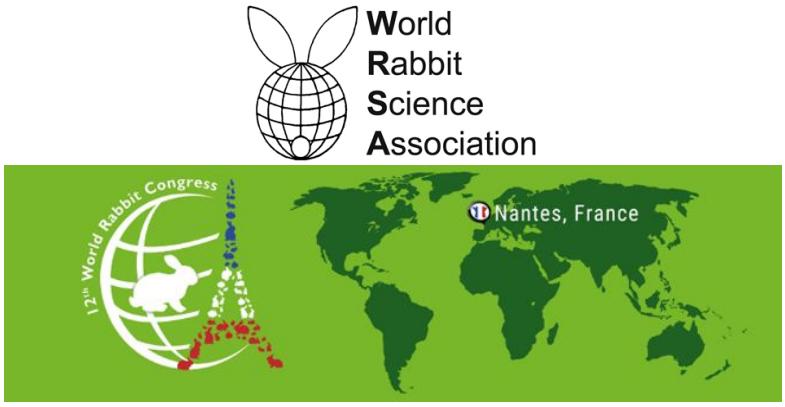

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ADVANCES IN PART-TIME GROUP HOUSING SYSTEMS FOR DOES: AN OVERVIEW OF REPRODUCTIVE PERFORMANCES

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ABSTRACT

Part-time group housing of farmed rabbits does has gained increasing attention over the last years. Based on recent published literature, this paper aims to provide a brief overview of the reproductive performances and highlights problems and perspectives concerning part-time group housing systems. From a welfare point of view, group housing of does seems desirable because of the increased possibilities for social interactions and the larger absolute space available (facilitating the creation of functional areas and expression of certain behaviours that require adequate freedom of movement). Experiments on continuous group housing systems for does, however, have shown poor reproductive performance mainly caused by aggression, skin injuries, pseudo-pregnancies and competition for nests. In order to tackle these problems several researchers are investigating so-called part-time group housing systems in which does are grouped for some duration in the reproduction cycle. Does in part-time group housing, however, do not fully meet the reproductive performances compared with individually housed does. A lower litter size at weaning, higher pre-weaning losses and less weaned kits per doe are reported compared with individual housing. Furthermore, group housing seems to affect the body condition of does due to social stress. Aggressive behaviour has been reported among does and does towards alien kits. Therefore, in order to tackle the remaining aggression problems in part-time group-housed does and to fill the gap in production performances with individually housed does, efforts have to be focused to better understand the social interactions among does.

Key words: Group housing, does, reproductive performance.

INTRODUCTION

To date there are no minimum requirements for the protection of commercially housed rabbits in the EU (EFSA, 2005; Szendrő *et al*., 2019). Rabbit housing under farmed conditions is criticized by society calling for more animal-friendly housing systems. Recently, the European Parliament approved a resolution aimed at promoting a conversion from conventional rabbit cage systems to alternative housing systems with regard to animal welfare (European Parliament, 2017).

The dimensions of conventional individual cages for breeding does are not sufficient for the needs and species-specific behaviour of rabbits. The area of basic cages is between 3300 and 3900 cm² for lactating does with their kits, although wider versions exist (Szendrő *et al.*, 2019). Even so, such cages do not allow does to make more than a few jumps or to fully raise in a vertical position (Verga *et al*., 2007; DiVincenti and Rehrig, 2016). Enriched cages allow a wider repertoire of behaviour due to a larger surface area ranging between 4370 and 6400 cm², an adjusted height of 60-80 cm and a raised platform (Szendrő *et al.*, 2019).

