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Health and welfare challenges for laying hens kept in free-range systems

Matthias Gauly and Gürbüz Das

Livestock Production Systems
Department of Animal Science
University of Goettingen
Germany



Overview

- Introduction
- What is animal health and welfare?
- What is the expected impact?
- What can be done?
- Conclusions



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Council Directive 1999/74/EC

- EU Directive for the protection of laying hens -

- ⇒ Since 1.1.2012 ban of conventional cages for laying hens throughout the EU (40 % of hens in EU still in cages; Betz et al., 2012)
- ⇒ 'Alternative' production systems

Production systems for layers

Floor system

Aviary system

Furnished cages/
Enriched colony system

with or without winter garden



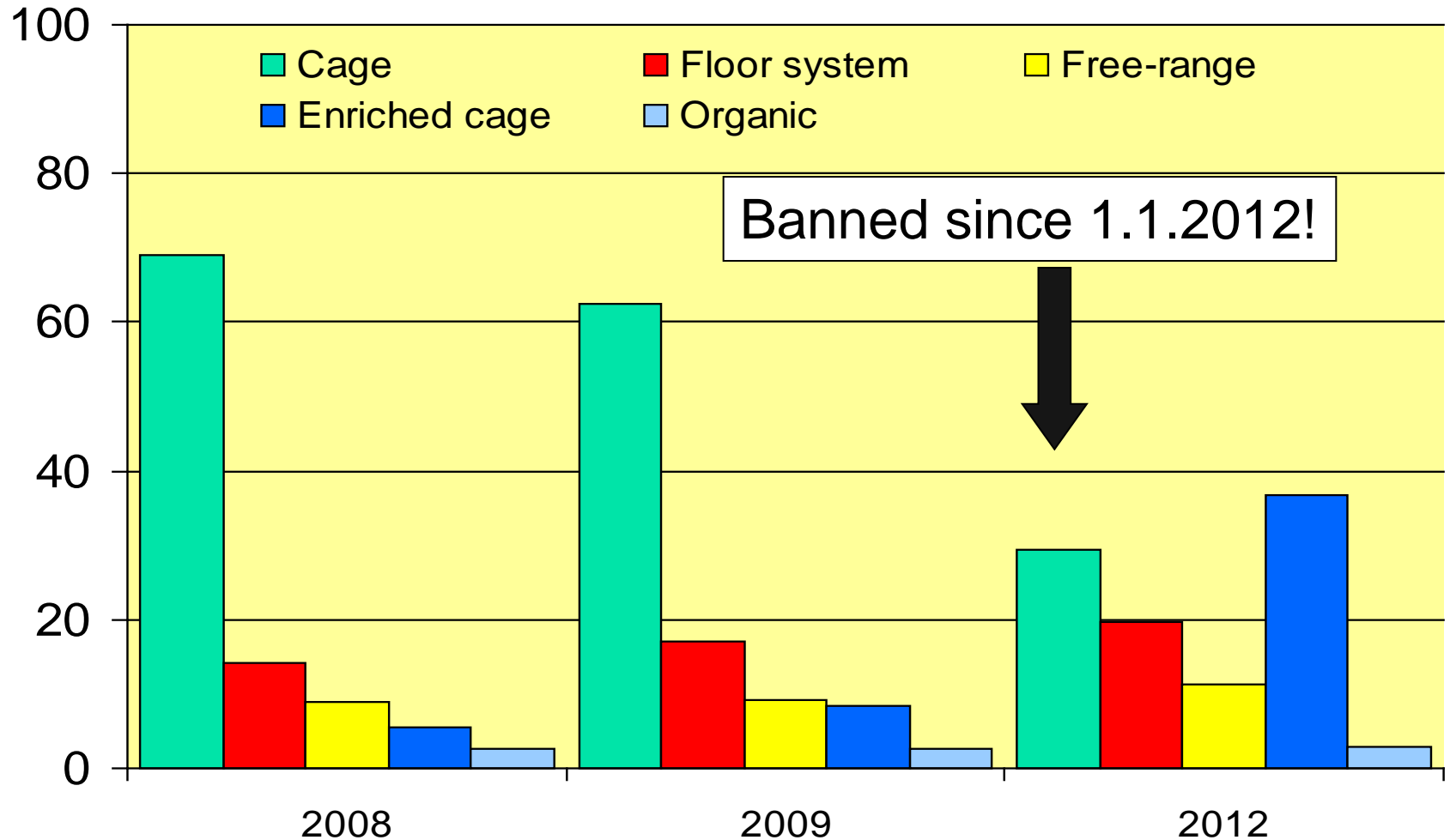
Free range
(organic/conventional)



