A DEFICIENT PROTEIN SUPPLY COULD BE AFFECTING SELECTION FOR GROWTH RATE IN RABBITS

Marín-García, P.J.*, Blas E. Cervera, C. Pascual, J.J.

Institute for Animal Science and Technology, Universitat Politècnica de València, Camino de Vera s/n, 46022, Valencia, Spain.
*Corresponding author: pabmarg2@doctor.upv.es

ABSTRACT

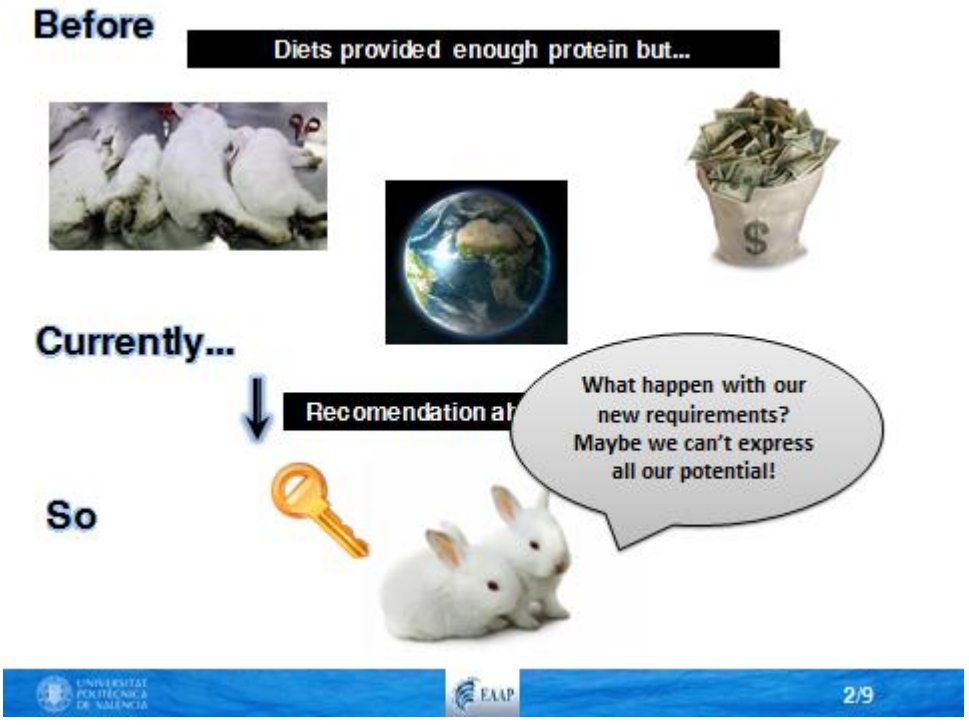
The use of non-specific diets during the fattening period could be affecting the expression of the genetic potential in parental lines of rabbits. A total of 175 growing rabbits from different genetic lines (differing on growth rate) were used to evaluate how a common growing diet, with low digestible protein content to avoid digestive problems, could be affecting protein supply, as well as protein and amino acids retention during the growing period in function of animal's growth rate. Expected protein and amino acids retentions were drafted using the data from non-limited animals; growing rabbits with empty body weight (EBW) gain below 45 g per day. Animals having a higher daily growth rate showed a slightly lower protein intake, as well as a clear lower protein and amino acids retention, to that expected from their daily EBW gain. These results reveal a possible protein deficit on growing rabbits with a high growth rate, when common low-protein diets are used, affecting their genetic expression and hindering the selection process. Determining limiting amino acids requirements in function of growth rate will be need to develop specific growing diets for paternal lines.

A DEFICIENT PROTEIN SUPPLY COULD BE AFFECTING SELECTION FOR GROWTH RATE IN RABBITS

Marín-García P.J., Ródenas L., Martínez-Paredes E., Blas E., Pascual J.J.

