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Wean-finish performance and carcass composition of indoor and outdoor weaner pigs reared in conventional or deep-litter housing

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Background

- WA producers often report that piglets born outdoors are more robust and experience less of a growth-check after weaning than indoor counterparts
- Recent Australian survey found that in 45% of herds carcass backfat increased by 1-2 mm when pigs were housed on deep-litter
- Research program now in progress to investigate possible reasons for performance and carcass differences

Background

- WA producers often report that piglets born outdoors are more robust and experience less of a growth-check after weaning than indoor counterparts
- Recent Australian survey found that in 45% of herds carcass backfat increased by 1-2 mm when pigs were housed on deep-litter
- Research program now in progress to investigate possible reasons for performance and carcass differences

Literature reports

- Outdoor-born pigs grew faster than indoor-born pigs at all stages from wean-finish in indoor or outdoor pens

  Gentry et al., J. Anim. Sci. 2002. 80:1707-1715

- Pigs in straw yards grew faster wean-finish & were fatter than those in fully-slatted or outdoor pens

  Guy et al., 1994. Pig News & Information Vol15 no.4

- Pigs reared in bedded pens had heavier carcasses and were fatter than those reared in fully slatted pens

  Gentry et al., 2002. J. Anim. Sci. 80:1781-1790

Literature reports

- Pigs with straw (deep-straw & straw-flow pens) grew faster than those without (solid concrete & full slat pens)
  Lyons et al., Livestock Prod. Sci. 43 (1995) 265-274
- Apparently no reports of comparisons of indoor- or outdoor-bred weaners in deep-litter or conventional wean-finish facilities
- Given the importance of deep-litter systems in WA, these comparisons were deemed a research priority.

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Aim of experiments

- To examine the post-weaning performance of indoor- and outdoor-bred weaners reared from wean-finish in conventional or deep-litter pens

- To measure carcass characteristics of financial interest to producers

Experiments 1 and 2

- Two x two factorial design
  - Factor 1: Birth environment (indoors or outdoors)
  - Factor 2: Rearing environment (conventional or deep-litter)
- 160 animals
  - 4 treatments
  - 4 pens/treatment
  - 10 pigs/pen
- Experimental unit: pen

Materials and methods

- Eighty 21 d old female weaners of similar genetics & health status sourced from an indoor & an outdoor farm
- Transported from farms to MRS (2 hr trip)
- Ear-tagged, weighed, stratified by weight and allocated to treatment group
- Sorted and moved into experimental pens within 2 hr of arrival
- Exp 1 ran from Nov 02 to Mar 03
  Exp 2 ran from Oct 03 to Apr 04

Accommodation

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- Conventional from start to 7 weeks:
  - Naturally ventilated weaner room
  - Part-slatted pens with heated kennels
  - 0.4 m^2 per pig
  - 115 mm feeder space per pig
  - 2 nipple drinkers per pen
- Conventional from 7 weeks to finish:
  - Naturally ventilated grow/finish shed
  - 0.77 m^2 per pig
  - Single space feeder (30 mm per pig)
  - Two nipple drinkers per pen
  - Spray cooling

Accommodation

- Deep-litter from start to 7 weeks:
  - Naturally ventilated Eco-Shelter
  - Concrete floor with 150 -300 mm barley straw
  - 4.6 m^2 per pig
  - 200 mm feeder space per pig
  - 4 cup drinkers per pen
- Deep-litter from 7 weeks to finish:
  - As above
  - 115 mm feeder space per pig
  - Spray cooling
- Straw added to maintain 50% of bedded area clean and dry

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Nutrition

- Feed offered ad libitum
  - Commercial six diet phase feeding program
  - First stage diet in crumble format, some feed spread on mat or feed pad daily for first few days
  - Other five diets pelleted
  - Diets based on wheat, barley & lupins
- Exp 1 first stage diet contained: 100 ppm olaquindox+3000 ppm zinc oxide
- Exp 2 diets contained no antimicrobials

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Management

- Conventionally housed pigs were moved from weaner to grow/finish pens at 7 wk
- Deep-litter pigs were swapped into diagonally opposite pens and weaner feeders removed at 7 wk
- Spray cooling activated automatically from 7wks when temperature exceeded 24° C
- Pigs weighed weekly and slaughtered in the week they attained 105 kg live weight

