Handling Challenges: Non-ambulatory Pigs

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Areas to Discuss

- Definitions
- Why are transport losses important?
- Fatigued pigs
  - Incidence
  - Symptoms
  - Metabolic characteristics
  - Pre-disposing factors
- What can we do to reduce transport losses?

Terminology

- Deads on arrival (DOA):
  - Pigs that die during transport
- Non-ambulatory pig:
  - A pig unable to rise and move or keep up with contemporaries
  - Downers, subjects, slows, cripples, fatigued, injured, NANI, NAI
- Transport losses:
  - Deads on arrival and non-ambulatory pigs at the plant

Anderson, D. B., D. J. Ivers, M. E. Benjamin, H. W. Gonyou, D. J. Jones, K. D. Miller, R. K. McGuffey, T. A. Armstrong, D. H. Mowrey, L. F. Richardson, R. Seneriz, J. R. Wagner, L. E. Watkins, and A. G. Zimmermann. 2002. Physiological responses of market hogs to different handling practices. Pages 399-400 in Proceedings of the American Association of Swine Veterinarians, Kansas City, MO.

Classifying Non-ambulatory Pigs

Fatigued

(Stress related)

Injured

(Structure/injury related)

Ellis, M., F. McKeith, and M. Ritter. 2004. Handling Non-Ambulatory Pigs. Proceedings of the International Meat Animal Welfare Research Conference, Kansas City, MO.

Overview of Transport Losses

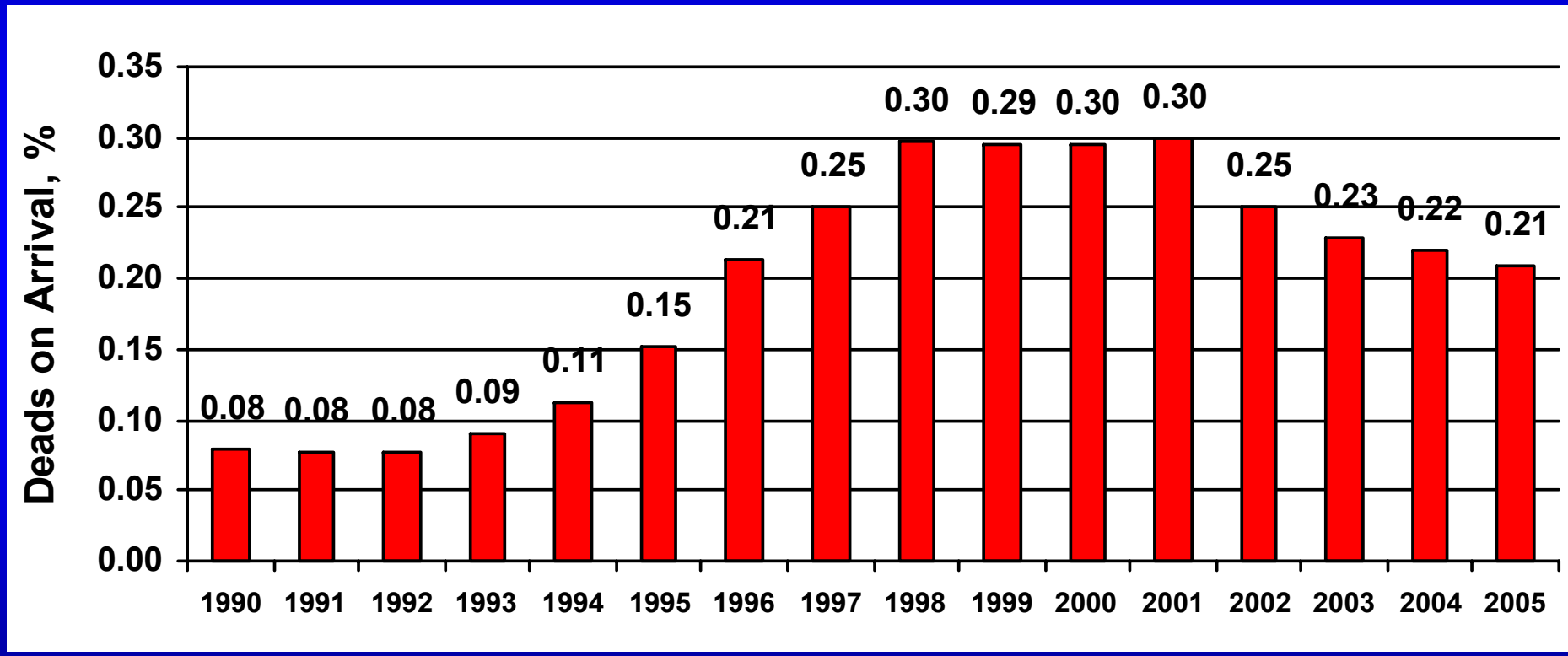
- Not a new issue to the industry (stress gene)
- Losses can occur at any stage of the marketing process
- Transport losses represent many growing concerns:
  - Animal Welfare
  - Legal
  - Economic

Proposed Legislation

- Downed Animal Protection Act (H.R. 661 & S. 394)
  - Allows the Secretary of Agriculture to enforce regulations for handling and disposition of non-ambulatory livestock
  - Prevents movement of non-ambulatory livestock while these animals are conscious
  - Requires non-ambulatory livestock to be humanely euthanized
  - Prohibits non-ambulatory livestock from entering the food chain

(www.house.gov)

U.S. Incidence of Deads (1990-2005)



SBU2044

(FSIS, 1990 –2005)

Incidence of Non-ambulatory Pigs?

- National statistics are not available
- Field studies suggest ~ 0.2% to 1.0%
- Ratio of fatigued to injured = ~2:1
- Total transport losses = ~0.5 to 1.3%

SBU2044

Ellis, M., and M. Ritter. 2006. Impact of season on production: transport losses. Pages 205-207 in Proceedings of the 2006 Allen D. Leman Swine Conference, St. Paul, MN.

Economic Impact of Transport Losses

- Economic losses associated with:
  - Producer
    - Loss of value on DOAs
    - Severe discount on non-ambulatory pigs at the plant
    - Carcass trim loss and bruising
  - Packing Plant
    - Increased labor costs for handling non-ambulatory pigs
    - Pork quality defects (DFD, PSE)
    - Negative public perception

SBU2044

Ellis, M., F. McKeith, D. Hamilton, T. Bertol, and M. Ritter. 2003. "Analysis of the current situation: what do downers cost the industry and what can we do about it?" Pages 1-3 in Proceedings of the 4th American Meat Science Association Pork Quality Symposium, Columbia, MO.

Ritter, M., M. Ellis, M. Benjamin, E. Berg, P. DuBois, J. Marchant-Forde, A. Green, P. Matzat, P. Mormede, T. Moyer, K. Pfalzgraf, M. Siemens, J. Sterle, T. Whiting, B. Wolter, and A. Johnson. 2005. The fatigued pig syndrome. Journal of Animal Science. 83(Suppl. 1):258. (Abstr.)

Symptoms and Metabolic Characteristics of Fatigued Pigs

Fatigued Pig Symptoms

Normal Pig

↓ Stress

Open-Mouth Breathing

Skin Discoloration

Refuse to move

↓ Stress

Abnormal Vocalization

Muscle Tremors

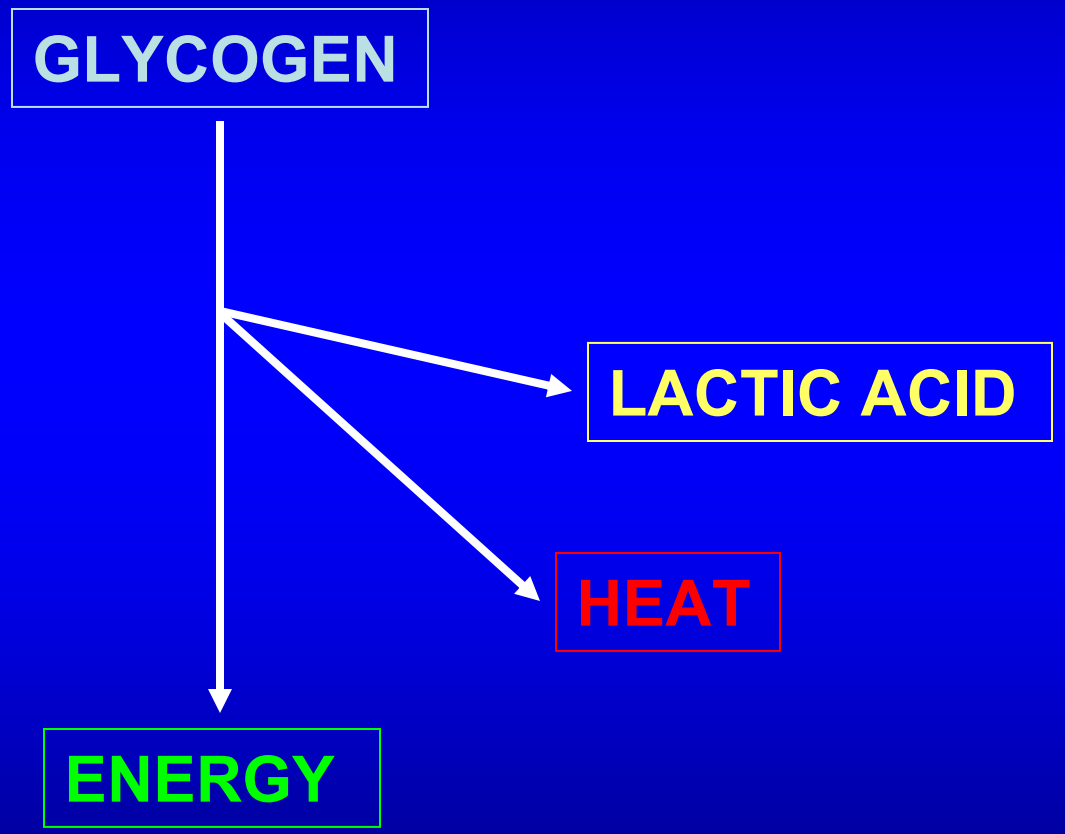
Collapse = Fatigued

↓ Stress

Death

Ritter, M., M. Ellis, M. Benjamin, E. Berg, P. DuBois, J. Marchant-Forde, A. Green, P. Matzat, P. Mormede, T. Moyer, K. Pfalzgraf, M. Siemens, J. Sterle, T. Whiting, B. Wolter, and A. Johnson. 2005. The fatigued pig syndrome. Journal of Animal Science. 83(Suppl. 1):258. (Abstr.)

