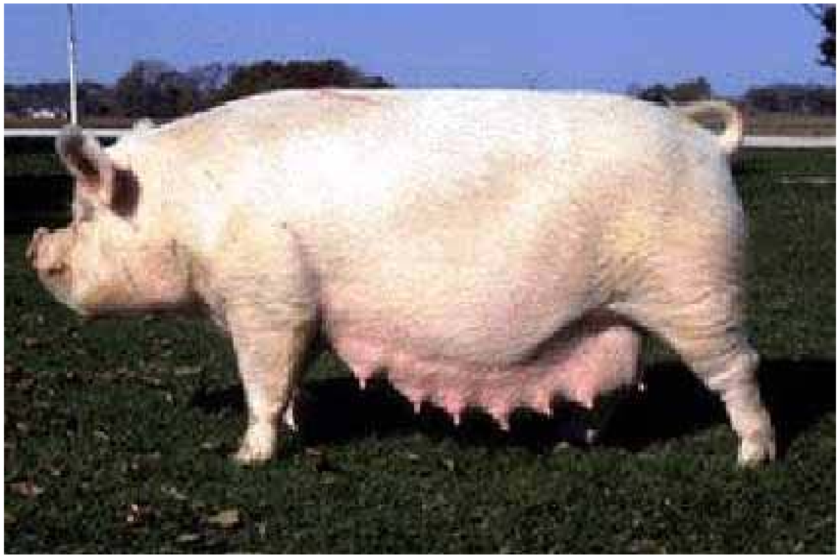
Feeding DDGS to Sows – Current Knowledge and Research Needs

Dr. Jerry Shurson
University of Minnesota

Producer Perceptions and Observations

- Perception
  - DDGS is a risky ingredient because of mycotoxin concerns
    - Has limited DDGS use compared to potential
- Observations
  - Increased lactation feed intake
  - Sows are more content
  - Fewer constipation problems

Feeding DDGS to Sows



Introduction

- Adding high fiber ingredients (e.g. alfalfa, wheat straw) to gestation diets has been shown to:
  - Increased litter size
    - (Munchow et al., 1982; Carter et al., 1987; Hagen et al., 1987; Everts, 1991; Ewan et al., 1996)
  - Increased sow feed intake during lactation
    - (Farmer et al., 1996; Vestergaard and Danielson, 1998).
  - Decrease expression of stereotypic behaviors
    - (Robert et al., 1993)

Introduction

- Fiber composition of DDGS and alfalfa are similar
  - Soluble fiber = 4.3%
  - Insoluble fiber = 52.4%

- Feeding high amounts of DDGS in sow diets may increase litter size

Introduction

- Previously published recommendations for maximum use of DDGS in sow diets:
  - Feed Co-Products Handbook (1997)
    - up to 50% in gestation diets
    - up to 20% in lactation diets
  - Pork Industry Handbook
    - up to 40% in gestation diets
    - up to 10% in lactation diets

Methodology – Wilson et al., 2003

- Trial was conducted at SROC (Waseca, MN)
- Used 93 sows divided among 5 breeding groups
  - blocked by initial BW and parity and randomly assigned to one of four dietary treatment combinations
  - sows remained on dietary treatments through 2 reproductive cycles
- Each dietary treatment combination consisted of both a gestation and lactation diet
  - Corn-SBM Gestation and Corn-SBM Lactation
  - Corn-SBM Gestation and 20% DDGS Lactation
  - 50% DDGS Gestation and Corn-SBM Lactation
  - 50% DDGS Gestation and 20% DDGS Lactation

Methodology – Wilson et al., 2003

- Gestation diets were limit fed and feed intake was adjusted according to sow body weight on days 30, 60, and 90 of gestation
  - day 30 (1% BW + 100g)
  - day 60 (1% BW + 300g)
  - day 90 (1% BW + 500g)
- Lactation diets were limit fed until farrowing and then provided *ad libitum* post-farrowing

