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METABOLIC STUDIES OF PRONGHORN ANTELOPE

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ABSTRACT

Six young female antelope were trained to accept metabolic chambers which were constructed to permit temperature regulation. Metabolic response of fasting antelope to age followed a pattern similar to that of other ruminants. Metabolic rate dropped rapidly prior to seven months of age and became relatively stable after this age. The mean fasting metabolic rate of mature pronghorn is approximately 70 kcal/$kg^{3/4}$/day. The thermoneutral area for fasting antelope ranged from approximately 32°C to a point just above 0°C. Digestible energy for pronghorn on a mixed concentrate and leafy alfalfa diet was not different from domestic ruminants. Pronghorn, however, metabolized a greater percentage of its digested energy than reported for some domestic ruminants.

INTRODUCTION

Preliminary energy flow trials with four pronghorn antelope (*Antilocapra americana*), reported in the 1969 progress report, produced results similar to those described for other ruminants, with the possible exceptions of total heat production and fasting metabolic rates (Wesley et al. 1970). Fasting metabolic rates averaged above the interspecific mean of 70 kcal/$kg^{3/4}$/day; similar results have occurred with mature wild ruminants from other studies. The comparatively high heat production reported last year with our antelope was probably due to the ages of the animals, since they were only 4 to 6 months old during those preliminary measurements.

In the latest part of our study of energy metabolism and water kinetics in pronghorn, six young female antelope were similarly trained to accept metabolic chambers which were constructed to permit temperature regulation. These facilities also allowed the measurement of heat production by the method of indirect calorimetry. In addition, accurate records could be maintained on total intake and excretion for each animal.

OBJECTIVES

(*i*) Partition energy through the pronghorn, taking into consideration the effects of age and temperature.

(*ii*) Gain some index to the upper and lower critical temperatures for pronghorn.

(*iii*) Gain some insight to the effects of age-temperature interaction, artificial lighting, and barometric pressure on total food intake. Relative humidity was not considered since the refrigerated

chambers removed the moisture from the air and created conditions too artificial for biological validity.

(*iv*) Define water kinetics under the conditions listed above.

EXPERIMENTAL DESIGN

(*i*) Age effect on metabolic rate was determined by conducting four trials at different ages with the temperature constant at 21°C.

(*ii*) Temperature effect was measured by conducting five trials at equal increments from -12°C to 32°C. Food and water intake, excretion losses, and metabolic rates were measured for each antelope. Two of the antelope were also subjected to -23°C, during which time their metabolic rates were recorded. This temperature range was selected to include the normal environmental temperatures encountered by wild pronghorn.

(*iii*) Food intake in grams per hour and barometric pressures in millimeters of mercury were recorded each morning and afternoon. Lights in the animal room were controlled by a timer to correspond approximately with sunrise and sunset.

RESULTS

Metabolic response of fasting antelope to age followed a pattern similar to that of other ruminants (Fig. 1). Data indicate that the fasting metabolic rate (FMR) drops rapidly prior to seven months of age and becomes relatively stable after this point. The mean FMR of a metabolically mature pronghorn is approximately 70 kcal/kg$^{3/4}$/day, which is considerably lower than reported for other mature wild ruminants. This apparent discrepancy may be due to