Muscle Energy Metabolism



SBU2044

Hedrick, H. B., E. D. Aberle, J. C. Forrest, M. D. Judge, and R. A. Merkel. 1994. Principles of Meat Science, Third Edition. Kendall/Hunt Publishing Company, Dubuque, IA.

Metabolic Changes in Fatigued Pigs

- **Fatigued pigs are in a metabolic state of acidosis**
  - High blood lactic acid
    - >20 mmol/L
  - Low blood pH
    - 6.9-7.2
  - High body temperature?

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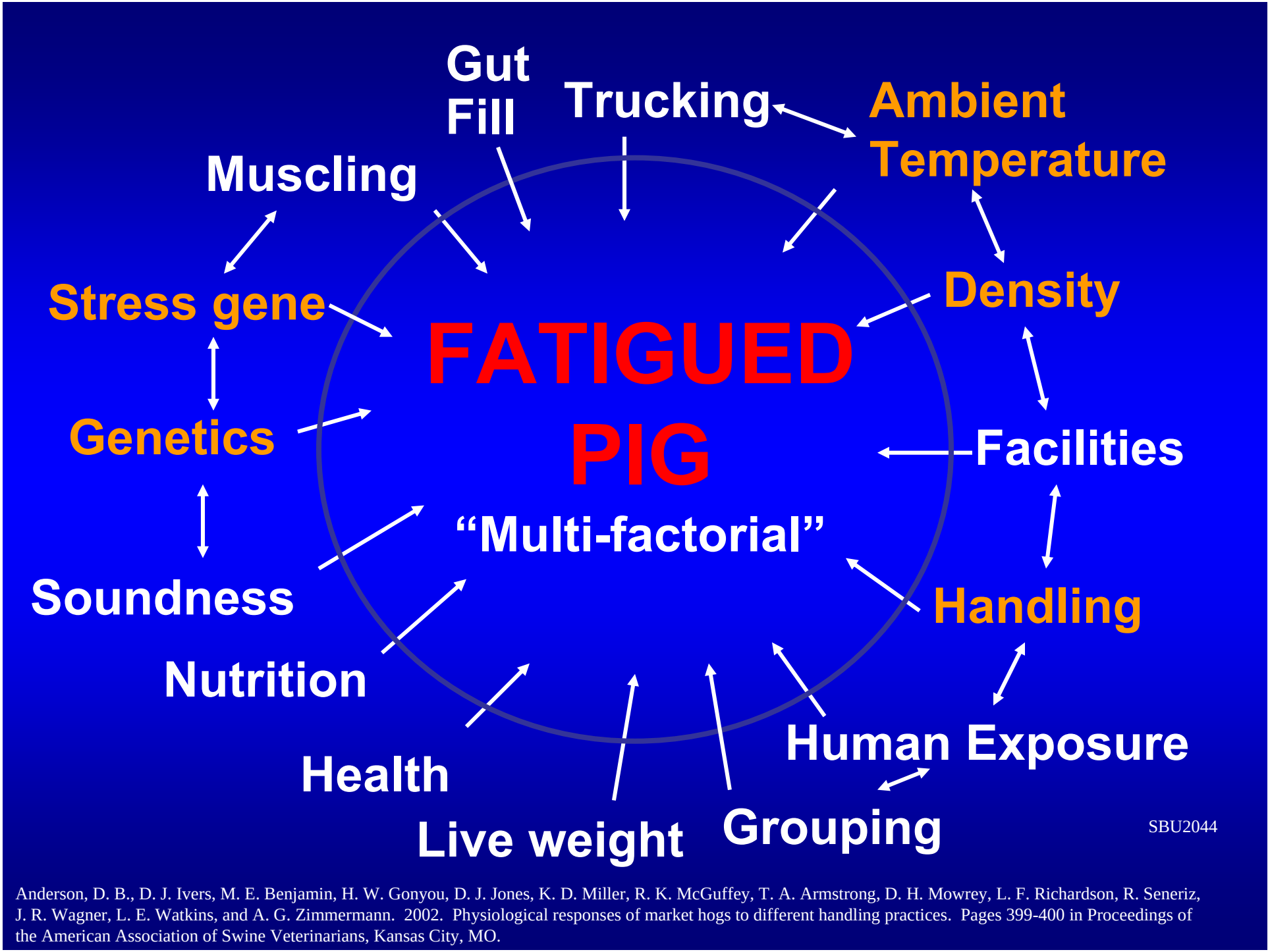
Anderson, D. B., D. J. Ivers, M. E. Benjamin, H. W. Gonyou, D. J. Jones, K. D. Miller, R. K. McGuffey, T. A. Armstrong, D. H. Mowrey, L. F. Richardson, R. Seneriz, J. R. Wagner, L. E. Watkins, and A. G. Zimmermann. 2002. Physiological responses of market hogs to different handling practices. Pages 399-400 in Proceedings of the American Association of Swine Veterinarians, Kansas City, MO.



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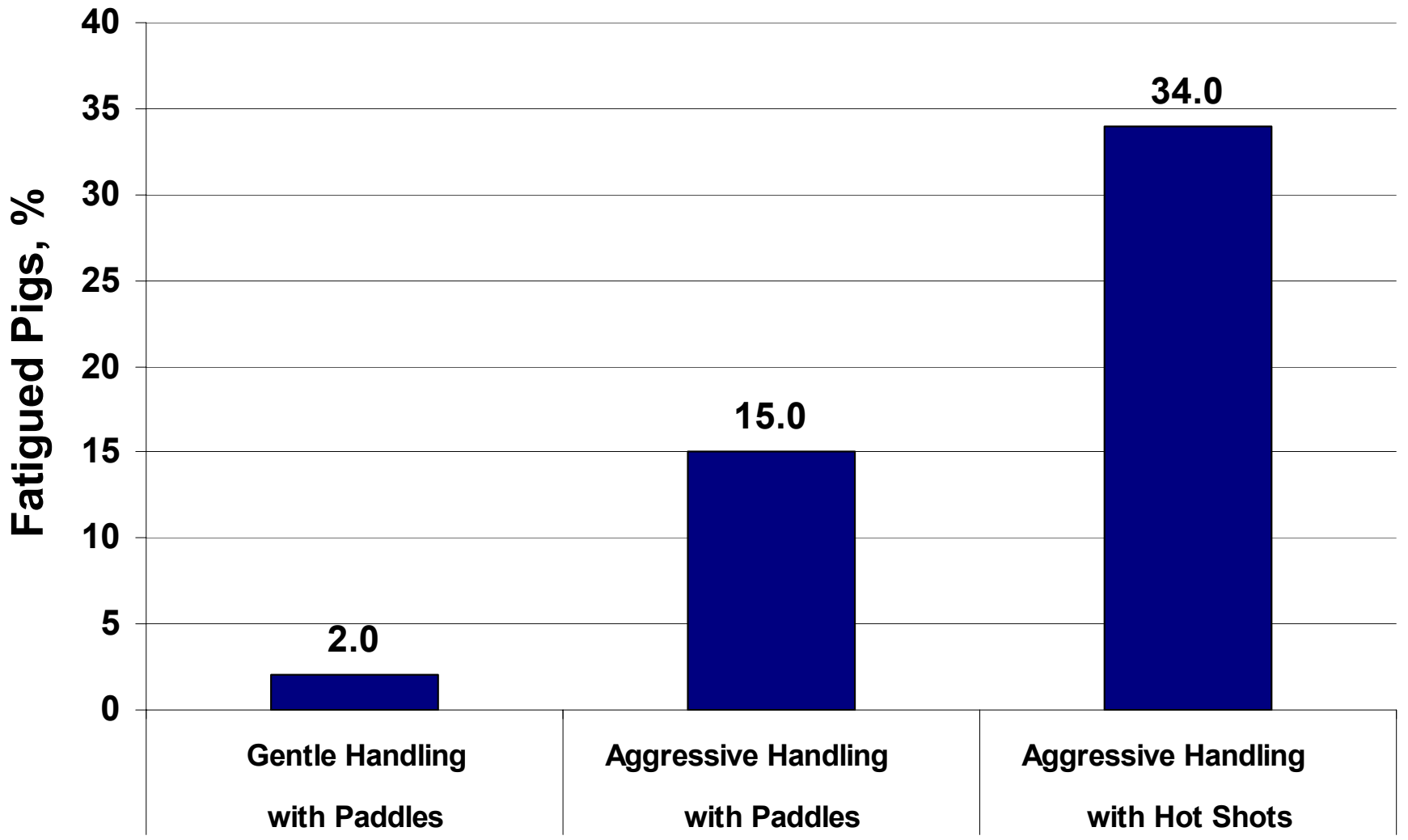
Handling



(Gonyou, unpublished data)
ELANCO Study #AF7CA0101

It isn’t just handling!