Methodology – Wilson et al., 2003

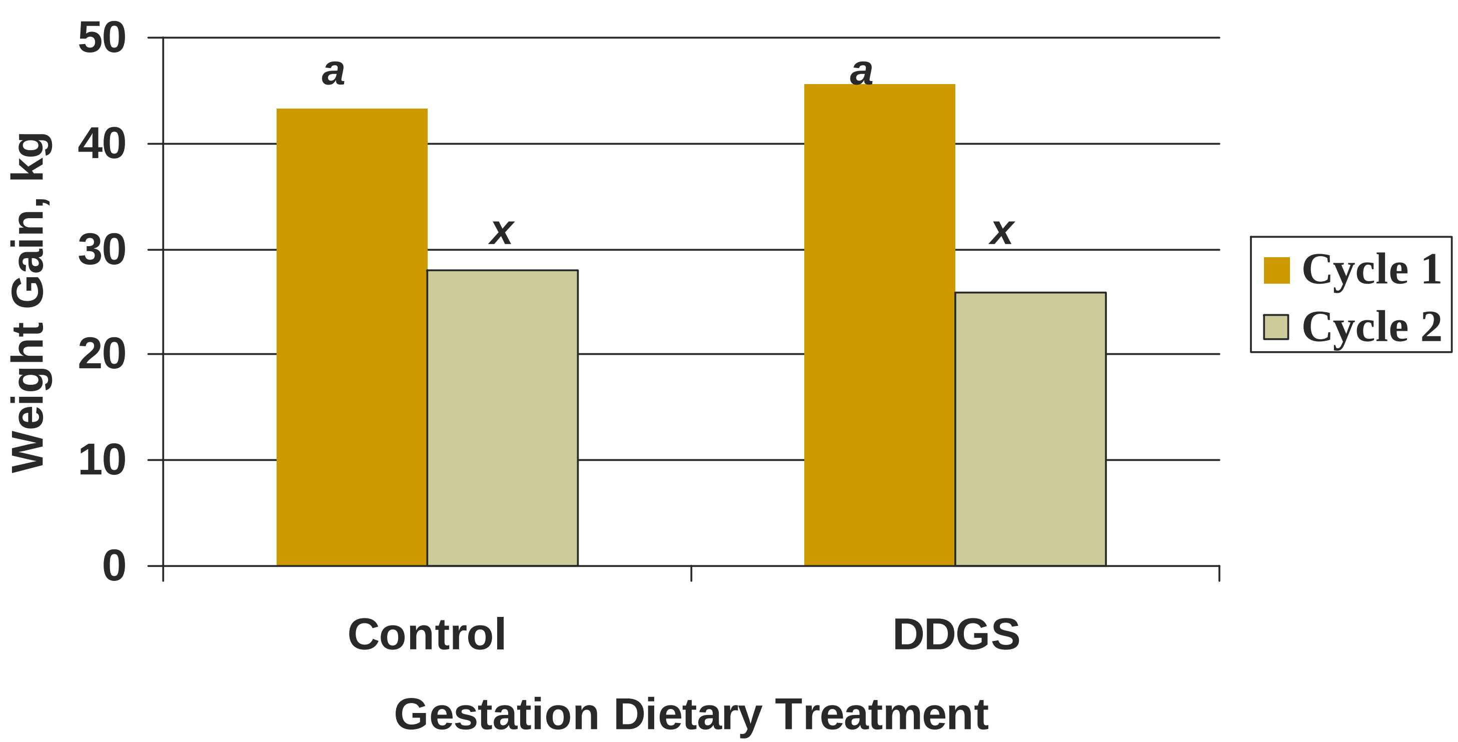
- Weight and backfat measurements taken at:
  - Breeding
  - After farrowing
  - Weaning
  - Days 30, 60, and 90 during gestation

- At farrowing, total pigs born, total pigs born alive, and individual pig birth weights were recorded.

