Consequences of fat trimming in meat cuts on the nutrient supplies for human. Objective information to guide consumer attitudes.

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Abstract.- In European countries, many consumers trim their meat portion to eliminate most of the visible fat because they are aware that eating meat fat is suspected to increase risks for many diseases. Up to now, very little is known about the consequences of this habit on micronutrient supplies such as vitamins and minerals.

This paper provides objective data on the nutritional composition of cuts before and after fat trimming with emphasis on some micronutrients (B vitamins, iron, selenium, zinc). Two cuts (rib eye, brisket) from dairy (Holstein) and meat (Charolais) cows were analysed.

The results showed that:

1 – Lipid content of muscle part was similar in dairy and meat cows, but the ratio between fat and muscle was far higher in dairy cows than in meat cows.

2- Compared to 100 g of trimmed cut, consumption of 100 g of whole cut dramatically increased energy intake (30 to 100%) and the part of energy supplied by lipids (x 2 to 3) and, slightly reduced protein intake.

3 – Consumption of 100 g of trimmed cut supplied more iron, zinc selenium and B3 and B6 vitamins than eating 100 g of whole cut (+20-30%).

4 – Both trimmed and untrimmed cuts provided similar amount of B12 vitamin.

These results are explained by the higher lipid content and the lower minerals and B3 and B6 vitamin contents of fat compared to muscles. Consequently, trimming visible fat from cuts has no significant impact on minerals and vitamin supply, but significantly reduces fat and energy consumption. So, it must be recommended without restriction.

Meat is an important item in our feeding system and meals are often planed around a meat dish. Meat contributes to our nutritional equilibrium because it supplies a considerable part of daily requirements in some nutrients such as amino-acids, iron, zinc and B vitamin (Hermus and Albert, 1986; Rogowski, 1980). It provides also a significant amount of long chain polyunsaturated fatty acids (Bauchard et al. 2008). In developed countries, meat consumption increased continuously until 1980-1990 to reach a high level (around 100 Kg/year/Hab.). Since, meat consumption is decreasing continuously and its image is deteriorating progressively. This is the consequence of various associated factors including health, animal welfare, environment impact of animal rearing and some crisis (mad cow disease). Among them, those regarding public health are the most important. In developed countries, it is widely admitted that our consumption of fat is too high and is a risk factor for many diseases including obesity, diabetes and cardiovascular diseases (Rogowski, 1980) and some cancers (Tabatebaei et al., 2011, Corpet, 2011). Most of the critics are focused on red meat and nutritionists recommend reducing its consumption. Most of these critics are not based on objective data that indicate that a large number of meat cuts contains less than 5-6% fat (Gandemer, 1992; Bauchard et al., 2008). Only some cuts have a high proportion of fat. These cuts are often composed of several muscles between which fat is infiltrated. They are often named "heterogeneous cuts". Because fat is located between muscles, it is easy to remove with a knife and to leave on the side of the plate. Many consumers aware of health problems do this. Obviously, the goal of this practice is to reduce lipid and energy intakes. However, the consequences of this practice on the supplies of some other nutrients such as minerals and vitamins have not been evaluated. For some of these components, meat consumption largely contributes to cover the daily requirements. That is why this paper deals with the comparison of nutritional values of lean and edible part (lean + visible fat) of heterogeneous beef cuts.

Materials and methods. Sixteen cows, 8 dairy cows (Prim'Holstein) and 8 meat cows (Charolais) were reared in one of Inra experimental unit. Animals were fed typical fattening diet made of maize silage (ad libitum) and 1.8 Kg of soya meal for 7 weeks. Animals were 7 year old when they are slaughtered. The carcasses were R according to the EUROPA classification.