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Experiment 1 – preliminary results

Measure	Birth environment		Rearing environment	
	Indoor	outdoor	Intensive	Deep-litter
Start wt	5.5	5.7	5.5	5.7
47 d wt	25.1	27.7***	25.4	27.4***
Final wt	106.2	106.8	106.4	106.7
Days on exp.	137	137	139	134***
ADG 0-47 d (g)	416	467***	423	460***
ADG 0-fin. (g)	744	740	727	758***
Carcass wt (kg)	79.2	81.0***	79.1	81.0***
P2 fat (mm)	13.6	14.2	14.2	13.6
KO %	74.4	75.8***	74.4	75.9***

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Experiment 1 – preliminary results

Measure	Birth environment		Rearing environment	
	Indoor	outdoor	Intensive	Deep-litter
FI 0-47d (kg/d)	0.72	0.74	0.74	0.72
FCR 0-47d	1.75	1.59***	1.75	1.58***
FI 47d-fin (kg/d)	2.35	2.35	2.24	2.45**
FCR 47d-Fin	2.54	2.58	2.47	2.65**
FI 0-fin (kg/d)	1.77	1.77	1.71	1.83**
FCR 0-fin	2.38	2.36	2.32	2.42**

Experiment 2 – preliminary results

Measure	Birth environment		Rearing environment	
	Indoor	outdoor	Intensive	Deep-litter
Start wt	5.6	5.6	5.6	5.6
47 d wt	25.3	24.8	25.3	24.8
Final wt	107.3	107.3	107.0	107.6
Days on exp.	143	151***	149**	145
ADG 0-47 d (g)	418	409	418	409
ADG 0-fin. (g)	721***	683	686	718***
Carcass wt (kg)	79.3	81.1***	79.1	81.0***
P2 fat (mm)	12.4	13.5**	12.3	13.6***
KO %	73.4	75.1***	73.5	74.9**

Experiment 2 – preliminary results

Measure	Birth environment		Rearing environment	
	Indoor	outdoor	Intensive	Deep-litter
FI 0-47d (kg/d)	0.72	0.74	0.74	0.72
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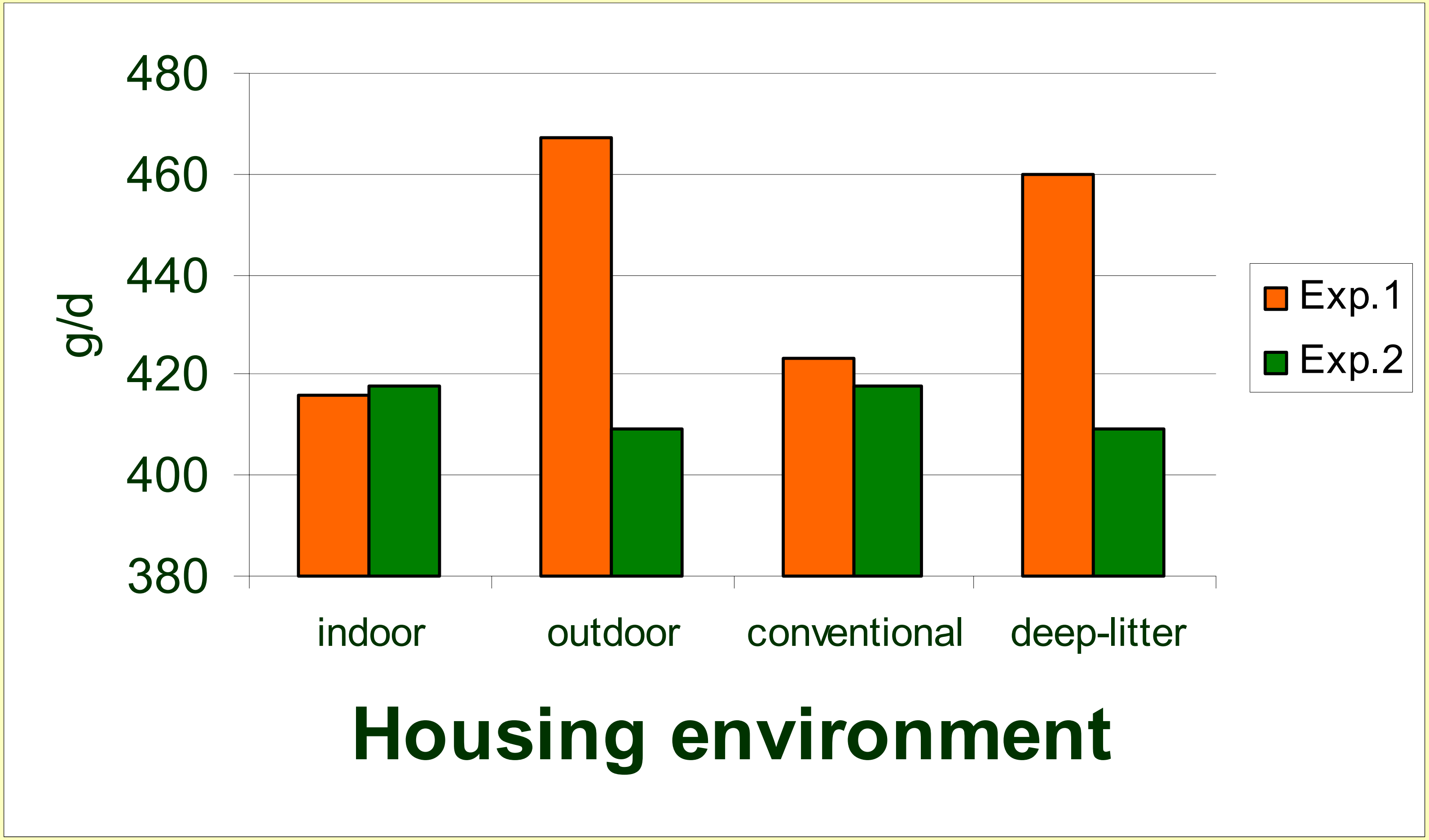
ADG 0 -47 d