- Pigs were cross-fostered among litters within dietary treatment within 24-48 hrs after birth to equalize litter size

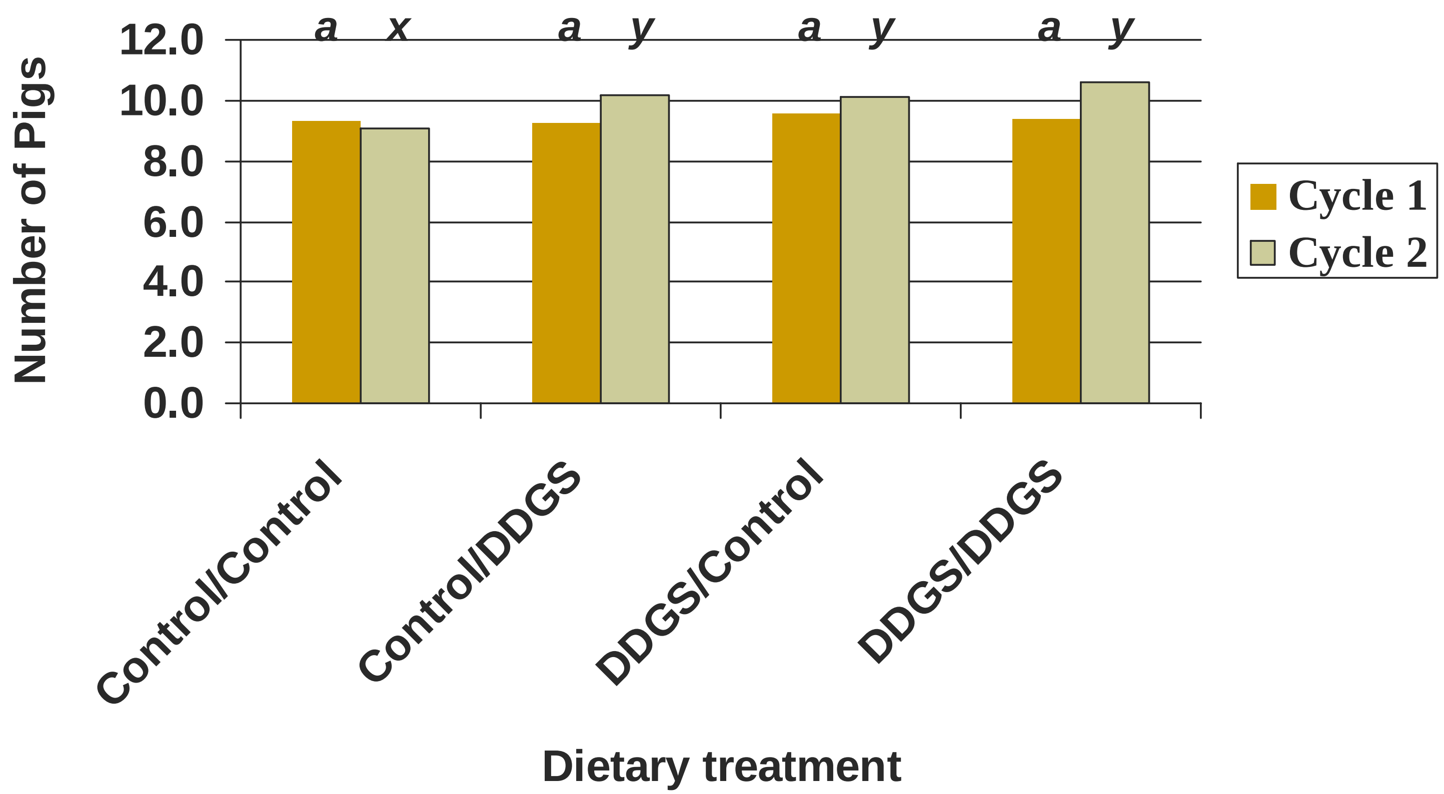
- Pigs were weighed at weaning (18 ± 1 d of age)

Effect of Feeding a 50% DDGS Diet on Sow Weight Gain During Gestation – Wilson et al., 2003



