

Transition of some heavy metal elements (Zn, Cd, Cu, Hg, Pb) from piglet feeding root soil into pork liver and kidney.

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1. Preliminary note

In the solid waste treatment station "MURA", located in the city of Biel-Bienne, a part of the solid waste is transformed into a special compost product (Ferkelwüherde) which serves as a root soil for pigs in their early age (1-3 months) effecting like a natural fodder additive. As heavy metal contents in such waste products is regularly high Cd : 600-6 000 ppb, Cu : 7 000-12 000 ppb, Hg : 250-2 500ppb, Zn : 100 000-300 000 ppb, a possible transition of the said metal elements into pork kidney and liver was studied. A series of 20 pigs which has been served with solid waste root soil were slaughtered at a weight of 80-100 kg and their kidneys and livers analyzed (incineration with HNO₃-H₂O₂, reflux, mesure of the metal elements by atomic absorption spectrometry, graphite cell). An O-Test series of 20 pigs of the same origine which had not been given the compost product were slaughtered at the same weight and age as those of the test series, and their kidneys and livers investigated in the same way.

2. Analytical methods

The whole kidneys respectively the livers of the freshly slaughtered pigs were homogenized in an Aquaren Quartz Blender. 50 g of each homogenate weretransferred in a Büchi Incinerator, frozen with sufficient liquid nitrogen and finally pulverized using an Ultraturrax Homogenizer making sure to not have contamination with heavy metal element traces from preliminary analysis. After evaporating nitrogen add 40 ml of concentrated HNO₃ and 5 ml of H₂O₂ 35%, pass under reflux, cook gently till solution gets cleared. For mercury, a separate incineration must be made using 20 ml concentrated H₂SO₄ + 0,5 g KMnO₄. In the clear solution heavy metals were mesured using an Ingold-IL Video Atomic Absorption Spectrophotometer fitted with graphite cell IL 755.

3. Results

The following tables show heavy metal contents of 20 kidneys and 20 livers of 20 pigs feeded without solid waste compost product = Series 0, and of 20 kidneys and 20 livers of 20 pigs of the same origin which had been served with this fodder additive = Series T.

TABLE 1

Zn, Cd, Cu, Hg, Pb in 20/20 pig kidneys / T = Test-Series, administrated
O = O-Series, not administrated
with compost root soil

Test-Series	O-Series	µg/kg	µg/kg	µg/kg	µg/kg
Pig Nr.	Pig Nr.	T Zn O	T Cd O	T Cu O	T Hg O Z Pb O
1	1	25`100/20`200	104/130	7`200/6`800	8/ 8 112/102
2	2	22`100/20`600	122/130	5`800/6`200	8/ 9 110/108
3	3	19`800/20`600	143/129	6`800/7`700	8/10 108/116
4	4	21`200/20`800	120/106	5`700/6`200	8/ 8 105/112
5	5	19`400/21`200	185/170	5`900/7`200	8/ 8 110/110
6	6	25`600/23`200	120/110	6`300/6`800	8/10 115/112
7	7	24`100/23`800	105/123	7`000/5`800	8/ 9 109/112
8	8	23`700/20`200	111/166	7`400/5`900	8/ 9 102/102
9	9	23`800/21`800	170/180	6`000/6`800	8/ 8 108/114
10	10	19`900/21`600	132/146	7`600/7`200	9/ 9 116/108
11	11	24`800/23`200	107/120	7`700/7`100	9/ 8 111/118
12	12	20`200/21`200	146/172	5`900/6`900	10/ 8 118/102
13	13	24`000/20`200	160/112	7`100/6`200	9/ 9 100/102
14	14	21`400/21`900	115/172	6`900/7`500	8/ 8 102/112
15	15	23`700/19`900	122/180	6`300/6`800	10/ 8 116/112
16	16	20`500/22`600	170/120	5`800/6`000	8/ 8 113/112
17	17	25`100/22`600	150/113	5`800/7`500	9/ 8 107/103
18	18	21`800/20`200	110/118	5`200/7`300	10/ 8 103/114
19	19	24`200/20`100	129/178	7`100/6`200	10/ 8 102/106
20	20	22`200/20`000	110/160	6`300/7`600	8/ 8 108/106
Ranges µg/kg	19`400-25`600	104-185	5`700-7`700	8-10	102-118
Averages	22`630/21`345	132/142	6`500/6`790	9/ 9	109/109