Production systems in the EU (%)

(Lukanov and Alexieva, 2013)

%





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What is animal health?

- New Common Animal Health Strategy of the EU (2007): ‘Animal health covers not only the absence of disease in animals, but also the critical relationship between the health of animals and their welfare’.
- ‘Health and disease is a continuum on which an individual is located at a certain time, and therefore not either healthy or ill, but rather being more in the direction of health or disease ‘ (Antonovsky, 1997).



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Expected impact on health and welfare

Decrease of:

- Adiposis hepatica (e.g. Kaufmann-Bart and Hoop, 2009; Weitzenbürger et al., 2005)
- Osteoporosis and bone fractures

Increase of:

- Bacterial and viral diseases
- Parasitic diseases
- Foot pad dermatitis
- Rank order problems
- Feather pecking and cannibalism
- Mortality



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Osteoporosis


First described by Couch (1955)

⇒ “cage layer fatigue”

⇒ lack of exercise (e.g. Knowles and Broom, 1990; Jendral et al., 2008)

Bone structure and breaking strength in layers housed in different husbandry systems
(Fleming et al., 1994)

	Cage	Floor	Aviary
Tibia			
Breaking force (N)	213.9	252.1	280.6
Radiographic density (mm Al)	2.95	3.48	3.33
Humerus			
Breaking force (N)	128.5	221.7	249.2
Radiographic density (mm Al)	0.75	1.11	1.25



Bone fractures in dependence of the housing system (Sandilands, 2008)

	Conventional cage	Enriched cage	Free-range system	Floor housing
Farms (N; 1 hens/farm)	Genotype problem ???			
Fresh fractures (%)	0	0	45	53
Total	49	0	0	0
Arranging of the perches is important!				

53 % of the animals with bone fractures !!!!

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Decrease of:

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Environments in which hens are exposed to litter, soil and fomites (e.g., rodents, beetles) provide a greater opportunity for disease and parasites.

Kreienbrock et al., 2003)

- Parasitic diseases

The more complex the environment, the more difficult it is to clean, and the larger the group size, the more easily disease and parasites are able to spread (Lay et al., 2011).



Proportion of herds treated with antibiotics and antiparasitics during the laying period in different housing systems (Gayer et al., 2004)

	Free-range	Floor	Cage
Antibiotics	35.7 %	35.0 %	0.0 %
Antiparasitics	25.0 %	20.0 %	0.0 %

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Important parasites in hens

Ectoparasites:

- *Dermanyssus gallinae* (red mite) \Rightarrow occurs in all systems (Sherwin et al., 2010), but favour a more complex environment (e.g. Höglund et al., 1995)

Endoparasites:

- Eimeria
- Nematodes
- Cestodes

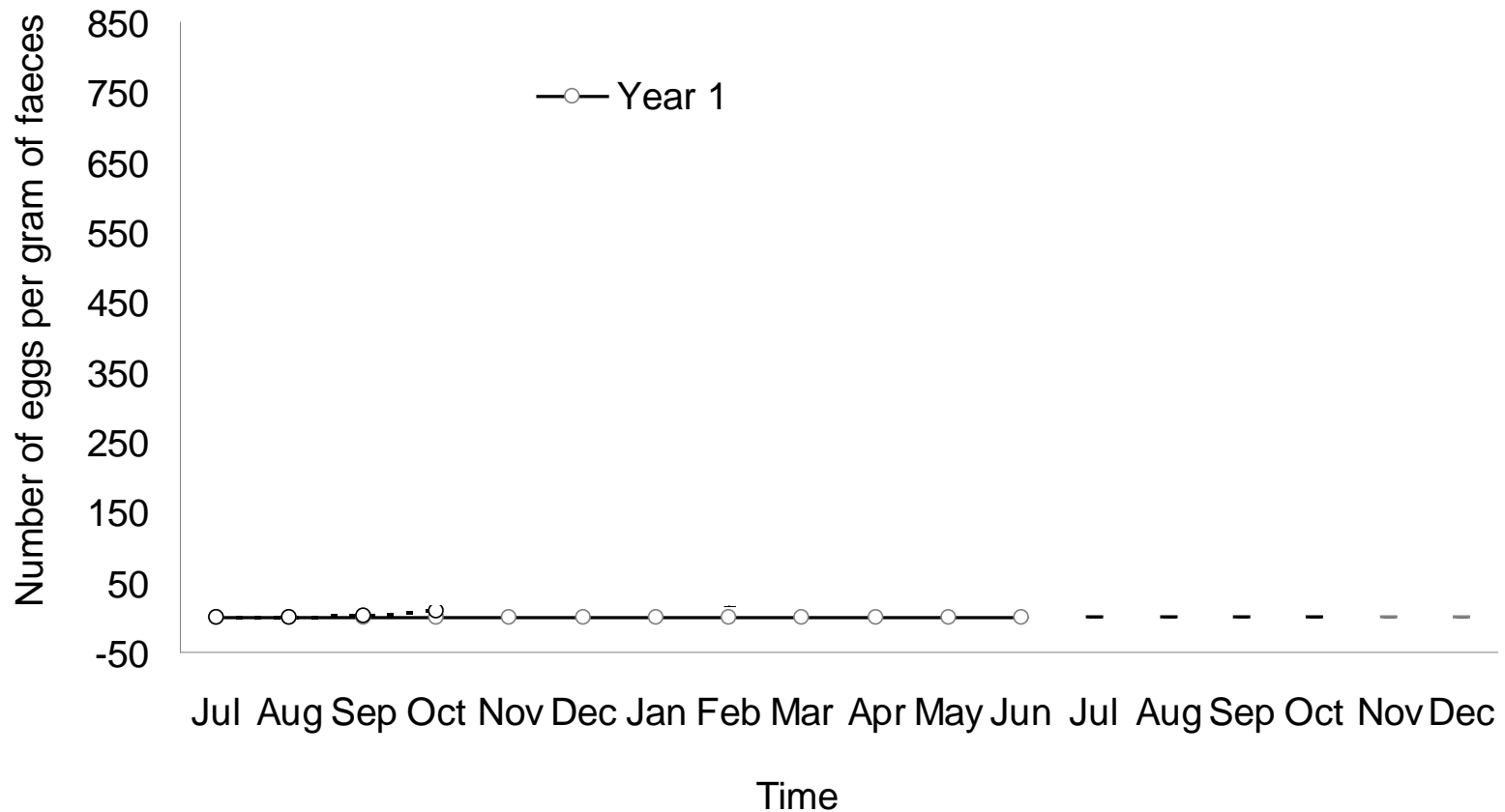
Prevalence of gastrointestinal helminths in relation to production system (in %)

Author	Housing system	<i>Ascaridia galli</i>	<i>Heterakis gallinarum</i>	<i>Capillaria obsignata</i>
Gayer et al., 2004	Cage	2.2	0.0	0.0
	Floor	54.8	37.0	7.2
	Free-range	50.7	42.2	4.8

