EFFECTS OF HEMPSEED OIL CAKE INTRODUCTION IN RABBIT FEEDING ON GROWTH PERFORMANCE AND CARCASS QUALITY

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INTRODUCTION

By pressure extraction of hempseed, it is possible to obtain an high siccative index industrial oil and an oil cake with high protein, fiber and energy level (12-14 % residual oil). The aim of the present study, is to establish the real possibilities of utilization of hempseed meal in rabbit feeding. The study includes growth performances, carcass qualities and meat tasting.

MATERIAL AND METHODS

The composition of the hempseed meal employed is indicated on table 1. This sample has been obtained from the french hemp committee (CEAPC, B.P. 119, 79003 LE MANS Cedex, France). The oil cake contains a high level of lipids. The proteins are lysine highly deficient, but sulfur amino acids (SAA) and arginine are relatively abundant.

TABLE 1
Chemical composition of hempseed meal

Gross composition		*Quality of proteins*		
COMPONENTS	p.100 DM	Amino acids	g/16 g N	% requirements (1)
Dry matter	92.5	Lysine	2.60	- 36 %
Organic matter	91.0	Leucine	5.75	- 12 %
Minerals	9.0	Pheala+tyrosine	6.65	- 11 %
Crude proteins	28.6	Threonine	3.15	- 8 %
Crude fiber	31.5	Isoleucine	3.75	=
Lipids	12.4	Valine	4.45	=
Calcium	0.28	Histidine	2.30	+ 5 %
Phosphorus	1.06	Sulfur A. acids	4.05	+ 8 %
Gross energy (kcal/kg)	4875	Arginine	9.65	+ 71 %

(1) According to INRA (1984)

The hempseed meal was introduced in experimental diets at 0 - 10 - 20 or 30 % (table 2) according to the following equation :

30 hempseed meal + 3 soya meal = 31 sunflower meal + 2 cassava

The diets were calculated to be isonitrogenous, and with the same levels of lysine and crude fiber. But as the fiber level of the hempseed sample studied was higher than expected, the fiber level of diets appeared increasing with hempseed incorporation level (table 2).

TABLE 2
Composition of the experimental diets

	Control	Hempseed meal diets		
	"C"	"H 10"	"H 20"	"H 30"
Formula				
Sunflower meal	31.0	20.67	10.33	-
Hempseed meal	-	10	20	30
Soya meal	-	1	2	3
Cassava	20.00	19.33	18.67	18.00
Wheat	20	20	20	20
Alfalfa	21.36	21.343	21.237	21.310
Wheat straw	5	5	5	5
Minerals and vitamins	2.5	2.5	2.5	2.5
l lysine HCl	0.14	0.157	0.173	0.190
Chemical composition % DM				
Dry matter	90.7	90.8	91.1	91.3
Crude proteins	15.8	15.7	16.2	16.4
Minerals	7.7	7.9	8.1	8.5
Crude fiber	15.0	15.8	16.9	18.6
Gross energy	4331	4382	4400	4418

Hundred, 35 day old New Zealand White rabbits of both sexes were divided into 4 homogenous groups of 25 animals according to weight and genetic origin (litter). They were caged individually in wire mesh cages. They were fed ad libitum one of the 4 diets for 5 weeks. Diet digestibility was studied with 6 rabbits per diet between 42 and 53 days of age.

At the end of the fattening period, 10 representative animals of each group were slaughtered. Carcass and kidney fat were weighted. Six from the 10 rabbits of "control" and "H20" groups were selected for analysis of kidney fat and sensorial tasting of meat. The fatty acid composition of "C" and "H20", as well as that of the kidney fat of the rabbits fed these diets were determined (OUHAYOUN et al., 1981). A sensorial analysis was carried out according to a tripartite test. Carcass cuts (from 12th thoracic to the 7th lumbar vertebra) were cooked for 90 mn at 120°C in closed glass jars. The test was performed with 12 members ; results were compared according to BENGTSSON and HELM (1953).

Data were statistically analysed according to variance and covariance models. Means were compared by Newman et Keul's test (DAGNELIE, 1970).

RESULTS AND DISCUSSION

Increasing of hempseed incorporation rate in diets induced a significant decrease of dry matter and energy digestibility (table 3). This was associated with an important reduction of fiber digestibility ; the variations in nitrogen digestibility are not significant, despite the low value observed with the "H30" diet. The digestible energy concentration appeared equivalent for diets "C" and "H10", but reduced by 9 % for the diet "H30".

