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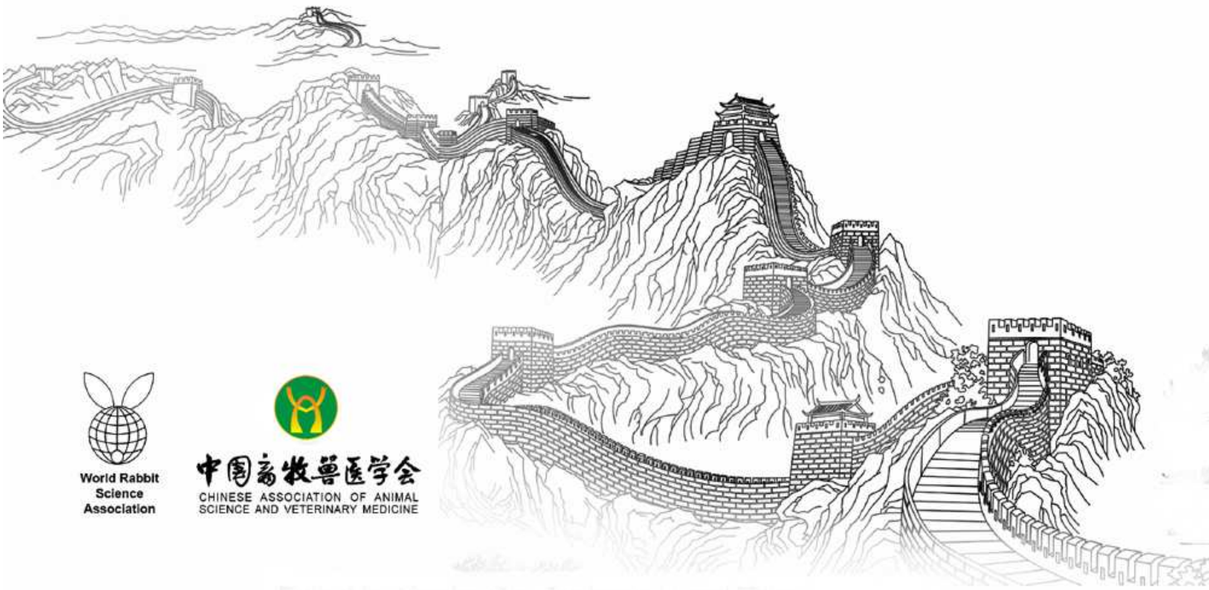

EFFECT OF FEED ENERGY SUPPLY FORM ON FATTENING RABBITS' PERFORMANCE AND FEEDING COST

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ABSTRACT

This study aims to compare the effect of 3 sources of energy supply on fattening rabbits' performance between 31 and 70 days old. Three pelleted diets whose digestible energy level (DE) respectively stems from a more important supply of fat, starch or digestible fibers are being compared with a diet including a more balanced supply of these 3 sources of energy. In a good sanitary context, with the same DE level, daily weight gain (DWG) turns out to be impaired by 1.8 g/day and feed conversion ratio (FCR) increased by 0.11 with a more important supply of fat, compared to a feed with a balanced mix of the 3 supply sources (44.4 vs 42.6 g/day of DWG and 2.37 vs 2.48 of FCR, $P<0.05$). The carcass yield is lower when using digestible fibers than with starch (resp. 57.4% vs 59.0%, $P<0.05$). Regarding feed prices, a diet formulation with a balanced supply of energy has the lowest feeding cost for growth, both in live weight and carcass weight.

Key words: energy form, starch, fat, digestible fibers, performance, carcass yield, feeding cost

INTRODUCTION

The energy level of feed plays a major role on the intake control, growth performance of rabbits fed ad libitum, and feed conversion ratio (Montessuy *et al*., 2009; Knudsen *et al.*, 2013). The digestible energy (DE) level of feeds results from several nutritional contributions, and mainly from: fat, starch and digestible fibers. For an equivalent DE level, the form of the energy supply is likely to vary substantially. Some works have studied the impact of different forms of DE supply on fattening rabbits' performances and health issues. The positive effect of digestible fibers (insoluble pectin and hemi-cellulose) on health issues is widely recognized (Gidenne *et al.*, 2015). However, some authors have suggested that the impact of starch on weaned rabbits was negative (Carraro *et al.*, 2007), it is most of all a lack of effect that has been demonstrated (Gidenne *et al.*, 2004). Concerning growth performance, results are sometimes contradictory, whether it is for starch (El-Tahan *et al.*, 2012), fat (Bhatt and Swain, 2003), or digestible fibers (Soler *et al.*, 2004). On the other hand, the various forms of energy supplies have seldom been the object of trials.