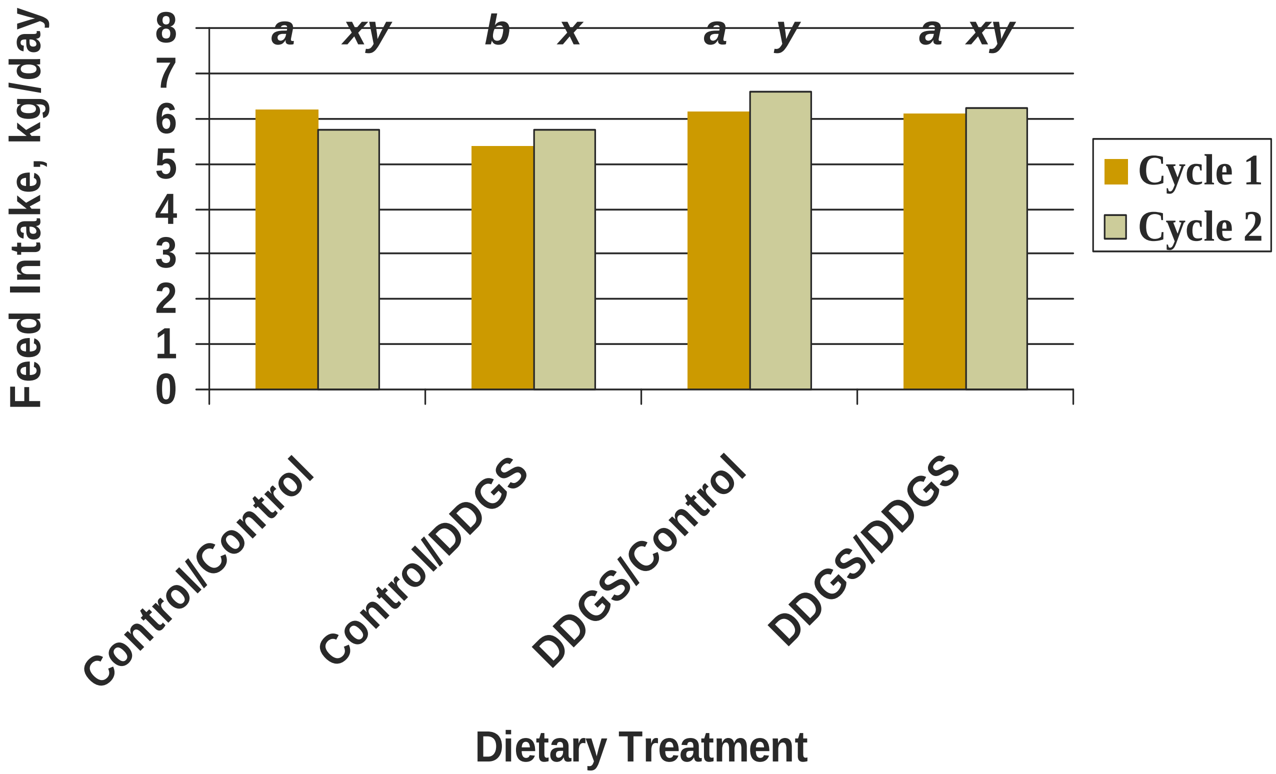
[a,b,x,y] Different superscripts indicate significant difference (P < .10).

Effect of Feeding 0 or 50% DDGS Gestation Diets and 0 or 20% DDGS Lactation Diets on Pigs Weaned/Litter – Wilson et al., 2003



[a,b,x,y] Different superscripts indicate significant difference (P < .10).

Effect of Dietary Treatment Combination on Sow Lactation ADFI – Wilson et al., 2003



[a,b,x,y] Different superscripts indicate significant difference (P < .10).

