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Qualitative and quantitative risk factors concerning the introduction and spread of *Salmonella* in different pig housing systems

***J.Krieter^{1*}, E. große Beilage² and
C.Meyer¹***

***¹Institut of Animal Breeding and Husbandry,
Christian-Albrechts-University, 24098 Kiel***

***² Bakum Field Station for Epidemiology, School
of Veterinary Medecine, Hannover, Germany***

****jkrieter@tierzucht.uni-kiel.de***



Implication of Salmonella

Foodborne pathogens

**2002: 72.377 human cases in Germany
(unknown cases: 80 - 90%)**

**Symptoms: diarrhoea, septicaemia with fatal
consequences**

**Main source of infection: foodstuffs made from animals
(human cases attributable to pork: 15-25%)**

Estimation of the population and herd prevalence in sows and finishing pigs

Comparison of conventional, ecological and outdoor farms

Risk factor analyses (housing, feeding, management)

Farms

108 Farms in Schleswig-Holstein and Lower Saxony

78 conventional (farrowing, fattening)

17 ecological (farrowing, fattening)

13 free range, outdoor (farrowing)

Farm selection

Unknown Salmonella status

Vertical linkage between stages

Differences in housing- and managementsystems

Prevalence

4.343 blood samples of sows and finishing pigs
Salmotype[®] meat juice ELISA (Cut Off at 40%)

Risk Factors

Questionnaire about housing system and management practices

Prevalence rates

Animal and herd level (PROC SURVEYMEANS)