The aim of this study is to assess the impact of starch (SH), fat (FT) and digestible fibers (DF), on rabbits' growth and slaughter performance. These results are then compared with those of a fourth feed that has a more balanced supply of these 3 forms of energy (SFD).

MATERIAL AND METHODS

The trial is carried out at the St Symphorien experimental station (France).

Animals

672 Hyplus kits, weaned at 31 days old, are split in 4 homogeneous batches of 24 pens of 7 kits (regarding to their maternity batch, their litter and their individual weaning weight). The trial is conducted from 31 to 70 days old.

Experimental feeds

The four experimental feeds (table 1 and 2) have the same DE and nitrogen matter levels. They differ with regard to their energy form. In the SH, FT and DF feeds, DE is respectively provided by a more important supply from starch, fat and digestible fibers. In the SFD feed, the digestible energy results from a more balanced supply of these 3 forms of energy. Rabbits are fed every day according to the same restricted feeding program: 65 g/day at weaning, then an increase of 15 g/week. The 4 batches have the same energy intake and the amount fed is daily adjusted depending on mortality results.

Table 1. Feeds composition (%)

Feeds	SFD	SH	FT	DF
Barley	6.5	15.0	4.0	/
Milurex®	25.0	17.6	18.2	19.6
Rapeseed	/	/	3.0	/
Sunflower meal	21.0	21.0	21.0	21.0
Rapeseed meal	5.0	5.7	5.2	7.0
Beet pulp	16.9	12.4	13.0	28.6
Cane molasses	3.5	3.5	4.0	3.5
Grape pulp	3.4	3.1	2.8	4.2
Apple pomace	3.0	3.0	3.4	2.0
Straw	3.7	4.0	5.0	2.0
Alfalfa	10.0	12.5	17.0	10.0
Rapeseed oil	0.5	0.7	1.5	0.7
Minerals, premix and amino-acids	1.5	1.5	1.9	1.4

Table 2. Calculated chemical composition of experimental feeds

Feeds	SFD	SH	FT	DF
DE (kcal/kg)[1]	2381	2380	2385	2379
Fat (%)	3.0	3.0	5.1	2.9
Starch (%)	12.5	14.3	9.0	7.6
Crude proteins (%)	15.6	15.6	15.7	15.5
Digestible fibers (%)	20.8	19.0	19.3	23.9
Mineral matter (%)	7.0	7.0	7.9	7.3
Moisture (%)	12.2	12.1	11.7	12.2

[1]Digestible energy calculated with Techna France Nutrition's table

Measures

Rabbits are collectively weighed in each pen at 31, 53, 63 and 70 days old. Feed intake is measured for the following periods: 31-53, 53-63 and 63-70 days. Mortality and morbidity are registered daily. Feed intake of dead rabbits is subtracted from the total real intake of the pen for each period. 20 animals per batch (10 males and 10 females) chosen in the middle weight of the batch are slaughtered. An individual weighing is done on live animals just before slaughtering. Then, an individual weighing of hot empty carcasses is performed to calculate the dressing percentage.

Statistical analysis

Growth performance, feed intake, feed conversion ratio and dressing percentage are processed with a variance analysis with weaning weight as a covariate under the GLM procedure from the SPSS software. Mortality percentages are compared with the Chi-square test.

RESULTS AND DISCUSSION

Health status

The trial is carried out in a good sanitary context: there are two dead rabbits (SFD) and seven sick rabbits — four of which are in the FT batch and two in the DF batch out of 672 rabbits — hence a lack of experimental treatments effect (table 3).