Compared to individual cages, commercial group housing in the so-called park systems provide a larger surface area (5400-6350 cm² per doe in a park of 4 does) (Szendrő *et al.*, 2019) and an open roof. These park systems are currently in commercial use only in some countries for the housing of

fatteners (Rommers and De Greef, 2018). There have been several efforts to develop continuous group housing systems for does (Stauffacher, 1992; Ruis, 2006) but these developments have been unsuccessful because of animal welfare concerns and/or reproductive performances (Szendrő *et al.*, 2019). The main reasons for the failure of this housing system are the very high rates of aggression of does towards other does and alien kits, skin injuries, pseudo-pregnancies, competition for nests and lower reproductive performances (Rommers *et al.*, 2006; Andrist *et al.*, 2013).

In order to cope with problems related to continuous group housing, part-time group housing of does was proposed (Maertens *et al.*, 2011). Since then, increasing efforts have been done in several countries to develop such housing for farmed rabbit does. This paper will give a brief overview of reproductive performance with reference to recent published literature with the aim of highlighting problems and perspectives of part-time group housing systems.

PART-TIME GROUP HOUSING OF DOES

The large majority of farmed rabbit does follows a strict batch reproduction cycle with a fixed day for artificial insemination (AI) (EFSA, 2005). Does are kept with their kits until weaning after which does are prepared for the next litter. In enriched parks, the weaned kits are raised in group with different litters until slaughter age. Depending on the farm management and available housing system, does and the kits are separated and relocated after weaning or only the does are moved to another location.

In part-time group housing does are housed in group during at least some part of the reproduction cycle. To avoid competition for nesting places among does it is advised to house does individually a few days prior to kindling. After the kits start leaving the nest box and have found the feeder and water nipple, does can be housed in group with their kits (Maertens *et al.*, 2011; Maertens and Buijs, 2016).

Table 1. Characteristics of different experimental part-time group housing systems

Reference	Dimensions of the pen LxW(xH) (cm)	Enrichment	Duration reproduction cycle (days)	Begin and end group housing period	Number of does in group
Buijs *et al.* (2014)	200 x 100 x open top	Platform of 30 cm, gnawing stick	42	Days 18-39 post parturition	4
Maertens and De Bie (2017)	180 x 100 x open top	Platform of 30 cm, gnawing stick	42	Days 22-33 post parturition	4
Rommers and De Greef (2018)	228 x 100 x open top	Platform of 40 cm, 2 wooden panels, PVC pipe	42	Days 23-36 post parturition	5
Dal Bosco *et al.* (2019)	158 x 130 x 60 Transfer of females at weaning (day 30)	-	61	Days 7-56 post parturition	4
Machado *et al.* (2019)	240 x 100 x 65	-	42	Days 18-28 post parturition	6
Zomeño *et al.* (2018)	Connection of four adjacent individual modules (78 x 64 x 110) open top	-	-	Days 2-33 post parturition	4

Various part-time group housing systems have been tested with different duration of the individual versus group-housed period. For instance, Buijs *et al.* (2014) grouped does when kits were 18 days old in a reproduction cycle of 42 days. This system, where does were housed in group during half of the reproduction cycle, was called semi-group housing. Maertens and De Bie (2017) housed does in group between day 22 and 33 after kindling. Machado *et al.* (2019) between day 18 and 28 post parturition whereas Dal Bosco *et al.* (2019) housed does in group between day 7 after kindling till 4 days prior to the next parturition. The latter used a reproduction cycle of 61 days. An overview of the different experimental part-time systems and their characteristics is presented in table 1.

For management and hygienic reasons, a single batch management system is recommended with AI and an all in all out approach. Most often does and fatteners are housed in dual purpose systems (Szendrő *et al.*, 2019). After weaning does are removed to a cleaned and disinfected stable and the kits remain in the same housing as before until slaughter age. In order to maintain this management system, a housing system was developed to create larger pens or parks (with enrichment) from individual cages suitable for the housing of both fatteners and does by removing walls between the individual units (hence the name combi-park system) (Maertens *et al.*, 2013; Dal Bosco *et al.*, 2019). Although the ground surface area per doe in a combi-park system may be the same as for individual cages, the total floor space available to each doe in a park system is much higher when housed in group (Maertens *et al.*, 2011).