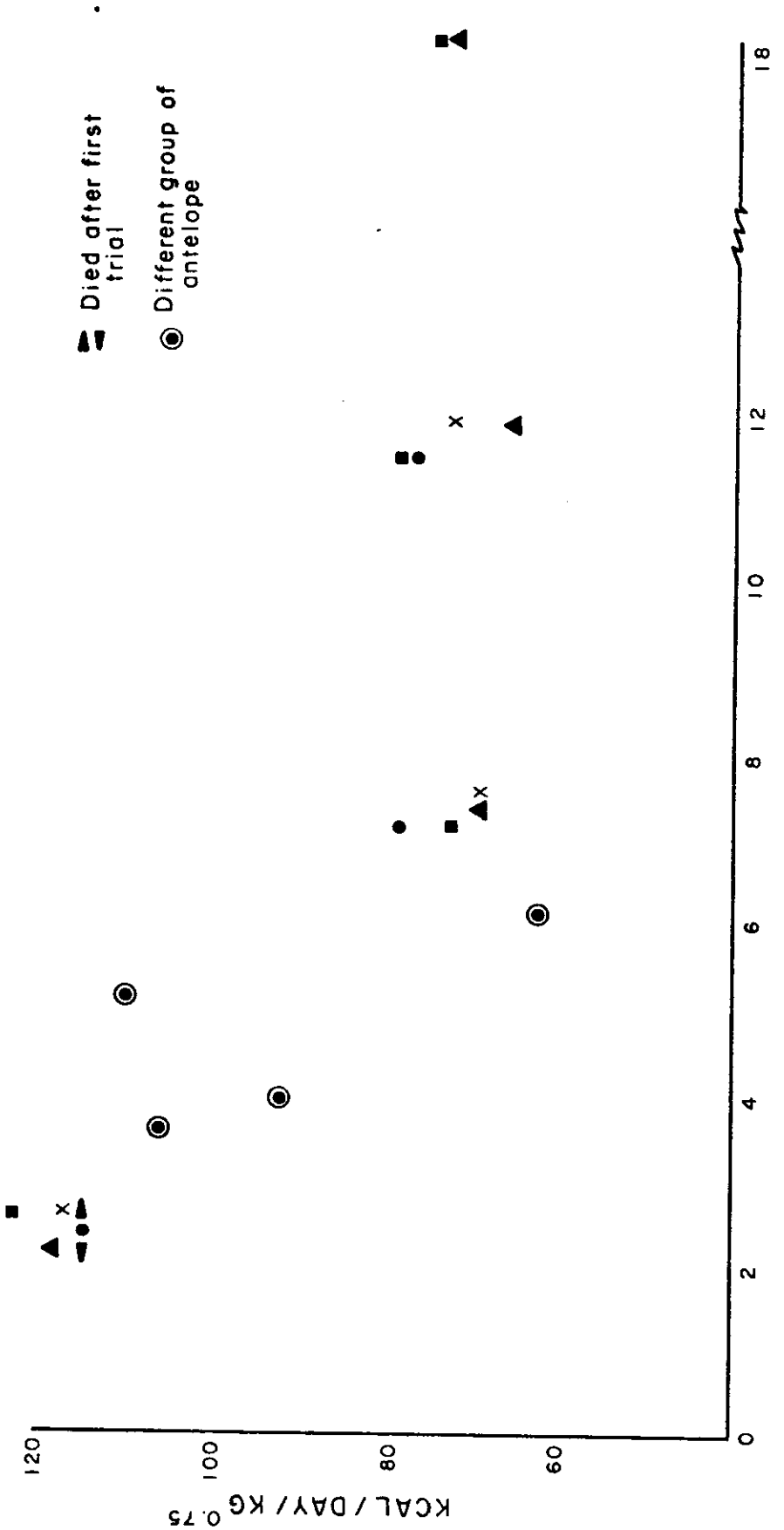

Fig. 1. Metabolic response of fasting antelope to age.

differences in animal training between investigators (Graham 1958). Data gathered in this study are subject to slight modifications, since one necessary correction for the respiration equipment has not been made at this report.

Metabolic response of fasting antelope to temperature showed that the thermoneutral area ranges from some point just below 32°C to a point just above 0°C (Fig. 2). Although the response to temperature varied widely between animals, individuals which showed the greatest response to low temperatures responded the least to high temperature. This fact may be attributed to the lighter hair coat on these animals.

Digestible energy for pronghorn on a mixed concentrate and leafy alfalfa diet, was not different from certain domestic ruminants (Table 1). Pronghorn metabolized a greater percentage of its digested energy than reported for some domestic ruminants (Maynard and Loosli 1962). Rogerson (1968) found metabolizable energy to be high for the eland and the wildebeest, and that these animals were generally more efficient at using this energy for production than were cattle and sheep.

Total heat production, as a percentage of gross energy intake, did not change noticeably as the pronghorn increased in age. With age, however, there was a decrease in the portion attributed to fasting heat production and a general increase in the portion attributed to heat increment. Net energy of production generally decreased with age and showed considerable variation (Table 1).

The effects of age-temperature interaction, artificial lighting, and barometric pressure on total food intake have not been determined, but will be reported in the June summary.

