R79-83z

[Reprinted from Food Research, 1953, Vol. 18, No. 2, Pages 109-112]

THIAMINE, RIBOFLAVIN, AND NIACIN CONTENT OF ORGAN MEATS[a]

HAROLD E. SCHEID, BARBARA A. BENNETT, AND B. S. SCHWEIGERT

Division of Biochemistry and Nutrition, American Meat Institute Foundation and Department of Biochemistry, University of Chicago, Chicago, Illinois

(Manuscript received August 10, 1952)

Some data are available on the thiamine, riboflavin, and niacin content of muscle cuts and certain organ meats from swine, cattle, and sheep *(1-12)*, but a comprehensive study of the vitamin content of organ meats is not readily available. The purpose of this study was to determine the thiamine, riboflavin, and niacin content of representative, composite samples of beef, pork, and lamb organ meats that were obtained directly from two meat-packing companies within 48 hours after the animals were slaughtered.

EXPERIMENTAL METHODS

Samples for the experiment were obtained from 2 meat-packing companies and were representative of the October-November slaughter period. The samples were taken from young lambs, hogs averaging 225 pounds in weight, and beef graded good (source 1) and commercial (source 2). Additional samples of liver were obtained from old sows (325 pounds in weight) and from old cows (cutters and canners). Whole organs, or in the case of liver 1- to 2-pound portions, were obtained from 10 different animals, composited and finely ground through an electric grinder. Extraneous fat and connective tissue that accompanied the sample were removed before grinding. Each sample was well mixed and a portion taken for vitamin analyses. Proximate analyses were made on a duplicate sample. The remainder of the sample was lyophilized, ether extracted, ground, and stored in the refrigerator for future research.

The fresh samples were analyzed for proximate composition and for thiamine, riboflavin, and niacin. Thiamine was determined fluorometrically, riboflavin microbiologically and fluorometrically, and niacin microbiologically. These methods have been discussed earlier *(10)*.

RESULTS AND DISCUSSION

The sampling technique provided a good, representative sample within the limits of one slaughter season and one section of the United States. The organs studied included brain, spleen, pancreas, liver, heart, lung, and kidney. Liver from old cows and sows was also selected in order to evaluate the influence of age of the animal on nutrient composition of the liver. The proximate composition of the samples is given in Table 1.

The thiamine, riboflavin, and niacin content of the samples is given in Table 2. The values for beef liver and heart compare favorably with those found in the literature *(1, 3, 4, 6)*. Pork muscle cuts are high in thiamine *(11)* compared to beef or lamb cuts. The thiamine content of pork organ meats was found to be essentially the same as that for beef and lamb organ meats. In general, heart, kidney, and liver contain approximately twice as much thiamine as brain, spleen, lung, and pancreas. The riboflavin and niacin content of liver is much higher than that of other organs. The values for riboflavin range from 0.2 mg. per 100 g. for brain to 3.9 mg. per 100 g. for lamb liver. The niacin content of the organs studied varied from approximately 3.0 mg. per 100 g. for beef pancreas to approximately 18 mg. per 100 g. for pork liver.

It is of importance to point out that on an overall basis the data for the thiamine and riboflavin content of the composite samples obtained from 2 sources were in excel-

[a]Journal paper No. 57, American Meat Institute Foundation.