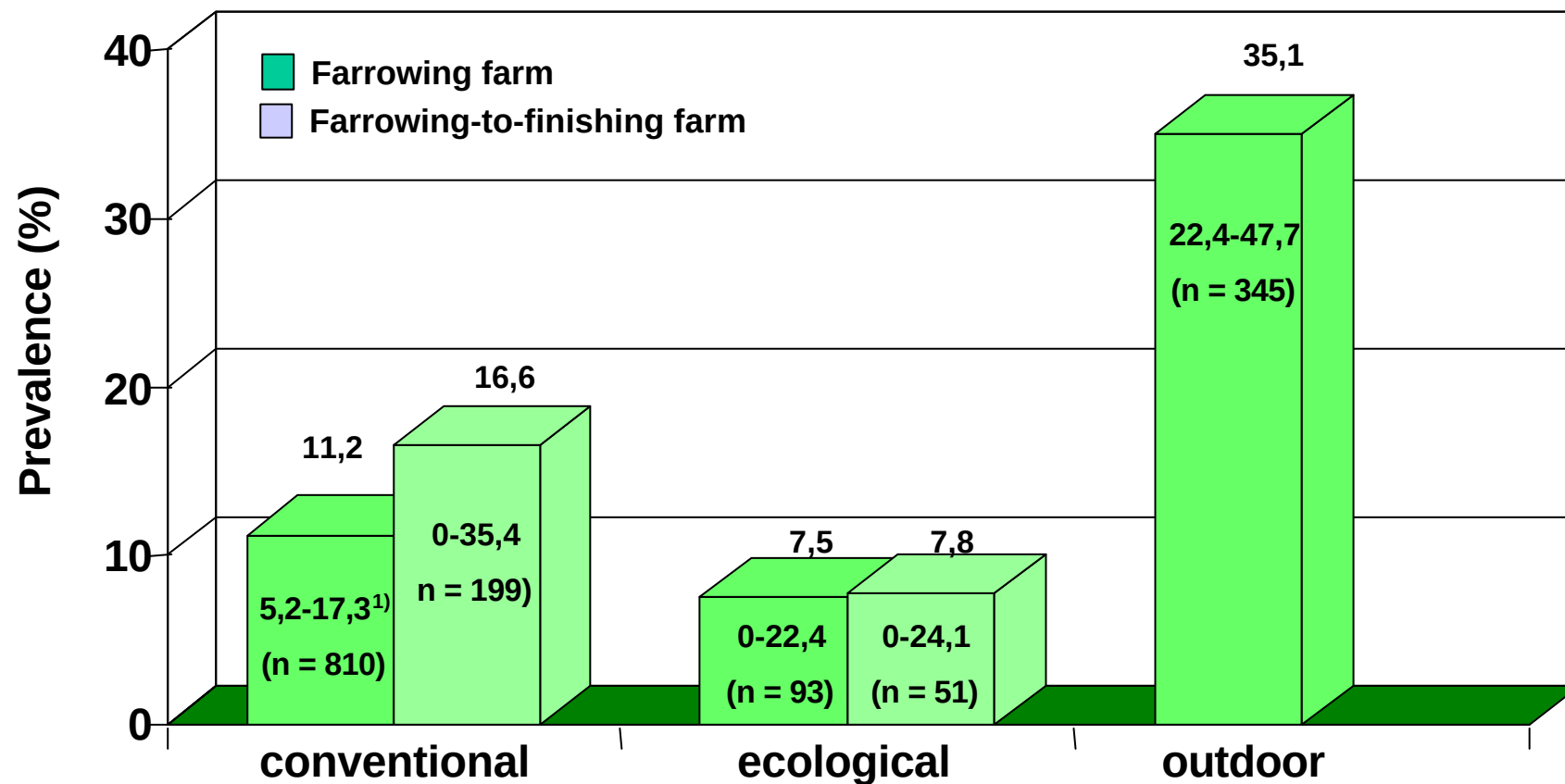
Risk factor analyses

Generalised linear mixed model analyses
(SAS Macro GLIMMIX; binomial distribution, logistic
link function)

Different statistical models (e.g. housing, management)

Odds ratio (OR) = $\exp(c_{\text{logistic}})$, confidence interval

Sows - animal level (OD%>40)