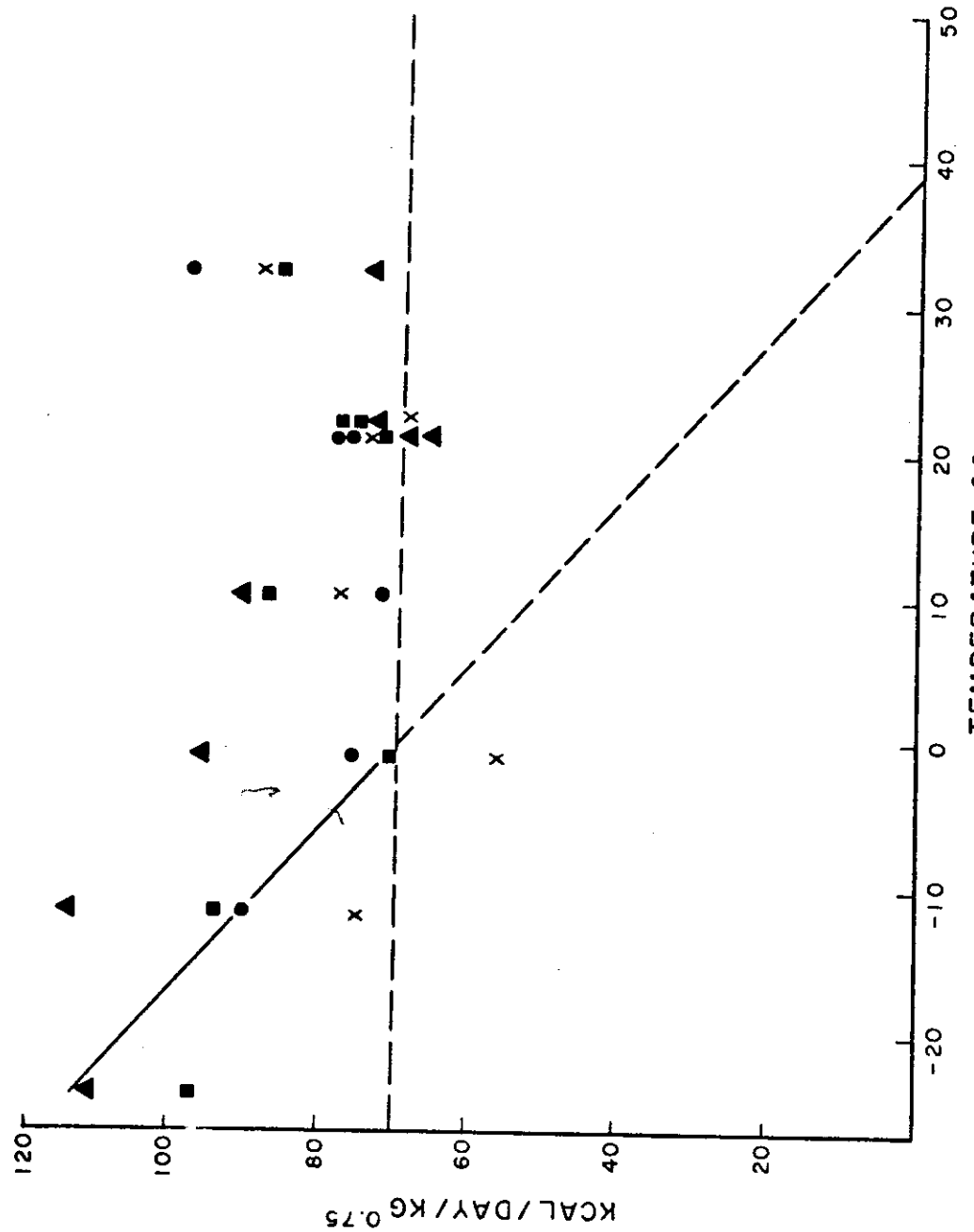

Fig. 2. Metabolic response of fasting female antelope to temperature.

Table 1. Energy utilization by female antelope (percent of gross energy intake).

Metabolic Status	Digestible Energy	ME_n	Total Heat Prod.		NE_p
			Fasting Heat Production	Heat Increment	
Immature (2-2½ months)	84.9 *±1.0	79.4 ±.9	46.7 ±3.4	12.3 ±2.4	20.4 ±4.1
Mature (7-12 months)	73.1 ±3.2	67.9 ±3.2	35.6 ±3.7	22.2 ±3.8	10.6 ±6.1

* 90% Confidence limits

Water kinetic data have not been completely analyzed at this stage. Attempts will be made to relate water flux to metabolic rate. Water demands under the test conditions will be ascertained. Data from the preliminary study (Wesley et al. 1969) indicate that sex differences in water kinetics of pronghorn exist.

LITERATURE CITED

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Rogerson, A. 1968. Energy utilization by the eland and wildebeest. *In* M. A. Crawford [ed.] Comparative nutrition of wild animals. Academic Press, Inc., New York. 427 p.

Wesley, D. E., K. C. Knox, and J. G. Nagy. 1969. Water kinetics in pronghorn antelope. Western Section, Amer. Soc. Anim. Sci., Proc. 20:79-82.

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APPENDIX I

FIELD DATA--ANTELOPE RESPIRATION DATA

Antelope respiration data collected in 1970 is Grassland Biome Data Set A2U6000. A description and example of the data follow.