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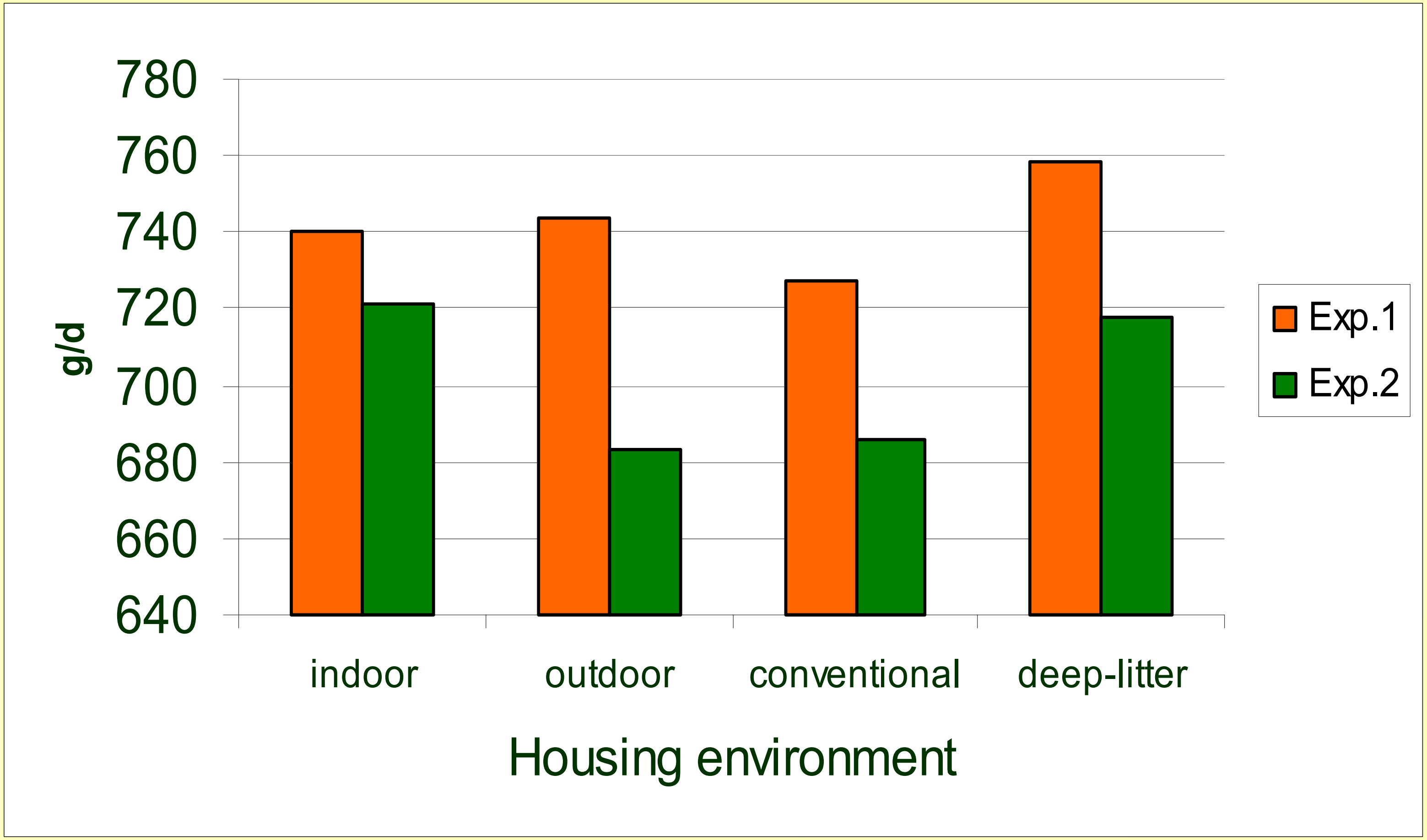
ADG 0 d - Finish



