Feeding Fats Safety

"Quality and safety of feeding fats obtained from co-products and by-products from the food chain"

RESULTS ON LIPID COMPOSITION AND OXIDATION IN ANIMAL SAMPLES (WP-3)

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EXPERIMENTAL DESIGN, common to WP2,3 & 4

From the results obtained in WP1

Two fat sources with high and low level of:

1) OXIDATION; 2) *trans* FATTY ACIDS; 3) DIOXIN/PCB; 4) PAH

POULTRY | **RABBIT**

HO Fat	HT Fat	HP Fat	HC Fat
50% HO + 50% LO	50% HT + 50% LT	50% HP + 50% LP	50% HC + 50% LC
LO Fat	LT Fat	LP Fat	LC Fat

4 TRIALS x 3 treatments x 8 replicates = 4 x 24 = TOTAL 96 samples RABBIT

TOTAL 96 samples POULTRY

96 samples of MEAT - 96 samples of LIVER - 96 samples of PLASMA (+ faeces or urine)

O = oxidation level **T** = *trans* FA isomers **P** = PAH **C** = dioxins, PCB & PBDE

Fats added to experimental feeds

Criteria for selection: ***Values in the range observed for fats in WP1**

***Similar FA composition (if possible) inside each trial**

***Similar in another factors that could interfere**

Trial	*Level*	*Fat*
PAH	Low	Acid oil from chemical refining of olive oil
	High	Acid oil from chemical refining of pomace olive oil
Oxidation	Low	Sunflower-olive oil (70:30, v/v)
	High	Sunflower-olive oil (70:30, v/v), after commercial frying process
Dioxin	Low	Fish oil A
	High	Fish oil B
Trans	Low	Palm fatty acid distillate
	High	Hydrogenated palm fatty acid distillate

RESULTS

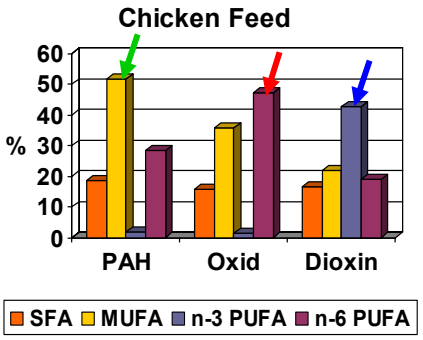
FA composition
Tocopherol and tocotrienol content
Oxidation values

FA composition – Chicken PAH, Oxid, Dioxin Trials
(% compensated area normalization)

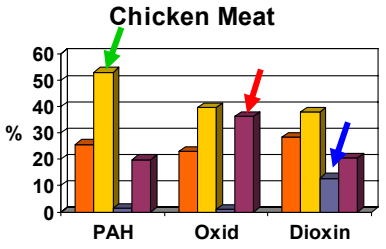
Low PAH: acid oil from olive refining
High PAH: acid oil from pomace olive refining

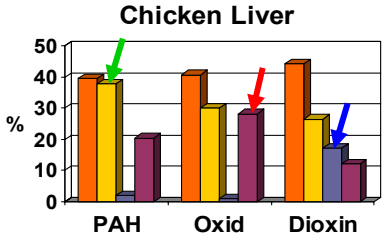
Low Oxid: sunflower/olive oil (70:30, v/v)
High Oxid: idem after a frying process

Low Dioxin: fish oil A
High Dioxin: fish oil B



Predominance MUFA

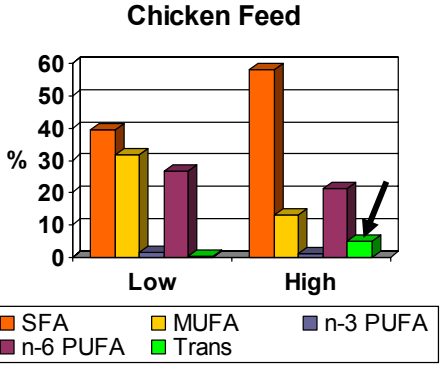




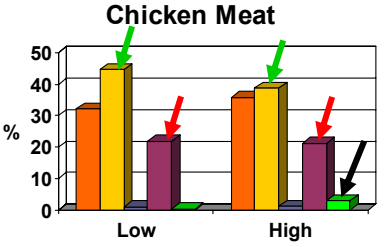
Predominance SFA

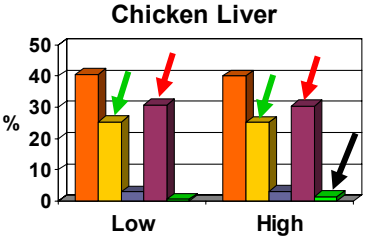
FA composition – Chicken Trans Trial
(% compensated area normalization)

