

Reproductive Characteristics of Young Boars Exposed to 8 or 16 Hours of Light Daily

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Story in Brief

Crossbred boars were exposed to either 8 or 16 hours of fluorescent light daily from 75 to 175 days of age to determine the influence of duration of daily light exposure on growth rate, testicular characteristics and endocrine function. Growth rate was similar between the two groups of boars. However, serum concentrations of testosterone, the areas under plotted 12-hr testosterone profiles and the number and magnitude of testosterone secretory spikes were elevated in boars exposed to 16 hours of light. Serum luteinizing hormone (LH) concentrations were not influenced by treatment. Infusion of gonadotropin releasing hormone (GnRH) resulted in similar concentrations of LH in both groups of boars. Serum testosterone response to GnRH-mediated LH release was greater at 0.5 and 1.0 hr following GnRH in boars exposed to the longer photoperiod, but was similar between both groups of boars thereafter. Testicular and epididymal weights and sperm reserves were not significantly influenced by treatment. We conclude that exposure of young boars to 16 hr of light daily enhances testicular endocrine function compared to boars exposed to 8 hr of light.

Introduction

The duration of daily light that animals are exposed to regulates certain physiological processes. Reproductive cycles of sheep and horses are directly affected by the duration of photoperiod. In addition, exposure to longer day-lengths accelerates growth rate of both nonseasonally (cattle) and seasonally breeding animals (sheep). Since the pig is not a seasonal breeder, the influence of duration of photoperiod on reproductive development and growth rate has received little attention.

Data obtained in recent years suggests that boars which are exposed to increased photoperiods are more sexually aggressive, and semen can be collected at a younger age compared to boars exposed to shorter photoperiods. Limited information is available on the extent to which duration of photoperiod affects testicular endocrine and spermatogenic function of the young boar. Consequently, we designed an experiment to evaluate the influence of duration of daily

light exposure on growth rate, testicular characteristics and serum concentrations of LH and testosterone of young boars.

Experimental Procedures

A total of 30 pairs of full-sib crossbred boars of Duroc, Landrace, Spot and Yorkshire breeding were used in three replicates for this study. Each boar of a full-sib pair was assigned to either 8 or 16 hours of light daily from 75 to 175 days of age. All boars were maintained on solid concrete floors and supplied with feed and water ad libitum. Body weights were obtained every two weeks throughout the experiment.

When the boars averaged 160 days of age, a venous catheter was placed in each of 10 boars from both treatment groups. Serum samples were obtained at 30-minute intervals for 12 hours. Then, 200 μg of GnRH were infused, and serum was obtained at frequent intervals for 4 hours. All serum samples were analyzed, using specific radioimmunoassays, to determine concentrations of LH and testosterone.

All boars were castrated at about 175 days of age. One testis from each boar was saved and weighed, a sample of testicular parenchyma was homogenized and sperm numbers were determined by microscopic count. The epididymides were removed from the testes and sectioned into pieces containing the head and body (capita-corpora) and the tail (cauda). These tissues were weighed and homogenized and sperm numbers were determined.

Results and Discussion

Average daily gain tended to be increased for boars exposed to 8 hours of light daily (1.70 ± 0.07 lb/day) compared to boars in the longer photoperiod (1.59 ± 0.04 lb/day), but this difference was not statistically significant (Table 1). Testicular weights and weights of the capital-corporal and caudal epididymides were similar for boars in both treatment groups. Likewise, sperm reserves in the epididymides were not influenced by photoperiod. But, there was a tendency for boars exposed to 16 hours of light daily to have more sperm in their testes.

Table 1. Characteristics of boars exposed to 8 or 16 hours of light daily

Criteria	Duration of photoperiod	
	8 hr	16 hr
Number of boars	25	28
ADG (lb/day)	$1.70 \pm .07^a$	$1.59 \pm .04$
Testicular wt (g)	281.3 ± 15.9	278.3 ± 14.5
Total testicular sperm ($\times 10^9$)	25.2 ± 2.4	30.3 ± 3.3
Capital-corporal wt (g)	28.6 ± 1.5	29.6 ± 1.5
Total capital-corporal sperm ($\times 10^9$)	28.0 ± 3.2	26.8 ± 3.0
Caudal wt (g)	31.8 ± 2.1	30.8 ± 1.6
Total caudal sperm ($\times 10^9$)	69.5 ± 13.2	57.0 ± 7.1

^aMean \pm SEM.

Average serum LH concentrations (Table 2) were not influenced by treatment. In addition, the frequency and magnitude of LH secretory spikes and the area under plotted 12-hr LH profiles were similar for boars in both treatment groups. In addition, the LH release in response to GnRH infusion did not differ significantly between boars in either treatment.

Table 2. Serum LH and testosterone in boars exposed to 8 or 16 hours of light daily

Criteria	Duration of photoperiod			
	8 hr		16 hr	
	LH	Testosterone	LH	Testosterone
Number of boars	9	9	10	10
Concentration (ng/ml)	1.4 ± .1 ^b	3.2 ± .8 ^c	1.5 ± .1	4.9 ± .8 ^c
Area under 12-hr curve (ng•hr/ml)	16.1 ± 1.3	35.9 ± 9.2 ^c	17.8 ± 1.3	57.7 ± 8.8 ^c
Secretory spikes ^a per 12 hr (no)	2.3 ± .3	1.7 ± .4 ^d	2.5 ± .3	2.8 ± .4 ^d
Magnitude of secretory spikes (ng/ml)	2.0 ± .2	7.1 ± 1.1 ^c	2.1 ± .2	9.5 ± 1.1 ^c

^aIncreases in serum concentrations greater than one SD above the mean.