Objectives - Hill et al., 2005

- To determine if DDGS can be used in sow lactation diets
  - to minimize P excretion
  - to support sow performance

Materials and Methods – Hill et al., 2005

- Two dietary treatments
  - 5% Beet pulp (BP)
  - 15% DDGS
- Diets formulated to meet or exceed NRC
  - 1.2% Lysine
  - 0.9% Ca
  - 0.84% P
  - 3320 kcal/kg
- P supplied by
  - BP - 100% of P from mono-calcium phosphate
  - DDGS - 17% of P from DDGS and 83% from mono-calcium phosphate

Materials and Methods – Hill et al., 2005

- Sows allotted based on parity
  - Beet pulp
    - 9 primiparous
    - 21 multiparous
  - DDGS
    - 9 primiparous
    - 22 multiparous
- Common gestation diet
  - gradual adaptation to treatment diets

Materials and Methods - Hill et al., 2005

- Litters balanced to 11 pigs by 2 d of age
- Feed increased according to
  - genetics, appetite, and body condition
- Sow and litter weighed
  - d 2
  - d 18

Materials and Methods- Hill et al. 2005

- Fecal grab samples from sows
  - d 7
  - d 14
  - d 18

- Fecal samples analyzed for total P

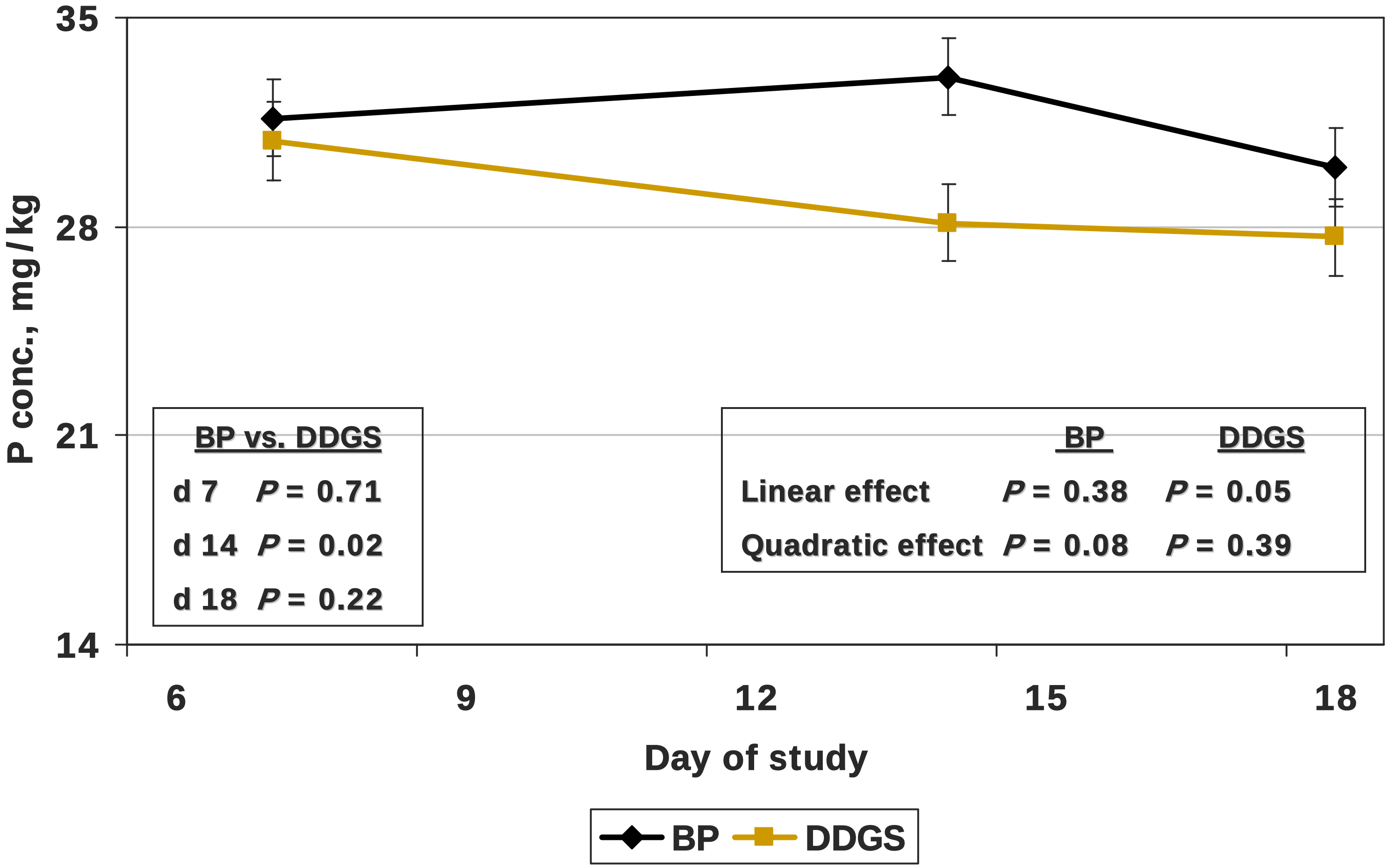
Influence of beet pulp and DDGS on sow weights – Hill et al. 2005