Low Trans: Palm Fatty Acid Distillate
High Trans: Hidrogenated PFAD



Predominance MUFA





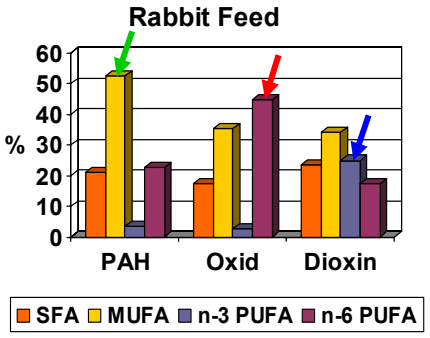
Predominance SFA

FA composition – Rabbit PAH, Oxid, Dioxin Trials
(% compensated area normalization)

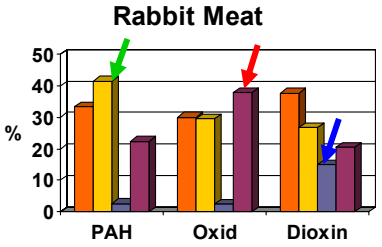
Low PAH: acid oil from olive refining
High PAH: acid oil from pomace olive refining

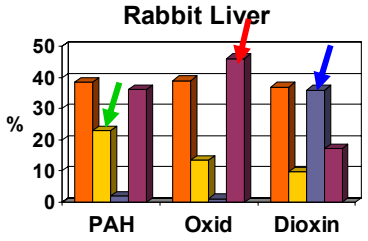
Low Oxid: sunflower/olive oil (70:30, v/v)
High Oxid: idem after a frying process

Low Dioxin: fish oil A
High Dioxin: fish oil B



NOT predominance MUFA

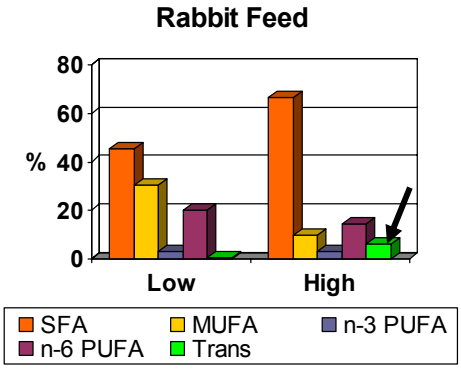


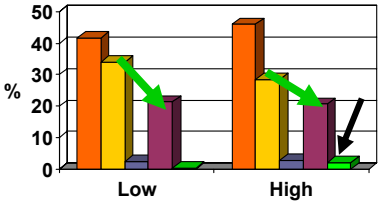


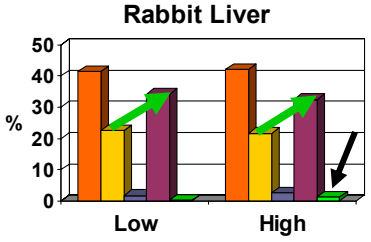
More constant SFA

FA composition – Rabbit Trans Trial
(% compensated area normalization)

Low Trans: Palm Fatty Acid Distillate
High Trans: Hidrogenated PFAD







Always predominance SFA

FA composition - Conclusions (I)

• When fats high in MUFA were added to the feed, % MUFA were significantly higher than for the rest of the treatments, both for chicken and rabbit meat.

•In contrast, higher % MUFA was found in chicken liver but not in rabbit liver, when fats high in MUFA were added to the feed.

•When fats high in n-3 PUFA were added to the feed , % n-3 PUFA were significantly higher than for the rest of the treatments, both for chicken and rabbit meat.

•In liver, we can found a similar effect of the fish oils treatments leading to higher contents in n-3 PUFA than the rest of the treatments.

•However, rabbit liver showed higher values of these fatty acids than chicken liver.

•When fats high in n-6 PUFA were added to the feed , similar effect on n-6 deposit in meat and liver is observed, as for n-3 FA.

FA composition - Conclusions (II)

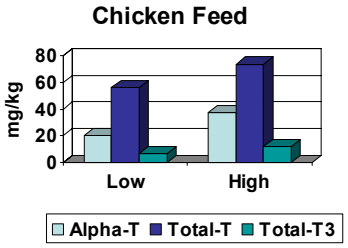
• When the most saturated fats were added to the feed ("Trans" trial), % SFA in meat were significantly higher than for the rest of the treatments. Differences were observed between species, since the rabbit showed a higher ability to increase saturated fatty acids (however, we have to take into account that chicken meat includes the skin).