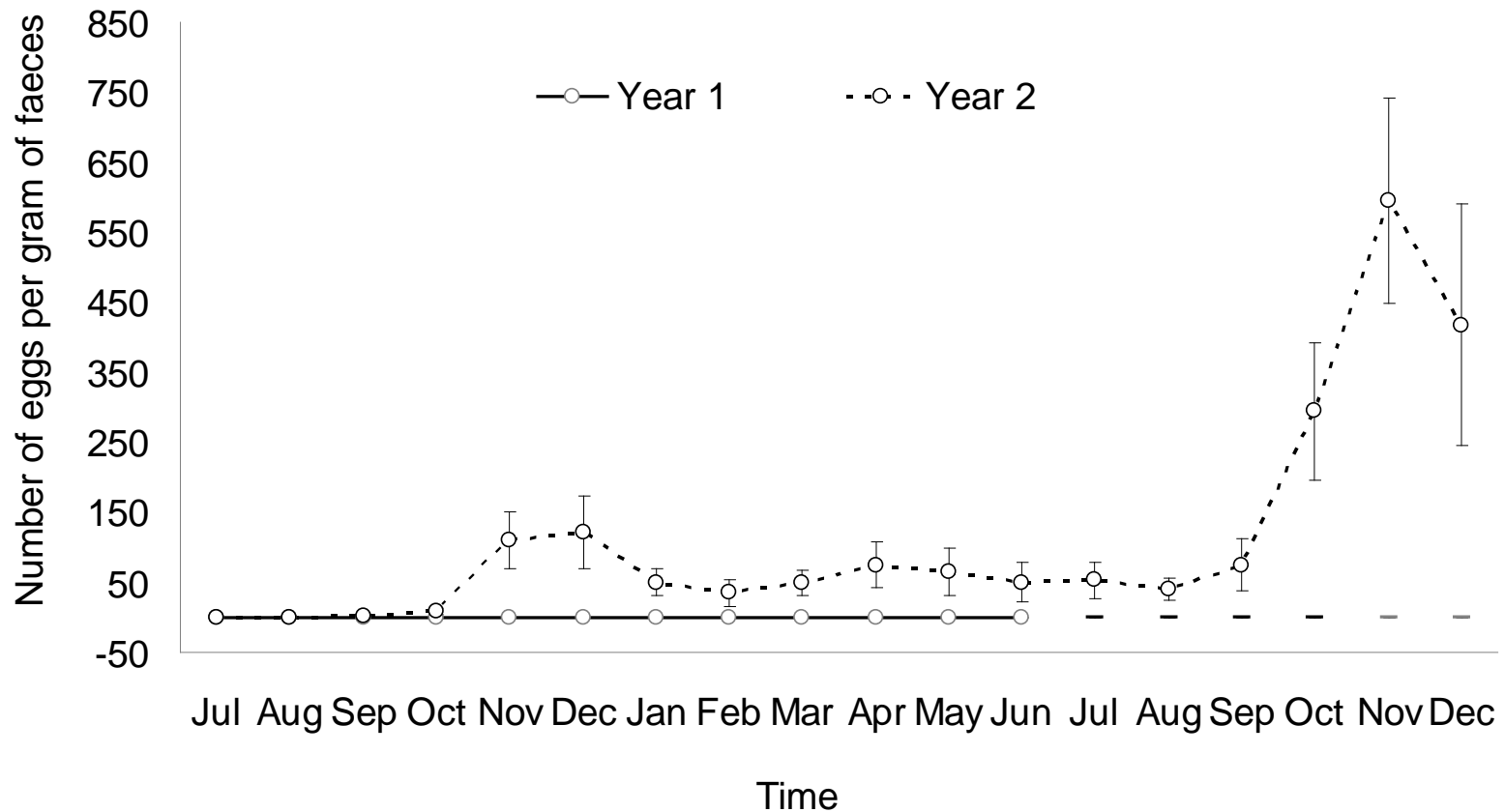
Prevalences and worm burden in organic free-range systems (144 hens in 11 farms)

	Prevalence	Mean worm burden (SD)	Range
Nematodes	92.4	135.7 ± 136.8	2 - 775
Cestodes	25.7	42.9 ± 34.8	1 - 350

Development of helminth infections (EpG) in a free-range system (unpublished, 2013)



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The effect of housing on foot health of hens (Lay et al., 2011)

	Floor	Aviary	Free-range	Cage	Colony system
Foot dermatitis/Bumble-foot/hyperkeratosis	-	-	-	+	+
Claws	++	++	++	-	++