- Handling is critical ***BUT!***
- There are many potential stressors that a pig experiences during transportation
- The fatigued pig is a

  MULTIFACTORIAL PHENOMENON

Effects of the Stress Gene on DOA Rates

Study	Country	DOA, %		
		Negative	Carrier	Positive
Fàbrega et al., 2002	Spain	0.02	0.09	2.29
Murray & Johnson, 1998	Canada	0.05	0.27	9.20
McPhee et al., 1994	Australia	0.30	2.20	17.5

- ***Ellis et al., 2007***
  - ***98% of fatigued pigs and 95% of DOAs were negative for the stress gene.***

Fàbrega, E., A. Diestre, D. Carrión, J. Font, and X. Manteca. 2002. Effect of the halothane gene on pre-slaughter mortality in two Spanish comercial pig abattoirs. Animal Welfare. 11:449-452.

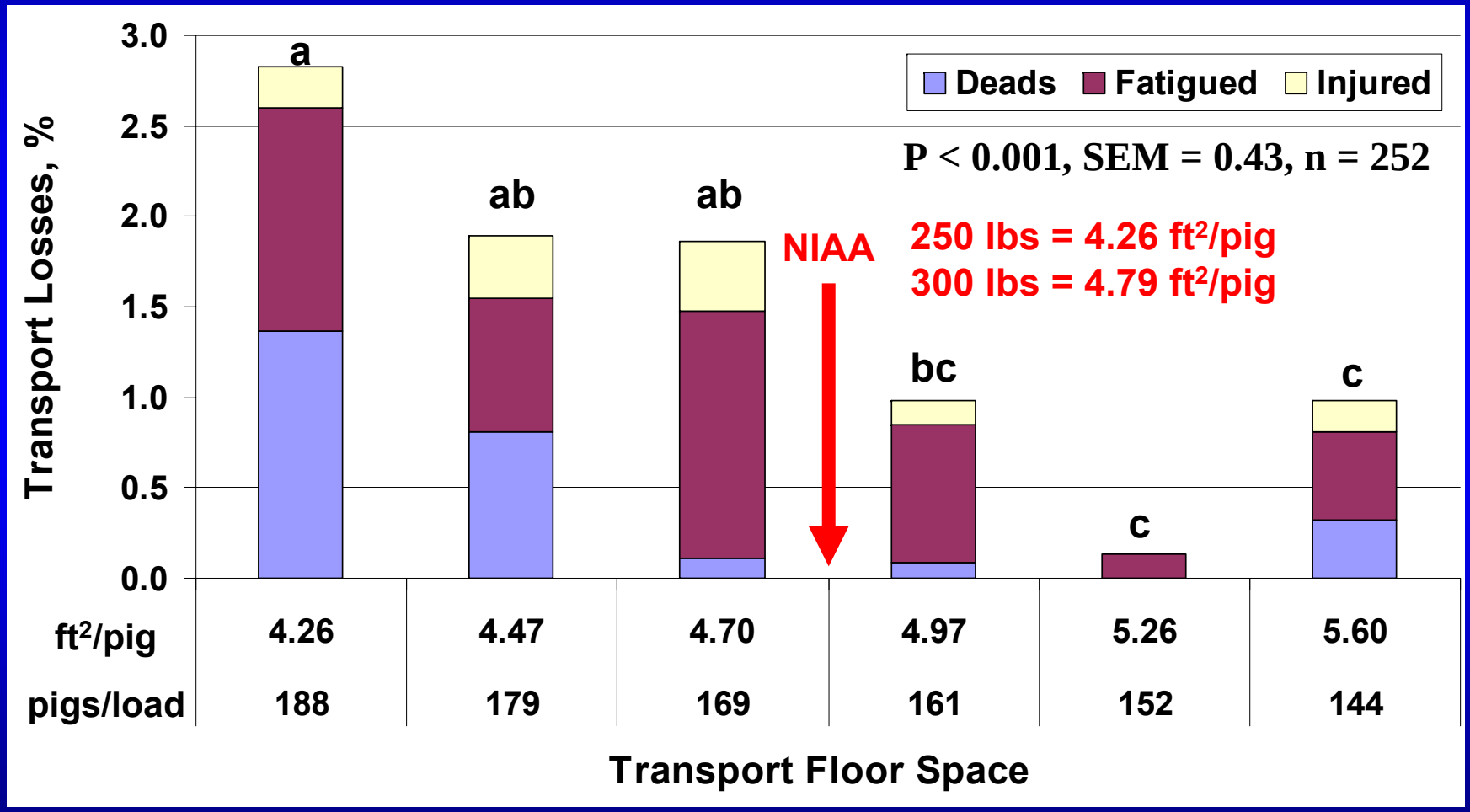
Murray, A. C., and C. P. Johnson. 1998. Impact of the halothane gene on muscle quality and pre-slaughter deaths in Western Canadian pigs. Canadian Journal of Animal Science. 78:543-548.

McPhee, C. P., L. J. Daniels, H. L. Kramer, G. M. Macbeth, and J. W. Noble. 1994. The effects of selection for lean growth and the halothane allele on growth performance and mortality of pigs in a tropical environment. Livestock Production Science. 38:117-123.

Ellis, M., M. J. Ritter, G. R. Hollis, and J. M. Schlipf. 2007. The frequency of the HAL-1843 mutation of the RYR1 gene in dead and non-ambulatory/non-injured pigs on arrival at the packing plant. Proceedings of the 2007 Midwest Animal Science Meetings, Des Moines, IA.

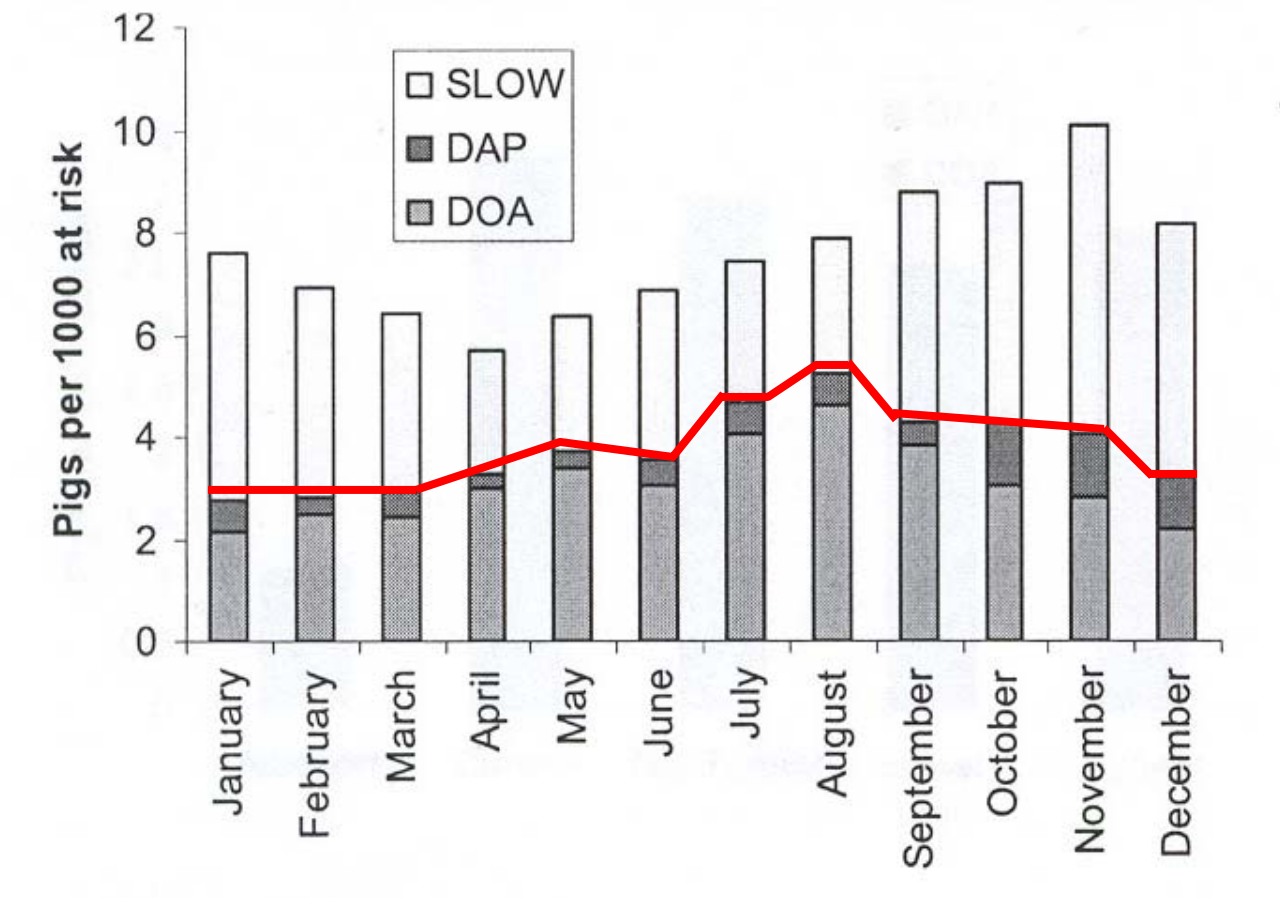
Transport Floor Space

- Utilized 42 loads in spring and fall to determine the effects of transport floor space on losses at the plant



Ritter, M. J., M. Ellis, C. R. Bertelsen, R. Bowman, J. Brinkmann, J. M. DeDecker, K. K. Keffaber, C. M. Murphy, B. A. Peterson, J. M. Schlipf, and B. F. Wolter. 2006. Effects of distance moved during loading and transport floor space of market weight pigs on transport losses at the packing plant. Page 137 in Proceedings of the 2006 Midwest Animal Science Meetings, Des Moines, IA. (Abstr.)