PERFORMANCES WITH PART-TIME GROUP-HOUSED DOES

As presented in table 2, inferior production performances have been reported in part-time group housing systems compared with individual housed does, although there are notable differences between experiments. Maertens and Buijs (2016) accounted the pre-weaning losses and lower litter size at weaning partly to the experimental equipment, which prevented the kits from reaching the water nipples at an early age. This problem was solved later in the experiment but even though, performances still remained slightly lower compared with the individual housed does. Machado *et al.* (2019) found similar findings: litter size at weaning (and the number of weaned kits per doe per year) was lower when does were housed in group. Furthermore, grouping seemed to have a negative effect on the feed intake of the does and kits. Dal Bosco *et al.* (2019) reported lower performances for part-time group-housed does. Social rank (and stress) seemed to play an important role as subordinate does had a less good body condition compared with dominant does. In contrast with other studies, Zomeño *et al.* (2018) found similar reproductive performances compared with individually housed does. The large variability in pen dimensions, pen design, enrichment, duration of the grouping phase and management between experiments could be an explanation.

Table 2. Overview of performances of does: individual vs. part-time group-housed

Trait	Individual cage (A)	Part-time (B) group-housed	Difference A - B[3]	Reference
Fertility (%)	90.3	83.3	-7.0	Maertens and Buijs (2016)[1]
	82.8	76.2	-6.6	Dal Bosco *et al.* (2019)
No. of AI to get pregnant	1.24	1.43	**0.19**	Machado *et al.* (2019)
Litter size at birth	12.3	12.2	-0.01	Maertens and Buijs (2016)[1]
	10.54	10.08	-0.46	Machado *et al.* (2019)
	8.90	7.95	**-0.95**	Dal Bosco *et al.* (2019)
Litter size at weaning	10.23	9.91	**-0.32**	Maertens and Buijs (2016)[1]
	8.82	8.22	-0.60	Maertens and De Bie (2017)
	9.75	9.74	-0.01	Zomeño *et al.* (2018)
	9.49	9.24	**-0.25**	Machado *et al.* (2019)
	7.85	7.20	**-0.65**	Dal Bosco *et al.* (2019)
Pre-weaning losses (%)	1.0	1.8	0.8	Maertens and Buijs (2016)[1]
	1.3	3.9	**2.6**	Maertens and De Bie (2017)[2]
	5.5	7.2	**1.7**	Dal Bosco *et al.* (2019)
Time in the assay (d)	182	147	-35	Machado *et al.* (2019)
Doe replacement (%/y)	75.0	87.5	+12.5	Dal Bosco *et al.* (2019)
Weaned kits/doe/year	66	56	**-10**	Machado *et al.* (2019)
	35.5	25.6	**-9.9**	Dal Bosco *et al.* (2019)

[1] Between d18-32 post parturition. [2] Between d22-33 post parturition. [3] Differences in bold are significant ($P<0.05$)

As reported in several studies, aggression still remains a problem in part-time group housing, especially shortly after regrouping, (Buijs *et al.*, 2014; Rommers *et al.*, 2014; Rommers and De Greef, 2018; Zomeño *et al.*, 2018; Dal Bosco *et al.*, 2019) negatively affecting reproductive performances. Agonistic behaviour among does serves as a basis for the establishment for a social hierarchy which has to be reinstalled at each regrouping (Rommers *et al.*, 2006). Furthermore, under farmed conditions, due to the replacement of e.g. unproductive or non-pregnant does, it is difficult to maintain a stable group composition.

Therefore, in order to tackle the remaining aggression problems in part-time group-housed does and to fill the gap in production performances with individually housed does, efforts have to be focused to better understand the social interactions among does. Further investigations are urgently requested to study the effects of enrichment or other designs of group housing systems (Dal Bosco *et al.*, 2019).