- = poor, + = medium, ++ = good

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Feather pecking in different system (%)

(Kreienbrock et al., 2003)

	Floor w.o. Free- range	Floor with Free- range	Aviary w.o. Free- range	Aviary with Free- range	Conven- tional Cage	Enriched colony system
n =	41	50	10	34	288	2
Not	13	8	60	6	80	0
Sometimes	39	29	0	44	18	100
Often	58	63	40	50	2	0

Cannibalism in different system (%)

(Kreienbrock et al., 2003)

	Floor w.o. Free- range	Floor with Free- range	Aviary w.o. Free- range	Aviary with Free- range	Conven- tional Cage	Enriched colony system
n =	41	50	10	34	288	2
Not	22	5	0	20	76	50
Sometimes	21	35	77	27	22	50
Often	57	60	33	53	2	0

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- **Mortality** (e.g. Michel and Huonnic, 2003; Rodenburg et al., 2008)





Mortality rates in different system (%)

(Kreienbrock et al., 2003)

	Floor w.o. Free- range	Floor with Free- range	Aviary w.o. Free- range	Aviary with Free- range	Conven- tional Cage	Enriched colony system
n =	40	5	10	33	286	2
Mean	15.8	17.9	19.2	19.7	10.4	11.2
Median	14.8	17.7	18.8	18.5	8.7	11.2
Min	2.3	65	13.0	5.8	1.4	10.3
Max	32.8	34.8	26.4	33.0	32.7	12.2



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Approaches to reduce health and welfare problems

- Drugs/Vaccines/Alternative products
 - ⇒ Limited availability, development of resistency
 - ⇒ Effects on product quality, problems for organic farms
- Animal-friendly design of the environment
 - ⇒ Minimize stress factors
 - ⇒ Adapted management
- Optimized nutrient composition
- Use of resistant/tolerant genotypes

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Antibiotic residues in eggs in relation to management system

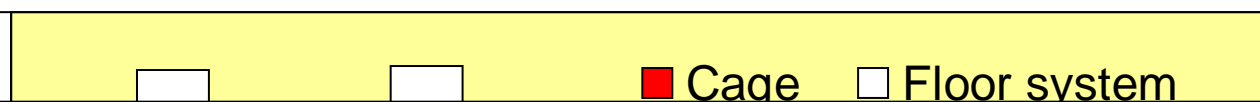
(Hafez et al., 1988; Friedrich et al., 1985)

Antibiotic, concentration	Days of treatment	Residues in egg after treatment (days)	
		Cage	Floor system
Nicarbazin (2 mg/kg feed)	29	16	➤ 60
Tetracycline (500 mg/l water)	7	26	37
Enrofloxacin (50 mg/l water)	4	8	➤ 46

Excretion time of flubendazole ($\mu\text{g}/\text{kg}$) via the egg in dependence of the production system

μg flubendazole/kg egg

200



Means: $10.8 \mu\text{g} / 60 \text{ g}$ egg

corresponds to approx. 0.05 % of the administered substance.