Zootechnical performance

Restricted feeding strategy was successfully managed and the 4 batches had the same quantitative intake and the same theoretical DE intake, no matter the reporting period (table 3). During the global period (31-70 days), DWG and FCR are impaired for the FT batch (42.6 g/j and 2.48 resp.). The best growth performance are achieved by the SFD batch (44.4 g/j and 2.37 resp., P<0.01). These differences are especially obvious between 31 and 53 days. In the context of this trial, it seems that the high level of fat in the FT feed is less efficiently utilized by rabbits at the start of the fattening period. Other trials have shown an improvement of the final weight as fat level in feed is increased (Bhatt and Swain, 2003; Alhaidary *et al.*, 2010), but the different feeds used did not have the same energy level. Whatever the zootechnical criteria, SH and DF batches do not differ significantly and they achieve intermediate results between SFD and FT batch.

Slaughter results

Dressing percentage of DF feed is significantly downgraded by 1.6 and 1.1 points when compared to SH and SFD feeds. These results are in line with those obtained by Nagadi (2008). The latter noted that the dressing percentage decreased from 57.5% to 55.9% as the level of cellulose was increased from 13.4% to 16.4%. Dressing percentage of SH batch is 1 point higher than FT batch and 1.6 point higher than DF batch (P<0.05), whereas the gap with SFD batch is more limited (+ 0.5 point). SH feed, and to a lesser extent SFD feed, have a higher level of starch than FT and DF feeds (14.3 and 12.5% against 9.0 and 7.5%). The results of these slaughters suggest that starch concentration has a positive effect on carcass yield. A similar effect has been noticed by Xiccato *et al.* (2002) when higher levels of starch (17.0 vs 20.6%) were included in feed.

Table 3. Zootechnical results and nutritional intakes

	SFD	SH	FT	DF	Feed effect	RSD
DFI 31-70 j (g/d)	105.5	105.4	105.4	105.4	/	/
Weight at 70 d (g)	2603c	2576bc	2530a	2559b	p<0.001	34
DWG 31-53 d (g)	44.5c	44.0bc	42.4a	43.3b	p<0.001	1.1
DWG 53-63 d (g)	44.3b	43.4ab	43.0ab	42.8a	p<0.001	1.9
DWG 63-70 d (g)	44.5	43.8	42.7	44.2	NS	3.1
DWG 31-70 d (g)	44.4c	43.8bc	42.6a	43.3b	p<0.001	0.9
FCR 31-53 d	1.96c	1.98bc	2.06a	2.01b	p<0.001	0.05
FCR 53-63 d	2.75b	2.81ab	2.84ab	2.85a	p<0.05	0.13
FCR 63-70 d	3.17	3.21	3.30	3.18	NS	0.23
FCR 31-70 d	2.37c	2.41bc	2.48a	2.43b	p<0.001	0.04
Dressing percentage (%)	58.5bc	59.0c	58.0ab	57.4a	p<0.01	1.3
Total morbidity (%)	0.6	0.0	2.4	1.2	NS	/
Total mortality (%)	1.2	0.0	0.0	0.0	NS	/

DFI = Daily Feed Intake; DWG = Daily Weight Gain; FCR = Feed Conversion Ratio; NS = Non Significant (P>0.05); RSD: Residual Standard Deviation; Means with different letters significantly differ at 5% threshold

Economic study

Each energy source has a different impact on feed price, it is worth examining the most economical feeding strategy regarding feeding costs for both live weight and carcass weight (table 4). The feeding cost of live weight is calculated by applying the price of the feed to the FCR value of each pen. Regarding the feeding cost of carcass, as the dressing percentage is measured only on 20 animals per batch, the calculation is made by applying the average dressing percentage of each batch to each pen. In the context of the French market of April 2015, with the same level of energy, both FT, DF and SH feeds are more expensive than SFD feed (+ 5.7, + 1.0 and + 0.6 % resp.). The feed cost per kilo of live weight is penalized by +10.4% for the FT batch when compared to The SFD batch (P<0.01), because its feeding cost is higher and its FCR is downgraded. The SFD feed, with a more balanced supply of the 3 energy forms, has the cheapest feeding cost per kilo of live weight. The SFD and SH feeds, which have the highest starch level, have a significantly lower feed cost per kilo of carcass weight. Even though SH batch achieves the best dressing percentage, this difference does not fully compensate its extra feed cost.