	Beet Pulp	DDGS	*P*-value
Sow wt d2, kg	205.6	211.1	0.34
Sow wt d 18, kg	201.7	204.2	0.62
Sow wt change, kg	- 6.2	- 8.0	0.42

Influence of beet pulp and DDGS on litter weights – Hill et al. 2005

	Beet Pulp	DDGS	*P*-value
Litter wt. d 2, kg	21.1	19.5	0.12
Litter wt. d 18, kg	62.9	62.3	0.83
Litter gain, kg	41.7	43.4	0.50
No. pigs weaned	10.9	10.8	0.82
Gain/pig, kg	3.82	3.91	0.61

Phosphorus concentration in fecal grab samples of sows fed beet pulp vs. DDGS during lactation – Hill et al. 2005



Conclusion

- Inclusion of 15% DDGS in sow lactation diets
  - Supports sow lactation performance
  - May reduce fecal P excretion

Objectives - Song et al. (2006)

- To determine the effects of increasing levels of DDGS in lactation diets on:
  - Sow and litter performance
  - Energy and nitrogen balance in sows
  - Blood urea nitrogen
  - Milk fat and protein concentrations
  - Economics

Experimental Diets

Ingredient	Control	10% DDGS	20% DDGS	30% DDGS	30%DDGS High Protein
Corn	66.20	62.34	58.81	54.92	47.70
SBM,47.5%	27.40	21.75	15.87	10.33	18.14
DDGS	0	10.00	20.00	30.00	30.00
Tallow	2.50	1.92	1.25	0.62	0.41
Dical. phos.	2.38	2.14	1.87	1.59	1.52
Limestone	0.47	0.65	0.83	1.01	1.00
Salt	0.35	0.35	0.35	0.35	0.35
VTM premix	0.50	0.50	0.50	0.50	0.50
Biotin	0.20	0.20	0.20	0.20	0.20
Lysine-HCl	0	0.15	0.32	0.48	0.18
Total	100	100	100	100	100

Song et al. (2006)

Calculated Nutrient Composition of Experimental Diets

	NRC 1998	0% DDGS	10% DDGS	20% DDGS	30% DDGS	30% DDGS High Protein
ME (Mcal/kg)	3.26	3.40	3.41	3.41	3.41	3.41
Crude Protein,%	18.50	18.80	18.80	18.80	18.80	22.00
Total calcium,%	0.75	0.80	0.80	0.80	0.80	0.80
Total phos.,%	0.60	0.80	0.79	0.77	0.74	0.76
Available phos.,%	0.35	0.51	0.51	0.51	0.51	0.51
Total lysine,%	0.97	1.04	1.06	1.07	1.09	1.12
TID lysine,%	0.85	0.98	0.98	0.98	0.98	0.98
TID met+cys,%	0.42	0.59	0.60	0.62	0.63	0.71
TID threonine,%	0.53	0.68	0.65	0.61	0.58	0.72
TID tryptophan,%	0.16	0.22	0.20	0.17	0.16	0.20

Song et al. (2006)

Analyzed Nutrient Composition of Experimental Diets

	Control	10% DDGS	20% DDGS	30% DDGS	30% DDGS HP
Crude protein, %	17.81	18.00	17.33	16.99	20.27
ADF, %	8.94	4.37	5.29	6.98	8.48
Total calcium, %	0.88	0.88	0.84	0.82	0.76
Total phosphorus, %	0.81	0.78	0.75	0.74	0.73
Gross energy, Mcal/kg	3.95	4.03	4.10	4.18	4.02
Metabolizable energy, Mcal/kg	3.34	3.37	3.51	3.57	3.42