UNIVERSITAT POLITÈCNICA DE VALÈNCIA

Institute for Animal Science and Technology



Aim

To evaluate how a common growing diet, could be affecting protein supply and amino acids retention during the growing period in function of animals growth rate.

N=175

H LINE: selected by litter size at weaning

LP LINE: selected by litter size at weaning

R LINE: selected by average daily gain

D=28

D=63

Digestible protein: 120,5 g/kg feed

✔*Body Weight and Feed Intake*

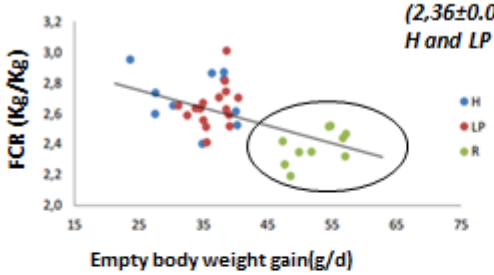
½ Slaughtered

½ Slaughtered

✔*Empty bodies crushed and lyophilized*

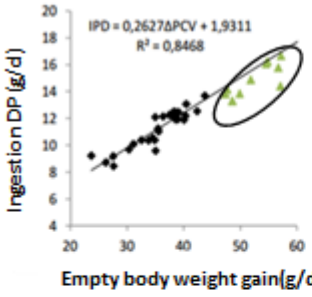
Retention of protein and aa were studied

✔*R animals have better FCR than H and LP (2,36±0.05, 2.70±0.05 and 2.65±0.04 for R, H and LP animals, respectively; P<0.05)*



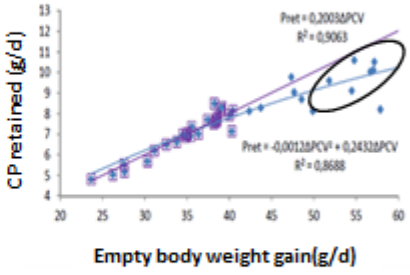
	Feki (1996)		Our work:	
	Maternal lines	Paternal lines	Maternal lines	Paternal lines
FCR	3,06 kg/kg	2,73 kg/kg	2,68 kg/kg	2,36kg/kg
Diference	11%		11%	

It reveal a lack of effectiveness…

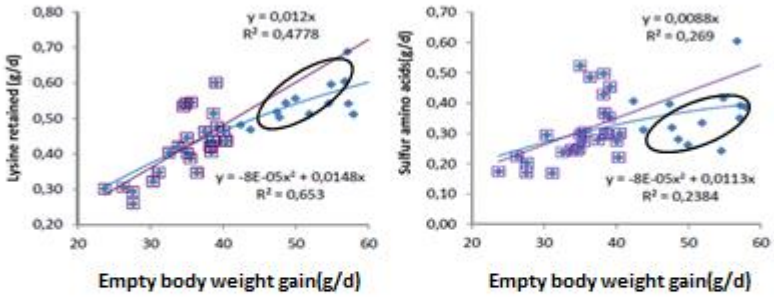


✔*R animals have greater IPD, but lower to that expected*

✔*Animals with an EGW up to 45 g/day showed a lower protein retention to that expected*

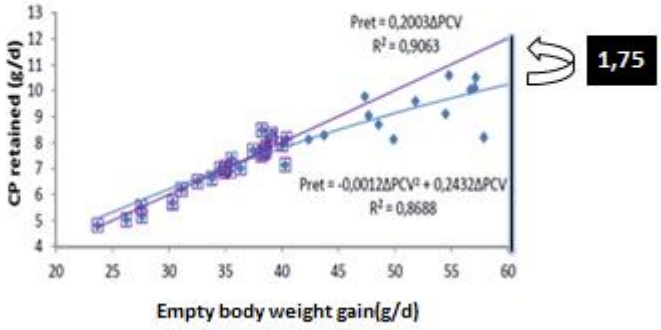


Could be related to a lack on some limiting aa?