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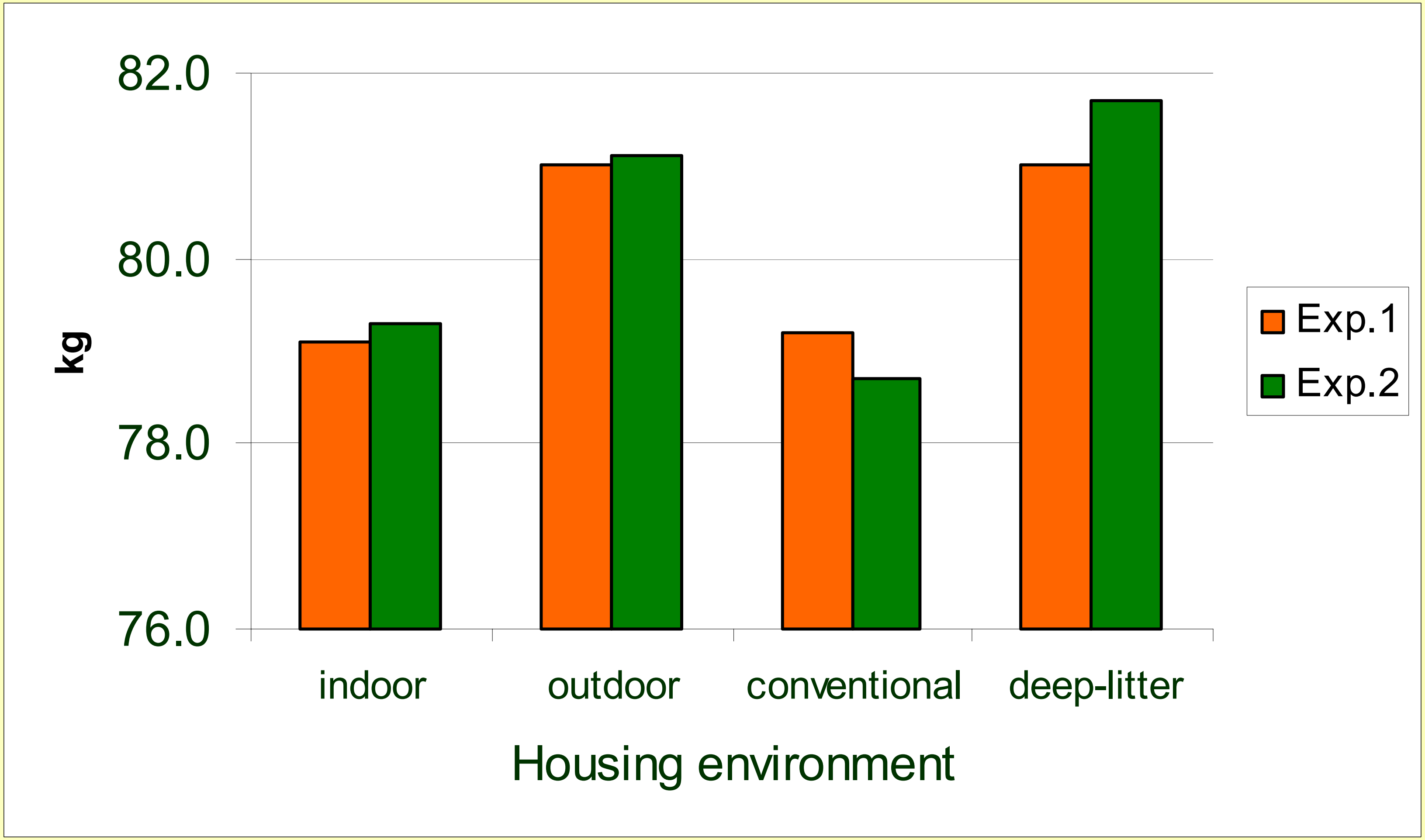