Song et al. (2006)

Lactating Sows - Song et al. (2006)

- 307 mixed parity sows

  - Group housed = 147 sows
  - Individual crates = 160 sows

- English Belle, GAP genetics, Winnipeg, MB, Canada
- Average initial weight of about 222 ± 15 kg

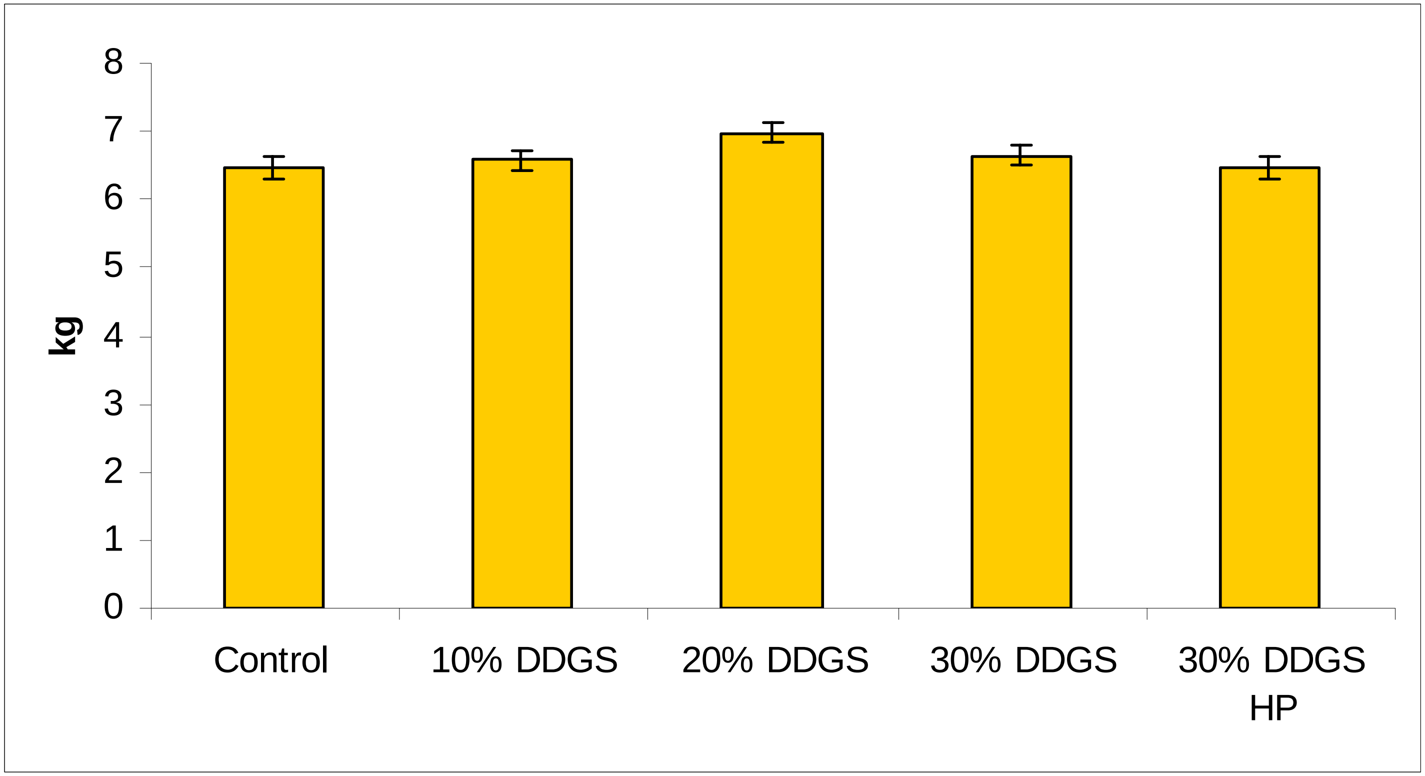
Group housing

Individual housing

Animal Management - Song et al. (2006)

