FEEDING RHYTHMS OF CAGED HEDGEHOGS (*ERINACEUS EUROPAEUS* L.)

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SUMMARY: The feeding behaviour of four adult caged hedgehogs was studied for a period of 22 weeks. The maximum feeding activity of all four animals occurred between 1900 and 2200 hours, and two of them showed a second, but minor, peak of activity about 0300 hours. Individual feeds were of short duration with the first feed each evening tending to exceed the mean. Variations in behaviour between individuals were considered to be a function of their differing body weights, or to be related to the size of the sample. The feeding behaviour of the caged animals was similar to that reported from comparable field studies.

INTRODUCTION

Herter (1938), Burton (1969) and Campbell (1973) have shown that hedgehogs in their natural habitats have a definable feeding rhythm. Observations of caged hedgehogs (Kristoffersson 1964 and Otway 1965) have shown comparable feeding rhythms, but these studies were of only 6 and 14 days duration respectively. The present study was an attempt to determine if hedgehogs retained their natural feeding rhythm when fed under laboratory conditions for an extended period.

METHODS

Four adult hedgehogs taken from pasturelands near Lincoln were fed under laboratory conditions for 22 weeks. The animals were housed in a temperature controlled room (18 ± 2°C) to prevent hibernation and lessen the risk of pneumonia, a major mortality factor of caged hedgehogs (Campbell 1973). To avoid possible effects from the abrupt change in habitat the first 9 weeks were used to condition the animals to captivity, and the remainder for a feeding trial. Each animal was housed in a separate 120 x 30 x 30 cm cage that had a nest box partly filled with shredded paper at one end. The entrance to the nest box was covered by a light-proof curtain. A food tray, which was too narrow for a feeding hedgehog to stand in, was located against the opposite end of the cage, and a pressure pad connected to a four-pen event recorder was placed in front of it (Fig. 1). The pressure pad did not operate unless weight was applied near the contact end. The event recorder operated continually, but movement of the

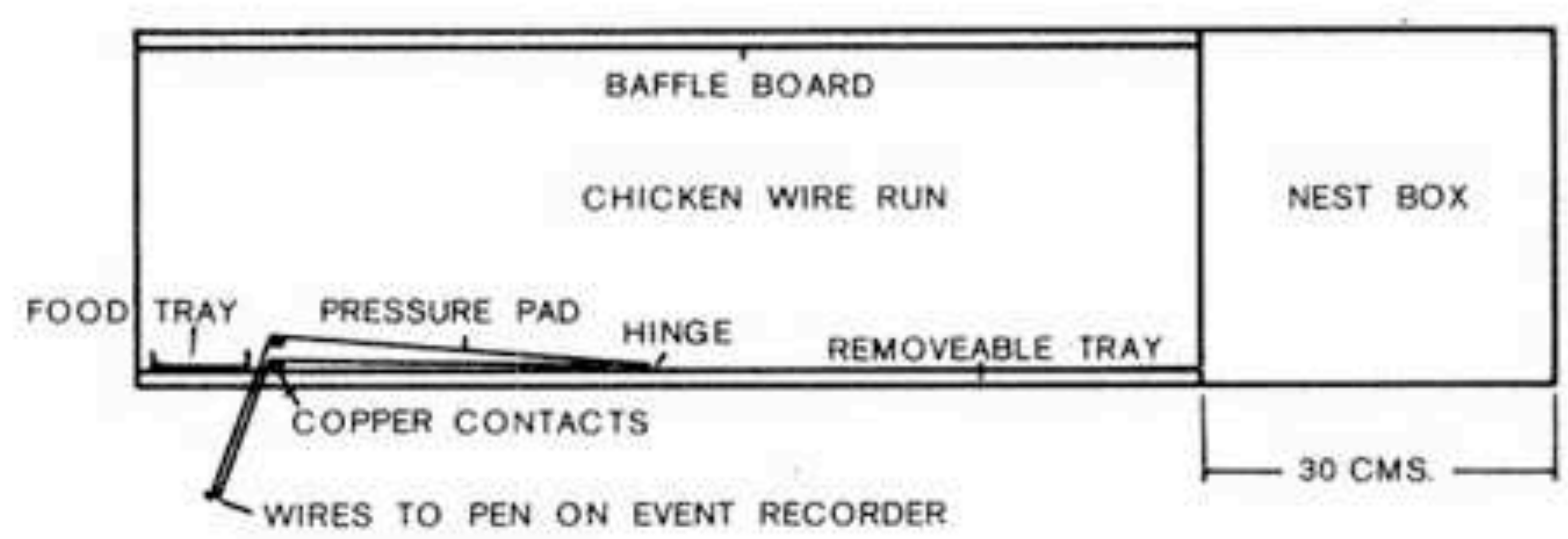

FIGURE 1. *Diagramatic lateral view of a test cage.*

paper tape was restricted to between 1800 and 0700 hours daily.