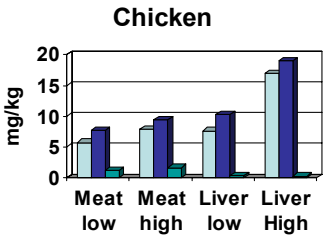
•In chicken and rabbit meats, there is a clear tendency to increase % SFA and *trans* FA accoding to the treatment (<u>from low to high</u> *trans*).

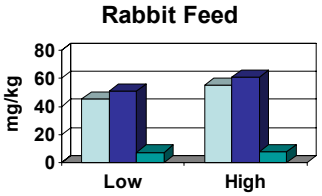
•In chicken and rabbit liver a similar increase can be observed for % *trans* FA, but not for % SFA, <u>from low to high</u> *trans*.

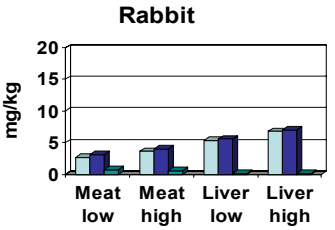
•Both in chicken and rabbit, regarding liver FA composition, we found a particular high deposition of MUFA and n-6 PUFA when very saturated fats ("Trans" trial) were added to the feed, although these treatments showed low levels of those fatty acids.

PAH trial: Tocol composition



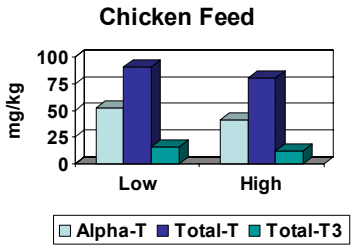


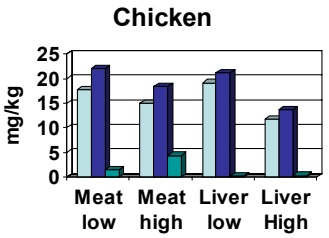


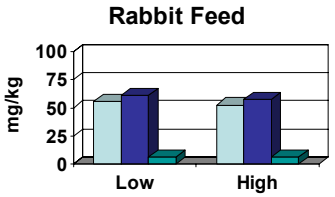


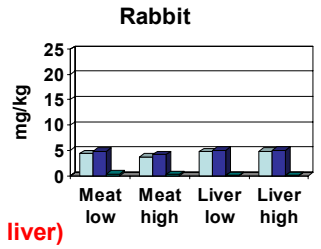
** Good correlation with feeds
** Chicken > Rabbit

Oxidation trial: Tocol composition



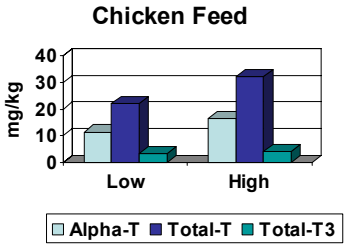


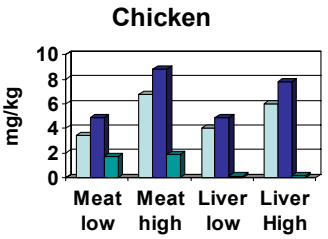


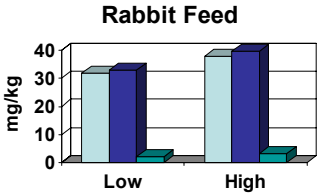


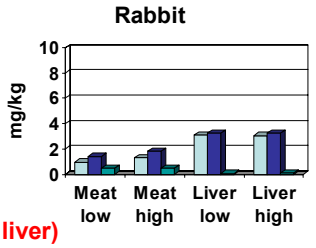
**Good correlation with feeds (except rabbit liver)
**Chicken > Rabbit

