CHOLESTEROL CONTENT OF VARIOUS MEAT SPECIES AND ITS RELATION TO FAT CONTENT

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Background

Many people believe that pork and beef are fat foods which are high in cholesterol. In literature a wide variation of cholesterol content of meats is reported, often supporting the statement above. Quite often the reference unit remains unclear or varies. Some relate cholesterol to raw, some to cooked meat, some relate it to fresh matter, some to the lipid content of the meat. Furthermore people believe in analogy to milk and dairy products that the cholesterol content is closely related to the fat content of the cut. But cholesterol is solely a membrane lipid in meat, also adipose tissue and fatty tissue contain it only in their cellular membranes.

Objectives

With a new quantitative method for measuring the cholesterol content of meat, we analysed meat of various species and in cuts with various fat contents to prove differences between species and to try explaining them. Furthermore the poor correlation of fat and cholesterol concentration in meat cuts should be proven.

Materials and Methods

Various cuts of different species were bought in butcher shops, super markets or were cut by butchers on request in retail shape Thus all cuts are in composition similar to those on retails sale.
Fat content was deterimined by extraction with petrolether (40 - 60°).Cholesterol concentration was measured according to Arneth and Hussein (1995) by extracting the lipids with n-hexane/isopropanol (3:2,v/v). Separating triglycerides and phospholipids from cholesterol by chromatography on a short silica-column and determining the cholesterol on a RP 18-column on HPLC detecting at 210 nm.

Results

Pork and Beef. In a wide variety of pork and beef cuts (table 1 reports only a selection of the ones analysed) with 1.6 to 82% fat we found between 48 and 66,5 mg cholesterol/100g (table 1). There was no single value above 70 mg cholesterol/100 g. As can be seen by the increasing fat content there is a tendency to higher cholesterol contents in cuts with higher fat percentage. On average all measured pork and beef cuts have a mean of about 58 mg cholesterol/100 g carying from 45 - 70 mg/100 g.

Table 1: Mean Values of Fat and Cholesterol Content of Pork and Beef Cuts (g resp. mg/100 g raw meat)

species	cut		fat (g)	cholesterol (mg)
pork	fillet	(N = 3)	1.6	55
	chop	(N = 3)	7.0	54
	neck	(N = 3)	11.9	62
	belly	(N = 3)	27.1	59
	backfat	(N = 2)	82.0	59
beef	hip	(N = 2)	2.6	49
	fillet	(N = 2)	2.7	51
	roastbeef	(N = 2)	6.3	48.5
	entrecote	(N = 3)	11.3	48
	breast	(N = 2)	13.9	66.5

Fowl. Table 2 shows the data of the birds investigated. Cuts from breast muscles without skin are rather lean and contain in chicken and turkey on average about 44 mg cholesterol/100 g. In cuts with skin the fat and cholesterol content jump up. In chicken breast e.g. from 43.5 to 61.5 mg cholesterol/100 g. Besides the breast muscles of chicken and turkey all other cuts contain more cholesterol per 100 g than pork and beef cuts at the same fat level. Wild duck breast without skin is higher in cholesterol than in chicken and turkey Domesticated ducks are extreme in their cholesterol content. But as there were only two animals these data must be double-checked again. Ostrich meat is similar to beef and pork. In general chicken and turkey cuts except breast muscles have 60 - 80 mg cholesterol/100 g. Wild duck falls into the same range.

In conclusion meat of birds contains more cholesterol over all cuts than beef and pork.

The explanation lies probably in the difference size of muscle cells. Smaller cells of birds have a larger cellular membrane area per 100 g of meat than pork and beef with larger muscle cells. This fact can explain species, muscle differences and the poor correlation between fat content and cholesterol concentration.

Table 2: Mean Values of Fat and Cholesterol Content of fowl Cuts (g resp. mg/100 g raw meat)

species	cut		fat (g)	cholesterol (mg)
chicken	breast without skin	(N = 20)	0.7	43.5
	breast with skin	(N = 20)	6.2	61.5
	upper leg without skin	(N = 20)	6.4	84.0
	upper leg with skin	(N = 20)	15.1	84.5
turkey	breast without skin	(N = 10	1.0	44
	lower leg with skin	(N = 10)	5.5	72
	upper leg with skin	(N = 10)	13	79
wild duck	breast without skin	(N = 5)	1.4	67.5
	breast with skin	(N = 5)	10.9	74
	upper leg without skin	(N = 5)	4.5	68
	upper leg with skin	(N = 5)	10.6	76
domesticated duck	breast without skin	(N = 2)	2.8	123
	breast with skin	(N = 2)	28.5	103
ostrich	various cuts	(N = 4)	1.4	61

Venison. The large differences in domesticated and wild ducks let us investigate the cholesterol and fat contents of venison and wild boar. Both species have similar cholesterol content around 60 mg/100 mg (table 3). But whereas venison is very lean with ca. 1% fat, loin of wild boar contains about 9% fat (table 3).

Table 3: Mean Values of Fat and Cholesterol Content of Wild Animals (g resp. mg/100 g raw meat)

species	cut		fat (g)	cholesterol (mg)
venison (deer)	various cuts	(N = 24)	0.8	63
wild boar	loin	(N = 20)	9.3	62

Conclusion

There is a wide variation of cholesterol content in meat. 45 mg cholesterol in chicken and turkey breast without skin to 123 mg cholesterol in duck breast without skin. In birds the fat below the skin contains a high cholesterol content. Birds muscle cells (except chicken and turkey breast muscle cells) must be smaller than pork and beef muscle cells which contain less cholesterol as the latter have less membrane surface per 100 g of muscle. Also fat cells need cholesterol only in their membranes. Pork backfat shows therefore not very much more cholesterol than the lean fillet. While butter with 80% fat contains 240 mg cholesterol/100 g, backfat of pork with 82% fat has only a quarter of that value. Eating about 150 g meat per day of the most common meat species one takes up between 68 and 130 mg cholesterol. This is 22 to 43% of the 300 mg cholesterol per day, recommended for non healthy people.

References

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