The only lighting in the room throughout the 13 week feeding trial was daylight from an east-facing window shaded by a baffle. A selenium photocell, which could be read from outside the room was used to record light intensities. During the conditioning period only, the animals were observed with the aid of a shaded red photographic safety lamp.

A daily diet of 300 g of a 1:1:3 volume mixture of cooked mince, bread and milk was provided. Small quantities of mineral salts, cod-liver oil and liver were added regularly.

As the variances were different the modified t-test (Snedecor and Cochran 1967) was used to test data for significance.

RESULTS AND DISCUSSION

The animals did not react to the red light used to assist observations made during the conditioning period. On first emerging from their nests each night the animals normally groomed themselves, then evacuated. Behaviour beyond this point was variable but they would usually complete at least one circuit of their cages before feeding, with hedgehogs A, B and D tending to move clockwise and C anti-clockwise. While moving about their cages the animals tended to avoid approaching the front half of the pressure pads. Whether this was caused by a dislike of the tilting motion, or by the noise of the closing contacts was not determined. After feeding the animals usually retired to their nests, but on occasions would move about their cages before returning again to feed, or retiring. Behaviour was more variable when the animals emerged on subsequent occasions. They often moved directly to feed, but on other occasions would first groom themselves and/or move about their cages. They seldom retired, however, without feeding. During the conditioning period no animal was observed to activate the event recorder unless feeding.

Mean daily food consumption and weekly hedgehog weights are listed in Table 1. Each animal consumed between 100 and 300 g of food daily, and weight increases of approximately 20 to 50 percent occurred over the conditioning period. Photocell readings indicated that the animals did not feed if the light intensity in the laboratory exceeded 0.2 lux. Although feeding times would ultimately be controlled by sunset and sunrise no direct relationships were observed. The initiation of feeding varied from 30 to 232 minutes (mean 116) after sunset. There appeared to be no relationship between the amount of cloud cover and the time after sunset that feeding commenced. The animals would begin feeding at widely scattered times on the same night. There were no consistent early or late feeders, and any animal was liable to feed early or late irrespective of the outside weather conditions. Commencement of feeding did not appear to be related to the food intake of the previous night. Examination of the recorder traces showed that no animal fed before 1800 or after 0700 hours during the trial period.

Frequency distribution histograms of the number of feeds per night (Fig. 2) show that the feeding behaviour of hedgehogs A and B differed from that of C and D. The mean number of feeds per night (and standard errors) were 7.8 ± 2.3, 8.0 ± 3.1, 12.3 ± 5.5 and 14.7 ± 7.4 for hedgehogs A to D respectively. There was no significant difference between the means of hedgehogs A and B, or of C and D. Differences between the means of the two males (A and D), and of the two females (B and C) were significant at the 0.1 percent level. Thus the observed differences in behaviour were unlikely to have a sexual cause.

Frequency distribution histograms for the duration of the first feed each night (Fig. 3) show that these ranged from less than one to 15 minutes, with those of hedgehogs A and B tending to be longer than those of C and D. Differences between the means of all pairings involving hedgehog A were

TABLE 1. *Mean daily food consumption, and weekly weights of four hedgehogs fed under laboratory conditions.*

	Hedgehog A		Hedgehog B		Hedgehog C		Hedgehog D	
	Weight (g) *	** Mean daily food consumption (g)	Weight (g) *	** Mean daily food consumption (g)	Weight (g) *	** Mean daily food consumption (g)	Weight (g) *	** Mean daily food consumption (g)
At capture	1189		942		767		685	
Week: 10	1525	274	1355	269	918	227	1041	206
11	1620	272	1334	273	963	229	1146	242
12	1637	279	1305	253	962	228	1167	241
13	1686	279	1330	259	1018	229	1206	242
14	1700	272	1308	258	1009	227	1261	237
15	1746	274	1411	261	1006	200	1281	236
16	1725	273	1312	225	1001	198	1335	240
17	1802	273	1370	253	968	167	1275	235
18	1598	193	1232	184	901	131	1175	158
19	1640	242	1306	231	919	189	1257	203
20	1642	267	1310	255	920	229	1206	242
21	1687	280	1349	260	968	220	1278	239
22	1640	274	1313	246	893	187	1225	248
Mean for trial	1665	266	1326	248	957	205	1219	228

