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# Effect of genotype, housing system and hay supplementation on performance and ear lesions of growing rabbits

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ABSTRACT

There is growing demand by consumers for meat produced in alternative systems. Since its market share is quite small, but is growing, it could be important to deal with this issue. The aim of the experiment was to examine the effects of genotype (terminal line or traditional giant breed), housing system (cage or pen) and feeding method (only pelleted diets or pelleted diets plus hay) on production and ear lesions of growing rabbits. The crossbred rabbits ($n=336$) Pannon Large × Pannon Ka (Large) and Hungarian Giant × Pannon Ka (Hung) were weaned at 5 wk of age. Half were randomly housed in cages (3 rabbits/cage) and the other half in pens (14 rabbits/pen). Two other subgroups were formed, rabbits that received only pelleted commercial diets (Pellet) or pelleted commercial diets plus grass hay (P+Hay), *ad libitum*. Differences were found in body weight at 12 wk of age and in weight gain and pellet intake between 5 and 12 wk in favour of the Large rabbits (3170 *vs* 2935 g, $P<0.001$; 42.3 *vs* 39.5 g/d, $P<0.001$; 147 *vs* 132 g/d, $P<0.01$, respectively). There were no significant differences in feed conversion ratio or mortality. The caged rabbits achieved better results for body weight at 12 wk and daily weight gain than the rabbits housed in pens (3123 *vs* 2982 g, $P<0.001$; 42.5 *vs* 39.4 g/d, $P<0.001$): while differences in pellet intake, feed conversion ratio and mortality were not significant. The rabbits that consumed only pelleted diets had higher body weights at 12 wk and weight gains than group P+Hay (3093 *vs* 3017 g, $P<0.05$; 41.6 *vs* 40.3 g/d, $P<0.05$, respectively). Ratios of ear lesions in the Large and Hung rabbits were not significantly different but were affected by housing system (0 and 34%; $P<0.001$, in cage and pen, respectively) and feeding method (20.6 and 8.3%; $P<0.003$, in the groups Pellet and P+Hay, respectively). It can be concluded that the alternative systems negatively influenced the production; the genotype had the greatest, while the feeding method had the lowest impact. Housing of rabbits in large groups was contrary to animal welfare (more ear lesions), although the hay supplementation reduced the aggressiveness.



## 1. Introduction

Besides the rabbit meat products from intensive rabbit breeding, there is a growing interest in less intensive breeds kept in alternative housing and feeding condition. Because of this, most hybrid breeding companies distribute not only a

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white terminal line, but sell also coloured terminal males to produce growing rabbits for alternative systems. The organic systems (Biosuisse, Naturland etc.) defined more stringent requirements. However, the ratio of bio and other organic-like product in the market is low, but it shows an increasing tendency (Borell von and Sørensen, 2004; Hughner et al., 2007).

Most countries have one or more local breeds which could play an important role in commercial production. One of the groups is the giant rabbit breed. They are used as pet rabbits or for crossing in commercial farms. Several papers have been published about their production: Flemish Giant (Lukefahr et al., 1982; Lukefahr and Ozimba, 1991; Bolet, 2002; Prayaga and Eady, 2003; Maj et al., 2012), Spanish Giant (López and Sierra, 2002), German Giant (Bianospino et al., 2006), Moravian Blue (Tůmová et al., 2013), Transylvanian Giant (Petrescu-Mag et al., 2011), Hungarian Giant (Holdas and Szendrő, 2002; Hungarian Giant Rabbit-breeders Association).

Hungarian Giant is the only traditional Hungarian breed. It originated from a native coloured population. Formerly they were crossed with Flemish Giant and other giant breeds (Holdas and Szendrő, 2002), however, currently some breeders cross them with intensive breeds to improve their productive performance. Pannon Large rabbits, as a Hungarian terminal breed, have been selected for daily weight gain and hind leg muscle volume based on the data from computer tomography (CT) measurement at 10.5 wk of age since 2005 (Matics et al., 2014). Their adult weight is 4.8–5.5 kg (Matics et al., 2014). Pannon Ka (maternal line) has been selected for number of kits born alive. Their adult body weight is 4.0–4.5 kg. About half of the Hungarian rabbit production originates from Pannon breeds (Juráskó, 2014). Selection and performances of terminal lines were described by Estany et al. (1992), Piles and Blasco (2003), Blasco et al. (2003), Larzul and Rochambeau (2004), Baselga (2004), Khalil and Al-Saef (2008) and Pascual et al. (2008).

