Environmental Temperature and Composition of Body Fat.* (27663)

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(Introduced by Paul Griminger)
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Henriques and Hansen(1) in studies with pigs demonstrated an inverse relationship between environmental temperature and extent of depot fat unsaturation. They also showed that at certain environmental temperatures there existed a temperature gradient from outer- to innermost fat layer and that the degree of unsaturation of these fat stores was also inversely related to the temperature of the tissue in which the fat was embedded. Hilditch(2) commented on the relationship between tissue temperature and depot fat composition and suggested that the relative lack of insulation on the skin of the pig was probably responsible for the body temperature gradient and fat composition changes mediated by changes in the environment. In substantiation of this hypothesis, Hilditch(2) pointed to the absence of differences in composition of depot fat from various anatomical sites in the hen, an animal that derives considerable insulative protection from feathers.

In this work is reported a study of the effect of 3 different environmental temperatures on body fat composition and on body and tissue temperature of the hen. Our results showed significant changes in fat composition without concomitant changes in temperatures.

Materials and methods. Three groups of 5 Leghorn hens that had been maintained for 6 weeks in temperature controlled rooms, respectively at 32°C and 60% relative humidity, at 21°C (humidity not controlled) and at 0°C (humidity not controlled), were biopsied for subcutaneous fat. A fat layer weighing several grams was removed from the posterior abdominal region, 2-3 cm ventral to the cloaca. After removal, the fat tissue was heated at low temperature until all the fat had melted and a homogenous sample could be removed for analysis. Iodine values were determined by the Wijs method(3) and polyunsaturated fatty acids by the alkaline isomerization procedure of Luddy *et al.*(4). Deep body temperatures were determined with a flexible thermistor inserted 10 cm into the cloaca and subcutaneous temperatures with a needle thermistor inserted just under the skin at the site of fat biopsy.

Results. Table I gives the results of the study. The iodine value for the fat obtained from hens kept at 0°C was significantly greater ($P<0.05$) than that of the fat from hens at either of the higher ambient temperatures. Among the fatty acids, the dienoic and hexaenoic acid fractions from the fat of hens maintained at 0° were significantly larger ($P<0.05$) than the corresponding fractions from the fat of the other two groups.

The deep body temperature measurements showed little difference among the 3 groups and the subcutaneous temperature measurements, while higher for the hens maintained at 32°C, were in no way correlated with the

TABLE I. Effect of Environmental Temperature Changes upon Changes in Fat Composition and of Body Temperature in Leghorn Hens.

Measurement	Environmental temperatures: Hot* 32°C	Temperate 21°C	Cold 0°C
Body fat composition			
Iodine value	86.2 ±1.5†	87.0 ± .9	90.2 ± .7
Fatty acids (as % of fat):			
Saturated	27.5 ± .8	27.6 ± .3	26.6 ± .7
Monoenoic	50.6 ±1.5	50.0 ±1.0	48.6 ±1.0
Dienoic	20.8 ±1.3	21.1 ± .9	23.4 ± .4
Trienoic	.82± .7	.97± .02	.93± .05
Tetraenoic	.11± .02	.09± .02	.13± .02
Pentaenoic	.05± .02	.05± .01	.06± .01
Hexaenoic	.07± .04	.15± .04	.22± .01
Body temp. (°C)			
Deep cloacal	41.6 ± .1	41.2 ± .1	41.3 ± .05
Subcut.	41.5 ± .1	39.9 ± .4	40.0 ± .2

* 60% relative humidity.
† Mean value from 5 hens with stand. error.

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fat composition changes in the 0° group.

Discussion. These results indicate that body fat composition can be altered upon changing environmental temperature even in a species that is well insulated externally, and in absence of a correlation with body temperature. The body temperature gradient noted in the pig may therefore be only incidental to the changes observed in fat composition, while altered metabolic activity resulting from acclimation to cold and warm environments may more likely be responsible.

We have previously shown(5) that degree of unsaturation of body and liver fat increased on starvation as a result of the preferential retention of polyunsaturated fatty acids. At 0°C temperature the hens in this study lost body weight (8.5%) during adjustment to their new environment. However, this weight loss, which resembles the loss during starvation, does not explain completely the greater unsaturation of the depot fat from the birds maintained in the cold, because the hens kept at 32°C also lost weight (10.8%) during the adjustment period without concomitant change in body fat composition. The changes in body fat composition are also probably not related to differences in reproductive activity, for while the birds at 0°C were below controls in rate of egg production (56% *vs* 78%), the birds at 32°C also produced at a reduced rate (62%).

While the exact mechanism of the observed change is not clear, it is of interest to point out that Henriques and Hansen(1) believed (without citing data) that the greater unsaturation in pig depot fat was due to an increase in oleic acid concentration. In the present study oleic acid actually decreased while the dienoic and hexaenoic acid fractions increased.

Summary. Samples of subcutaneous body fat were analyzed for fatty acids and iodine values in hens maintained at 3 environmental temperatures. It was found that fat from hens maintained at 0°C was significantly more unsaturated and contained more di- and hexaenoic acid than fat from birds kept at either 21° or 32°C. There were no changes in deep body temperature or temperature of the tissue at site of fat biopsy which correlated with the changes in fat composition. It is suggested that metabolic adjustments associated with cold adaptation are responsible for the changes in body fat composition.

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Application of Direct and Indirect Immunofluorescence for Identification of Enteroviruses and Titrating their Antibodies.* (27664)

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The reports dealing with immunofluorescence of enteroviruses have dealt with either the time sequence of events in tissue culture cells after infection with the agents or with identification of unknown enteroviruses. Buckley(1), using the indirect procedure, stained the 3 types of poliovirus in tissue culture and noted the time and morphology of newly formed virus antigen within tissue culture cells. Other workers(2,3,4) using different tissue culture systems and modifica-

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