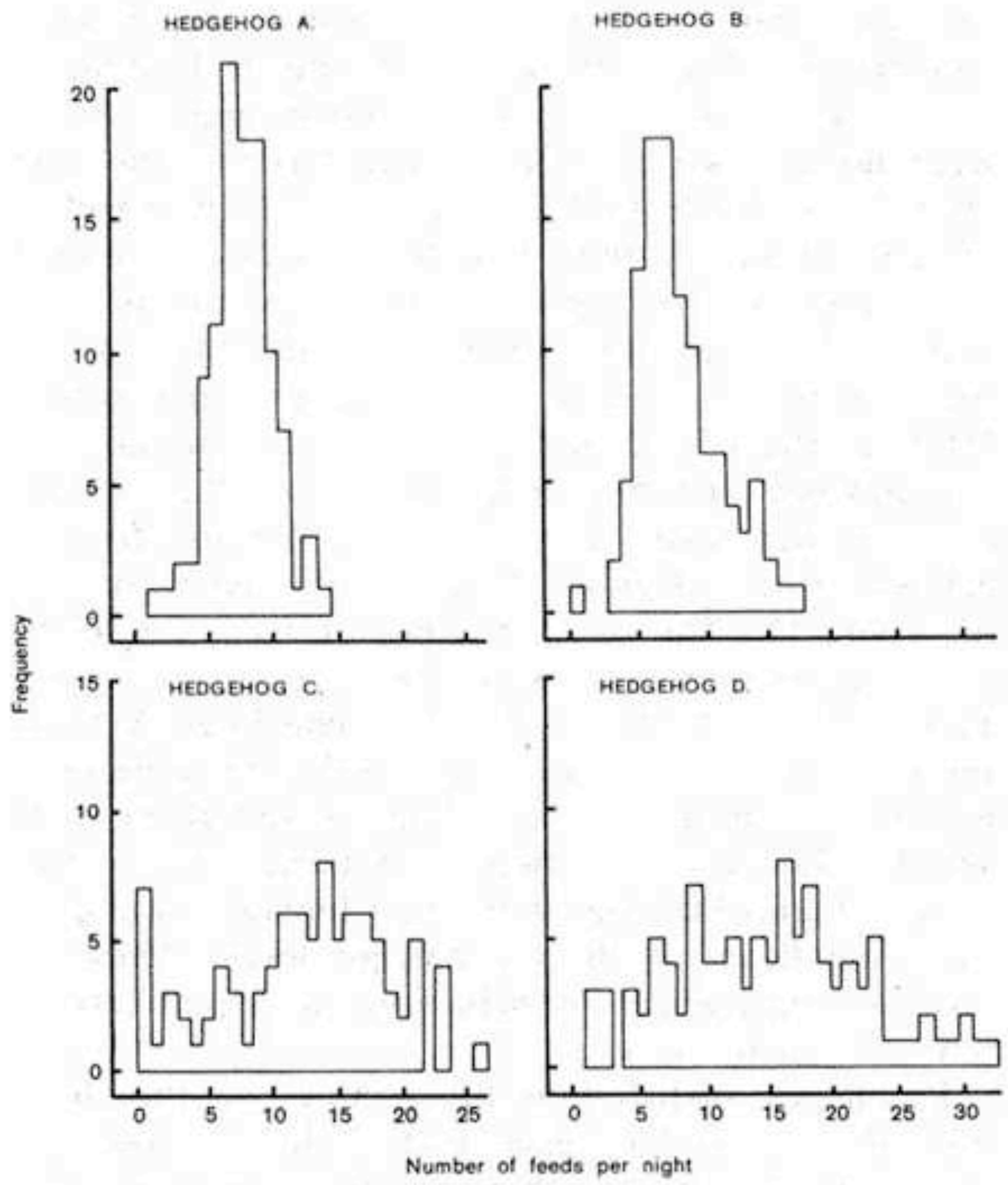

FIGURE 2. *Feeding frequency per night.*

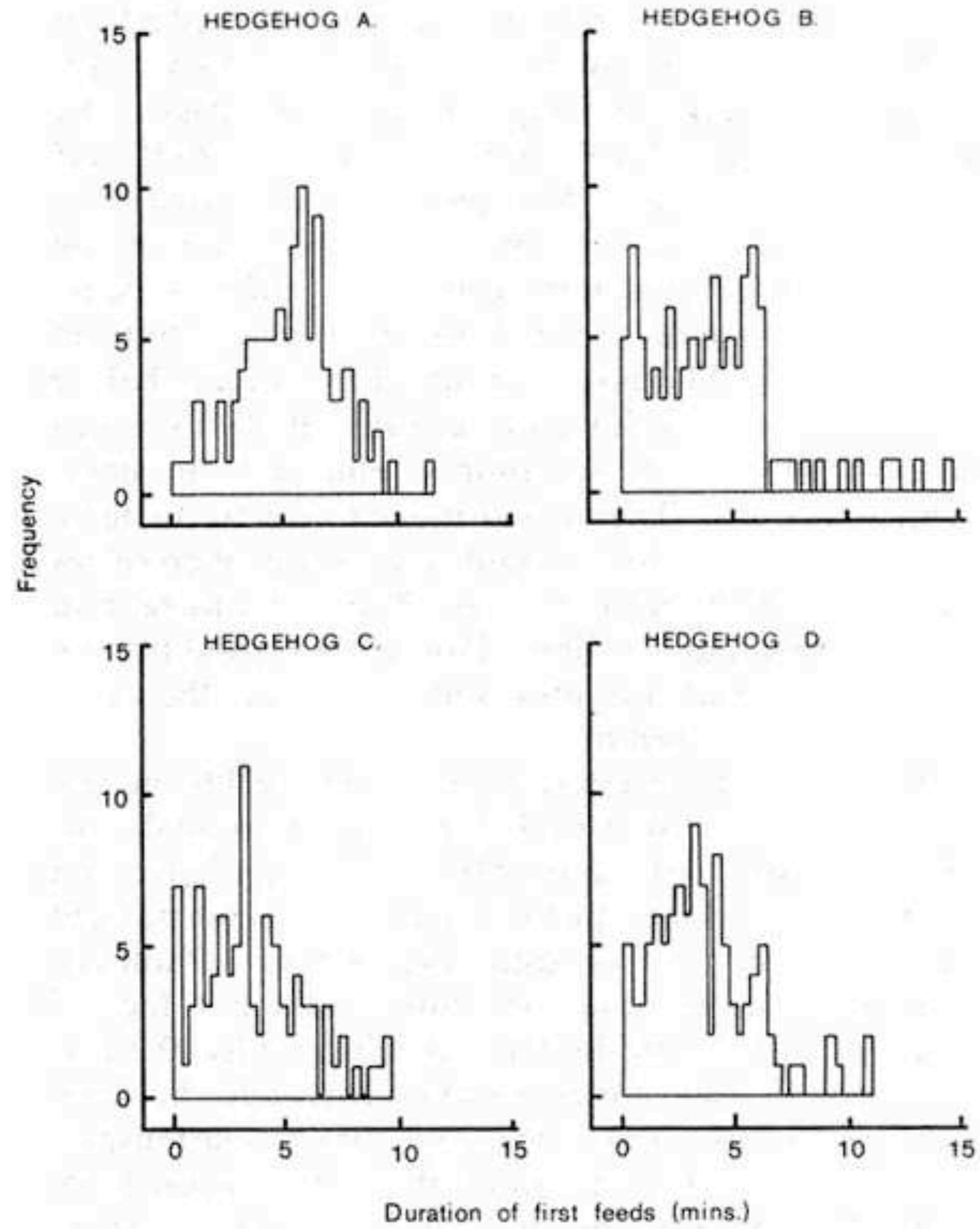

FIGURE 3. *Frequency of the duration of the first feed each night.*

significant at the 0.1 percent level, but differences were not significant for other pairings.

Frequency distributions for the duration of each feeding period, excluding the first, are shown in Figure 4. The mean durations (and standard errors) for hedgehogs A to D were 3.3 ± 2.1, 3.0 ± 2.5, 1.8 ± 1.2 and 1.9 ± 1.5 respectively. Differences between the means of the two males and of the two females were again significant at the 0.1 percent level. Differences between the means of A and B, and of C and D were not significant. The two heavier animals, A and B, tended to have longer individual feeds than did the two lighter animals. Comparison of Figures 3 and 4 indicates that the first feed each night tended to be longer than subsequent feeds.

The mean number of feeds, and the mean time spent feeding in one hour periods throughout the night are shown in Figures 5 and 6 respectively. Hedgehogs A and B tended to feed less frequently than C and D, particularly before midnight, but as their individual feeds were longer, the time spent feeding by all four animals was comparable.