Seasonal Variation in U.S.



(Based on 1.3 million pigs ; Rademacher & Davies, 2005)

Rademacher, C., and P. Davies. 2005. Factors associated with the incidence of mortality during transport of market hogs. Pages 186-191 in Proceedings of the Allen D. Leman Swine Conference, St. Paul, MN.

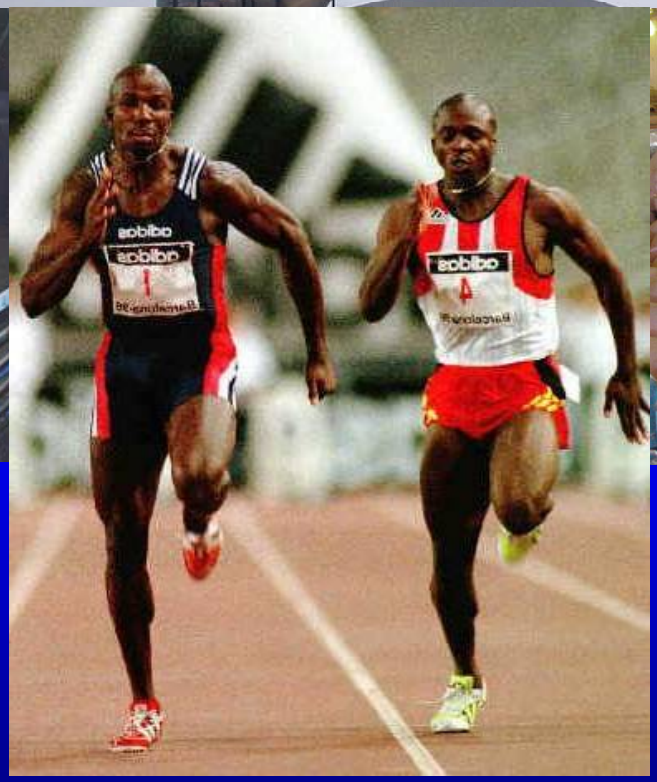
Potential Causes of Seasonal Variation in Transport Losses

- Temperature stress
  - Caused by hot conditions in the summer and cold conditions in the fall/winter
- Heavier pigs
  - Growth rates of pigs generally increase in the fall due to cooler conditions and “new crop corn”
- Increased number of pigs transported
  - Typically, more pigs are slaughtered in the fourth quarter of the year
- Health status?

Ellis, M., and M. Ritter. 2006. Impact of season on production: transport losses. Pages 205-207 in Proceedings of the 2006 Allen D. Leman Swine Conference, St. Paul, MN.

What can we do to reduce transport losses?

Prepare Pigs for Transport

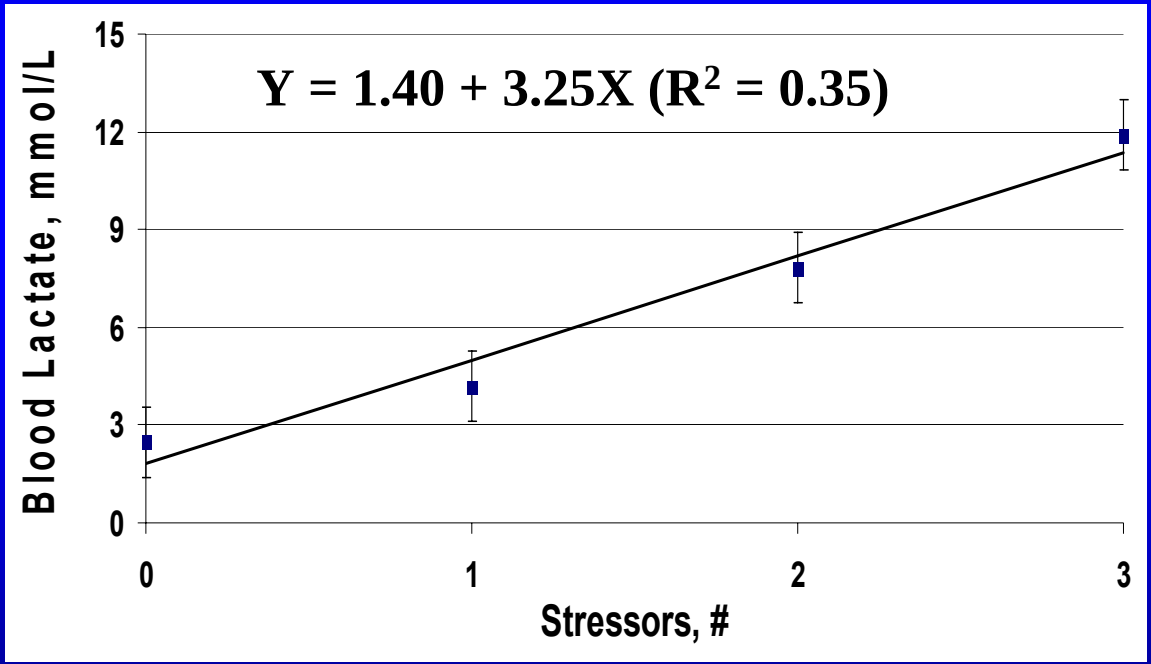


Prepare Pigs for Transport

- Walk pens daily
- Routinely move pigs prior to loading
- Pre-sort pigs prior to loading (if feasible)
- Remove feed prior to loading (if feasible)

Minimize Stress

- Aggressive handling, restricted transport floor space, and long distance moved treatments had additive effects on rectal temperature, blood acid-base balance, and loin muscle lactate values (Ritter et al., 2007)



Removing just one stressor will improve the pig's well-being!

ELANCO Study # T2F170606

Minimize Stress at the Farm

- Do not use hot shots to sort pigs from pens
- Move pigs in small groups (4-6 pigs) using a normal walking pace
- Minimize the distance pigs are moved during loading
- Minimize the use of hot shots during loading
- Load stressed pigs only if walking normally

Minimize Stress during Transport

- Do not mix unfamiliar pigs (if feasible)
- Provide pigs with at least 5 ft^2/pig during transport
- Optimize the environment inside the trailer
  - Summer: shower pigs prior to transport
  - Winter: provide adequate bedding and board up the trailer
- Keep the truck moving, avoid unnecessary stops

Minimize Stress at the Plant

- Minimize waiting time at the plant
- Use sorting boards and paddles during unloading
- Allow pigs to rest for at least 2 h prior to harvest
- Minimize distance pigs are moved at the plant
- Minimize hot shot use during the final drive

Overall Summary

- Transport losses represent growing animal welfare, legal, and economic concerns to the U.S. swine industry
- ~1% of all pigs transported die or become non-ambulatory
- Transport losses are a multi-factorial problem
- It is well established that transport losses are increased by:
  - Aggressive handling
  - Porcine stress syndrome (stress gene)
  - Crowding pigs during transport
  - Extreme weather conditions
- Pre-slaughter stressors have additive effects in pigs
- Transport losses can be minimized by better preparing pigs for transport and minimizing stress during the marketing process

Questions? Comments?

Back-up Slides

HAL-1843 Normal but Halothane Sensitive

- Allison et al. (2005 & 2006)
  - Reported that pigs negative for the stress gene reacted abnormally to halothane gas (0-62% by sire line)
  - Subjected halothane reactors (n=47) and non-reactors (n=33) to an aggressive handling model
  - Concluded that halothane reactors were more susceptible (18.7% vs. 9.0%) to becoming non-ambulatory in an aggressive handling model than non-reactors

Allison, C. P., R. C. Johnson, and M. E. Doumit. 2005. The effects of halothane sensitivity on carcass composition and meat quality in HAL-1843 normal pigs. Journal of Animal Science. 83:871-678.
Allison, C. P., A. L. Marr, N. L. Berry, D. B. Anderson, D. J. Ivers, L. F. Richardson, K. Keffaber, R. C. Johnson, and M. E. Doumit. 2006. Effects of halothane sensitivity on mobility status and blood metabolites of HAL-1843-normal pigs after rigorous handling. Journal of Animal Science. 84:1015-1021.

