Using Blood DDT Residue to Predict Fat Residue in Beef Animals[1]

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In early 1968, the U. S. Food and Drug Administration proposed that the tolerance for DDT-DDE (DDTR) in the fat of beef be reduced from 7.0 to 1.0 ppm. Our laboratory immediately began to analyze for DDTR in carcass fat samples from major feedlots in Arizona. Individual 50-100 gram fat samples were collected from the kidney knobs, placed in baby food jars and frozen. DDTR analyses were conducted using the on-column extraction-cleanup method of Cahill, Estesen and Ware (1970).

This proposed tolerance reduction for beef fat was probably the final persuading factor resulting in Arizona's 1969 moratorium on the use of DDT in agriculture (Ware et al. 1970). Following the moratorium we continued the analyses of beef fat samples through September of 1970 for both moratorium monitoring data and to keep the industry informed of its status relative to residues in carcasses entering interstate commerce. The averaged results of this survey are shown in Table 1, indicating that beef fat residues of DDTR declined following two years of DDT moratorium.

The U. S. Food and Drug Administration's proposed tolerance failed to materialize and the original tolerance was continued at 7.0 ppm. Consequently there was no further need for additional sampling in that all individual fat samples contained less than one-half the legal tolerance.

It appeared, however, in 1968-69 that our analytical facilities would become deluged with requests to analyze beef fat samples before being marketed, should the 1.0 ppm tolerance be established. We thus sought the opportunity to develop a short-cut analytical method which would reveal fat residues before slaughter. Residue determinations of whole blood remained the only pragmatic possibility beyond the very difficult subcutaneous fat biopsy of cattle.

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At that time the Department of Animal Science conveniently had underway a feeding study of beef animals to determine the overall effect of prolonged, high dietary fat levels. We assumed that high fat levels, which were essentially from added local beef tallow, would result in high DDTR residues in the fat of test animals. It was agreed that at slaughter adequate fat and blood samples would be collected for DDTR analysis.

Twelve half-sibling steers (182 kg) were utilized in this experiment. Three steers were randomly allotted to each of four diets: control with no added tallow (3% naturally occurring), 5% added tallow (total - 8%), 10% added tallow (total - 13%) and 15% added tallow (total - 18%). The concentrate level of each diet, regardless of tallow additions, was increased after 56 days on test from 60 to 75%, and 56 days later to 90% until slaughter weight was attained (477 kg). Prior to the initiation of the experiment, the steers were fed a sub-maintenance diet for 56 days to reduce body fat stores.

Blood samples (25 ml) were collected from each animal at slaughter, and 50 gram fat samples were removed from the left kidney knob after 24 hours of chilling. Samples were collected from only 10 steers because of early slaughter.

Fat samples were extracted and analyzed as referenced above, while the blood was lysed and extracted with ethyl ether according to the method of Morgan and Roan (1972).

TABLE 1

DDTR residues in beef fat from selected Arizona feed lots.

Feed Lot No.[1]	Residues in PPM			
	Nov. 1968	May 1969	Dec. 1969	Sept. 1970
1	1.34	0.74	0.59	0.60
2	1.07	1.27	1.93	0.45
6	1.15	0.77	0.75	--
9	0.80	0.14	0.71	--
12	0.47	0.48	0.84	0.46
Average	0.97	0.68	0.96	0.49

[1] Average of five animals per feed lot.

