USA are Dorper, Katahdin, and St. Croix, which differ in many ways.
  - But, responses to varying nutritional planes at critical times such as the breeding season have not been studied.
- Therefore, objectives were to evaluate indicators of body composition with Dorper, Katahdin, and St. Croix sheep subjected to different nutritional planes.

MATERIALS AND METHODS

- The study occurred in the Fall of 2018 (September 10), with lambing in the Spring of 2019.
- 85 female hair sheep (most ewes) - 25 Dorper (D), 27 Katahdin (K), and 33 St. Croix (S)
  - 4.9 yr of age (SEM = 0.20); 2.8 to 11.1 yr
- Allocated to 4 groups per breed based on BW and age, with 6 to 9 per group
- Supplement treatments (2 breed groups/treatment):
  - Soybean meal (SBM) at approximately 0.16% of initial BW (L)
  - 25% SBM and 75% ground corn at approximately 0.8% BW (DM basis; H)
- Measures at 0, 4, and 8 wk
  - Shrunk (24 h) BW (EBW)
  - BCS (1-5)
  - Height at the withers (Wither) and length from the point of the shoulder to pin bone (Pin)
  - BMI addressed here = BW / (Wither × Pin) [g/cm^2]
  - Urea space (USP) or dilution method to estimate body composition
    - USP = urea infused/change in serum concentration before infusion and at 12 min
    - kg empty body water (EBH$_2$O) = 7.86 + (0.259 × EBW in kg) + (0.195 × USP in kg)
    - kg empty body fat (EBFAT) = -8.92 + (0.625 × EBW in kg) – (0.275 × USP in kg)
    - % empty body protein (EBPRO) = % EBH$_2$O × 0.27173
    - 23.096 and 39.330 kJ/g of protein and fat, respectively
- Animal group or pen within the breed and supplement treatment the experimental unit

Week 8

Item		D-L	D-H	K-L	K-H	S-L	S-H
				Treatment			
Shrunk BW (kg)		61.30	64.95	59.06	65.76	49.19	55.43
Water (%)		47.24	46.30	48.16	46.43	49.70	48.01
Fat (%)		36.05	37.15	34.87	37.00	33.37	35.32
Protein (%)		12.84	12.58	13.09	12.62	13.50	13.05
Energy (MJ/kg)		17.15	17.52	16.74	17.45	16.24	16.90
BCS		3.27	3.61	3.33	3.57	2.91	3.36
BMI (g/cm^2)		13.46	14.52	12.50	13.30	10.96	12.09

Change from week 0 to 8

Item		D-L	D-H	K-L	K-H	S-L	S-H
				Treatment			
Shrunk BW (kg)		-0.80	2.90	-2.74	3.33	-2.02	3.36
Water (kg)		-0.47	0.59	-0.89	1.13	-0.82	0.87
Fat (kg)		-0.14	2.03	-1.45	1.70	-0.85	2.10
Protein (kg)		-0.13	0.16	-0.24	0.31	-0.22	0.23
Energy (MJ)		-8.4	83.7	-62.5	73.8	-38.4	88.1
BCS		-0.02	0.20	0.04	0.29	-0.08	0.17
BMI (g/cm^2)		-0.265	0.297	-0.185	0.491	-0.571	0.587

Relationships between composition and BCS and BMI in week 8

Item		BMI	Shrunk BW (kg)	Water (%)	Fat (%)	Protein (%)	Energy (MJ/kg)
BCS	r	0.73	0.75	-0.64	0.60	-064	0.59
	P	<0.001	0.001	<0.001	<0.001	<0.001	<0.001
BMI	r		0.83	-0.70	0.66	-0.65	0.59
	P		<0.001	<0.001	<0.001	<0.001	<0.001

Relationships between change in composition and BCS and BMI from week 0 to 8

Item		BMI	Shrunk BW (kg)	Water (kg)	Fat (kg)	Protein (kg)	Energy (MJ)
BCS	r	0.27	0.45	0.44	0.35	0.44	0.35
	P	0.020	0.001	0.001	0.004	<0.001	0.002
BMI	r		0.59	0.42	0.54	0.42	0.56
	P		<0.001	<0.001	<0.001	<0.001	<0.001

DISCUSSION

- Supplement treatment had appreciable effects on change in BW and tissue mass, which were similar among breeds.
- Change in BMI was relatively greater than that in BCS.
- Relationships with body composition in week 8 were either similar between BCS and BMI or slightly stronger for BMI.
- However, the r between change in mass of fat and energy were considerably greater for BMI than for BCS.
- In conclusion, a BMI can be more highly related to and predictive of change in body composition of hair sheep resulting from different nutritional planes compared with BCS.