Table 4. Economic study

Feed (batch)	SFD	SH	FT	DF	Feed effect	RSD (%)
Feed DE (kcal)	2380	2380	2380	2380	/	/
Feeding level (g/d)	105.5	105.5	105.5	105.5	/	/
DE intake (kcal/d)	251.1	251.1	251.1	251 .1	/	
FCR	2.37c	2.41bc	2.48a	2.43b	p<0.001	1.8
Digestible Energy Conversion Ratio	5.65	5.73	5.90	5.79	/	/
Dressing percentage (%)	58.5bc	59.0c	58.0ab	57.4a	P<0.01	2.3
Feed price (100 base – Ref. SFD)	100	100.6	105.7	101.0	/	/
Feeding cost per live weight kilo (€/kg) (100 base – Ref. SFD)	100a	102.1b	110.4c	103.5d	p<0.001	2.1
Feeding cost per carcass weight kilo (€/kg) (100 base – Ref. SFD)	100a	101.1a	111.3b	105.4c	p<0.001	2.1

DE = Digestible Energy calculated with Techna France Nutrition's table; FCR = Feed Conversion Ratio; Digestible Energy Conversion Ratio = FCR x DE; RSD: Residual Standard Deviation (as percent of average); Means with different letter significantly differ at 5% threshold

CONCLUSION

This study suggests that the form of energy supply in feed can influence the rabbits' zootechnical response. Within a feeding strategy consisting of a single feed during the fattening period, it seems that a more important supply from starch leads to the best dressing percentage. However, when considering feed costs and their impact on zootechnical performance, the feed with a more balanced supply from these 3 energy sources (starch, fat, digestible fibers) achieves the best feeding cost both for live weight and carcass weight. These results are promising and can suggest interesting strategies for improving the technical and economical parameters of rabbit farms. This is especially relevant in the case of two-phase feeding strategies which allow one to modulate the nutritional levers over a limited, and so less expensive, period of time.

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11th WRC

Qingdao, CHINA – June 15-18, 2016

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Impact of the form of energy supply on rabbit performance

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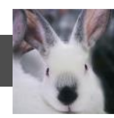
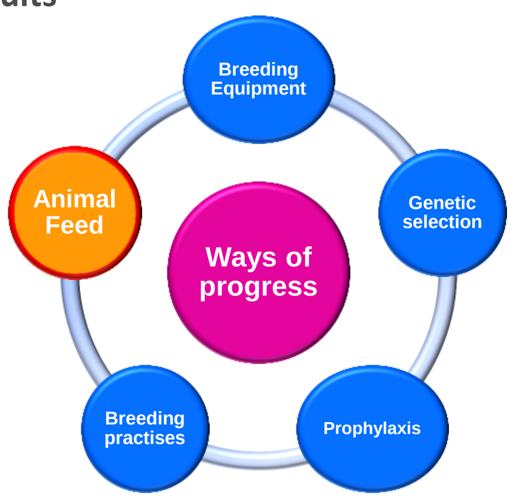
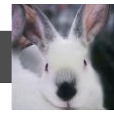
Introduction



- **In rabbit sector, constant search to improve the technical and economic results**



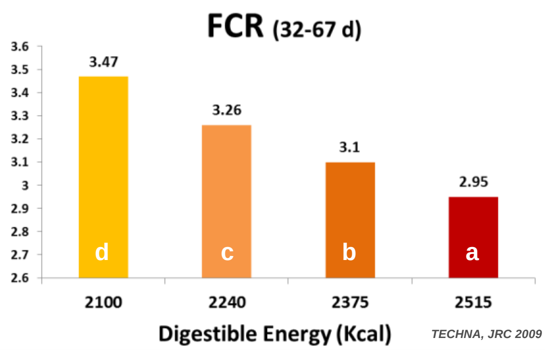
Introduction



Previous study

- **Energy level** in feed

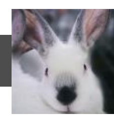
→ Impact on animal **growth performance** and **production costs**



Aim of this study

- Which impact of the **form** of energy supply on **growth performance, dressing percentage** and **productions costs**?

