

FAT GAINS DURING PAN FRYING OF PORK AND BEEF CUTS

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Background

Obesity is an increasing problem reaching epidemic proportions in many parts of the world (WHO 1997). Obviously, many care about their energy and fat intake, and one of the questions asked in this respect is how much fat the meat gains during frying on pan? And how much fat can be saved by frying in a limited amount of frying fat or by frying without frying fat. A few studies have shown that meat does not gain much fat on frying (Johansson and Laser, 1987; Kreutzer *et al.*, 1994; Clausen and Ovesen 2001). But still there are questions to be answered: Will the amount or type of frying fat, meat thickness, frying time and resting time in frying fat influence fat gain?

Objectives

The purpose of the present study was to obtain data on fat gain during frying in oil and in different amounts of margarine, and the effect of the thickness of meat, species, cut, fat content, frying time and resting time in frying fat.

Methods

Meat samples: Pork leg schnitzel, sliced strip loin, minced pork and beef patty (both 10% and 18% fat) were selected for analysis. Fat content was determined in raw and after frying. Pork leg was cut into a rectangular and divided into 9 slices numbered in succession. Slice number one, three and nine were analysed in the raw condition, and slice number 2 and 6, 3 and 7, and 4 and 8 were paired for frying together. From each of 4 strip loin, 4 slices were cut, and alternate slices were analysed raw and fried. Minced meat with uniform fat content was mixed and clayed into patties (125 g \pm 2 g) with a mould. Repetition (4) was carried out from different animals and from different batches. Meat was fried and homogenized the day it was delivered.

Frying methods: Two slices or 4 patties were fried together on a pan with "slip easy cover" (bottom diameter: 23 cm). Meat was fried in plenty of frying fat (75 g margarine corresponding to 60 g fat or 60 g oil) or in small quantities of frying fat (10 g for pork leg schnitzel and 25 g for patties) or without the use of any frying fat. Meat was browned on both sides ($\frac{1}{2}$ min) and fried for different lengths of time (see table 1), and then put on a dish for 5 minutes. Some pork leg schnitzels also rested for 15 minutes on the pan after frying was finished.

Homogenisation: All slices were homogenized in a mincer (Bear Varimixer) following further homogenisation in a blender (Braun electronic). Minced meat was only homogenized in the blender. Samples were collected from 10 locations in the matrix and put into two 50 ml boxes and frozen (-20°C) until analysis.

Weight registration and calculation of fat gain/loss: Meat weight was registered before frying and 5 min after frying to calculate fat gain/loss during frying. Percent fat loss: $\text{Fat (wt \%)} \text{ in raw meat} - (\text{fat (wt \%)} \text{ in fried meat} \times ((100 - \text{weight loss (\%)})/100))$.

Analyses: The fat content (double determinations) was determined gravimetrically after liberation by boiling with hydrochloric acid and extraction with diethylether/petroleum ether mixture after addition of ethanol and evaporation of the solvents (Nordic Committee on Food Analysis, No. 131).

Statistical analyse: Analysis of variance (ANOVA) (SAS System for Windows, version 8).

Results and discussion

Table 1 shows the fat content in raw and fried meat and the calculated fat gain during frying. Minced meat was not delivered with the desired fat content (10% and 18 %). Minced pork contained 11.1% and 18.0 % fat and minced beef contained 8.2% and 12.5 % fat.

The largest fat gain found was 2.0 % (pork leg schnitzel fried in 60 g oil, followed by resting on pan for 15 min). The largest fat loss was 2.7 % in pork patties (18 % fat in raw meat) fried in 75 g margarine.

Amount of frying fat: Pork leg schnitzels and pork patties (11% and 18 % fat) were fried in different quantities of fat. There was no significant difference in fat gain (or loss) when fried in large or small quantities of margarine. There was a significant difference in fat gain ($P=0.015$) for pork leg schnitzels between the use of plenty of margarine (0.5%) and without fat (0%).

Meat thickness: Pork leg schnitzels were cut in $\frac{1}{2}$ and 1 cm thick slices and fried in 75 g margarine. Fat gain tended to be larger for thin than for thick slices (1.1 % and 0.5 %, respectively; $P=0.0538$).

Type of fat: Pork leg schnitzels were fried in plenty of oil and margarine for a short time (5 min), a long time (11 min) and for long time followed by a resting period on the pan for 15 min. Frying in oil for a short time resulted in higher fat gain (1.3 %) than frying in margarine (0.5 %; $P=0.0115$), whereas fat gain when frying for a long time and for a long time followed by a resting period was similar for oil and margarine.

Frying time: Pork leg schnitzels were fried in oil and margarine for a short and a long time. Frying in margarine resulted in lower fat gain when fried for a short time compared to a long time (0.5 % and 1.2 %, respectively; $P=0.0036$), whereas frying time did not affect fat gain when frying in oil.

Resting time on pan in frying fat: Comparison of pork leg schnitzels (fried in oil and margarine) for a long time and for a long time followed by a resting period of 15 min increased fat gain (1.3 % and 2.0 %, respectively; $P=0.0061$).