The following cuts were dissected out of the carcasses: rib eye and brisket. These cuts were heterogeneous and contained in various proportions lean, visible fat and bones (brisket only). In each cut, 3-4 portions of 100-150g were cut in the middle of each cut. Visible fat and connective tissues, and bones were removed from each portion by the butcher with a knife as close as possible to what a consumer can do in his plates when they choose to eat only lean part of their portion. Doing this, consumers removed not only visible fat but also connective tissue and small amount of muscle. That is why in this paper this fraction will be named "plate wastes". Bones, trimmed meat (lean) and plate wastes were weighed. Bones were discarded and both lean meat and plate wastes were kept for further analyses.

The following components were determined in each meat cuts according to the method placed in brackets: dry matter (AFNOR, NF V 04 4021), lipids (Folch and al., 1957), total iron and zinc (AFNOR, EN 14082), heme iron (Hornsey, 1956), selenium (Ducros and Favier, 1992), B3 (Ndaw et al., 2002), B6 (Ndaw et al., 2000) and B12 (Ortigues-Marty et al, 2005).

The composition of 100 g portion of each cut was calculated from the composition of lean and plate wastes and the relative amount of both in the portion. Energy content of both lean and edible portion were calculated multiplying lipid content by 37 and protein content by 17. Results were expressed as Kj/100 g fresh.

Data were analysed using a one, two or three way variance analysis including meat cuts (rib eye, brisket), type of portion (lean, edible part), type of cows (dairy, meat) and the interaction between factors. Means were compared by a Neuman keuls test.

Results and discussion

Cut composition. 100 g portion of brisket had a similar proportion of bones and edible part in both dairy and meat cows (Table 1). The relative proportions of lean and plate wastes differed greatly between the two types of cows. So, the edible part of brisket and rib eye contained more plate wastes and less lean in dairy cows (Prim'holstein) than in meat cows (Charolais)(Table1). This is due to the larger amount of visible fat in cuts from dairy cows. This result is consistent with the fact that carcasses of dairy cows are always fatter than those of meat cows after a fattening period before slaughtering.

Plate waste composition. Plate wastes are mainly composed of visible fat of cuts. However during cut trimming to remove visible fat, the butcher or the consumer eliminate a certain amount of connective tissues along with a small amount of lean. That is why the composition of plate wastes differs from that of adipose tissue. In the present study, plate wastes had similar composition whatever the cut and the type of cow (Table 2). Their compositions were characterized by a high dry matter content related to high lipid content. Consequently plate wastes provided more energy than the corresponding lean (2045-2254 versus 644-706 Kj). Conversely, they contained less protein than lean. Even if they contained less iron, zinc and B3 and B6 vitamins than lean, it must be underlined that plate waste contained a significant amount of all of these components. This is probably explained by the metabolism of adipose cells and the presence of a small amount of lean in plate wastes. Selenium was detected as traces. In contrast, plate wastes contained more B12 vitamin than lean. This result must be considered with caution because B12 quantification in adipose tissue is difficult and give very heterogeneous results.

Nutritional composition of lean and edible part of heterogeneous cuts. This comparison between the content of 100 g of lean and 100 g of whole cut (lean + visible fat) allows to precise the differences in the nutritional supplies of several components related to consumer attitude. As expected, 100g edible part of a portion provided considerably more energy (+200 to 500 Kj/100g) and more lipids (+6 to 13 g/100g) than 100 g lean (table 3). They contained slightly less proteins, iron, zinc, selenium and B3 and B6 vitamins than lean. The amount of B12 was similar in lean and edible part of cuts. The results were similar in both cuts (brisket and rib eye). They are affected by cow type. Indeed, 100g edible part from cuts of dairy cows (Prim'holstein) provided more energy and more lipids than those from cuts of meat cows because edibles part of cuts from dairy cows contained more visible fat and more plate wastes than those from meat cows (See table 1).

Conclusion: Eliminating visible fat as plate wastes from heterogeneous cuts containing a large amount of visible fat improves the nutritional value of meat. This strongly reduces calorie and lipid intake. Besides, the reduction of lipid intake causes a correlative reduction of saturated and monounsaturated fatty acid intake because lipids from beef contain a large proportion of saturated and monounsaturated fatty acids (Bauchard et al., 2008). Conversely, it slightly increases minerals and B vitamins supplies. That is why consumers must be advised to remove visible fat in meat cuts at least in developed countries where the level of obesity is increasing. Results are in preparation on the changes in fatty acid supplies related to this practice to complete the present data.

