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Two groups of white leghorn hens were subjected to 95 db (C) level of traffic noise and 65 db (C) level of ambient non-traffic noise. No statistically significant difference in egg production was detected between the two groups.
INDEX DESCRIPTORS: Traffic Noise, Egg Production

Effects of noise, particularly those of high intensity, on poultry constitute a modern problem because of the encroachment of high-density population centers upon poultry production areas. Because these centers result in increased highway traffic near these areas, several aspects of the problems caused by this increase have been investigated. One such study (Stadelman, 1957), for example, reported that hatchability of eggs subjected to sound levels of 96 decibels (db) and 115 db (scale unspecified) was not affected. However, the latter level interrupted brooding. Later, Hamm (1967) suggested that sonic booms could decrease egg production but that such a decline was attributable not to physiological effects of noise but to scaring hens from the feed. However, noise of 90 db (scale ?) has inhibited release of thyroxin in sheep (Ames, 1971). Furthermore, Ames and Arehart (1972) reported that sound alters physiological functions. Auditory stimuli (75 and 100 db, scale ?) produced significant differences in certain digestive functions (Harbers and Ahmed, 1970). The RNA content of auditory cortical neurons was elevated after rats had been exposed to 100 db noise (350-10,000 Hz; Anthony, 1973). Osteogenesis of the skeletal system of fetal rats produced by dams subjected to noise (74-94 db, 20-25,000 Hz) was variably affected (Geber, 1973). Because endocrinological manifestations of high-intensity noise are known (e.g., Sackler, Waltman and Jurtshuk, 1960; Jensen and Rasmussen, 1963; Zondek and Tamari, 1960) and because at least one report showed a weight gain of swine (anonymous, 1973) and rats (unpublished data) living under high-intensity (120 db) sound conditions ("normal frequency range"), this pilot study was undertaken to determine possible production effects of traffic noise upon laying hens.

MATERIALS AND METHODS

One hundred white Leghorn female chicks were raised to 14 weeks at the Iowa State University Poultry Center. They were divided into a control and an experimental group and each was placed in a separate chamber about 7′ x 12′ x 10′. The two chambers were separated by a third into which no experimental sound was introduced. In each group pairs of hens were housed in cages equipped with an automatic, ball-type waterer. All chickens were fed a standard 16.3 percent protein egg mash and exposed to a photocycle of 16 hours dark and 8 hours light. Air was freely circulated by fans located outside the chambers.

The hens started laying March 31 and were culled April 13, with only the 38 highest producers in each group being retained. On April 14 the experimental group was subjected to tape-recorded highway traffic noise lasting only 36 hours because of tape failure. Noise, recorded during March from Interstate Highway 35, was withheld until April 16, when it was re-introduced and continued until May 12. It coincided with the light portion of the photocycle. Two cassettes of three minutes each were made. The two sound tracks differed in number of vehicles, spacing of vehicles and frequency of noise (determined subjectively). These two cassettes were played on a rotating schedule, one used one day, the other

TABLE 1. DAILY EGG PRODUCTION DURING NOISE AND ANTENOISE PERIODS

	Experimental Group	Control Group
Number of birds	38	38
Mean eggs/day		
Antenoise period	28.6 ± 0.60*	28.9 ± 0.339*
Noise period	28.50 ± 0.584*	29.3 ± 0.777*

* = standard error.

TABLE 2. PEAKS OF SELECTED NOISE GENERATORS*

Source	Peak Decibels (scale not specified)	Peak Frequency(ies) (in hertz)
Motorcycle (at 50 ft.)	87**	125-250
Tire noise (50 mph, rough road)	98	31-63
Passenger car (65 mph, 25 ft. from road)	78	63
Diesel truck (at 50 ft.)	82	125-250
Truck, with Cummins V8-265 engine, straight stack, stock muffler	118	125-250

* From Bolt, Beranek and Newman, Inc., 1970, reports 1411, 1412 and 1413. Additional information published in *Handbook of Noise and Vibration Control,* R. H. Warring, editor.
** db (A), this item only.

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the following day. This alternation was designed to minimize adaptation to specific noise cycles.

A General Radio sound-level meter, Type 1551, was used to determine the sound level using the C weighted scale.

Because the necessary electronic equipment was not available, a signal analysis was not made of component frequencies of the traffic noise. However, other reports (Blazier *et al.*, 1970; Warring, undated) indicate that some of these are in the 20-1000 Hz range (Table 2).

RESULTS

The investigation lasted 34 days, 17 with sound and 17 without. The noise levels were 92-95 db (on C scale) in the experimental chamber, 65 db (C), ambient non-traffic noise, in the control chamber. No significant difference in egg production ($P>0.05$) between the two groups was detected.