Walking Pens Daily

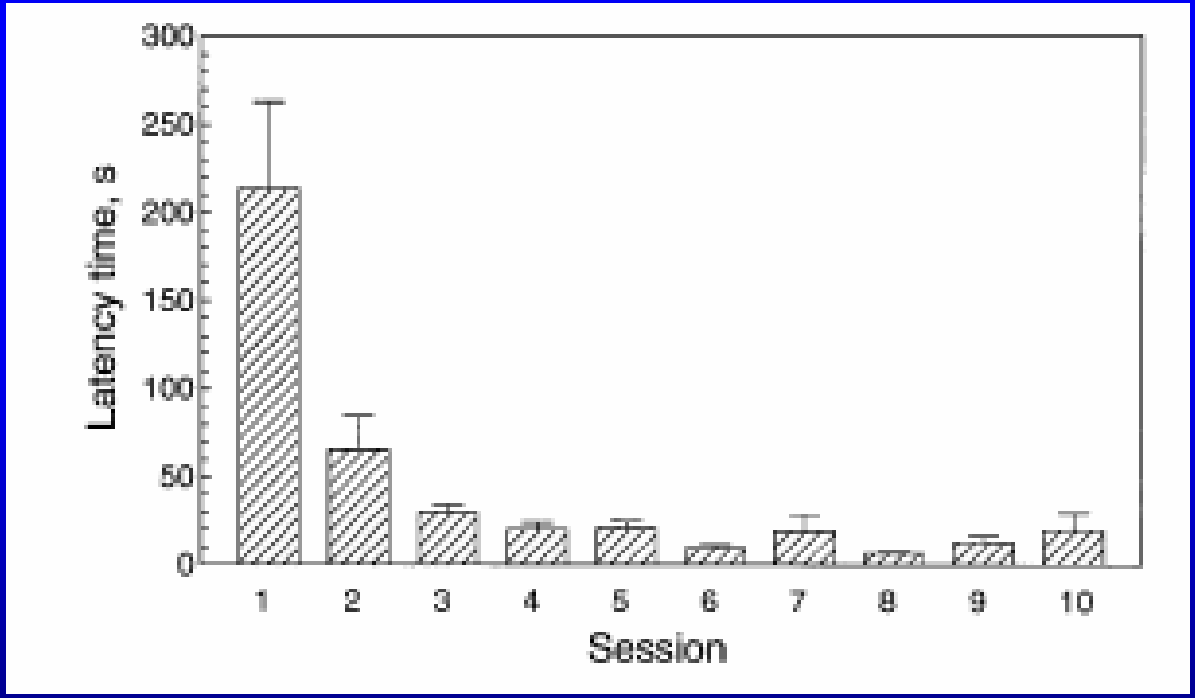
- Walking pens daily serves two purposes:
  - Allows you to inspect pig health
  - Allows for human and pig interactions
    - Reduces the pig's fear of humans

- Brown et al., 2006
  - Demonstrated that routinely walking pens improves pig behavior at the farm and at the plant

Brown, J. A., E. L. Toth, A. L. Stanton, T. M. Widowski, and P. Lawlis. 2006. The effects of different frequencies of weekly human interaction on handling responses in market hogs. Journal of Animal Science. 84(Suppl. 1):301. (Abstr.)

Previous Handling

- Pigs that are routinely moved prior to loading are easier to handle and require less time to load (Abbott et al., 1997; Geverink et al., 1998)



SBU2044

Abbott, T. A., E. J. Hunter, H. J. Guise, and R. H. C. Penny. 1997. The effect of experience of handling on pigs' willingness to move. Applied Animal Behaviour Science. 54:371-375.

Geverink, N. A., A. Kappers, J. A. van de Burgwal, E. Lambooij, H. J. Blokhuis, and V. M. Wiegant. 1998. Effects of regular moving and handling on the behavioral and physiological responses of pigs to preslaughter treatment and consequences for subsequent meat quality. Journal of Animal Science. 76:2080-2085.

Auto-sort Systems

- Wean-to-finish
  - Pigs are placed in pens of 25-30 pigs at 14-21 days of age
  - Pigs do not leave their pen until they are market weight
  - Pigs have limited exercise

- Auto-sort
  - Pigs are in large groups (500+)
  - Pigs can walk throughout the barn
  - Reduced pig aggression
  - Hit your target weights (avoid 300+ lbs)
  - Pigs are pre-sorted by the door (shorter loading distances)
  - No mixing during transport

Auto-sort Systems

Auto-sort vs. Conventional Finishers

- Brumsted, 2004
  - Identified 17 auto-sort barns and 49 conventional finishers
  - Counted deads at the plant on 342 loads of pigs
  - Deads at the plant
    - Auto-sort = 0.16%
    - Conventional finishers = 0.35%
  - Possible confounding factors:
    - Season, site, producer, genetics, hauling company
    - Paylean, handling intensity, trailer design, stocking density during transport, transport time

Brumsted, M. 2004. Automatically sorted, large pen finish barns reduce death loss during transportation to market. Page 47 in Proceedings of the American Association of Swine Veterinarians, Des Moines, IA. (Abstr.)

Feed Withdrawal

- Commercial surveys have suggested that FW reduces transport losses (Robertson, 1987)

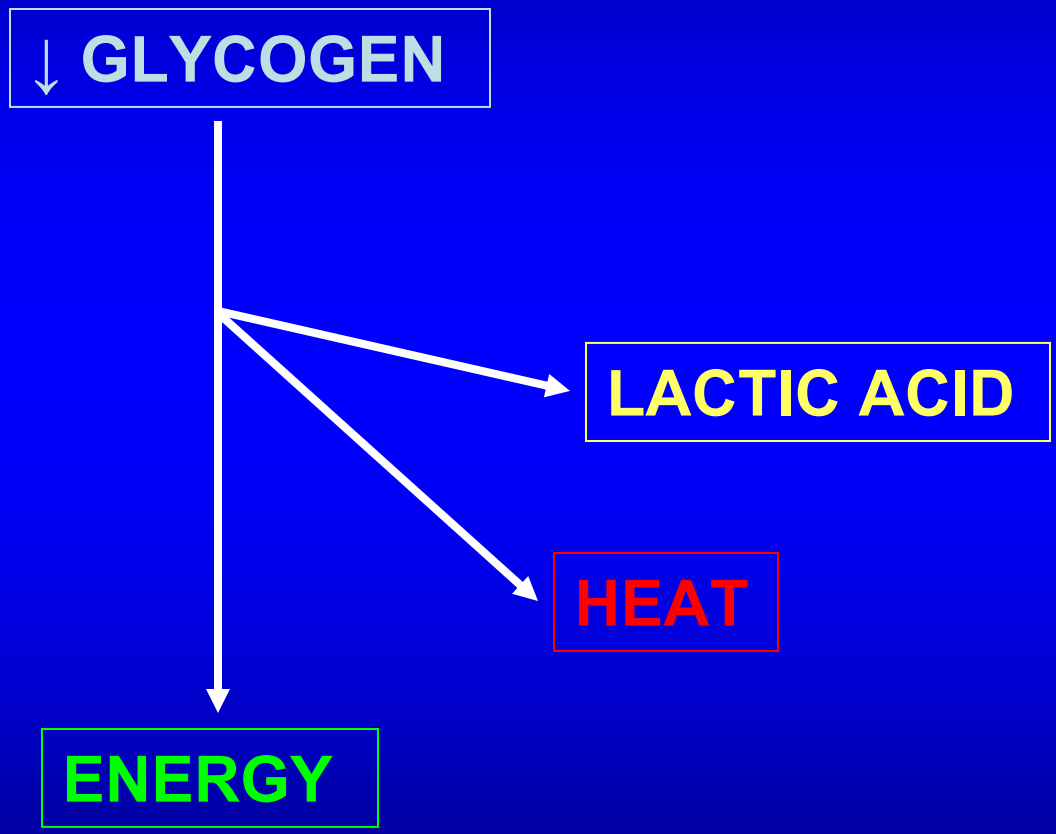
- 24 hour FW reduces before and after handling body temperature and after handling muscle glycolytic potential (Bertol et al., 2005)

SBU2044

Robertson, J. F. 1987. Bacon pigs: a practical approach to the reduction of deaths in transit. New perspectives in pig production. Pages 23-28 in Proceedings of the North of Scotland College of Agriculture Pig Conference, North of Scotland College of Agriculture.

Bertol, T. M., M. Ellis, M. J. Ritter and F. K. McKeith. 2005. Effect of feed withdrawal and handling intensity on longissimus muscle glycolytic potential and blood measurements in slaughter weight pigs. Journal of Animal Science. 83:1536-1542.