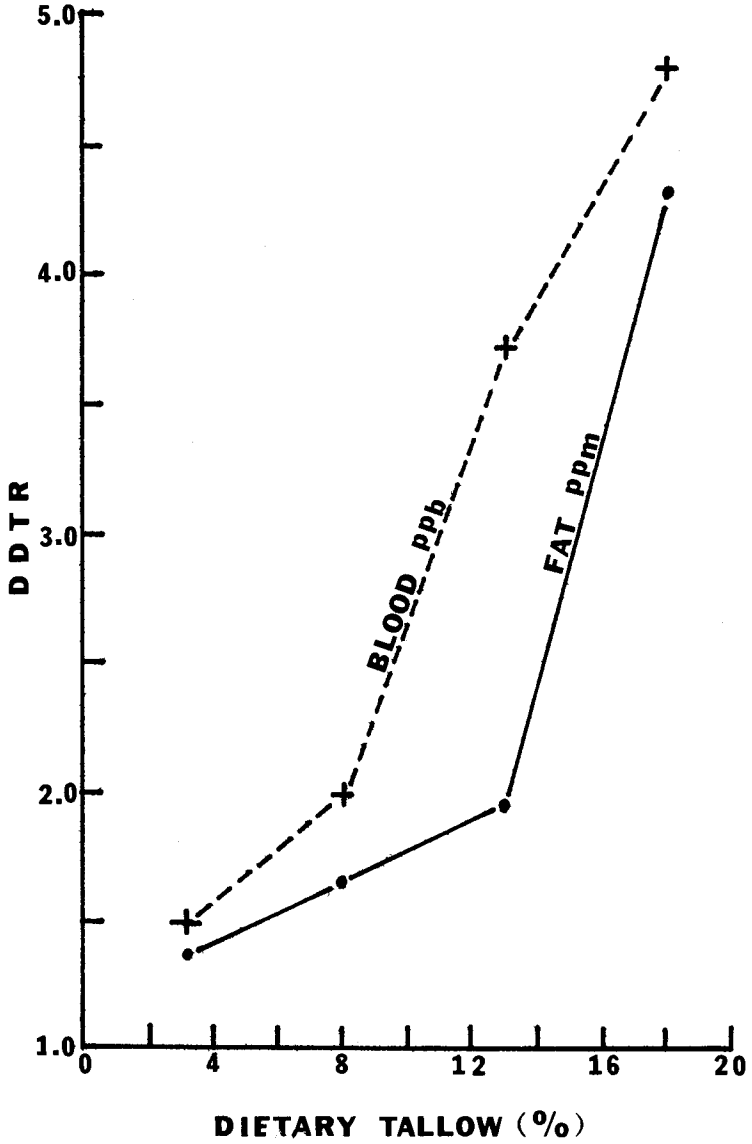

Figure 1. Relationship of kidney fat and blood DDTR residue in beef animals on high-fat diets.

The results are tabulated in Table 2 and illustrated in Figure 1. Except for the animals fed 13% fat, there is a good correlation between the ratios of DDTR residues in kidney fat and blood, ranging from 524 to 906, averaging 790.

Morgan and Roan (1974) working with human subjects observed ppb ratios of subcutaneous adipose lipid to whole serum of 314

TABLE 2

DDTR residues in kidney fat and blood from beef animals fed 4 levels of ration-incorporated beef tallow. (Tucson, 1969).

No.	Dietary Tallow %	Fat PPM DDE	DDD	p,p'-DDT	Total	Blood Total (PPB)
13	0	1.88	<0.03	0.20	2.08	2.6
18	0	1.04	~0.02	0.08	1.12	1.0
23	0	0.83	~0.02	0.04	0.87	<1.0
	Avg.	1.25	0.02	0.11	1.36	1.5
16	5	1.31	~0.02	0.15	1.46	2.9
22	5	1.71	~0.01	0.19	1.90	<1.0
	Avg.	1.16	0.01	0.17	1.68	2.0
15	10	1.59	0.05	0.21	1.85	3.5
24	10	1.84	0.04	0.14	2.02	3.8
	Avg.	1.72	0.04	0.17	1.94	3.7
14	15	4.13	0.11	0.75	4.99	6.6
19	15	4.12	0.10	0.27	4.49	5.3
21	15	2.89	0.11	0.42	3.42	2.4
	Avg.	3.71	0.11	0.48	4.30	4.8

for p,p'-DDT, 206 for o,p'-DDT, and 284 for p,p'-DDE. There is an approximate threefold difference between the two studies which may be attributed to differences of metabolism between species, and kidney vs. subcutaneous lipid deposition of DDTR residues.

In summary, from this study it appears that analysis of blood samples from living beef animals could provide an accurate estimate of carcass fat DDTR residues prior to slaughter.

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