✔ The same response presented when aa retained.

From these figures... A key rabbit with an empty body weight gain of 60g/d need to increase its protein retention in 1.75, with an efficiency value of 0.63, they would need a diet with at least 135.7 g DP/Kg , or an adjustament of the limiting aa.



Conclusions

A POSSIBLE PROTEIN DEFICIT EXISTS WHEN HIGH GROWTH RATE ANIMALS ARE FEED WITH A COMMON DIETS, AFFECTING THEIR GENETIC EXPRESSION AND HINDERING THE SELECTION PROCESS. DETERMINING CONCENTRATION OF LIMITING AMINO ACIDS REQUIREMENTS IN FUNCTION OF GROWTH RATE WILL BE NEED.

UNIVERSITAT POLITÈCNICA DE VALÈNCIA

EAAP

9/9

ARE GROWING DIETS PROVIDING ENOUGH PROTEIN TO HIGH GROWTH RATE RABBITS?

Marín-García, P.J.*, Ródenas L., Martínez-Paredes E., Blas, E. Cervera, C. Pascual, J.J.

Institute for Animal Science and Technology, Universitat Politècnica de València, Camino de Vera s/n, 46022, Valencia, Spain.
*Corresponding author: pabmarg2@doctor.upv.es

1 INTRODUCTION

Genetic selection has improved growth rate but probably it has changed animal requirements. Current growing diets ensure enough protein supply to crossbred animals. However, animals with high growth rate (>50 g/d) could have difficulties to express all their genetic potential punishing the progress of genetic select

Our hypothesis was that common diet enough protein to high growth rate rabb

2 OBJETIVE: To evaluate how growing diet could be affecting conversion rate and ileal dige function of animals grow

3 MATERIALS & METH

EXPERIMENTAL DIET:

Was formulated according to current (Blas and Mateos, 2010; Feed Formulat Rabbit, 222-232. CABI)

Diet chemical composition	
Digestible energy	11,5 MJ/k
Digestible protein	111 g/kg
Acid detergent fibre	159 g/kg
Lysine	7,54 g/kg
Methionine	2,55 g/kg
Cysteine	2,28 g/kg

ANIMALS:

N=140 animals with high variability weight gain

- H LINE: Maternal line selected by litt
- LP LINE: Maternal line selected by li
- R LINE: Paternal line selected by ave

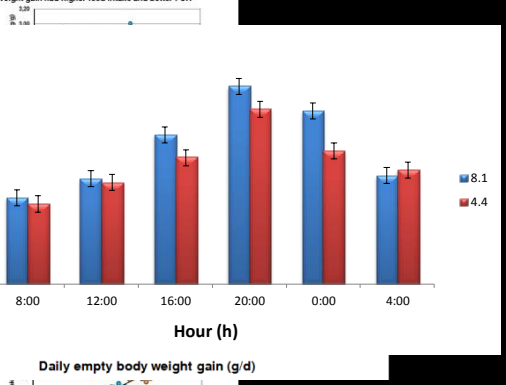
TRAITS CONTROLLED:

Dry matter (DM) intake- daily weight gain and feed conversion ratio (FCR) (28 to 63 days of life)

Analysis of ileal content at 63 days (using a Yb- marked version of feed from 53 to 63 days of life)