Dioxin trial: Tocol composition



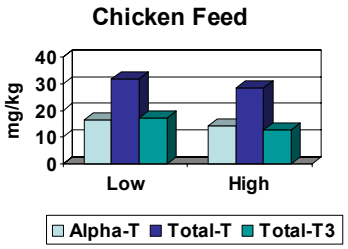


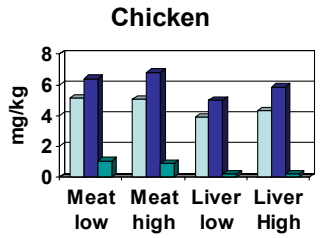


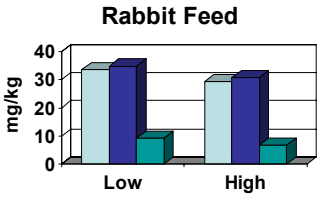


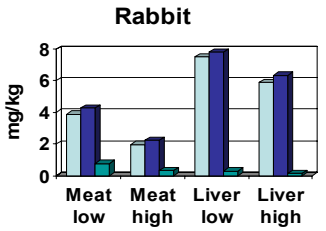
**Good correlation with feeds (except rabbit liver)
**Chicken > Rabbit

Trans trial: Tocol composition









** ↑ content of Tocotrienols (palm origin)
** Chicken meat > Rabbit meat
** Chicken liver < Rabbit liver

TOCOL composition - Conclusions

- Chicken meat with skin shows a higher content of tocopherols (1.4 – 5.5 fold) and tocotrienols (1.2 – 7.4 fold) than rabbit meat.

- Chicken liver shows a higher content of tocopherols (1.5 – 4.3 fold) and tocotrienols (2.1 – 8.6 fold) than rabbit liver, except for the "Trans" trial.

- Tocopherol deposition in rabbit liver showed a worst correlation with feed content than in chicken liver.

- Both in rabbit liver and meat samples, it can be observed that the higher %SFA the lower α-tocopherol content, but only when high saturated fats are added to the feed ("trans" trial treatments).

- In chicken and rabbit meats, for "Oxidation" and "PAH" trials a clear opposite tocol deposition pattern is observed among the three levels, which corresponds well to the respective feed content.

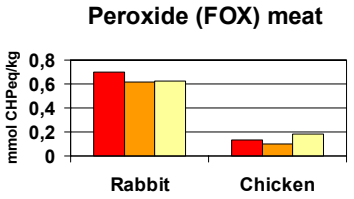
- In chicken meats, a better percentage of transfer from feed to meat is observed for "Oxidation" trial (n-6 PUFA added fats) than for "PAH" trial (monounsaturated added fats).

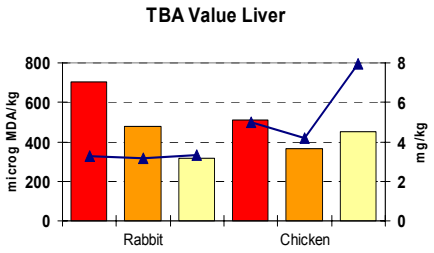
		Chicken			Rabbit		
Sample	Trial	Low	Med	High	Low	Med	High
Feed	Oxid	90.91	84.17	80.44	60.67	58.56	57.79
	PAH	56.15	51.36	73.69	51.15	44.35	60.88
Meat	Oxid	22.09	19.43	18.36	4.79	4.38	4.13
	PAH	7.74	9.33	9.39	3.14	3.86	4.01
Liver	Oxid	21.19	16.75	13.73	4.95	4.34	5.03
	PAH	10.3	15.40	19.02	5.59	4.79	7.01

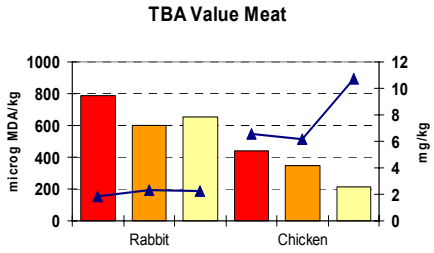
Dioxin trial: Oxidation parameters

(For the other 3 trials oxidation values are much lower)

OILS	Low	High
PV, meq/kg	1,7	4,3
FOX, mmol CHPeq/kg	0,34	3,66
Polymer, % (w/w)	2,65	0,21
TBA, µg MDA/kg	2819	65







Low Med High Tocol

Oxidation levels - Conclusions

The oxidation values are low in general, with the exception of meats and livers coming form the "Dioxin" trial. Some remarks can be done:

• A higher oxidation susceptibility was observed in rabbit and chicken meats coming from the "Dioxin" trial, as measured by the Peroxide content (FOX induced method). The higher n-3 PUFA content of fish oils used in this trial can explain this fact.

• Regarding TBA, liver and meat samples coming from the "Dioxin trial" showed much higher values than the rest of treatments. Moreover, in this case, a clear increase of the values existed from "high dioxin" to "low dioxin" treatments. This differences do not corresponded to relevant differences in PUFA content, but a decreasing tocopherol content can be observed in general from high to low dioxin meats, livers and feeds.