Experimental birds averaged 79.4 percent rate-of-lay before being subjected to noise and 79.1 percent after noise was introduced. The control group averaged 80.2 percent before and 81.4 percent after noise introduction to the experimental group. The 1.2 percent increase was not significant statistically ($P>0.05$).

These results demonstrate that a noise level of 95 db (C) may not measurably affect egg production. After the initial shock of its introduction, the hens quickly adapted to the noise. Experimental birds at first behaved erratically but seemed adjusted by the third day. Despite this abnormal behavior, egg production did not significantly decline during the initial period. Therefore, the reproductive physiology of the hens may not have been disturbed. However, neither tissue nor eggs were examined.

DISCUSSION

Birds, presumably including the common fowl, do not seem to be psychologically disturbed by sound, possibly because of the extrastapes. This cartilaginous portion of the stapes may absorb high-intensity sounds because of its composition or angular relationship with the tympanum (Pumphrey, 1961). The birds' rapid adaptation to acoustic trauma may be affected by the endocrine glands which serve as a multi-loop feedback system compensating for noise effects on the central nervous system (Anthony, Ackerman and Lloyd, 1959).

Further research into effects, physiological, behavioral and anatomical, seem called for by this pilot study. For instance, what effects might be demonstrable by traffic noise of higher (100-120 db C) levels? Of different frequency components? The latter question is particularly applicable in view of the lack of frequency analyses presented in many reports concerning effects of noise. In addition, what would result from any level of this noise being presented to the birds during the dark portion of the photocycle? What effects would be seen if noise were continuous? The influence of noise levels as modified by dietary factors should be studied. How is the histology of the hen's adrenal and thyroid glands and ovaries changed, if at all, under the influence of acoustic stress? Are the eggs changed in any way? Some unpublished data indicate misshapen eggs or eggs with thin shells result from this treatment of the hen.

While an increase in experimental noise might result in additional data, the lack of sound, near silence, should provide interesting, even if less practical, information.

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LITERATURE CITED

AMES, D. R. 1971. Thyroid response to sound stress. *J. Anim. Sci.* 33:247. (Abst.)

———, and L. A. AREHART. 1972. Physiological response of lambs to auditory stimuli. *J. Anim. Sci.* 34:994-998.

ANONYMOUS. 1973. Effects of sound on livestock. *Sperry Technology* 1:16-20.

ANTHONY, A. 1973. Azure B-RNA changes in the adrenal and cerebral cortex of rats exposed to intense noise. *Fed. Proc.* 32:-2093-2097.

———, E. ACKERMAN and J. A. LLOYD. 1959. Noise stress in laboratory rodents. I. Behavioral and endocrine response of mice, rats and guinea pigs. *J. Acoust. Soc. Amer.* 31:1430-1437.

BLAZIER, W. E., T. D. BOYS, P. A. FRANKEN, W. J. GALLOWAY, T. J. SCHULTZ, R. D. STRUNK and R. B. TANNER. 1970. Chicago urban noise study, reports 1411, 1412 and 1413. Bolt, Beranek and Newman, Inc., Downers Grove, Ill.

GEBER, W. F. 1973. Inhibition of fetal osteogenesis by maternal noise stress. *Fed. Proc.* 32:2101-2104.

HAMM, D. 1967. Sensory stress effect on layers. *Poultry Sci.* 46:-1267. (Abst.)

HARBERS, L. H., and M. B. AHMED. 1970. Metabolic responses of sheep to auditory stimuli. *J. Anim. Sci.* 31:1013. (Abst.)

JENSEN, M. M., and A. F. RASMUSSEN. 1963. Stress and susceptibility to viral infections. I. Response of adrenals, liver, thymus, spleen and peripheral leukocyte counts to sound stress. *J. Immunol.* 90:17-20.

PUMPHREY, R. J. 1961. Sensory organs: Hearing. *In* A. J. Marshall, ed., *Biology and comparative physiology of birds* 2:69-86. Academic Press, New York and London.

SACKLER, A. M., A. S. WELTMAN and P. JURTSHUK. 1960. Endocrine aspects of auditory stress. *Aerospace Med.* 31:749-759.

STADELMAN, W. J. 1958. Effect of sounds of varying intensity on hatchability of chicken egg. *Poultry Sci.* 37:166-169.

WARRING, R. H. Undated. *Handbook of noise and vibration control.* Trade and Technical Press Ltd., Surrey, England.

ZONDEK, B., and I. TAMARI. 1960. Effect of audiogenic stimulation on genital function and reproduction. *Amer. J. Ob. Gyne.* 80:-1041-1048.