DATA DESCRIPTION

	Columns	Contents
Card 1	1 - 5	Correction factor for Beckman Oxygen Analyzer
	20	A one (1) punched here means apply Span Gas Correction
Card 2	1 - 80	Alphanumeric experiment identifier
Card 3	1 - 10	Urinary nitrogen loss (gm/day)
	11 - 20	Metabolic body size (kg)
Card 4-N	1 - 4	Time (24 hour clock)
	9 - 16	Air flow meter reading
	17 - 24	Barometric pressure
	25 - 32	Temperature (°C)
	*33 - 40	Control air oxygen
	*41 - 48	Control air CO_2
	*49 - 56	Chamber air oxygen
	*57 - 64	Chamber air CO_2
	*65 - 72	Control air methane
	*73 - 78	Chamber air methane
Card N+1	1 - 4	-0.0 punched means end of run and that next card is of type 2

	Columns	Contents
Card N+2	1 - 80	Alphanumeric experiment identifier; a 9999 punched in columns 1 through 4 indicates that not only is the run complete but also that a new animal is being used and that the next card is of type 1 rather than type 3

* This information is not recorded on card 4 but only on cards 5 through N.

+++ EXAMPLE OF DATA +++

```
        1         2         3         4         5         6         7
.234567890123456789012345678901234567890123456789012345678901234567890123456789
.0537
  SHEEP NO.33(CSM)-24HR. RUN
1624.    12942.    625.5     18.3      82.3      2.90                  0.80
1630.    13218.    625.5     18.4      82.3      2.89      73.9        27.4      0.81      4.35
1700.    14548.    625.4     18.5      82.3      2.89      65.7        49.8      0.82      8.66
1730.    15888.    625.5     18.5      82.4      2.88      64.2        59.5      0.84     12.0
1748.    16688.    625.5     18.6      82.4      2.86      63.0        62.5      0.86     11.9
1800.    17289.    625.6     18.6      82.5      2.87      62.6        60.1      0.88     10.6
1830.    18756.    625.5     18.7      82.5      2.86      64.2        55.4      0.89      9.02
1900.    20167.    625.5     18.8      82.6      2.85      63.8        54.8      0.90      8.52
1930.    21574.    625.7     18.8      82.6      2.85      64.2        54.0      0.91      7.91
2000.    22984.    625.8     18.9      82.7      2.84      65.8        50.5      0.93      7.93
2031.    24424.    625.8     18.9      82.7      2.83      65.4        52.4      0.94      8.08
2100.    25765.    626.0     19.0      82.8      2.82      66.0        51.8      0.95      8.39
2130.    27132.    626.0     19.0      82.8      2.81      65.2        53.3      0.96      8.31
2200.    28497.    626.0     19.1      82.9      2.80      64.7        54.3      0.98      8.02
2230.    29827.    626.2     19.1      82.9      2.80      65.1        53.8      1.00      8.74
2300.    31157.    626.1     19.2      82.6      2.80      64.2        54.5      1.00      8.16
2333.    32645.    626.1     19.4      82.4      2.80      64.8        54.8      1.00      8.36
2400.    33864.    626.2     19.4      82.6      2.85      66.3        50.5      0.98      7.81
0030.    35203.    626.3     19.4      82.7      2.75      66.2        50.7      0.95      7.93
0100.    36521.    626.4     19.5      82.9      2.70      65.6        52.4      0.93      8.17
 130.    37819.    626.5     19.5      83.0      2.70      65.4        50.7      0.90      7.27
0200.    39224.    626.5     19.5      83.1      2.70      67.3        47.5      0.91      6.59
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0400.    45850.    626.9     19.6      83.7      2.70      70.7        39.9      0.97      6.29
0430.    47467.    626.9     19.6      83.8      2.70      71.7        37.4      0.99      5.74
0500.    49064.    627.1     19.6      84.0      2.70      70.8        39.7      1.00      6.33
0530.    50660.    627.1     19.7      84.0      2.72      69.5        43.1      1.01      6.57
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0700.    55293.    627.7     19.7      83.9      2.80      68.3        44.2      1.05      6.45
0730.    56818.    627.9     19.6      83.9      2.83      69.3        43.8      1.06      5.95
0800.    58353.    628.0     19.8      83.9      2.85      67.2        51.0      1.08      9.64
0830.    59793.    628.0     19.8      83.8      2.88      67.0        55.5      1.09     11.1
0900.    61273.    628.3     19.5      83.8      2.90      68.2        49.7      1.10      9.48
0930.    62770.    628.3     19.5      83.8      2.90      67.8        48.6      1.11      8.43
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1100.    67676.    628.9     19.6      83.6      2.90      69.6        44.3      1.15      8.03
1130.    69351.    628.9     19.7      83.6      2.90      70.0        46.5      1.16      8.93
1200.    71041.    628.9     19.8      83.5      2.90      70.2        46.1      1.17      9.53
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 430.    79642.    629.2     19.9      83.7      2.83      71.4        41.1      1.06      7.11
1502.    81477.    629.3     20.0      83.8      2.80      70.6        40.8      1.00      7.14
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9999
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