TABLE 2

Zn, Cd, Cu, Hg, Pb in 20/20 pig livers / T = Test-Series, administrated
O = O-Series, not administrated
with compost root soil

Test-Series	O-Series	µg/kg	µg/kg	µg/kg	µg/kg
Pig Nr.	Pig Nr.	T Zn O	T Cd O	T Cu O	T Hg O Z Pb O
1	1	62`200/72`800	37/35	12`200/10`200	5/ 6 99/100
2	2	65`000/68`000	42/40	11`000/10`000	6/ 6 102/ 95
3	3	61`000/68`000	40/40	8`200/ 8`900	4/ 6 95/ 95
4	4	75`800/61`000	41/36	11`000/ 9`200	6/ 6 100/106
5	5	72`200/73`200	43/36	7`200/ 9`200	4/ 4 90/ 92
6	6	58`900/80`200	36/36	11`200/10`000	4/ 4 92/103
7	7	82`800/81`300	38/40	5`500/ 7`700	4/ 6 90/106
8	8	76`200/81`200	40/40	7`900/11`000	5/ 5 93/ 95
9	9	65`200/78`500	42/45	13`700/ 6`200	4/ 4 105/100
10	10	61`000/72`200	45/45	12`600/ 9`800	6/ 6 102/106
11	11	63`500/73`500	36/35	10`200/ 8`200	12/ 4 95/ 96
12	12	59`200/80`000	37/36	13`700/ 8`500	4/ 4 90/ 98
13	13	61`700/60`200	42/40	12`000/ 7`200	4/ 4 105/100
14	14	50`200/73`300	43/41	8`200/ 9`200	4/ 5 102/100
15	15	72`400/75`200	40/40	7`200/12`000	5/ 5 100/100
16	16	61`800/60`500	36/38	13`100/12`100	4/ 4 89/ 99
17	17	72`200/81`900	35/38	11`900/ 7`200	4/ 4 97/102
18	18	80`000/71`000	40/42	7`700/11`500	5/ 6 95/ 99
19	19	72`900/71`200	42/43	8`200/12`000	6/ 6 90/100
20	20	59`800/68`700	40/35	12`700/ 7`780	5/ 6 95/105
Ranges µg/kg	58`900-82`800	35-45	5`900-13`700	4- 6	89-106
Averages	67`200/72`800	40/39	10`290/ 9`400	4,7/ 5,9	96/100

TABLE 3

Amplitudes, average-concentrations and tendencies

	Zn O ug/kg	Zn T ug/kg	Cd O ug/kg	Cd T ug/kg	Cu O ug/kg	Cu T ug/kg	Hg O ug/kg	Hg T ug/kg	Pb O ug/kg	Pb T ug/kg
KIDNEY										
Amplitudes	19900-23800	19400-25600	106-180	104-185	5900-7700	5700-7700	8-10	8-10	102-118	102-118
Ø von n=20	21345	22630	142	132	6790	6500	9	9	109	109
Tendency	↓	↑	↑	↓	± 0	± 0	0	0	0	0
LIVER										
Amplitudes	60200-81900	58900-82800	35-45	35-45	6200-12100	5900-13700	4-6	4-6	92-106	89-105
Ø von n=20	72800	67200	39	40	9400	10300	4,7	5,0	100	96
Tendency	↑	↓	± 0	± 0	↓	↑	± 0	± 0	± 0	± 0

4. Discussion

A significant difference between the O and T Series was not found. Although kidney and liver are commonly considered as organs accumulating heavy metal elements, our results show relatively low concentrations and it seems that even relatively high concentrations of Zn, Cd, Cu, Hg and Pb in root soil do not influence contents in kidney and liver of adult pigs. In consequence of these facts it would be allowed to admit that red meat quality will not be negatively influenced by using compost root soil as a fodder additive.