Plots of the mean number of feeds in one hour periods against the duration of the mean feed in those periods are shown in Figure 7. Correlation coefficients were calculated for these lines, and all were significant at the 0.1 percent level. Comparison of the residual mean squares by Bartlett's test showed no sign of heterogeneous variances between the gradients. Homogeneity was thus assumed, and comparison of the gradients using an F-test indicated that they were significantly different at the 1 percent level. The regression equations predicting the mean duration of feeding per hour (Y), from the number of feeds in each one hour period (X), are:

A: $Y = 3.4X + 0.2$
B: $Y = 3.0X + 0.2$
C: $Y = 2.2X + 0.2$
D: $Y = 2.1X + 0.1$

These equations indicate that the duration of feeding is dependent on its frequency.

Although variations occurred between individuals, the feeding behaviour of all four hedgehogs followed the same general rhythm. The animals fed mainly for short periods at a time, with the first feed each evening tending to be longer than later feeds. Feeding activity rose to a maximum between 2000 and 2100 hours and then declined. Hedgehogs A and B,

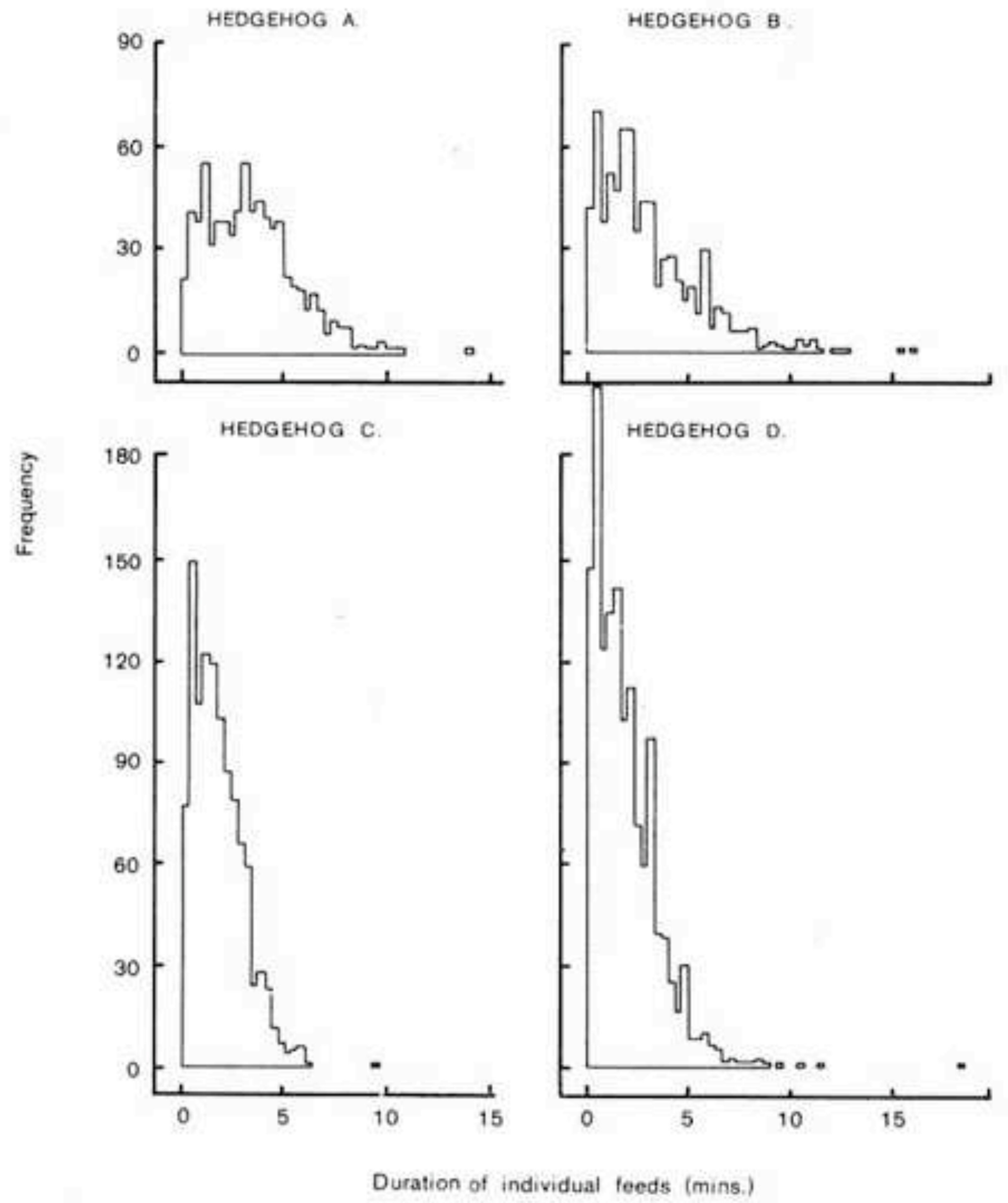

FIGURE 4. *Frequency of individual feeds.*

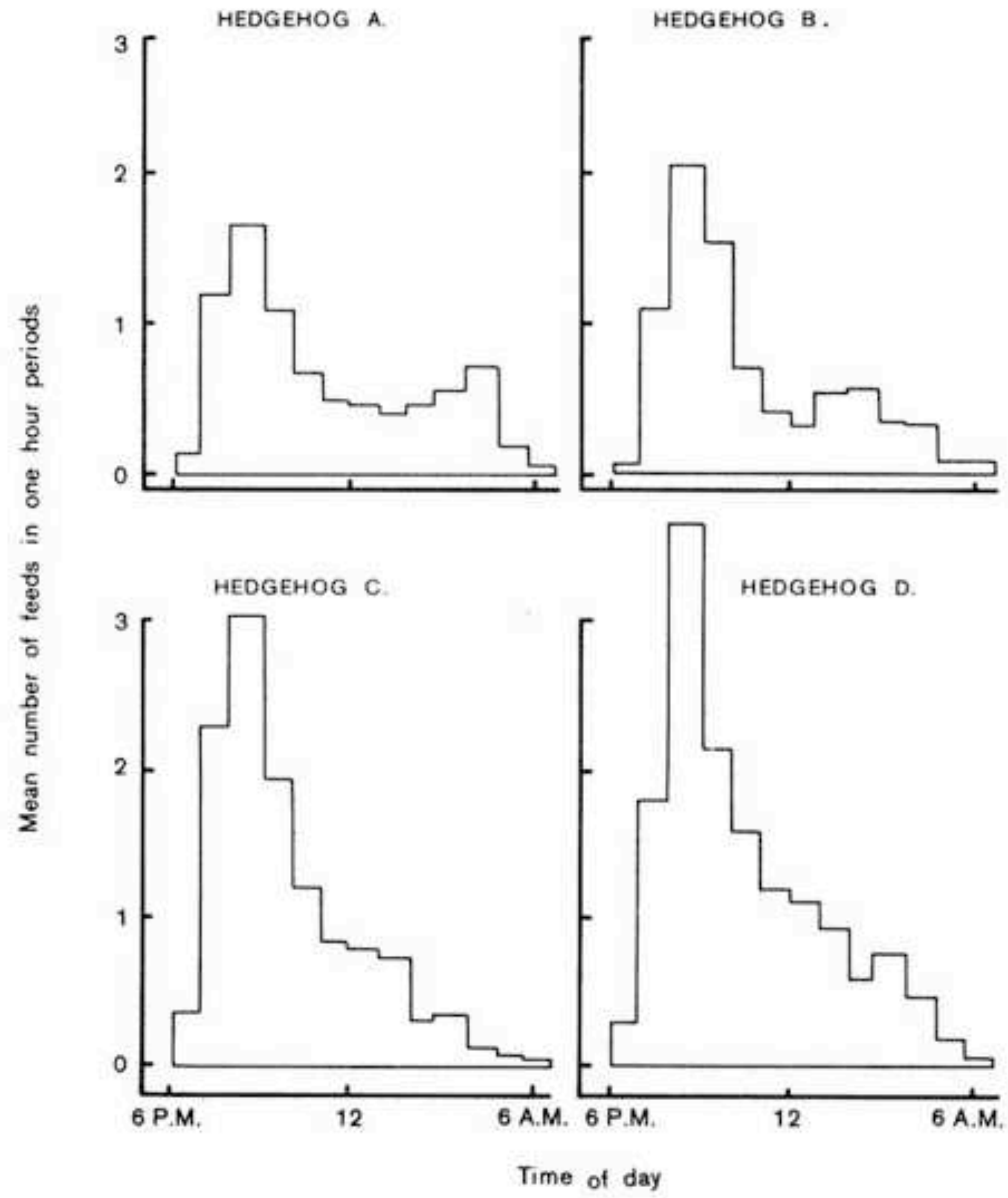

FIGURE 5. *Mean number of feeds in one hour periods throughout the night.*

however, showed a second, but smaller, increase in activity about 0300 hours.

The substantially lowered food intake by all animals in week 18 (Table 1), the similarities evident in the histograms, and the close location of the cages suggest that feeding interactions between individuals may have occurred. However, no such interactions were evident when the animals were observed during the conditioning period, or from examination of the individual daily feeding records of the animals during the trial period.