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Table 1: Composition of heterogeneous cuts of beef

	Charolais		Prim'Holstein		
	Mean	SD	Mean	SD	Statistical level
Brisket					
% of portion					
Lean	49.4 a	4.0	42.6 b	3.5	***
Plate wastes	23.3 b	3.2	29.6 a	5.0	***
Bones	27.3	1.3	27.8	2.5	NS
Edible part	72.7	1.3	72.2	2.5	NS
% of edible part					
Lean	67.9 a	4.7	59.1 b	5.8	***
Plate dishes	32.1 b	4.7	40.9 a	5.8	***
Rib eye					
% of edible part					
Lean	85.1 a	3.9	76.3 b	5.1	***
Plate wastes	14.9 b	3.9	23.7 a	5.1	***

On the same row, means with different superscripts are significantly different.

Table 2: Composition of plate dishes of beef cuts (as g, mg or µg/100 g fresh)

	Ribe Eye		Brisket	
	Prim'Holstein	Charolais	Prim'Holstein	Charolais
Energy (Kj)	**2246**	**2104**	**2228**	**2055**
Dry matter (g)	67.7	63.20	64.6	62.4
Lipids (g)	53.7	49.9	53.2	48.6
Proteins (g)	13.4	13.4	13.4	13.4
Iron (mg)	0.86	1.03	1.07	1.82
Zinc (mg)	0.34	0.43	0.50	0.60
Selenium	tr	tr	tr	tr
B3 (mg)	1.75	1.91	1.68	1.73
B6 (mg)	0.07	0.09	0.07	0.09
B12 (µg)	2.7	3.1	5.5	1.9

Table 3: Comparison of nutritional composition of lean and whole edible part of two beef heterogeneous cuts (as g, mg or µg/100 g of fresh portion)

Cow type	Prim'Holstein				Charolais				Statistical effet		
Cut	Ribe eye		Brisket		Ribe eye		Brisket				
Portion	Lean	Edible	Lean	Edible	Lean	Edible	Lean	Edible	Cow type	Portion	cut
Energy (Kj)	706 de	1070 bc	644 e	1301 a	647 de	864 cd	635 e	1100 ab	***	***	**
Dry matter (g)	31,5 cd	40,0 a	29,2 d	43,9 a	30,1 d	35,0 bc	28,9 d	39,8 ab	**	***	ns
Lipids (g)	9,8 cd	20,2 b	7,7 d	26,6 a	7,6 d	13,9 c	7,4 d	20,9 ab	***	***	**
Proteins (g)	20,1 c	18,5 d	21,1 abc	17,9 d	21,5 a	20,3 bc	21,3 ab	18,8 d	***	***	ns
Iron (mg)	2,7 a	2,2 ab	2,1 ab	1,7 b	2,4 a	2,2 ab	2,3 ab	2,1 ab	ns	**	**
Zn (mg)	5,1 a	4,0 bc	4,7 ab	3,0 d	5,2 a	4,5 ab	4,4 ab	3,2 cd	ns	***	***
Se (µg)	10,4 a	7,9 cd	10,5 a	6,2 d	9,7 ab	8,3 bc	10,4 a	7,1 cd	ns	***	ns

B3 (mg)	4,2 bc	3,6 c	4,7 ab	3,5 c	4,6 ab	4,2 bc	5,1 a	4,0 bc	***	***	ns
B6 (mg)	0,38 ab	0,30 bc	0,40 a	0,27 c	0,30 bc	0,27 c	0,32 bc	0,24 c	***	***	ns
B12 (µg)	1,6 b	1,9 b	1,8 b	3,3 a	1,6 b	1,8 b	1,8 b	1,8 b	**	***	***

On the same row, means with different superscripts are significantly different.