The effects of housing system on productive and carcass traits were summarized by Trocino and Xiccato (2006) and Szendrő and Dalle Zotte (2011). Most experiments demonstrated that with increasing group size, the feed intake, weight gain and body weight of growing rabbits decreased significantly (Maertens and Van Herck, 2000; Dal Bosco et al., 2002; Lambertini et al., 2001). In addition, Bigler and Oester (1996), Szendrő et al. (2009) and Princz et al. (2009) observed that the frequency of injuries on the body increased in larger groups as a result of aggressive behaviour. Despite these results, there is pressure by some specialists and animal rights movements to increase group size (BioAustria; BioSuisse; Naturland; Maertens, 2013; Szendrő and Dalle Zotte, 2011).

One of the alternatives to feeding rabbits only with pelleted commercial diets is provide some fresh or dried forage in addition to the balanced feed. Scientists tested several forages for rabbits: alfalfa (Bianchi et al., 2006; Linga and Lukefahr, 2000; Capra et al., 2013), cassava foliage hay (Scapinello et al., 2000), Guinea grass and Verano stylo hays (Bamikole and Ezenwa, 1999), sulla hay (Kadi et al., 2011), whole maize plants (Martínez et al., 2006), green barley (Morales et al., 2009). The results of the experiments in which forages were not mixed as a balanced pelleted diet showed low productive performance (Carabaño and Fraga, 1991).

Addition of forages to pelleted feed not only affects production but can also be used as enrichment for the purpose of preventing boredom. European wild rabbits spend long times grazing (Mykytowycz and Rowley, 1958). Rabbits fed with pelleted diets spend only about 10–17% of their time feeding (Dal Bosco et al., 2002; Postollec et al., 2006; Jordan et al., 2011). More free time may be one reason for more frequent occurrence of aggressive behaviour and incidence of injury. However, the most frequently used environmental enrichment is the gnawing stick (Jordan et al., 2004; Princz et al., 2007, 2008). The barren cages can be enriched with straw or hay, grass and branches with leaves, which enable rabbits to perform their natural activities and reduce stereotyped and aggressive behaviours (Lidfors, 1997).

In most of the experiments the effects of treatments were investigated separately. The aim of this experiment was to examine the effects of genotype, housing system and hay supplementation on productive performance and aggressiveness of growing rabbits.

## 2. Materials and methods

The study was approved by the Ethical Committee of Kaposvár University. All animals were handled according to the principles stated in the EC Directive 86/609/EEC regarding the protection of animals used for experimental and other scientific purposes.

### 2.1. Animals

The experiment was carried out at the Kaposvár University, Hungary. Pannon Ka does (maternal line of the Pannon Breeding Program) were inseminated with diluted pool semen of Pannon Large males (terminal line of the Pannon Breeding Program, hereafter Large) or Hungarian Giant males (Hung). The semen of Hung rabbits originated from a private farm.

### 2.2. Condition of the trial

The crossbred rabbits ($n=336$) were weaned at 5 wk of age. Half of them were housed randomly in wire-mesh cages (Cage, no. of cages: 56, 3 rabbits/cage, size of cage: $61 \times 32$ cm), the other half in wire-mesh pens (Pen, no. of pens: 12, 14 rabbits/pen, size of pen: $190 \times 50$ cm). Cages and pens were equipped with a feeder and nipple drinker (length of feeders was 15 cm in cages and 40 cm in pens and there was one drinker per cage and two per pen). The stocking density was 15 rabbits/m$^2$ in both cases. Two feeding method subgroups were formed in each group: pelleted commercial diets (Pellet) or pelleted diets plus grass hay (P+Hay), *ad libitum*. The hay was put on the top of the cages, or in case of pens, it was inserted in hayracks. All rabbits consumed medicated pelleted diet (1 ppm Clinacox/diclazuril, 500 ppm OTC, 50 ppm Tiamulin) between ages 5 and 9 wk, and thereafter they received non-medicated pelleted diet, till slaughtering at 12 wk of age. Chemical compositions of pelleted diets and hay are

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