Effect of the form of energy
Experimental device



Equal levels of:

Digestible Energy (2380 Kcal) – Crude Proteins (15.6 %)

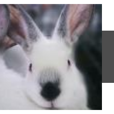
- **SFD** *Balanced mix*
- **SH** *Starch*
- **DF** *Digestible Fibers*
- **FT** *Fat*

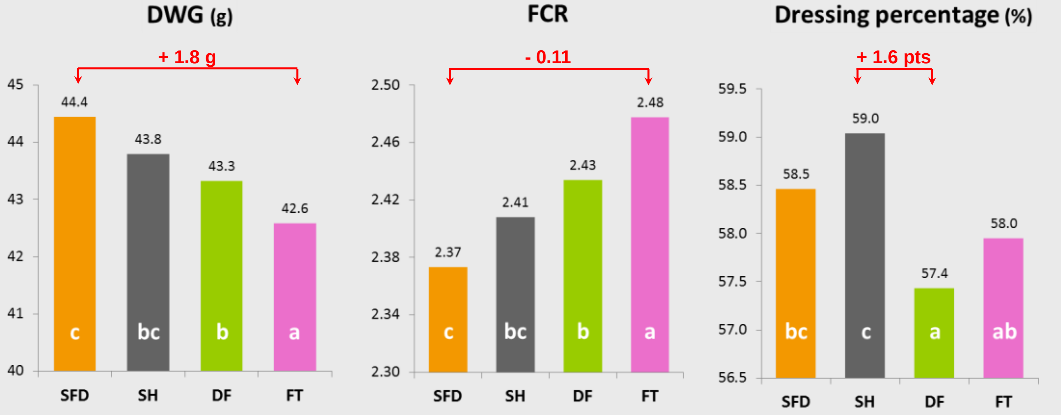
- **Fattening period** : 31 to 70 days
- 24 pens of 7 rabbits per batch
- **Feed restriction** : 65 g + 15g/week

➢ **Good sanitary context**

→Health Risk Index (HRI): 0 to 2.4%

Effect of the form of energy
Zootechnical results (31-70 d)





Fat: growth performance <u>impaired</u>

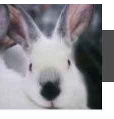
Balanced mix: growth performance <u>improved</u>

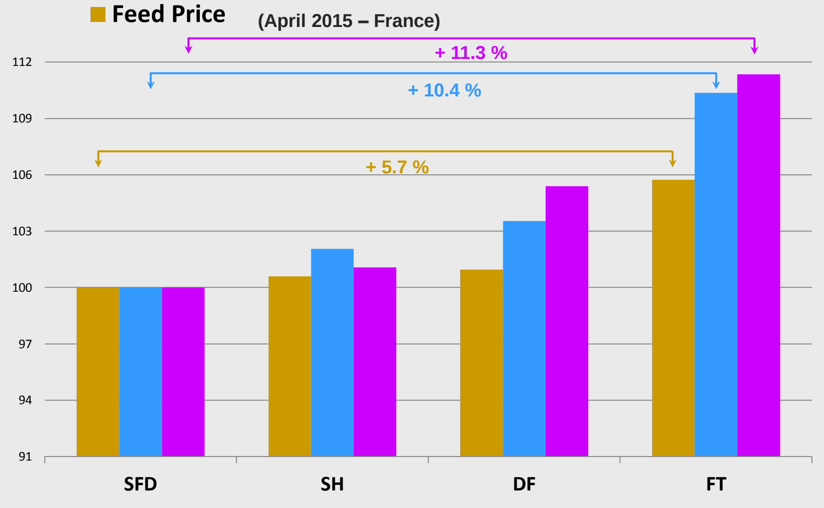
Dig. Fibers: dressing percentage <u>impaired</u>

Starch: dressing percentage <u>improved</u>

➔ More significant during the 1st period

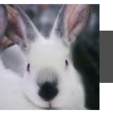
Effect of the energy form
Economic study





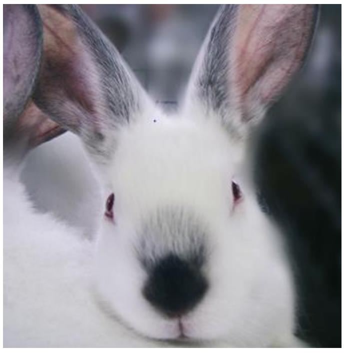
HRI
< 2.4%

Effect of the energy form
Conclusions



- The **form** of **energy supply** has an impact **on zootechnical performance**
  - ✓ **Zootechnical objectives drive the choice between energy supply forms**
- **What are the concrete applications of these findings?**

Thank you for your attention



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