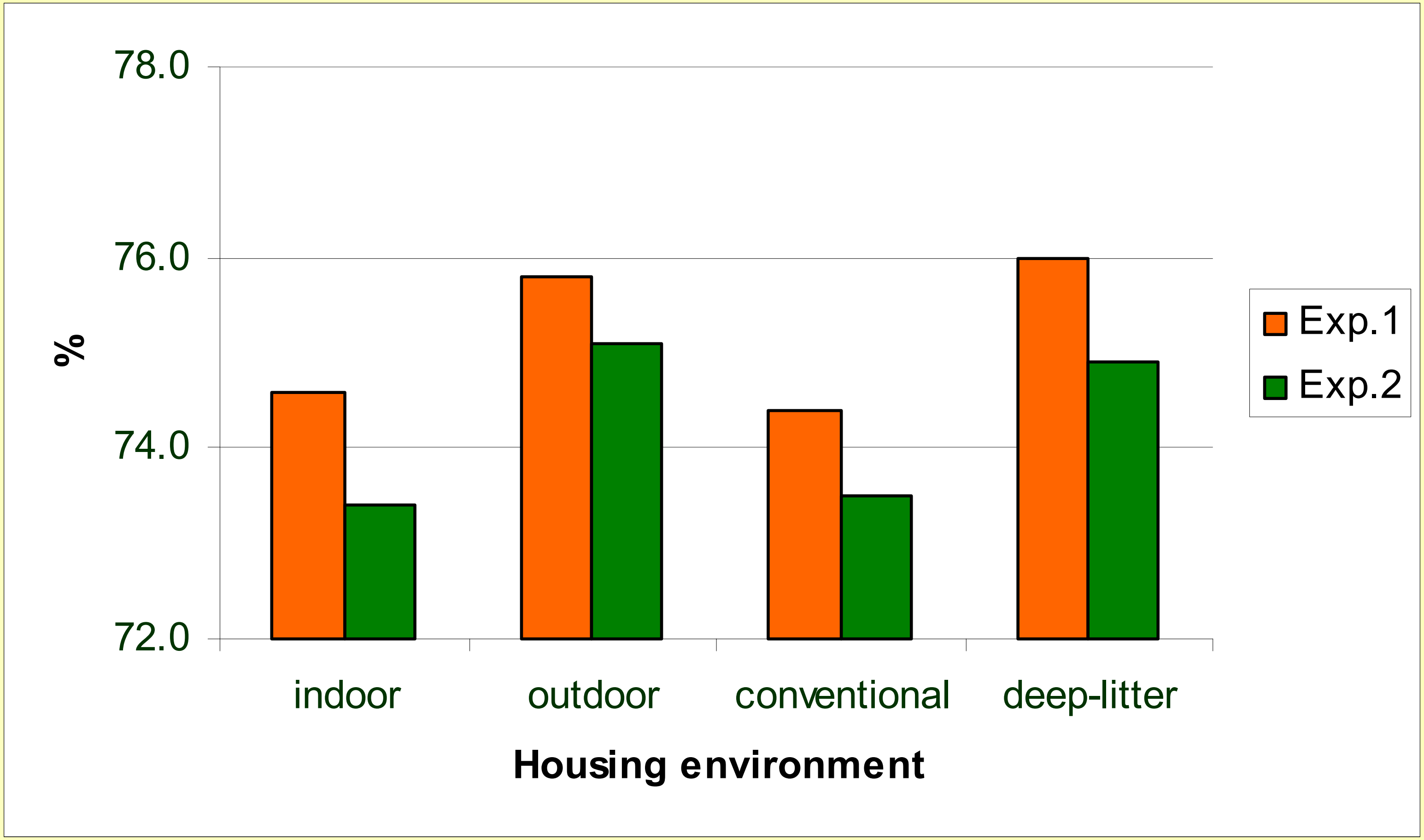
Hot Standard Carcass Weight