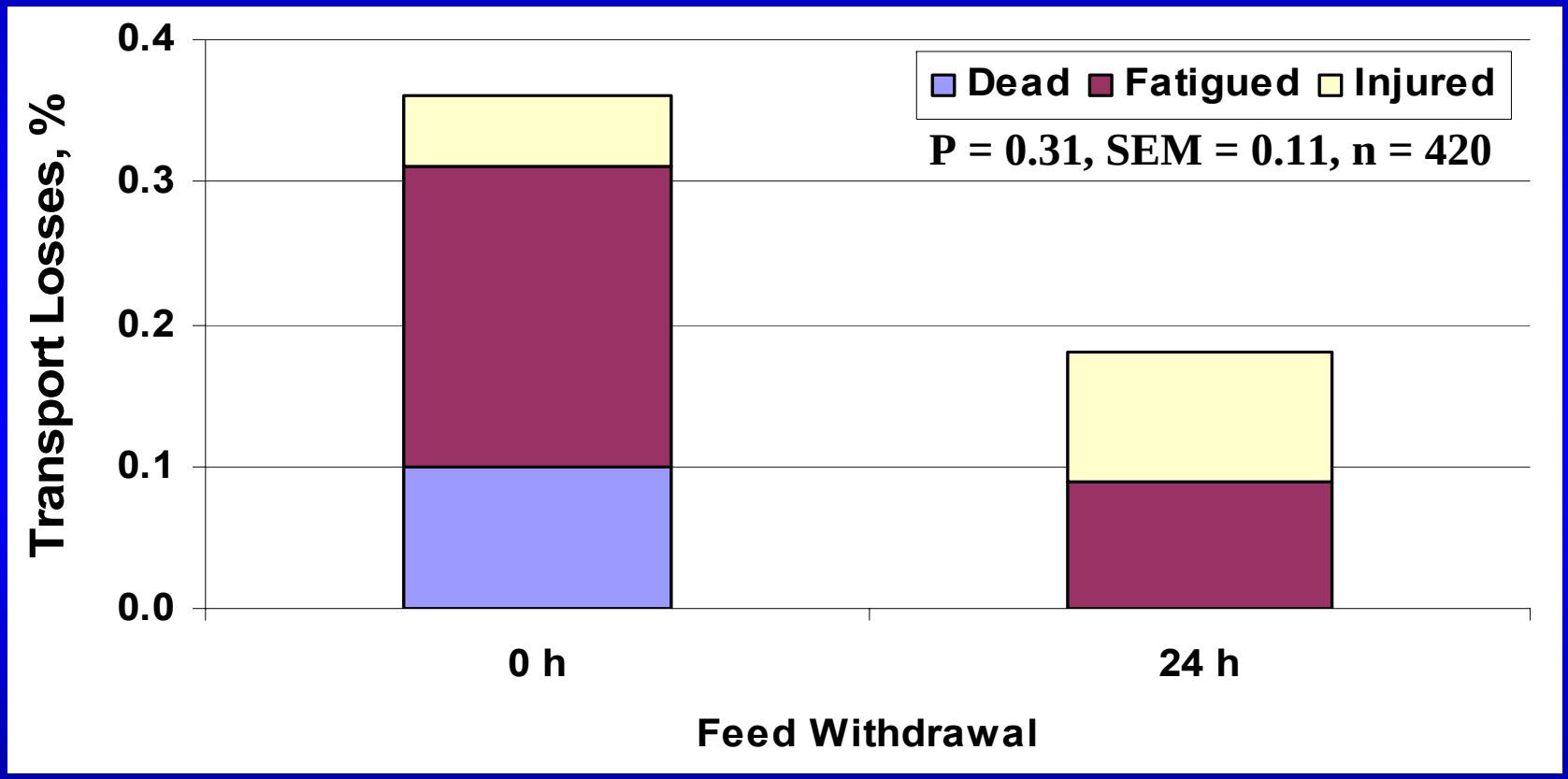
Feed Withdrawal



Hedrick, H. B., E. D. Aberle, J. C. Forrest, M. D. Judge, and R. A. Merkel. 1994. Principles of Meat Science, Third Edition. Kendall/Hunt Publishing Company, Dubuque, IA.

Feed Withdrawal

- Evaluated the effects of 0 vs. 24 h feed withdrawal on losses on 35 loads of pigs in the summer and winter



Ritter et al., 2006: 35 loads = 3,827 pigs, Mean pig weight = 282 lbs

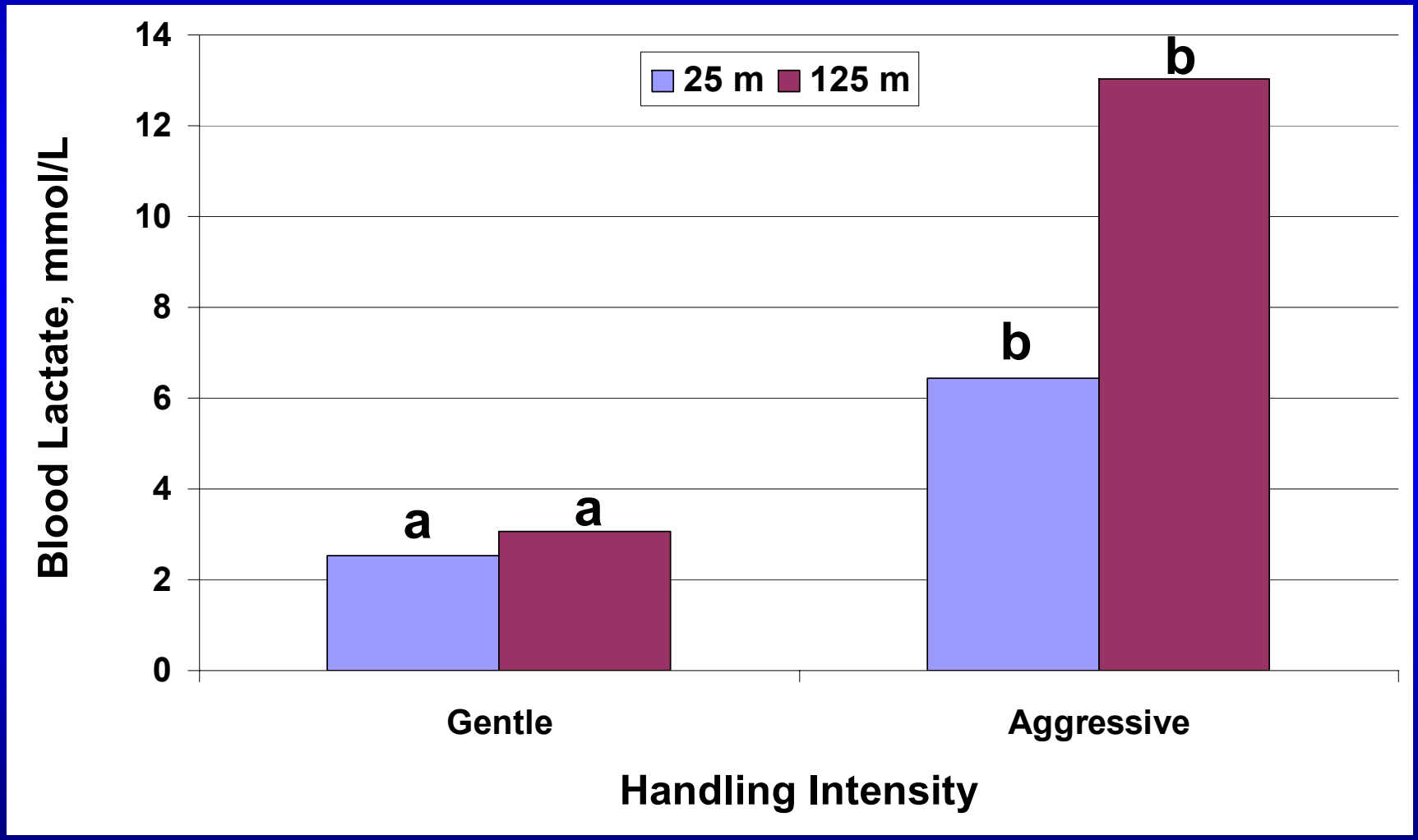
Ritter, M. J., M. Ellis, C. R. Bertelsen, R. Bowman, J. Brinkmann, J. M. DeDecker, O. Mendoza, C. M. Murphy, B. A. Peterson, A. Rojo, J. M. Schlipf, and B. F. Wolter. 2006. Impact of animal management and transportation factors on transport losses in market weight pigs at the packing plant. Journal of Animal Science. 84(Suppl. 1):302. (Abstr.)