TABLE 3
Digestibility coefficients according to the hempseed meal level in diets

DIETS	"C"	"H10"	"H20"	"H30"	CV%	Statistics (F)	
Components							
- Dry matter	68.6	67.6	65.0	58.8	5.4	9.6	**
- Organic matter	69.5	69.4	66.3	61.7	3.4	16.5	**
- Energy	67.8	68.1	64.9	60.2	3.6	15.1	**
- Nitrogen	75.9	77.5	74.6	71.6	5.5	2.6	P<0.1
- Crude fiber	23.5	16.8	13.7	12.0	-	(1)	
- Digest. Energy (kcal/kg DM)	2936	2984	2856	2660	-	-	

(1) only one determination/diet on a pooled sample
** P < 0.001

According to the diet digestibility values the digestibility coefficient of hempseed meal are the following : dry matter 47.8 ; energy 41.7 ; nitrogen 76.6 ; crude fiber - 9.8 (negative value). Then, the digestible energy concentration proposed is 2033 kcal DE/kg DM. This value is comparable to that proposed for alfalfa by MAERTENS and DE GROOTE (1981). But, if only "C" and "H10" diets are considered, the value calculated is 3250 kcal DE/kg DM. Consequently, other experiments are necessary to propose a suitable value.

During the fattening period, the differences induced by the diet in growth rate and food consumption were not significant (table 4). Nevertheless high hempseed incorporation rates reduced feed efficiency. It results probably of the lower digestible energy obtained.

In slaughtered rabbits, no effect of hempseed level was observed on adjusted carcass weights (table 5). On the other hand, weight of kidney fat increased with hempseed incorporation rate in diets. The slightly lower adiposity of "H30" rabbits group is probably due to its slow growth rate ("H30" : 35.2 g/d ; "H20" : 36.3 g/d ; NS). The more is hempseed incorporation rate, and then the lipid level in diet, the more is carcass adiposity. Nevertheless, the adiposity is not related to DE level of diet.

TABLE 4
Evolution of fattening performances according to the hempseed level in diets.
(covariance fitted means for a common initial weight of 904 g)

DIETS	"C"	"H10"	"H20"	"H30"	CV %	Statistics (F)
- Daily weight gain (g/day)	37.8	36.3	36.3	35.2	7.8	< 1 NS
- Feed daily intake (g/day)	122	119	125	120	11.6	< 1 NS
- Feed/gain ratio	3.26a	3.28a	3.48b	3.44b	9.4	3.4 P<0.05
- Final weight (g)	2151	2103	2101	2064	8.3	< 1 NS

TABLE 5
Slaughter data measured on groups of 10 rabbits/diet
Means fitted by covariance analysis for a live weight of 2185 g (carcass data) and a carcass weight of 1255 g (kidney fat)

DIETS	"C"	"H10"	"H20"	"H30"	CV %	Statistics (F)
(g)						
- Hot carcass	1373	1372	1378	1376	2.8	< 1 NS
- Cold commercial carcass	1252	1253	1258	1256	3.1	< 1 NS
- Kidney fat	14.3a	16.2ab	19.7b	18.4ab	25.5	3.07 P<0.05

There is no correlation between kidney fat weight and its total fatty acids content. The effect of diet lipid composition on kidney fat fatty acid profile is significant (table 6). The main effect of hempseed incorporation is an increase of linoleic and linolenic acids rates associated with a reduction of oleic and palmitic acids rates. Then, the ratio of unsaturation (U) to saturated (S) fatty acids is higher : 1.24 and 1.49 in "control" and "H20" groups, respectively. This ratio is very close to that observed with a standard commercial diet (OUHAYOUN et al., 1981).

The cooking loss of the back cuts was not significantly different in "H20" rabbit group (29.0 ± 2.1 %) and in "control" (28.2 ± 2.1 %). During the sensorial analysis of meat, 6 judges on 12 (non significant ratio) were able to identify the cut coming from hempseed fed rabbits : 4 with some difficulties and 2 more easily. In addition, 4 judges among 6 found that meat couring from hampseed fed rabbits was paler ; 3 judges among 6 prefered hempseed fed rabbit meat.

TABLE 6
Fatty acids composition of diet lipids and of kidney fat lipids (% of total fatty acids)

Groups	Diet lipids "C"	Diet lipids "H2O"	Kidney fat lipids "C"	Kidney fat lipids "H2O"	Effect on kidney fat
<u>Fatty acids</u>					
C 10	-	-	0.4	0.2	NS
C 12	0.3	0.6	0.5	0.4	NS
C 14	0.9	0.7	3.9	3.2	**
C 14:1	-	-	0.4	0.2	NS
C 15	-	-	0.6	0.5	NS
C 16	19.9	14.1	31.6	28.9	**
C 16R	-	-	0.2	0.3	NS
C 16:1	0.1	0.5	4.1	3.2	NS
C 17	-	-	0.7	0.6	NS
C 17:1	-	-	0.3	0.3	NS
C 18	3.8	3.0	6.4	6.2	NS
C 18:1	18.7	14.7	28.2	24.9	*
C 18:2	46.0	49.2	19.2	25.0	**
C 18:3	10.4	17.0	3.2	6.2	**

NB : - = not detected ; NS = non significant ; * $P<0.05$; ** $P<0.01$

CONCLUSION

Feeding rabbit with hempseed oil cake is possible ; but despite a very high lipid content, the energetic value seems to be moderate. A possible explanation of this low energetic value is an acceleration of the digestive transit rate due to the high level of fibrous material which reduces diet digestibility (LEBAS and LAPLACE, 1977). Consequently, hempseed meal has to be considered mainly as a forage.