Killing Out %



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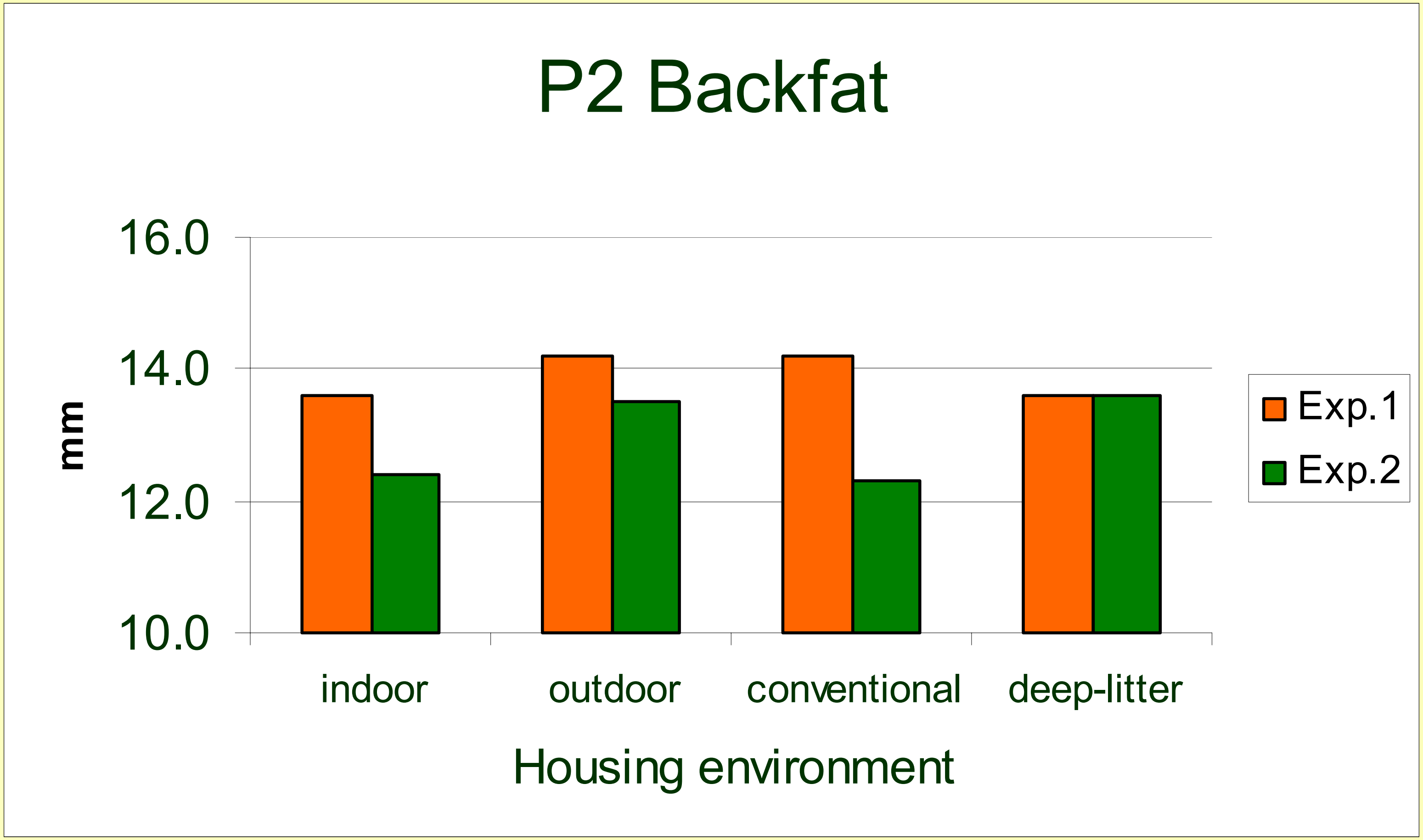
P2 Carcass backfat