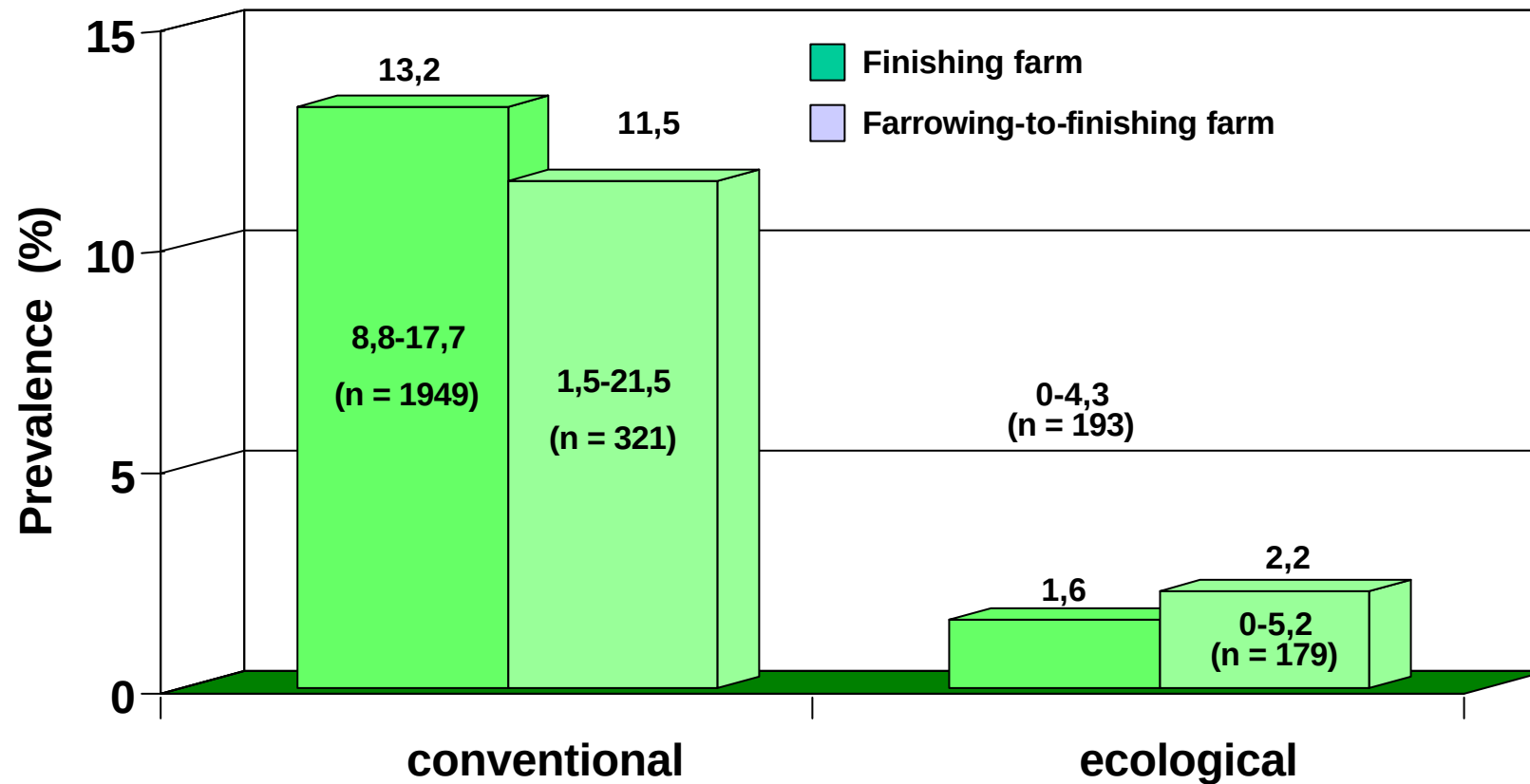


¹⁾ confidence interval 95 % (Taylor Expansion)

Sows - farm level (OD%>40)

Prevalence (%)	conventional		ecological		outdoor	
	n	%	n	%	n	%
0 bis < 2	11	28,2	5	55,6	1	7,7
2 bis < 10	14	35,9	1	11,1	–	–
10 bis < 20	6	15,4	1	11,1	3	23,1
20 bis < 40	5	12,8	2	22,2	5	38,4
³ 40	3	7,7	–	–	4	30,8
Total	39	100	9	100	13	100

Finishing pigs - animal level (OD%>40)



¹⁾ confidence interval 95 % (Taylor Expansion)

Finishing pigs - herd level (OD%>40)

Prevalence (%)	conventional		ecological	
	n	%	n	%
0 bis < 2	13	30,2	7	58,3
2 bis < 10	8	18,6	5	41,7
10 bis < 20	10	23,3	–	–
20 bis < 40	10	23,3	–	–
³ 40	2	4,6	–	–
Total	43	100	12	100

Risk factors

Sows - conventional (n = 1,009)

Factor	OR	95% CI
Quarantine (gilts)		
yes	1	
no	3.68	2.10 - 6.38
Outdoor runs		
no	1	
yes	2.01	1.30 - 3.10
Staff		
3 or more persons	1	
1 or 2 persons	3.43	2.26 - 5.19
Addition of organic acid		
yes	1	
no	6.02	1.88 - 9.26
Cleaning the food storage		
yes (occasional)	1	
no	2.16	1.25 - 3.40
Farm type		
farrowing	1	
farrowing-to-finishing	1.57	1.02 - 2.42

Sows - outdoor (free range, n = 345)

Factor	OR	95% CI
Change of pasture		
2 x per year	1	
1 x per year	1.79	0.97-3.32
1x in 2 years	6.75	2.63 - 17.32
Rodents		
low	1	
middle	2.21	1.20 - 4.06
high	5.11	1.97 - 13.27
Birds		
low/middle	1	
high	2.34	1.32 - 2.27

Risk factors

Finishing pigs - conventional (n = 2,270)

Factor	OR	95%CI
Antibiotic treatment		
no	1	
yes (occasional)	2.73	2.04 - 3.65
Floor		
slatted	1	
partially slatted	1.72	1.31 - 2.26
Feeding		
meal	1	
granulate	2.01	1.37 - 2.98
pellets	1.36	0.93 - 1.98
Cleaning feeding facilities		
yes (occasional)	1	
no	2.47	1.82 - 3.37
Location		
low pig density	1	
high pig density	2.33	1.67 - 3.25

Prevalence and production systems

Outdoor > Conventional > Ecological
(due to sampling, management factors)

Risk factor analyses

<i>Conventional</i>	<i>Outdoor</i>
quarantine outdoor runs feeding (form, facilities) farm type organic acid floor antibiotic treatment	change of pasture rodents, birds

