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Effect of Bromine on Chick Growth. (22432)

DAVID K. BOSSHARDT, JESSE W. HUFF, AND RICHARD H. BARNES.

Merck, Sharp and Dohme Research Laboratories, West Point, Pa.

Huff *et al.*(1) have shown that under certain dietary conditions a hyperthyroid-induced growth retardation in mice could be prevented by feeding selected whey fractions including whey ash or a dried sea salt preparation, Trace Element Sea Salt (TESS).* The active inorganic ingredient was found to be bromine. In view of the interest centered around whey as a source of unidentified growth factors for chicks, the present study was undertaken to determine the effect of bromine on chick growth.

Methods. In 2 of the experiments (1 and 2) one-day-old cockerels (New Hampshire Silver Cornish Cross)† were employed. In experiment 3 one-day-old Nichols strain New Hampshire‡ cockerels and in experiment 4 an unidentified strain of New Hampshire cockerels§ were used. They were housed, in groups of 15, on wire-mesh floors in electrically heated battery brooders. The brooders were lighted continuously. All studies were carried for 31 days. Feed and water were supplied *ad libitum*. All chicks were identified with numbered wing bands and weighed individually at the start of the experiment and weekly thereafter.

The basal diet, semi-synthetic in nature, employed in these studies had the composition shown in Table I. Whey and TESS substitutions were made at the expense of equal weights of glucose. The sodium bromide supplement was prepared by lyophilizing a water solution with dextrin to give a final concentration of 1.5 mg/g dry weight and was added at the expense of white dextrin in the basal diet.

The results obtained in Exp. 1, 2, and 3 (Table II) showed significant growth responses with whey and bromine. In Exp. 1, a positive effect was obtained with 1% TESS. The addition of 1% TESS to the diet supplied 15 ppm. bromine.

In Exp. 4 no significant growth response was obtained with either whey or bromine.

Discussion. A number of investigators [Norris(2), Couch *et al.*(3), and Edwards *et al.*(4)] have shown that chick growth can be stimulated by a mineral supplement in the form of an ash of natural products such as liver, whey, and distillers solubles. It appears possible from the results obtained in this study that bromine may be an active inorganic material. This suggestion is supported by the work of Huff *et al.*(1) who showed that bromine replaced whey ash or sea salt in the hyperthyroid mouse. On the other hand Morrison *et al.*(5) have reported

* Trace Elements Corp., Houston, Texas.

† Shaw Hatchery, West Chester, Pa.

‡ Moyer Hatchery, Quakertown, Pa.

§ Price Hatchery, Souderton, Pa.

TABLE I. Composition of Basal Diet.

G.B.I. vitamin test casein*	18.0
Gelatin	10.0
Glycine	2.0
L Arginine	.5
DL Methionine	.3
Soybean oil	4.0
Glucose†	48.0
White dextrin	3.0
Salt mixture (Jones and Foster) (8)	6.0
Calcium gluconate	2.5
Celluflour‡	5.0
Choline methionine tartrate	.6

All diets supplemented to contain, per 100 g, 2 mg α-tocopherol acetate, 4 mg menadione, 1100 U.S.P. units vit. A, 250 U.S.P. units vit. D, 200 mg butylated hydroxyanisole,§ 2 mg thiamine hydrochloride, 2 mg riboflavin, 4 mg calcium pantothenate, 10 mg niacin, 2 mg pyridoxine hydrochloride, 0.04 mg biotin, 0.4 mg folacin, 0.01 mg vit. B_{12}, 100 mg inositol, and 30 mg para-aminobenzoic acid.

* General Biochemicals, Inc., Chagrin Falls, O.
† Cerelose, Corn Products Refining Co., Argo, Ill.
‡ Chicago Dietetic Supply Co., Chicago, Ill.
§ Tenox BHA, Tennessee Eastman Co., Kingsport, Tenn.

that several elements including bromine were not responsible for the growth stimulation in chicks that was due to an unknown mineral substance.