4 RESULTS

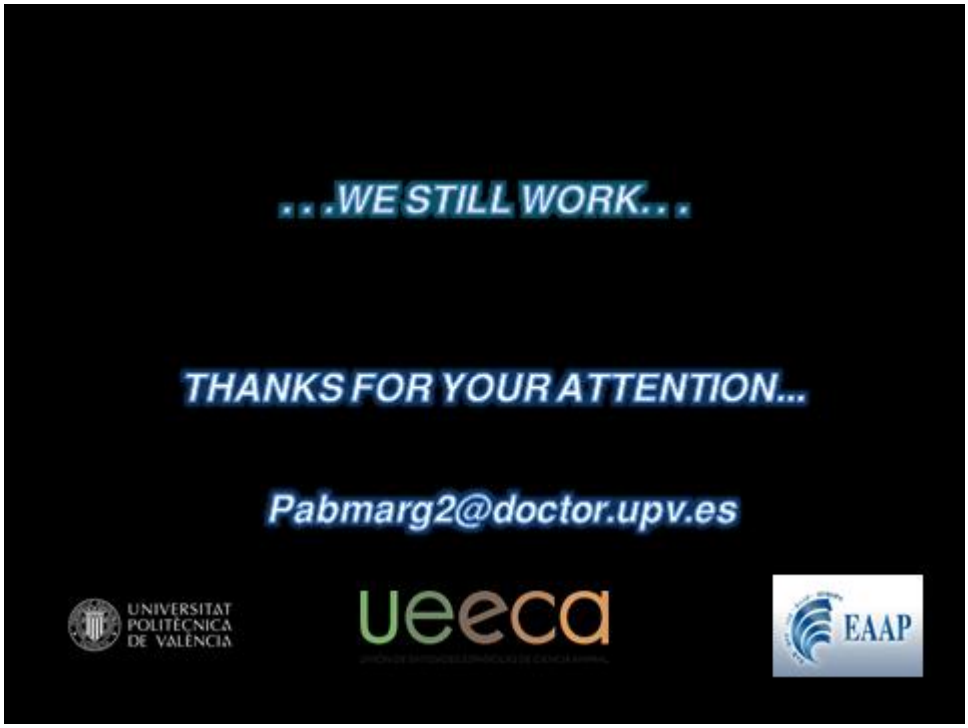
As expected, growing rabbits characterized by higher daily weight gain had higher feed intake and better FCR



Daily empty body weight gain (g/d)

5 CONCLUSIONS: A possible protein deficit on growing rabbits with a high growth rate exists when they are fed with a common diet (146 g CP/kg). It could be punishing their genetic potential expression

. . . BUT WE CONTINUE WORKING. . .


. . .WE STILL WORK. . .
THANKS FOR YOUR ATTENTION...
Pabmarg2@doctor.upv.es
UNIVERSITAT POLITÈCNICA DE VALÈNCIA
ueeca
EAAP

A DEFICIENT PROTEIN SUPPLY COULD BE AFFECTING SELECTION FOR GROWTH RATE IN RABBITS

Marín-García, P.J.*, Blas E. Cervera, C. Pascual, J.J.

Institute for Animal Science and Technology, Universitat Politècnica de València, Camino de Vera s/n, 46022, Valencia, Spain.
*Corresponding author: pabmarg2@doctor.upv.es

ABSTRACT

The use of non-specific diets during the fattening period could be affecting the expression of the genetic potential in parental lines of rabbits. A total of 175 growing rabbits from different genetic lines (differing on growth rate) were used to evaluate how a common growing diet, with low digestible protein content to avoid digestive problems, could be affecting protein supply, as well as protein and amino acids retention during the growing period in function of animal's growth rate. Expected protein and amino acids retentions were drafted using the data from non-limited animals; growing rabbits with empty body weight (EBW) gain below 45 g per day. Animals having a higher daily growth rate showed a slightly lower protein intake, as well as a clear lower protein and amino acids retention, to that expected from their daily EBW gain. These results reveal a possible protein deficit on growing rabbits with a high growth rate, when common low-protein diets are used, affecting their genetic expression and hindering the selection process. Determining limiting amino acids requirements in function of growth rate will be need to develop specific growing diets for paternal lines.

Key words: Rabbits, protein, amino acids, growth rate and retention.