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12th World Rabbit Congress, 3-5 November 2021, Nantes

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Group housing systems

- Promote natural behaviour
- Increased functional space per animal
- Enrichment: wood, platform, straw, …
- Mostly fatteners
- Possible for does?

Group housing for does?

Continuous group housing for does

- Kindling in group with other does
- Aggressive behaviour, skin injuries, pseudo-pregnancies, nest competition,...
- Lower reproductive performances

Are rabbits always social animals?

Group housing for does?

Continuous group housing for does

- Kindling in group with other does
- Aggressive behaviour, skin injuries, pseudo-pregnancies, nest competition,...
- Lower reproductive performances

Are rabbits always social animals?

Part-time group housing for does

- Avoid bad timed forced group membership
- Single-litter housing around kindling, group when kits are older
- Reproductive performance?

Reproductive performances

Trait	Individual cage (A)	Part-time (B) group-housed	Difference B - A[3]	Reference
Fertility (%)	90.3	83.3	-7.0	Maertens and Buijs (2016)[1]
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[1] Between d18-32 post parturition. [2] Between d22-33 post parturition. [3] Differences in bold are significant (P<0.05)

Part-time group housing

Aggressive behaviour

- Initial social unrest and stress
- Skin injuries (does and kits)
- Establishing hierarchy
  - Changing group composition!
  - Subsequent re-grouping

But not always bad!

- Groups with no major issues
- What can we allow/tolerate?

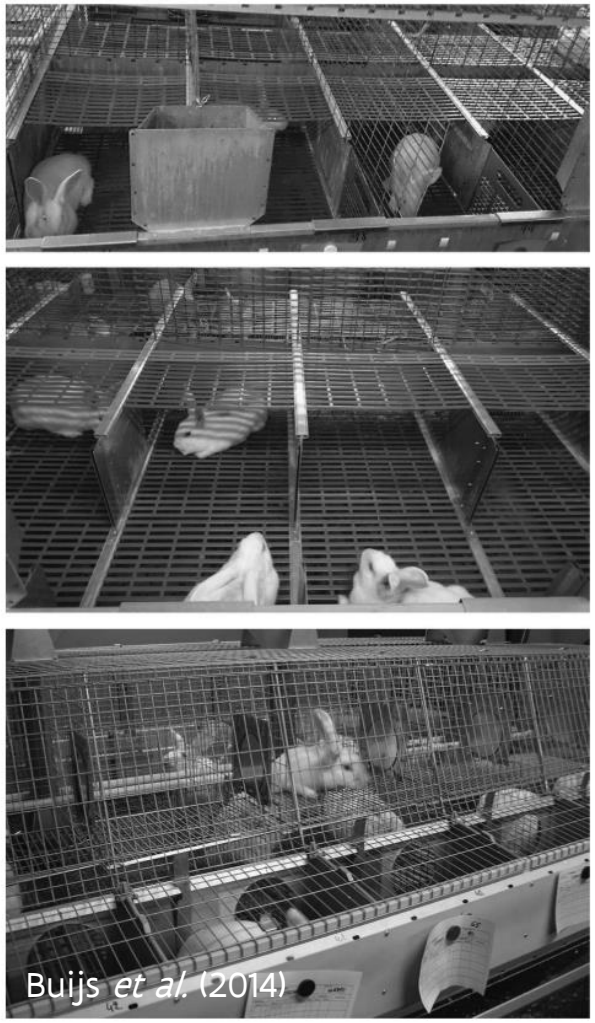

Figure 1 Housing systems. Top: a semi-group pen divided into four individual units (as used from 3 days before 18 days after kindling), middle: a semi-group pen with grouped does (as used from 18 days after kindling to 3 days before next kindling), bottom: a row of individual cages.

Figure 1b: Combi parks without nest box panels, standing model for fattening park.

Fig. 1. Pen outlay: Individual cage (1), closable grid with hay on top (2), extractable nest box (3), platform (4), individual pellet dispenser (5), common floor area (6).

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Thank you

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