TABLE 1

Proximate analyses of organ meats

Organ	Source	Protein[b]	Moisture	Ether extract	Ash
		% in sample			
Beef liver	1	19.0	69.2	5.6	1.1
Beef liver	2	20.0	71.6	1.3	1.3
Lamb liver	2	20.6	71.5	0.4	1.4
Pork liver	1	20.5	72.0	4.8	1.4
Pork liver	2	20.5	73.4	2.3	1.5
Beef liver (cow)	1	20.9	71.7	1.6	1.4
Beef liver (cow)	2	19.5	73.4	0.2	1.3
Pork liver (sow)	1	21.8	72.0	2.8	1.4
Pork liver (sow)	2	18.9	72.8	1.8	1.9
Beef kidney	1	16.9	78.4	3.1	1.0
Beef kidney	2	15.7	73.1	9.0	1.0
Lamb kidney	2	15.6	80.2	2.9	1.0
Pork kidney	1	15.1	79.6	3.9	1.0
Pork kidney	2	16.0	76.1	6.8	1.1
Beef heart	1	15.5	68.1	15.5	0.8
Beef heart	2	16.6	73.5	8.7	0.8
Lamb heart	2	14.3	65.5	19.4	0.7
Pork heart	1	16.4	76.5	6.2	0.9
Pork heart	2	16.8	74.6	7.5	0.8
Beef brain	1	11.0	78.0	10.9	0.6
Beef brain	2	10.9	79.2	9.6	0.7
Lamb brain	2	11.8	79.3	9.2	0.8
Pork brain	1	11.4	78.5	9.9	0.7
Pork brain	2	11.2	78.4	9.9	0.7
Beef pancreas	1	12.9	61.2	24.4	1.0
Beef pancreas	2	15.1	75.2	10.0	0.8
Lamb pancreas	2	15.9	75.3	9.9	1.3
Pork pancreas	1	17.3	65.7	16.7	1.0
Pork pancreas	2	16.4	64.7	20.4	0.9
Beef lung	1	17.8	78.4	2.7	1.0
Beef lung	2	18.8	79.0	0.9	1.0
Lamb lung	2	17.9	78.8	1.5	1.1
Pork lung	1	14.0	82.8	2.6	0.8
Pork lung	2	11.7	85.9	1.8	0.8
Beef spleen	1	16.9	75.2	6.9	1.1
Beef spleen	2	18.4	77.8	2.6	1.5
Lamb spleen	2	18.6	77.7	3.1	1.3
Pork spleen	1	16.2	71.2	11.7	1.1
Pork spleen	2	17.3	79.3	1.0	0.9

[b] N × 6.25. The proximate analyses were made by the Service Laboratory, American Meat Institute Foundation.

lent agreement. A composite sample for 10 animals was used and this provides a much sounder basis for computing the vitamin content of similar samples than can be obtained from data on individual organs. More variation was noted in the niacin values for the 2 composite samples in certain instances (pork liver, beef and pork pancreas).

The vitamin content of the livers from older animals (see Table 2 and text) was similar to that for the livers from younger animals. Variations in vitamin potency appear to be more markedly influenced by the vitamin intake than by the age of the animal [see references cited elsewhere *(10)*].

TABLE 2

The thiamine, riboflavin and niacin content of various organ meats (all values expressed as mg./100 g. on a fresh basis)

Material	Source[c]	Thiamine	Riboflavin	Niacin
Beef liver	1	0.18	2.51	11.9
Beef liver	2	0.21	2.89	11.3
Lamb liver	2	0.29	3.90	12.1
Pork liver	1	0.25	2.97	18.1
Pork liver	2	0.25	3.01	9.8
Beef liver (cow)	1	0.27	3.17	16.0
Beef liver (cow)	2	0.23	2.85	12.3
Pork liver (sow)	1	0.26	3.03	17.4
Pork liver (sow)	2	0.19	2.76	11.1
Beef kidney	1	0.27	1.95	5.47
Beef kidney	2	0.29	1.82	5.19
Lamb kidney	2	0.38	2.18	6.77
Pork kidney	1	0.26	1.84	8.51
Pork kidney	2	0.26	1.88	8.68
Beef heart	1	0.23	0.77	6.61
Beef heart	2	0.24	0.90	6.53
Lamb heart	2	0.31	0.86	4.55
Pork heart	1	0.33	0.79	7.95
Pork heart	2	0.29	0.82	6.64
Beef brain	1	0.12	0.24	3.41
Beef brain	2	0.12	0.20	3.76
Lamb brain	2	0.15	0.26	3.71
Pork brain	1	0.16	0.28	4.17
Pork brain	2	0.15	0.27	4.38
Beef pancreas	1	0.12	0.31	2.47
Beef pancreas	2	0.15	0.37	3.75
Lamb pancreas	2	0.13	0.50	3.90
Pork pancreas	1	0.11	0.45	4.17
Pork pancreas	2	0.10	0.47	2.73
Beef lung	1	0.11	0.35	4.04
Beef lung	2	0.11	0.36	3.92
Lamb lung	2	0.11	0.47	4.66
Pork lung	1	0.10	0.30	3.47
Pork lung	2	0.07	0.24	3.22
Beef spleen	1	0.13	0.28	4.34
Beef spleen	2	0.13	0.28	4.13
Lamb spleen	2	0.09	0.27	4.66
Pork spleen	1	0.13	0.28	4.31
Pork spleen	2	0.13	0.32	4.29