INTRODUCTION

Genetic selection on parental lines has improved growth rate and the conversion rate (CR) of rabbits (Baselga, 2004), but it probably will have changed their requirements. To ensure their genetic potential expression, growing diets must provide enough quantity of protein and amino acids in function of growth rate. Otherwise, growth rate of animals with a high potential could be punished, hindering the selection process.

Commercial feeds for growing rabbits are formulated to ensure an adequate growth of crossbred animals, and protein levels around 14% did not impair growth performance up to 55 g of body weight per day (Carabaño *et al*., 2009). Furthermore, since the epizootic rabbit enteropathy onset, the dietary content of protein was reduced (Carabaño *et al*., 2009), while the fibre was increased (Trocino *et al*., 2013), in order to reduce the impact of this illness during the growing period, usually also reducing the digestible protein of the diets. Under those conditions, animals with higher growth rate could have difficulties to express their genetic potential when fed with the current commercial growing diets.

The present study has evaluated how a common growing diet, with low digestible protein to avoid digestive problems, could be affecting protein supply, as well as protein and amino acids retention during the growing period in function of animals growth rate.

MATERIAL AND METHODS

Animals and experimental design

A total of 175 weaned rabbits from three genetic types were used to ensure a wide range for daily weight gain during the fattening period. The genetic types used were: H line (founded by hyper-prolific criteria at birth and selected for litter size at weaning during 17 generations), LP line (founded by hyper-functional longevity), and R line (founded and selected during 25 generations for average daily gain during the fattening period). Fifteen animals per line were slaughtered (sodium thiopental, 75 mg/Kg of live weight, intra-cardiac) at weaning (28 days of age). The rest of the animals, were feed with the experimental diet, described below, until the end of the growing period (63 days) when they were slaughtered. The content of the digestive tract and bladder were removed to obtain the empty body of the animals that were frozen at -20°C. Body weight and feed intake were controlled at 28 and 63 days of age.

Chemical Analyses

Although the experimental diet was formulated following the recommendations for growing rabbits (de Blas *et al*., 2010), it was also considered the current recommendations for safe diets under ERE outbreaks. Therefore, the dietary content of digestible protein (DP), neutral detergent fiber (NDF) and starch were 111, 304 and 157 g/kg dry matter (DM), respectively. The content of lysine, methionine and cysteine were 7.54, 2.55 and 2.28 g/kg DM, respectively.

Empty bodies were crushed and lyophilized. Crude protein (CP) of the empty bodies was determined by the method 976.06 of the Association of Official Analytical Chemists (AOAC, 2000), El contenido de aminoácidos de la dieta fue determinado por HPLC siguiendo el método descrito por Kivi (2000).

Statistical Analysis

Protein and amino acids retained in the empty body of animals during the growing period was calculated as the difference between 28 and 63 days of age. For each animal, body protein and amino acids contents at 28 days was determined for each genetic type using equations in function of body weight obtained from the animals slaughtered at 28 days of age. Lineal models for the protein intake, as well as retained protein and amino acids in function of the average empty body weight (EBW) gain were obtained with the procedure REG of SAS (2009). Expected protein and amino acids retentions were drafted using the data from non-limited animals; growing rabbits with empty body weight (EBW) gain below 45 g per day.

RESULTS AND DISCUSSION

The Figure 1 shows how average daily EBW gain affects feed conversion rate of growing rabbit. As expected, animals from the paternal line (R) showed a better FCR (2.36±0.04) than those coming from maternal lines (2.70±0.05 and 2.65±0.04 for H and LP animals, respectively; $P<0.05$). Feki et al. (1996) already showed similar differences between this same paternal line (2.63±0.05) and other maternal lines (on av. 3.05±0.05). However, although FCR values have been improved after 20 years of selection, distance between maternal and paternal lines has not been widely increased, which could reveal a lack of effectiveness of selection for growth rate to improve FCR in rabbits.