Variations in body weight may have caused some of the observed differences in feeding habits. The shorter and more frequent feeds of the two lighter animals are consistent with Rubner's surface area law (Blaxter 1962). An alternative explanation for the observed variations is that had a greater number of animals been used, a range of behaviour patterns both within and beyond those of the four animals may have resulted.

The feeding behaviour of these caged animals was comparable to that reported for a population of hedgehogs in pastureland near Lincoln (Campbell 1973). Maximum feeding activity occurred some two hours later in the field, but this difference could be explained by the more rapid reduction in light intensity in the laboratory. Burton (1969) has observed that wild hedgehogs in Britain had a main feeding period from dusk to soon after midnight, and a second period of less intense feeding about an hour before dawn. Similar behaviour has been reported for wild hedgehogs in Germany (Herter 1938), and for caged animals (Kristoffersson 1964 and Otway 1965).

This study has indicated that despite the very high body weights attained (Table 1) wild hedgehogs appear to retain their natural feeding rhythms for at least 22 weeks when fed under laboratory conditions.

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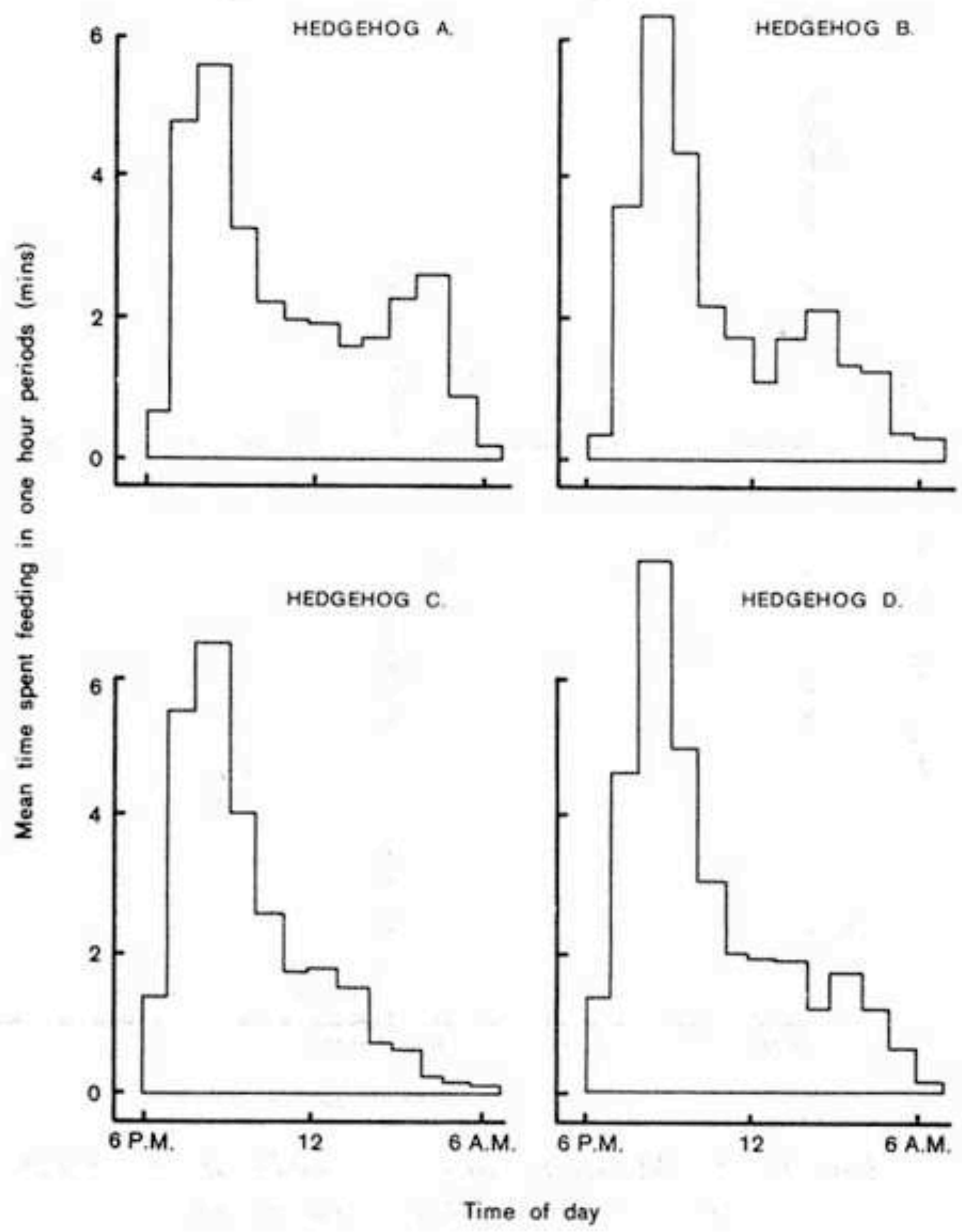