[c] 1 and 2 designate two different companies from which the samples were purchased.

SUMMARY

The thiamine, riboflavin, and niacin content and the proximate composition of liver, kidney, heart, pancreas, spleen, lung, and brain from beef, lamb, and pork and liver from old cows and sows have been determined. Composite samples of the organs from 10 animals were prepared, and these composite samples were made from beef and pork carcasses obtained from 2 sources. Liver was found to contain 10 times as much riboflavin

and 3-5 times as much niacin as brain, lung, spleen or pancreas. The thiamine content of liver, kidney, and heart was approximately twice that of brain, spleen, pancreas, and lung.

The thiamine and riboflavin contents of the composite samples were in excellent agreement. More variation was noted in the niacin content of certain of the composite samples of the same organs.

No marked differences in the vitamin content of the organs from beef as compared to pork and lamb were noted. Livers obtained from old cows or from sows were similar in vitamin content to those obtained from younger animals.

LITERATURE CITED

1. BATHURST, N. O. Vitamin B content of meat cuts. *New Zealand J. Sci. and Tech.*, **29**, 72 (1948).
2. CHELDELIN, V. H., AND WILLIAMS, R. R. Studies of the average American diet. II. Riboflavin, nicotinic acid and pantothenic acid content. *J. Nutrition*, **26**, 417 (1943).
3. DANN, W. J., AND HANDLER, P. The nicotinic acid content of meat. *J. Nutrition*, **24**, 153 (1942).
4. GRISWOLD, R. M., JANS, L. M., AND HALLIDAY, E. G. Retention of thiamin, riboflavin and niacin in pork hearts and beef kidneys. *J. Am. Dietet. Assoc.*, **25**, 866 (1949).
5. HARTZLER, E., ROSS, W., AND WILLETT, E. L. Thiamine, riboflavin, and niacin content of raw and cooked pork from grain-fed and garbage-fed pigs. *Food Research*, **14**, 1 (1949).
6. MCGILLIVRAY, W. A. Vitamin content of New Zealand meats. II. Lamb and mutton. *New Zealand J. Sci. and Tech.*, **31**, 30 (1949).
7. MCINTIRE, J. M., SCHWEIGERT, B. S., HERBST, E. J., AND ELVEHJEM, C. A. Vitamin content of variety meats. *J. Nutrition*, **28**, 35 (1944).
8. MCINTIRE, J. M., WAISMAN, H. A., HENDERSON, L. M., AND ELVEHJEM, C. A. Nicotinic acid content of meat and meat products. *J. Nutrition*, **22**, 535 (1941).
9. RICE, E. E., DALY, M. E., BEUK, J. F., AND ROBINSON, H. E. The distribution and comparative content of certain B complex vitamins in pork muscular tissue. *Arch. Biochem.*, **7**, 239 (1945).
10. SCHWEIGERT, B. S., BENNETT, B. A., MARQUETTE, M., SCHEID, H. E., AND MCBRIDE, B. H. Thiamine, riboflavin, and niacin content of processed meats. *Food Research*, **17**, 56 (1952).
11. WAISMAN, H. A., AND ELVEHJEM, C. A. *The Vitamin Content of Meat.* 1941, Burgess Publishing Co., Minneapolis, Minnesota.
12. WATT, B. K., AND MERRILL, A. L. 1950, Composition of foods—raw, processed, prepared, U.S.D.A. *Agr. Handbook No. 8*, Washington, D. C.