Figure 2a represents the effect of daily EBW gain during the growing period on average daily DP intake of rabbits. R animals showed clear greater feed, and consequently DP, intake compared with the animals from the maternal lines. However, when the expected DP intake was drafted from non-limited animals (growing rabbits with EBW gain below 45 g per day), R animals seems to show a lower DP intake to that expected from their EBW gain. This fact, coupled to the greater maintenance requirements, could lead to lower DP and amino acids available to be retained in the body.

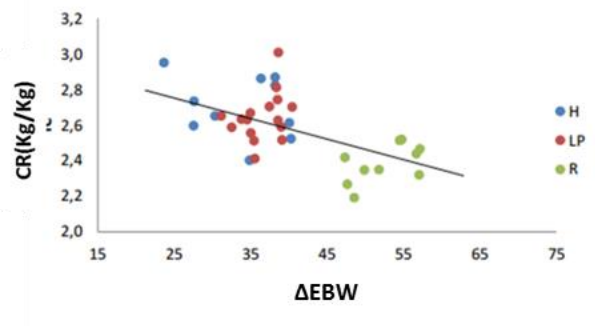


Figure 1: Feed conversion rate (FCR) between 28 and 63 days of life in function of daily empty body weight gain (ΔEBW).

In fact, when the amount of protein retained in the EBW of growing rabbits is represented in function of the daily EBW gain (Figure 2b), it can be observed how animals with an EBW gain up to 45 g/day showed a lower protein retention to that expected.

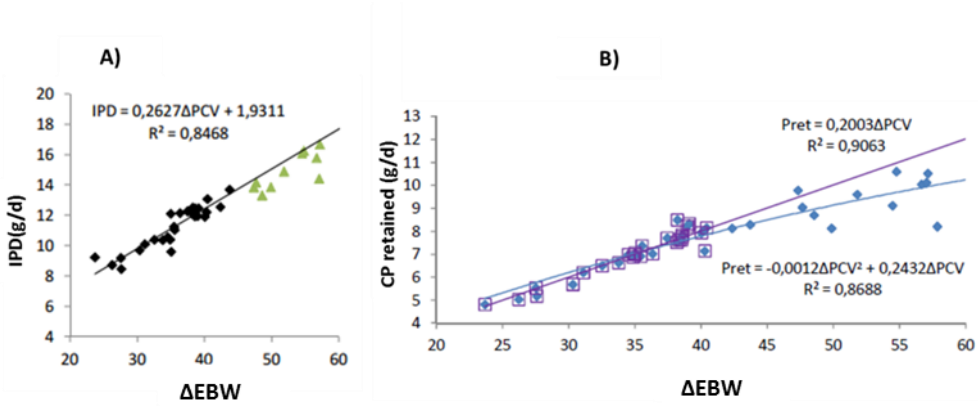


Figure 2: Relationship between daily increase of empty body (ΔEBW) with Ingestion in Digestible Protein (IPD) and Crude Protein retained (CP retained) in part A and B severally.

This relative lower protein retention could be related to a lack on some limiting amino acids when safe growing diets are used. These diets are characterized by lower protein content and a higher soluble fiber, which reduce the available protein for growth. In fact, when the amount of lysine and sulfur aminoacids retained in the EBW of growing rabbits are represented in function of the daily EBW gain (Figure 3), it can be observed the same response presented for the protein retained at the empty body.