Group Size

- Lewis & McGlone, 2007
  - Compared moving pigs through a handling course in groups of 1 to 10 pigs
  - Key findings:
    - Positive linear relationship between group size and:
      - Heart rate
      - Subjective handling score (more difficult to handle)
      - Time to complete the handling course
    - Conclude that the optimal group size is 5-6 pigs

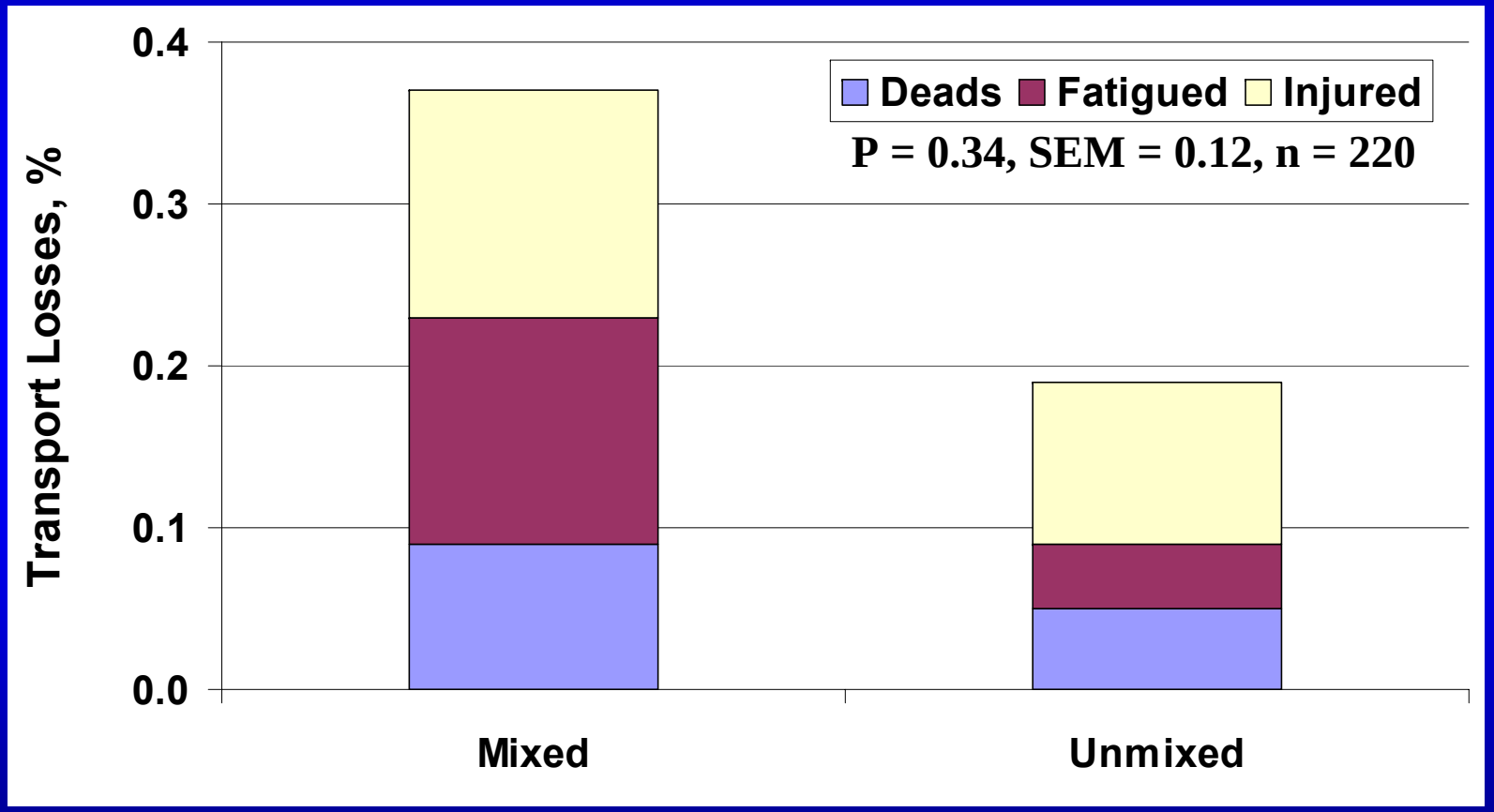
Lewis, C. R. G., and J. J. McGlone. 2007. Moving finishing pigs in different group sizes: Cardiovascular responses, time, and ease of handling. Livestock Science. 107:86-90.

Distance Moved



Mixing Pigs during Transport

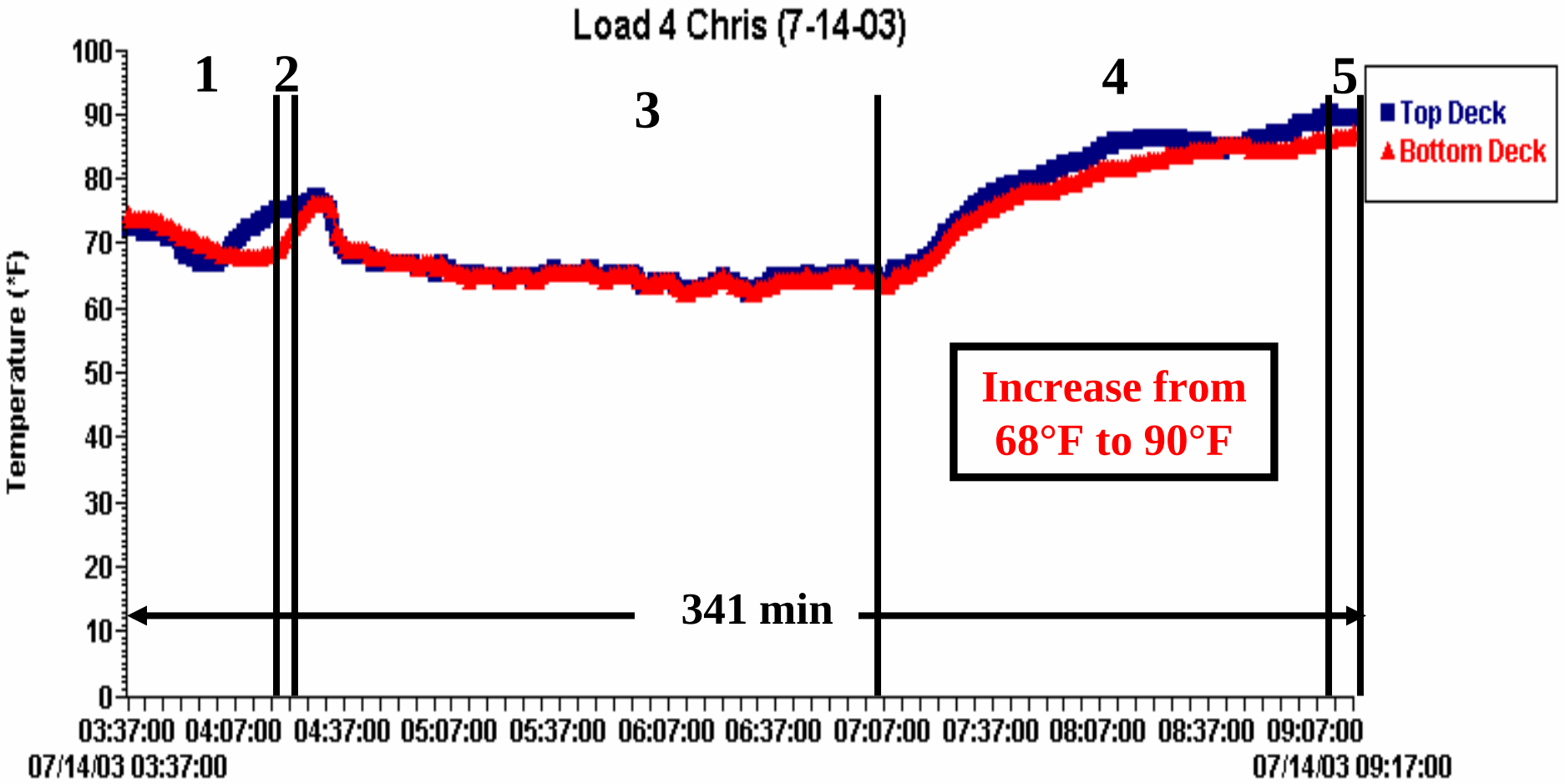
- Investigated the effects of mixing during transport on losses on 37 loads of pigs in the summer and winter



Ritter et al., 2006: 37 loads = 4,027 pigs, Mean pig weight = 282 lbs

Ritter, M. J., M. Ellis, C. R. Bertelsen, R. Bowman, J. Brinkmann, J. M. DeDecker, O. Mendoza, C. M. Murphy, B. A. Peterson, A. Rojo, J. M. Schlipf, and B. F. Wolter. 2006. Impact of animal management and transportation factors on transport losses in market weight pigs at the packing plant. Journal of Animal Science. 84(Suppl. 1):302. (Abstr.)