Cut, fat content and species: Only cuts with intramuscular fat (pork leg schnitzel and sliced strip loin) and cuts with minced fat (pork and beef patties) were included in this investigation. Studies have shown that cuts with subcutaneous fat and intermuscular fat can lose some fat during cooking/frying (Johansson and Laser, 1987; Clausen and Ovesen, 2001), whereas intramuscular fat remains in the meat (Renk *et al.*, 1985). Sliced strip loin (mean 6 % fat in raw meat as intramuscular fat) gained 0.5 % fat during frying in 75 g margarine – the same amount as pork leg schnitzel (2 % fat in raw meat). Pork patties with 11 % fat in raw meat gained 0.4 % fat during frying and patties with 18% fat in raw meat lost 2.7 % fat. The same pattern was seen for beef patties. There are indications that minced beef loses more fat than minced pork taken fat content in raw meat into consideration, which other studies also have demonstrated (Laser and Johansson, 1990; Clausen, 2000).

Fat gain, even when frying in plenty of fat, is small and insignificant compared to the variation in meat fat content from different cuts (1%-40%), and to the habitual mean fat intake in Denmark of about 100 g pr. day for an adult (Andersen *et al.*, 1996). The effect on fat intake by frying in different amounts of fat will be trivial. However, a significant and nutritional important reduction in fat intake can be achieved by choosing lean meat or discard visible meat fat.

Conclusions

In conclusion, meat (sliced ½ and 1 cm, or minced) gains small and insignificant quantities of fat when fried on pan in plenty of fat irrespective of frying time. Meat may even loose fat during frying in plenty of frying fat. In this investigation the largest fat gain found was 2 %. The gain is small compared to the variation in meat fat content from different cuts (1%-40%) and to the mean habitual fat intake in Denmark of about 100 g pr. day for an adult.

Pertinent literature

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Table 1. Weight of raw meat on pan, frying methods, fat content of raw and fried meat (%) and calculated fat gain during frying (% = g fat gained pr. 100 g raw meat). Negative value for fat gain indicates that meat has lost fat.

Cut	Weight raw meat (g)	Thick- ness (cm)	Frying fat and amount on pan (g)	Frying time (min)*	Resting period (min)	Fat (%)		Fat gain (%)
						Raw	Fried	
Sliced strip loin	203 (143-284)	1	Margarine 75 g	5 min.		6.0 (2.8-9.7)	9.6 (4.8-14.3)	0.5 (0.1-1.0)
Pork leg schnitzel	197 (165-230)	1	Margarine 75 g	5 min.		2.0 (1.5-2.6)	3.8 (3.2-4.7)	0.5 (0.1-0.7)
-	174 (162-190)	1	Margarine 10 g	5 min.		2.0 (1.5-2.6)	3.3 (2.8-3.4)	0.3 (0.1-0.7)
-	205 (179-219)	1	0 g	5 min.		2.0 (1.5-2.6)	2.8 (2.2-3.4)	0.0 (-0.2-0.2)
-	164 (149-180)	½	Margarine 75 g	1½ min.		1.9 (1.2-3.0)	3.6 (2.9-4.1)	1.1 (0.6-1.4)
-	273 (240-303)	1	Margarine 75 g	11 min.		1.4 (1.0-1.7)	4.3 (3.4-4.9)	1.2 (1.1-1.4)
-	261 (233-278)	1	Margarine 75 g	11 min.	15 min.	1.4 (1.0-1.7)	5.4 (4.5-6.2)	1.9 (1.3-2.3)
-	240 (215-268)	1	Oil 60 g	5 min.		1.7 (1.4-2.0)	4.8 (4.0-5.3)	1.3 (1.0-1.8)
-	248 (222-280)	1	Oil 60 g	11 min.		1.7 (1.4-2.0)	5.4 (5.0-5.9)	1.4 (1.0-1.8)
-	246 (226-267)	1	Oil 60 g	11 min.	15 min.	1.7 (1.4-2.0)	6.7 (5.3-7.5)	2.0 (1.5-2.8)
Pork patties, low fat	500	1,5	Margarine 75 g	12 min.		11.1 (10.8-11.3)	15.4 (14.6-16.8)	0.4 (-0.2-1.4)
-	500	1,5	Margarine 25 g	12 min.		11.1 (10.8-11.3)	15.0 (13.9-15.4)	0.3 (-0.2-0.8)
-	500	1,5	0 g	12 min.		11.1 (10.8-11.3)	13.5 (12.7-14.6)	-0.3 (-0.7- -0.4)
Pork patties, high fat	500	1,5	Margarine 75 g	12 min.		18.0 (17.7-18.2)	21.3 (20.9-22.3)	-2.7 (-3.2- -1.7)
-	500	1,5	Margarine 25 g	12 min.		18.0 (17.7-18.2)	20.9 (20.3-22.0)	-2.5 (-2.8- -1.8)
-	500	1,5	0 g	12 min.		18.0 (17.7-18.2)	20.5 (20.3-20.7)	-2.6 (-3.0- -2.2)
Beef patties, low fat	500	1,5	Margarine 75 g	12 min.		8.2 (5.3-10.1)	11.7 (9.1-13.0)	-0.1 (-0.9-1.2)
Beef patties, high fat	500	1,5	Margarine 75 g	12 min.		12.5 (10.3-13.8)	15.1 (14.4-15.8)	-1.8 (-3.1- -0.2)

* Frying time include time to browning.