

Correlation Between Pesticide Levels in Milk and Carcasses of Dairy Cows^{1,2}

by J. W. STULL, W. H. BROWN, and F. M. WHITING

Department of Dairy and Food Sciences

The University of Arizona

Tucson, Ariz.

Since the life expectancy of a dairy cow averages about four lactations (1), the value of cull animals sold for slaughter is a significant item in a dairyman's income. Recent indications are that regulatory groups are subjecting all agricultural products to the same comprehensive scrutiny concerning chemical residues as has been evidenced for some time in the case of milk and milk products. Since the possibility of exceeding residue tolerance exists, a dairyman might find value in being able to predict the carcass levels of pesticide by a correlation with the known amount in milk.

It has been well documented that milk is the primary excretory route of chlorinated hydrocarbon pesticides such as DDT from the cow (2,3,4,5,6). During lactation as well as in dry periods there is reason to believe that DDT and its metabolites can accumulate in the carcass of the dairy cow at a rate depending upon the intake level of pesticides in the diet. While it is possible to biopsy tissue from an animal and analyze it before slaughter, the technique is one that may not lend itself to routine, on-the-farm operations. Since most dairymen have rather current knowledge concerning the residue level in their milk supply, however, it was felt that a milk-carcass correlation would be valuable information.

Experimental

In this work, milk samples were taken from a series of animals just prior to slaughter. The animals were generally late in lactation and had been scheduled for culling for various reasons. They had been continuously exposed to a moderate level of pesticide intake from natural feed sources. Immediately after slaughter, carcass samples were taken from two convenient sites; the kidney knob and the tail head. The latter was selected as being one area that could be conveniently biopsied in any application wherein there

¹Arizona Agricultural Experiment Station Technical Paper No. 1815.

²This work was supported in part by a grant from the United Dairymen of Arizona, Tempe, Arizona.

would be interest in the extension of these observations. The milk and carcass tissue samples were analyzed for DDT and its metabolites by conventional gas chromatographic methods (7).

Results and Discussion

TABLE 1
Pesticide levels in milk and carcass of dairy cows

Range of pesticide concentration in milk fat (ppm)	Number of animals	Average pesticide concentration in fat (ppm)		
		Milk	Kidney	Tail head
1.00 or above	8	1.26	1.04	1.38
0.55 - 0.99	17	0.80	0.77	0.87
0.10 - 0.54	5	0.21	0.19	0.19
All samples	30	0.83	0.75	0.89

There is fairly close agreement or correlation between the pesticide concentration in milk fat and that found in the carcass of a lactating dairy cow (Table 1). While the pesticide levels in the tail head tissue were slightly higher than that in either the kidney or milk fat the difference is not considered significant. Three points should be made regarding these observations. First, all the animals in this work had been on naturally contaminated feed containing fairly uniform levels of DDT throughout an entire lactation or longer. Second, concurrent and other observations have shown that the pesticide level in the carcass is fairly uniform throughout all tissues when expressed on a fat basis (8). Finally, the principle involved in these data could be used in a converse relationship by a dairyman who might be uncertain about the previous pesticide exposure of certain non-lactating animals. He could rely on the analysis of a tail head tissue biopsy to give an indication of prior contamination. Information obtained in this way might be used to prevent unsuspected contamination of a herd milk supply.

References

1. VAN SANT, W. R., Dairy Extension Specialist, The University of Arizona, Tucson, Personal communication, (1971)
2. BROWN, W. H., WITT, J. M., WHITING, F. M., and STULL, J. W., Bull. Environ. Contam. and Toxicol. 1,21 (1966)
3. STULL, J. W., BROWN, W. H., WHITING, F. M., and WITT, J.M., J. Dairy Sci. 49,945 (1966)
4. BIDDULPH, C., BATEMAN, G. Q., BRYSON, M. J., HARRIS, R. J., GREENWOOD, D. A., BINUS, W., MONOR, M. L., HARRIS, L. E., and MADSEN, L. L., Adv. in Chem. Ser. 1,237 (1950)
5. BRUCE, W. N., LINK, R. P., and DECKER, G. C., J. Agr. Food Chem. 13,63 (1965)
6. SHEPHERD, J. B., MOORE, L. A., CARTER, R. H., and POOS, R. W., J. Dairy Sci. 32,549 (1949)
7. WITT, J. M., WHITING, F. M., BROWN, W. H., and STULL, J. W., J. Dairy Sci. 49,370 (1966)
8. WHITING, F. M., Unpublished data, Arizona Agr. Exp. Sta. (1971)