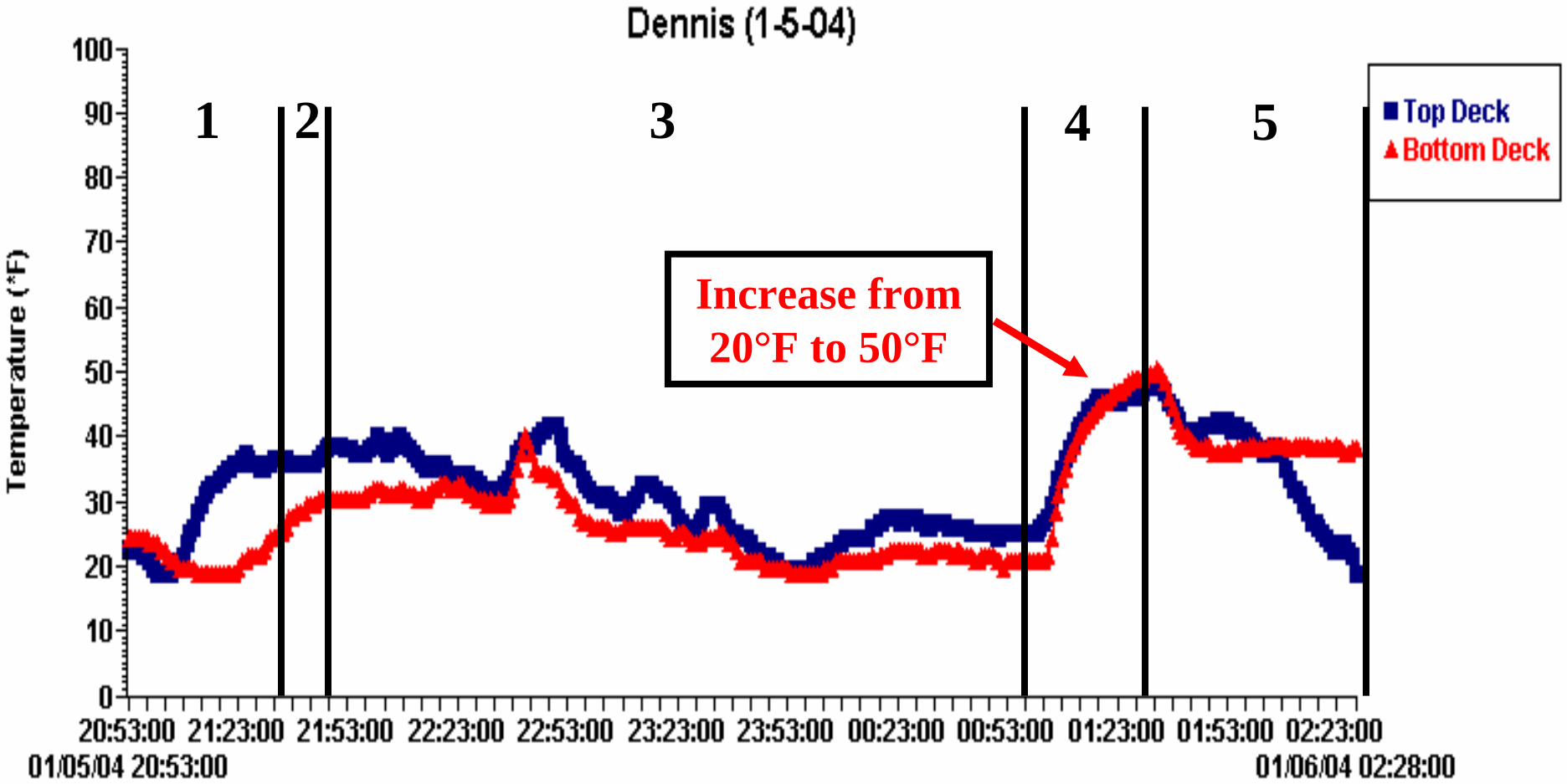
Summer Load



1: Loading (42 min)
2: Wait at the farm (3 min)
3: Transport (164 min)
4: Wait at Plant (124 min)
5: Unloading (8 min)

Ellis, M., and M. Ritter. 2006. Impact of season on production: transport losses. Pages 205-207 in Proceedings of the 2006 Allen D. Leman Swine Conference, St. Paul, MN.

Winter Load



1: Loading (41 min)
2: Wait at the farm (13 min)
3: Transport (189 min)
4: Wait at Plant (34 min)
5: Unloading (58 min)

Ellis, M., and M. Ritter. 2006. Impact of season on production: transport losses. Pages 205-207 in Proceedings of the 2006 Allen D. Leman Swine Conference, St. Paul, MN.

Paylean

Indications: Paylean is approved for improvement in feed efficiency, weight gain and carcass leanness in finishing swine not weighing less than 150 lbs.

Directions for Use: Feed at 4.5 to 9.0 g/ton to finishing swine in a complete ration containing at least 16% crude protein for the last 45 to 90 lbs of gain (group average).

Clinical registration studies showed no statistical difference between the effects of 4.5 g/ton and 9 g/ton

No withdrawal required

Caution: Ractopamine may increase the number of injured or fatigued pigs during marketing. Not for use in breeding swine.

The label contains complete use information including cautions and warnings. Always read, understand, and follow the label and use directions.

Paylean

- James et al., (2004)
  - Paylean was fed at 0 or 18 g/ton for 28 days
    - 18 g/ton is now an off-label dosage
  - Pigs were subjected to gentle or aggressive handling
  - Effects of Paylean were dependent upon handling
    - Paylean fed pigs were more susceptible to stress (body temperature, blood pH, and lactic acid) than control pigs when handled aggressively
    - When pigs were handled gently, there were no effects of Paylean on stress responses

James, B. W., M. D. Tokach, R. D. Goodband, J. L. Nelssen, S. S. Dritz, J. M. DeRouchey, and J. C. Woodworth. 2004. Effect of dietary L-carnitine and ractopamine-HCl (Paylean®) on the metabolic response to handling in grow-finish pigs. Journal of Animal Science. 82(Suppl. 2):77-78. (Abstr.)

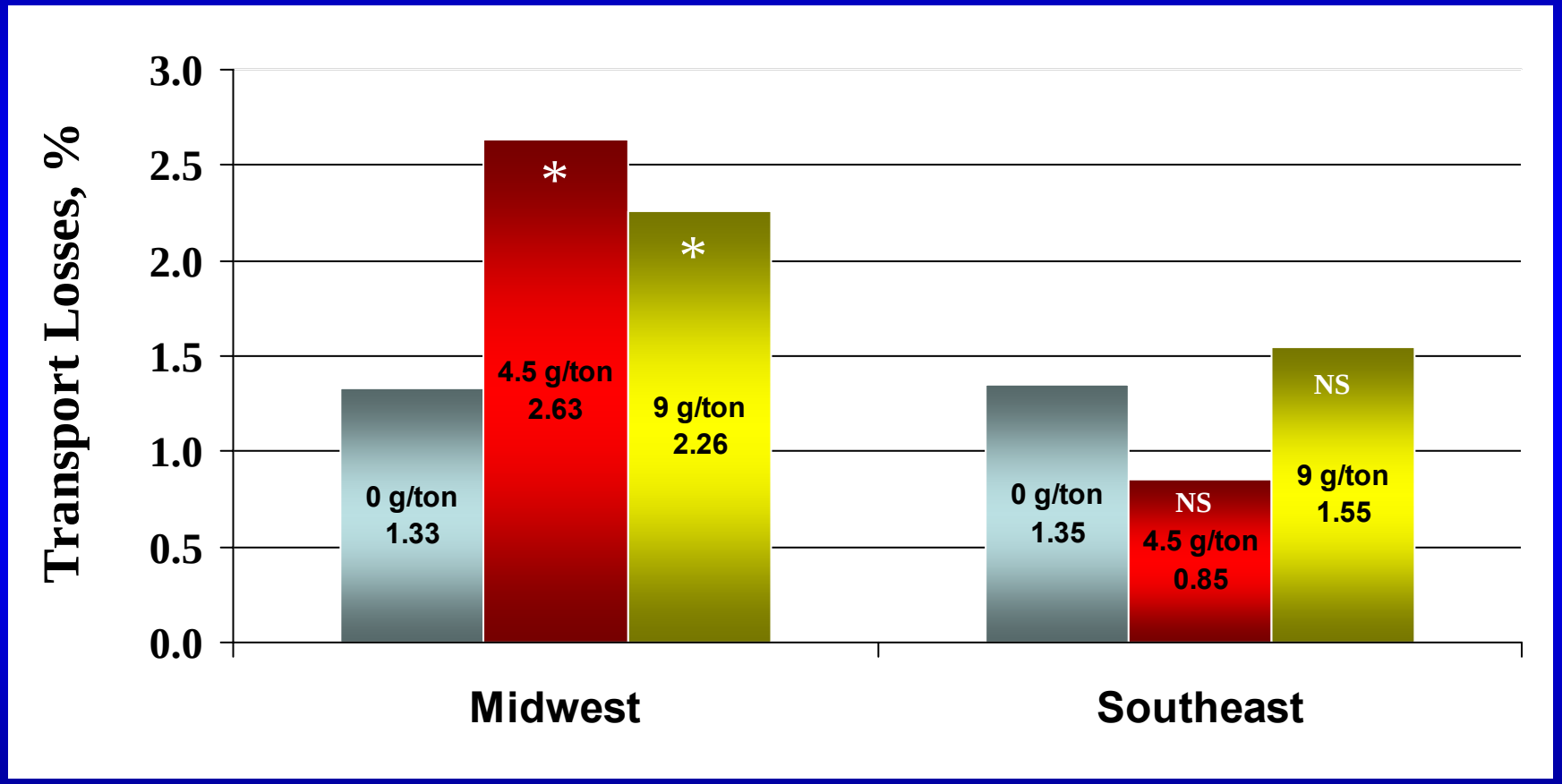
Post-Approval Surveillance Study

- Transport losses were monitored for 1 year under commercial conditions on 34,000 market pigs transported on 192 loads of pigs

- Regions
  - Midwest vs. Southeast

- Paylean
  - 0 vs. 4.5 vs. 9 g/ton for a duration of 21-35 d

Total Transport Losses: Effects of Region and Paylean Dose



16,725 pigs monitored - Mean exposure 23 days

17,339 pigs monitored - Mean exposure 26 days

Studies T4V910301-T4V910308

Regional Differences

	Midwest	Southeast
Electric prod usage, %		
Loading	100	100
Unloading	52	0
Final drive	97	0
Trailer design, %		
Straight deck	64	100
Pot-belly	36	0

Studies T4V910301-T4V910308