FIGURE 6. *Mean time spent feeding in one hour periods throughout the night.*

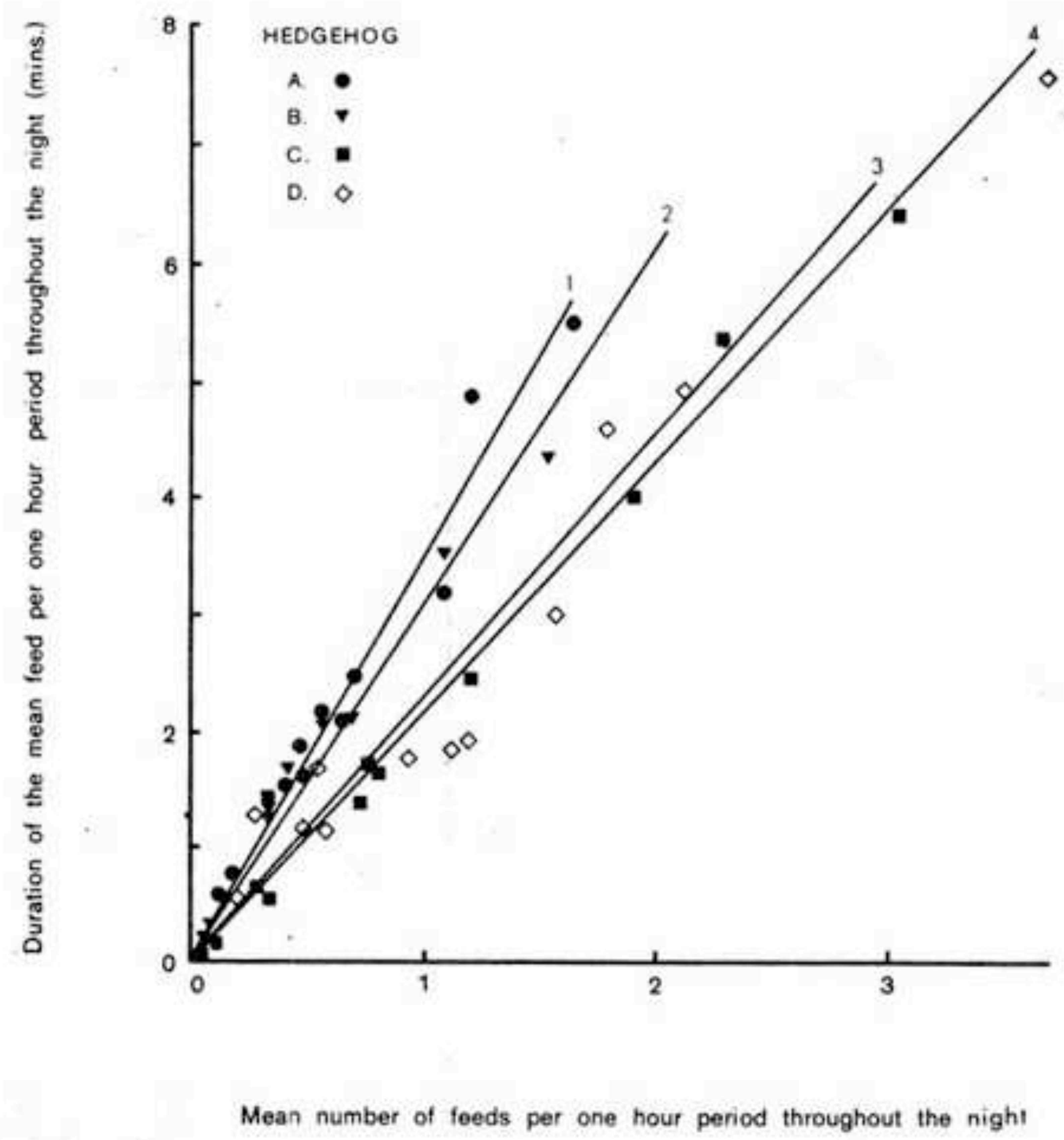

FIGURE 7. *Correlation between the mean number of feeds and mean duration of feeding in one hour periods throughout the night.*

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