The carcass quality of hempseed fed rabbit does not differ from that obtained with the control diet. The only difference is a slight increase of kidney fat polyunsaturation. But this modification is not able to induce any significant organoleptic effect on fresh meat.

BIBLIOGRAPHY

BENGTSSON K., HELM E., 1953. Principles of taste testing. Wallerstein Laboratories Communications.

DAGNELIE P., 1970. Théorie et Méthodes statistiques, Vol. 2, Duculot ed., Gembloux.

INRA, 1984. L'alimentation des animaux monogastriques : Porc, Lapin, Volailles. INRA éd., Paris, 282 pp.

LEBAS F., LAPLACE J.P., 1977. Growth and digestive transit in the rabbit. Variation determined by physical form, composition and crude fiber content of the feed. Ann. Biol. anim. Bioch. Biophys., 17, 535-538.

MAERTENS L., DE GROOTE G., 1981. L'énergie digestible de la farine de luzerne déterminée par des essais de digestibilité avec des lapins de chair. Rev. Agric., 1, 79-92.

OUHAYOUN J., DEMARNE Y., DELMAS D., LEBAS F., 1981. Utilisation des pellicules de colza dans l'alimentation du lapin en croissance. II/Effet sur la qualité des carcasses. Ann. Zootech., 30, 325-333.

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After pressure extraction of the oil contained in hempseed, the oil cake contains high level of proteins (29 %), fiber (30 %) and lipids (12-14 %). This oil cake was introduced in balanced pelleted diets at 0 - 10 - 20 or 30 % levels.

Twenty five growing rabbits were fed ad libitum each diets for 5 weeks. No effect of hempseed incorporation on growth was observed (average 36.4 g/d). Feed/gain ratio was increased by high level of hempseed incorporation (3.26 to 3.44). Digestibility of hempseed meal proteins was high (77 %) but energy digestibility was moderate (42 % ; 2030 kcal DE/kg DM). No difference was observed in slaughter yield between the 4 groups of rabbits. Carcass adiposity as estimated by weighing of kidney fat, increased with hempseed incorporation. The proportion of polyunsaturated acids (C 18:2 and C 18:3) was increased, at the expense of palmitic acid oleic acids, in kidney fat of rabbits fed 20 % hempseed diet when compared to the control. No difference on organoleptic quality of meat was observed with the 2 later diets fed rabbits.

CONSEQUENCES DE L'INTRODUCTION DE TOURTEAU DE CHENEVIS DANS L'ALIMENTATION DES LAPINS SUR LES PERFORMANCES DE CROISSANCE ET LES QUALITES DES CARCASSES

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Après extraction par pression de l'huile contenue dans les graines de chenevis, on obtient un tourteau riche en protéines (29 %), en cellulose brute (30 %) et en lipides (12-14 %). Ce tourteau a été incorporé dans des aliments équilibrés granulés aux taux de 0 - 10 - 20 ou 30 %. Les 4 aliments ont été distribués à volonté durant 5 semaines à 25 lapins en croissance par lot. Aucune différence significative n'est apparue pour la vitesse de croissance (moyenne 36,4 g/jour) ; par contre, l'indice de consommation a augmenté avec le taux d'incorporation du tourteau (3,26 à 3,44). La digestibilité des protéines du tourteau de chenevis est élevée (77 %) mais celle de l'énergie reste modérée (42 % - 2030 kcal ED/kg MS).

Après abattage de 10 lapin/lot, aucune différence n'apparaît dans les rendements à l'abattage ; par contre, les carcasses ont d'autant plus de gras périrénal que le taux de tourteau s'accroît : de 1,14 % pour le témoin à 1,47 % pour l'aliment avec 30 % de tourteau. Par rapport aux témoins, le gras périrénal des lapins recevant 20 % de tourteau est plus riche en acides gras polyinsaturés (C 18:2 et C 18:3), accroissement effectué aux dépens des acides oléique et palmitique. La viande de ces animaux n'a pu être distinguée de celle des témoins lors d'un test de dégustation tripartite.