In view of the fact that bromine is so widespread in nature and therefore its contamination of dietary ingredients would introduce a serious complication in any type of nutritional study, it is to be expected that reproducibility from experiment to experiment would be difficult. As shown in Exp. 4 of the current study negative results might not be conclusive in the consideration of any specific element unless in that particular study it could be shown that the ash of a natural product or the natural product itself gave a positive growth stimulation. The failure to obtain a growth response from natural products or preparations thereof may indicate a sufficient carry-over from mother to progeny to satisfy the requirements in the early stages of growth. This was recognized by numerous workers when studying vit. B_{12}. More recently it has been shown by Waibel *et al.*(6) that the progeny of hens fed a semi-synthetic or a corn-soybean meal diet were depleted of unidentified growth factors to a greater extent than were the progeny of hens fed a natural diet. Their source of unidentified growth factors was a mixture of dried liver, fish solubles, whey, grass juice, and distillers dried solubles. Winnek and Smith(7) in their reported bromine analyses of a number of natural products found egg albumin to contain a relatively high content of bromine (94 ppm.). This indicates a possible carry-over from the egg to the chick and quite likely is governed primarily by the bromine intake of the hen.

The growth responses to bromine that are noted here are relatively small (approximately 8-10%). Even though they were statistically significant in the three experiments in which positive growth was observed, it is to be expected that negative results will be encountered. It remains for extensive repetition of these studies in nutrition laboratories employing chicks and dietary ingredients derived from different geographical areas to establish the significance of the bromine effect in those areas.

Summary. A growth response to trace addition of bromine to a semi-synthetic diet has been observed in chicks. The conditions required in order to obtain this effect are dis-

TABLE II. Effect of Whey, Sea Salt, and Bromine on Growth of Chicks.

Supplement	Exp. 1 NH × SC	Exp. 2 NH × SC	Exp. 3 NH (Nichols)	Exp. 4 NH
	Avg wt gain, 31 days (g)			
None	449 (15)	448 (29)	480 (30)	458 (30)
5% delactosed whey‡	525†(15)	—	—	—
10% " "	537†(13)	494†(25)	557†(26)	480 (29)
8 ppm Br as NaBr	487*(14)	—	—	458 (29)
15 " " "	489*(14)	482†(26)	535†(29)	—
1% TESS	496†(12)	—	—	—

* Indicates significance $P < .05$.
† " " $P < .01$.
‡ Consolidated Products Co., Danville, Ill.
Figures in parentheses indicate No. of chicks surviving.

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Influence of Testis on Induction of Ovarian Tumors of Mice by X-rays. (22433)

ARTHUR KIRSCHBAUM, ANNABEL G. LIEBELT, AND GILBERT H. FLETCHER.

*Baylor University College of Medicine, University of Texas M. D. Anderson Hospital and Tumor Institute, Texas Medical Center, Houston.**

Absence of ovarian tumorigenesis when only a single ovary is irradiated suggests that the mechanism of induction of mouse ovarian tumors by x-rays is similar to that involved in tumor development within an ovary transplanted to a castrated animal's spleen(1). In either case a functional ovary *in situ* inhibits the development of ovarian tumors; this inhibition is said to result from suppression of output of excessive pituitary gonadotrophin (1,2).

Results. When Balb/c female mice received 200r of x-rays, ovarian tumors were present 16 months post-irradiation in 20 of 22. Ovarian tumor development was suppressed in all of 36 mice by isologous Balb/c subcutaneous ovarian grafts made within 24 hours following irradiation. If only a single ovary was irradiated, tumors developed in 3 of 37, indicating suppression of tumorigenesis by the functional ovary in 92%. When the functional ovary was removed immediately post-irradiation, tumors appeared in 58 of 66 irradiated ovaries. Only those ovaries exceeding 3 mm in diameter were considered tumorous.

Injection of estrogenic hormone has been shown to inhibit x-ray induced ovarian tumorigenesis, whereas injected androgen was relatively ineffective(3). To determine whether the functioning testis inhibits the development of ovarian tumors by x-rays, x-irradiated ovaries were grafted subcutaneously into both intact and castrated male Balb/c mice; the donor Balb/c females and the recipient males of this strain were 6-8 weeks of age at the time of grafting. Grafts were made within an hour after whole body x-irradiation of the intact female donor. The x-ray-treated mice were exposed to general body irradiation in cardboard boxes at 30 cm target-skin distance, 140 kv, 2-1 mm aluminum filters, dose rate 70r per minute.

Ovarian tumors developed in 10 of 12 intact males bearing irradiated ovarian transplants (13 of 24, or 54% of grafts). Similar tumors appeared in irradiated ovaries residing in all of 18 castrated male hosts (29 of 34, or 85% of grafts). The latent period of tumor induction was not significantly different in castrated and intact mice (12-16 months). Except for a tendency toward areas of undifferentiated carcinoma, histologically the neoplasms were the same as those occurring in the Balb/c strain following irradiation of the ovary *in situ*(1). Although seminal vesicle development was not maximum in all intact graft-bearing males, stimulation was sufficient to indicate testicular androgenic activity.

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