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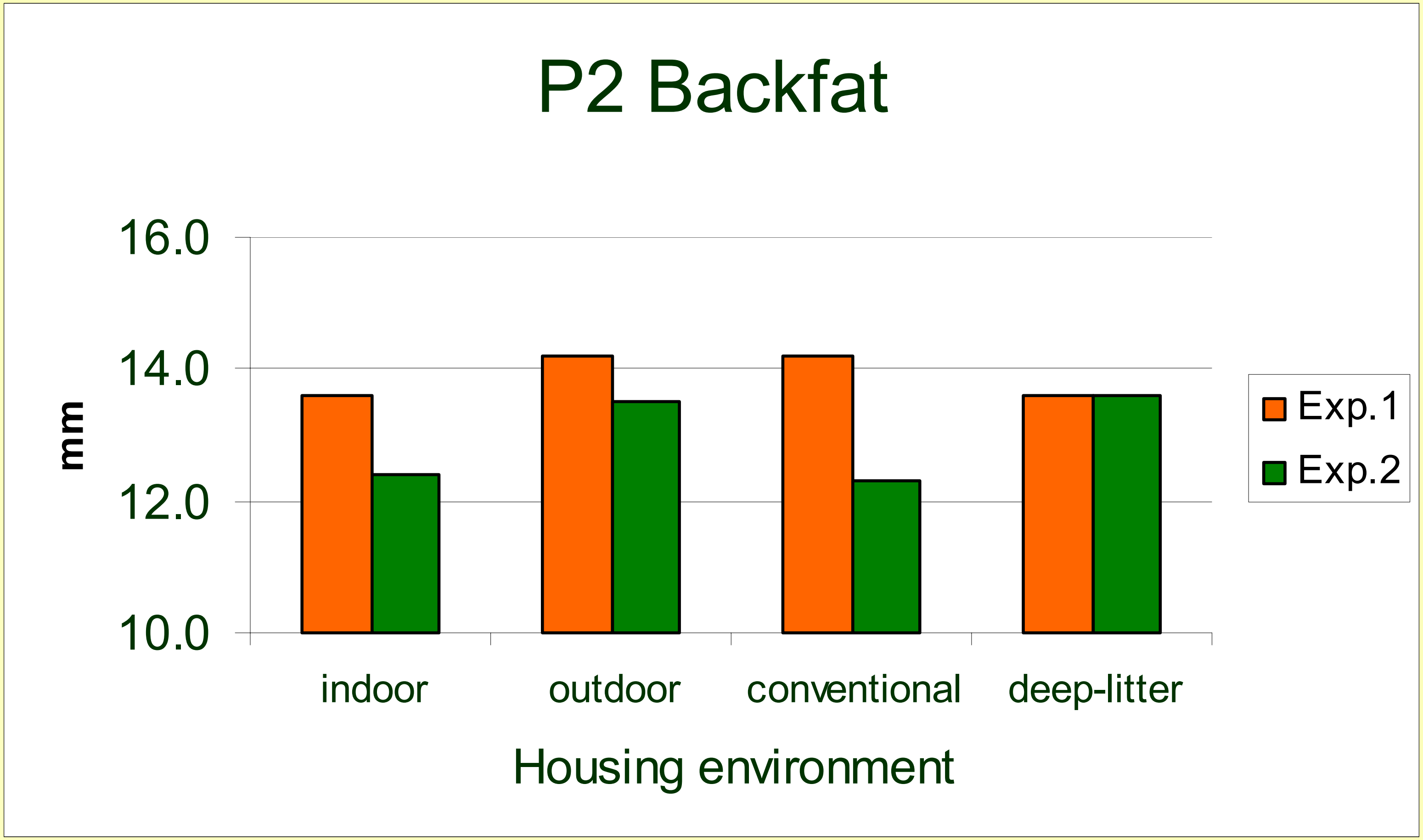