^bMean ± SEM.

^cSignificant difference, 8 hr vs 16 hr ($p < 0.10$).

^dSignificant difference, 8 hr vs 16 hr ($p < 0.05$).

Boars exposed to 16 hours of light daily had increased ($p < 0.10$) serum testosterone concentrations (4.9 ± 0.8 ng/ml; Table 2 and Figure 1) compared to boars exposed to 8 hours of light (3.2 ± 0.8 ng/ml). Even though secretory spikes of LH were not influenced by treatment, boars in the longer photoperiod had more

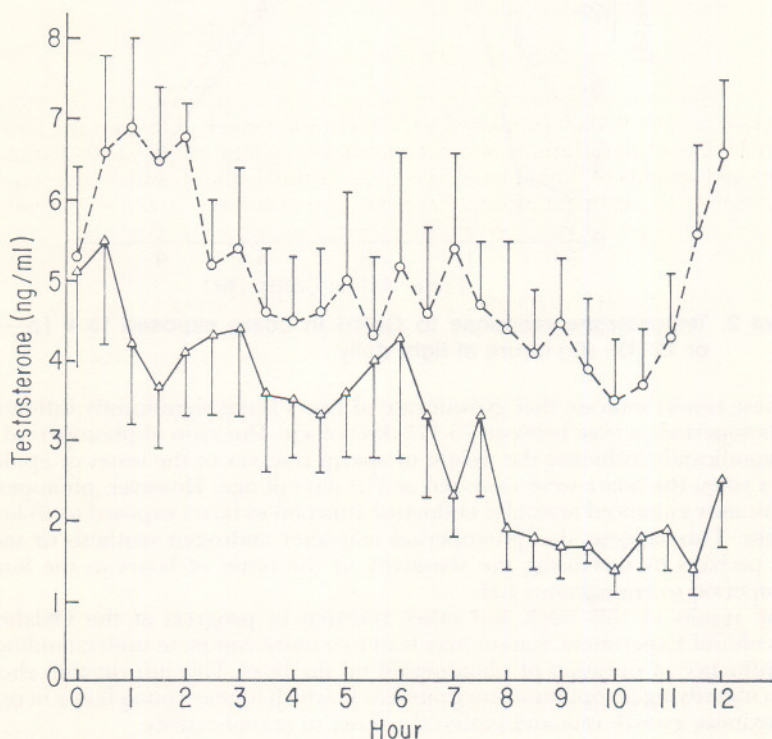


Figure 1. Average testosterone concentrations in boars exposed to 8 (Δ—Δ) or 16 (O—O) hours of light daily

testosterone secretory spikes per 12 hours ($p < 0.05$), and these spikes were of a greater magnitude ($p < 0.10$) than those observed for boars in 8 hours of light per day. The increased frequency and magnitude of testosterone pulses (and perhaps altered testosterone clearance rate) resulted in an increased area under plotted testosterone profiles ($p < 0.10$) for boars in 16 hours of light. Serum testosterone response to GnRH-mediated LH release was greater in boars exposed to 16 hours of light per day at 0.5 and 1.0 hr following GnRH treatment, but testosterone concentrations were similar for boars of both treatment groups thereafter (Figure 2).

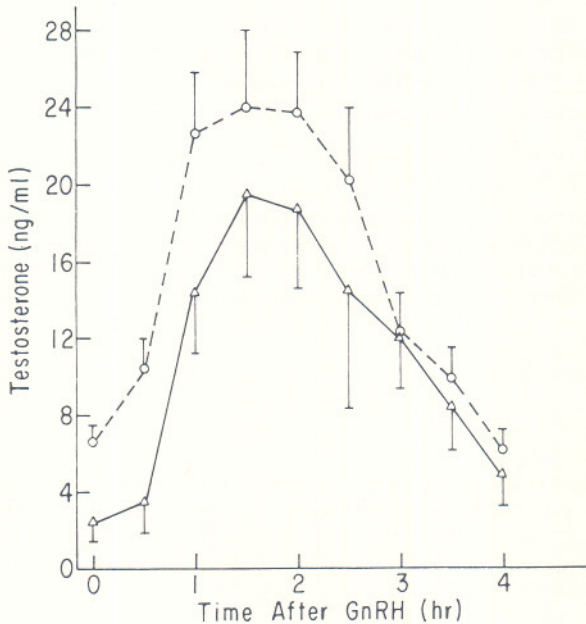


Figure 2. Testosterone response to GnRH in boars exposed to 8 (Δ—Δ) or 16 (O—O) hours of light daily

These results indicate that growth rate of boars is not significantly influenced by photoperiod, at least between 75-175 days of age. Duration of photoperiod did not significantly influence the weight or sperm reserves of the testes or epididymides when the boars were castrated at 175 days of age. However, photoperiod significantly enhanced testicular endocrine function in boars exposed to 16 hours of light. This suggests that photoperiod may alter androgen synthesis or secretion, perhaps by increasing the sensitivity of the testes of boars in the longer photoperiod to endogenous LH.

The results of this work and other research in progress at the Oklahoma Agricultural Experiment Station may lead to a more complete understanding of the influence of duration of photoperiod on the boar. This information should aid in identifying an optimum environment in which to rear young boars in order to maximize growth rate and hasten the onset of sexual activity.