120

80

40

0

1

2

3

7

14

Days after end of treatment

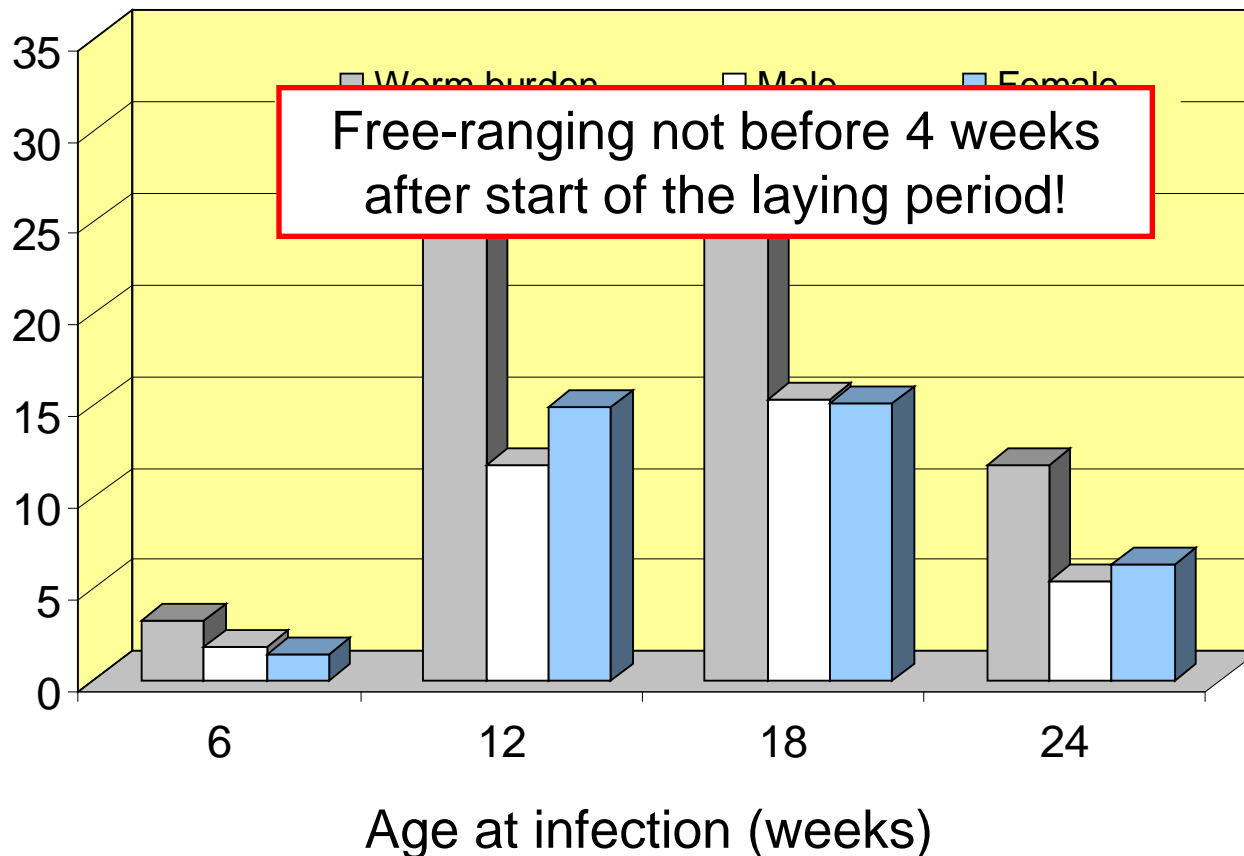
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Worm burden of LSL hens after artificial infection with 250 embryonated *A. galli* – eggs in dependence of the age

Worm burden



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Heritability estimates for genetic resistance against helminths



- Artificial infection with *Heterakis gallinarum*
 - Worm count: 0.31 (\pm 0.13) to 0.41 (\pm 0.9)



- Artificial infection with *Ascaridia galli*
 - EpG: 0.10 (\pm 0.04) to 0.19 (\pm 0.04)