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Exp.2 – Half-carcass Composition

Measure	Indoor Conventional	Outdoor Deep-litter	Significance
Live weight (kg)	107.0	107.4	0.7
Growth on exp (g/d)	707	709	0.4
Head-off half carcass wt (kg)	35.0	37.3	0.011
Fat (kg)	7.33	4.61	0.010
Bone mineral cont. (kg)	5.64	6.06	<0.001
Bone density (g/cm^2)	0.834	0.905	<0.001

Discussion

- Outdoor pigs outperformed indoor pigs in 1st but not 2nd experiment
- Deep-litter pigs outperformed indoor pigs in both experiments
- Why?

Possible explanation

- Omission of antimicrobials
- Why weren't indoor pigs equally affected?
- Sub-clinical disease burden of outdoor pigs may have been higher in both experiments
- Or, may have increase in outdoor pigs in second experiment

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Possible explanations

- Deep-litter environment more forgiving than conventional system
- Fewer restraints on feed intake
- Superior air quality

Possible explanations for carcass composition differences

- Increased fat may be due to higher feed intake, especially if amino acid balance incorrect (? requirement altered by ingestion of straw)
- Decreased energy requirement because of reduced immune response response

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Possible explanations for bone mineral differences

- Exercise factor
- Ingestion of minerals (bioavailability?) (bioavailability?)
- Increased natural daylight in deep-litter litter

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Stomach contents of 21 old piglets

outdoor

indoor

Questions

- Are outdoor-born piglets better adapted psycho-socially for life after weaning?
- Do piglets born outdoors ingest material that is beneficial to gut development, microbial ecology, and maintenance of a healthy gut immune system?
- Can some of the apparent benefits of outdoor production be transferred to indoor systems?

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Consequences of weaning at <21 d

- Piglets may not eat for 6-12 hours (10% may not eat for 24 hrs)
- Decreased energy intake
- Interrupted growth
- Disruption of gut function
- Predisposition to enteric disease

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Differences between indoor and outdoor production systems

	Indoor	Outdoor
Sow-controlled suckling	no	yes
Lower atmospheric microbial loading	no	yes
Enriched environment	no	yes
Enhanced behavioural skills	no	yes
Access to straw, pasture & soil	no	yes

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Sow controlled suckling

- Sows provided with 'get-away' areas in conventional pens spent time away from piglets (20% day 6, 70% day 27)

Pitts et al, 2002

- Piglets of get-away sows:
  - ate more creep, weighed less at weaning (28 d)
  - ate more and grew faster from 28 d to 42 d
  - same wt at 42 d

Weary et al, 2002

Reduced microbial challenge

- Outdoor pigs may be exposed to lower airborne microbial load.
- In one study, outdoor pigs at 28 d had:
  - ↓ white blood cells, lymphocytes & natural killer cell activity
  - ↑ neutrophil activity & neutrophil:lymphocyte ratio
- Immune status and performance similar to SEW model

Kleinbeck & McGlone, 1999

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Enriched environment

- More space pre-weaning may improve post-weaning growth and enhance development of muscle and other tissue

Gentry et al, 2002

- Provision of peat or straw improved performance of grower/finisher performance but not from birth to 7 wk

Beattie et al, 2000

Enhanced behavioural skills

- Outdoor and indoor pigs behave differently before and after weaning
- Pre-weaning, outdoor pigs perform:
  - ↑ rooting, standing, locomotive behaviours
  - ↑ investigative behaviour towards sow feed
- Post-weaning, outdoor pigs spend:
  - ↑ time feeding & rooting
  - ↓ time fighting

Cox and Cooper, 2001

Access to straw, pasture & soil

- Outdoor pigs consume straw, pasture and soil in considerable but unquantified amounts
- Possible to provide these subtrates to piglets in conventional farrowing crates