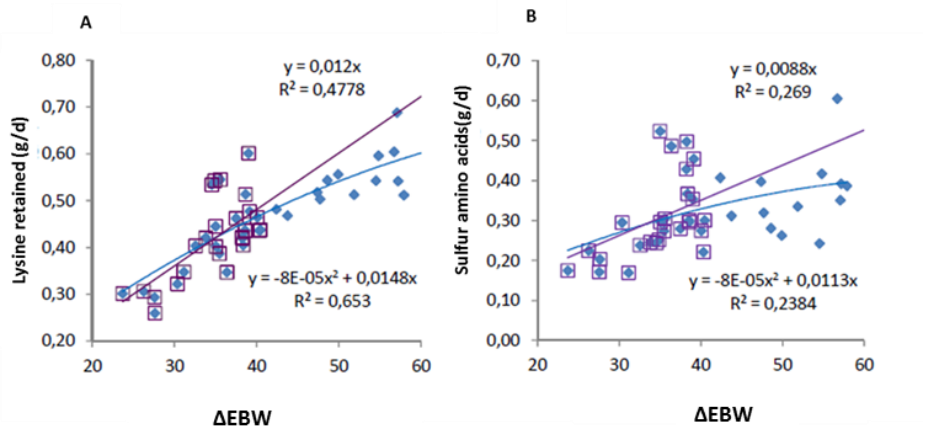


Figure 3: Lysine and Sulfur amino acids retained in function of daily empty body gain (ΔEBW).

From these figures can be deduced that a rabbit with an average daily gain of 70 g/d (approx. 60 g EBW/day) would need to increase its protein retention in 1.75 g/d to maximize its growth rate. This retention increase will allow expressing their genetic potential. Transformation of protein retention to digestible protein intake, the efficiency of how DP ingested is transformed on retained protein is needed. Although available literature is inconclusive, an efficiency value of 0.63 is accepted. Therefore, if daily feed intake is maintained, a rabbit with an average daily gain of 70 g/d would need a diet with at least 125 g DP/kg DM, or an adequate adjustment of the limiting amino acids.

CONCLUSIONS

These results reveal a possible protein deficit on growing rabbits with a high growth rate, when common low-protein diets are used, affecting their genetic expression and hindering the selection process. Determining limiting amino acids requirements in function of growth rate will be need to develop specific growing diets for paternal lines.

ACKNOWLEDGEMENTS

It is necessary to thank from UEECA As a sponsor of my assistance to EAAP. This study has been supported by the Interministerial Commission for Science and Technology (CICYT) from the Spanish Government (AGL2014-53405-C2-1-P). Grant for Pablo Marín from the Ministerio de Educación, Cultura y Deporte (FPU-2014-01203) is also gratefully acknowledged.

REFERENCES

A.O.A.C. 2000. Official Methods of Analysis. Association of Official Analytical Chemist. EUA.

Baselga, M. (2004). Genetic improvement of meat rabbits. Programmes and diffusion.Proccedings 8th World Rabbit Congress. Puebla. México.

Carabaño R., Villamide M.J., García J., Nicodemus N., Llorente A., Chamorro S., Menoyo D., García-Rebollar P., García-Ruiz A.I., De Blas J.C. 2009. New concepts and objectives for protein-amino acid nutrition in rabbits. A review. World Rabbit Sci., 17: 1‑14

De Blas, J.C., González-Mateos, G., García-Rebollar, P. (2010). Tablas FEDNA de composición y valor nutritivo de alimentos para la fabricación de piensos compuestos (3ª edición). Ed. FEDNA. Escuela Técnica Superior de Ingenieros Agrónomos de Madrid. 502 pp.

Baselga, M., and A. Blasco. 1989. Genetic improvement of rabbits bred for meat. Mundiprensa, Madrid, Spain.

Feki, S., Baselga, M., Blas, E., Cervera, C. y Gomez, E.A. (1996) Comparison of growth and feed efficiency among rabbit lines selected for different objectives. Livestock Production Science 45. 87-92.

Kivi J.T. (2000). Amino acids. In: Food analysis by HPLC. Marcel Dekker New York.

SAS Institute. 2002. SAS/STAT® User's Guide (Release 9.2). SAS Inst. Inc., Cary NC, USA.

Trocino, A., García, J., Carabaño, R., Xiccato, G., 2013. A meta-analysis on the role of soluble fibre in diets for growing rabbits. World Rabbit Sci., http://dx.doi.org/10.4995/wrs.2013.1285.