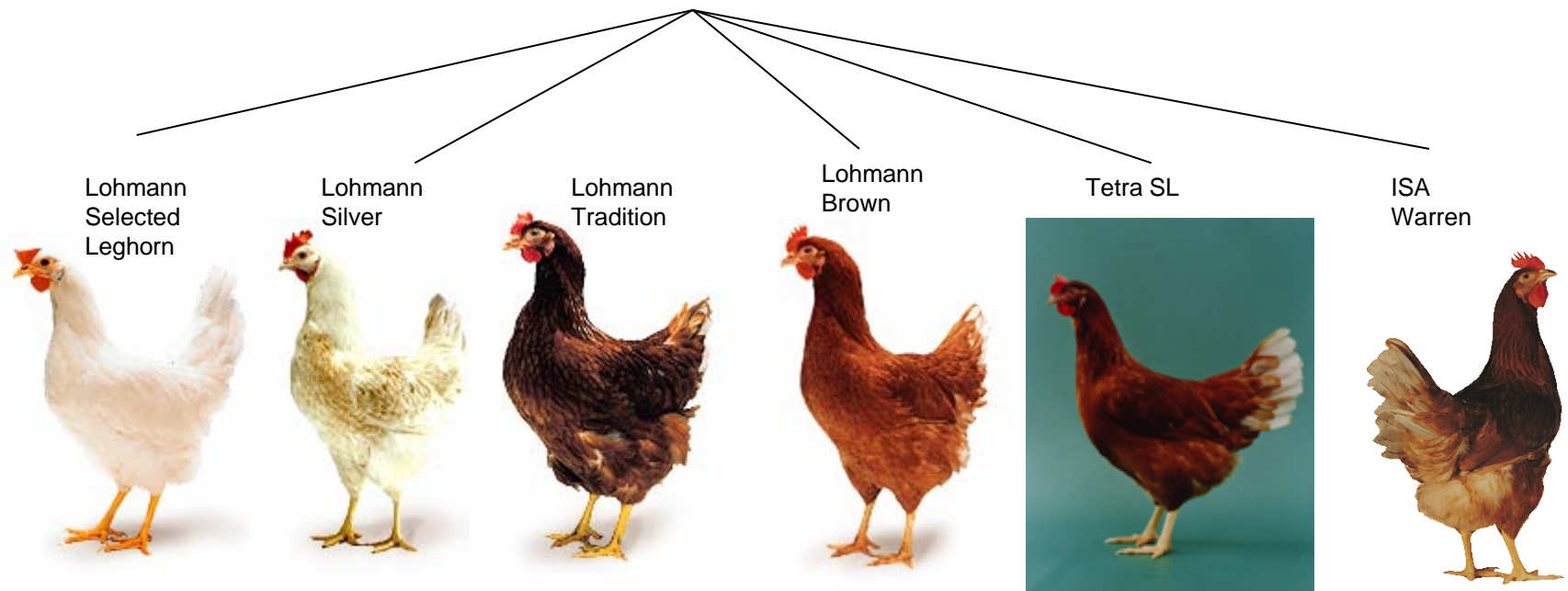


- Natural mixed infection
 - Worm count: 0.54 (\pm 0.07)



Genotypes and worm counts following an artificial infection with *Ascaridia galli*

- Genotypes, n = 60 layers:



Results

Traits	LSL	ISA	LT	LSi	LB	TETRA
Mean worm burden	10.2b	14.3c	8.3a	10.3b	7.1a	15.7c
Ø – Egg production (%)	85	89	85	86	88	87
Ø – Egg weight (g)	58.1	58.7	59.3	55.6	58.3	59
Feed consumption (g)	118	122.1	117	120.8	116.4	114.7
Feed consumption/kg egg (kg)	2.39	2.32	2.32	2.48	2.26	2.17
Ø – Body weight 250. LT (g)	1753	2037	2042	2029	1925	1909
Feather score	1.125	1.03	1.065	1.07	1.065	1.035
Mortality (%)	5.5	0	2	0	3.9	3.5

Results

Traits	LSL	ISA	LT	LSi	LB	TETRA
Mean worm burden	10.2b	14.3c	8.3a	10.3b	7.1a	15.7c
SD	11.9	15.3	8.9	17.3	7.1	21.8
Ø – Egg production (%)	85	89	85	86	88	87
Ø – Egg weight (g)	58.1	58.7	59.3	55.6	58.3	59
Feed consumption (g)	118	122.1	117	120.8	116.4	114.7
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Conclusions

- Each husbandry system has unique challenges.
- Non-cage, especially free-range systems provide a greater opportunity for diseases and parasites.
- However, the high prevalence of certain welfare and health problems is of concern across all systems.
- The welfare of modern genotypes is in general poor (Sherwin et al., 2010).



What to do?

- Improvement of management procedures.
- Selective breeding for desired traits.
- Lower yielding birds ?
- Dual purpose breeds ?

Thank you very much!



Happy or just full of mites ?