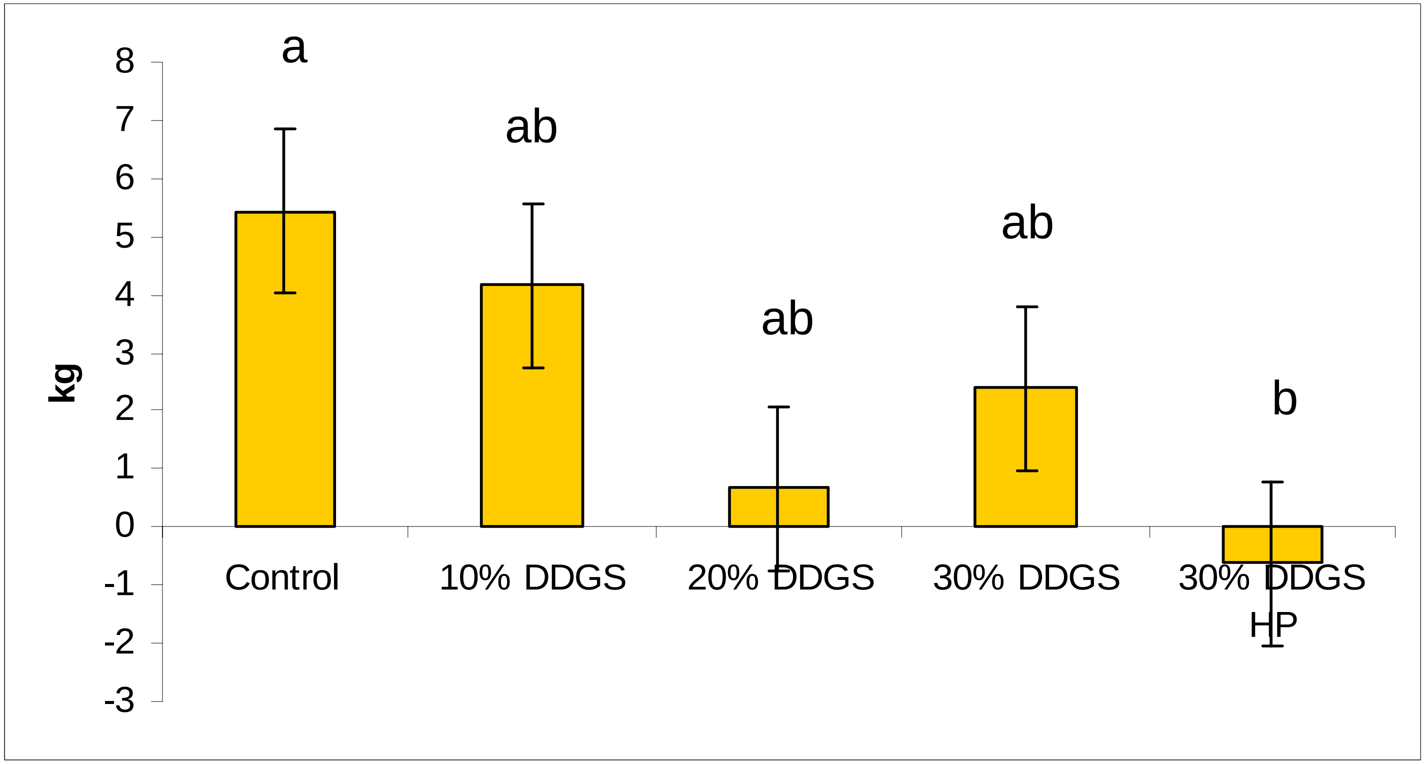
- Individually fully slatted farrowing crates
- Fed twice daily (07:00 AM and 02:30 PM)
- Ad-libitum access to water from nipple drinker
- Room temperature was set at 18-20°C
- Heat mat and lamp were provided for piglets

Effect of Increasing Dietary DDGS Level on Sow ADFI in Lactation



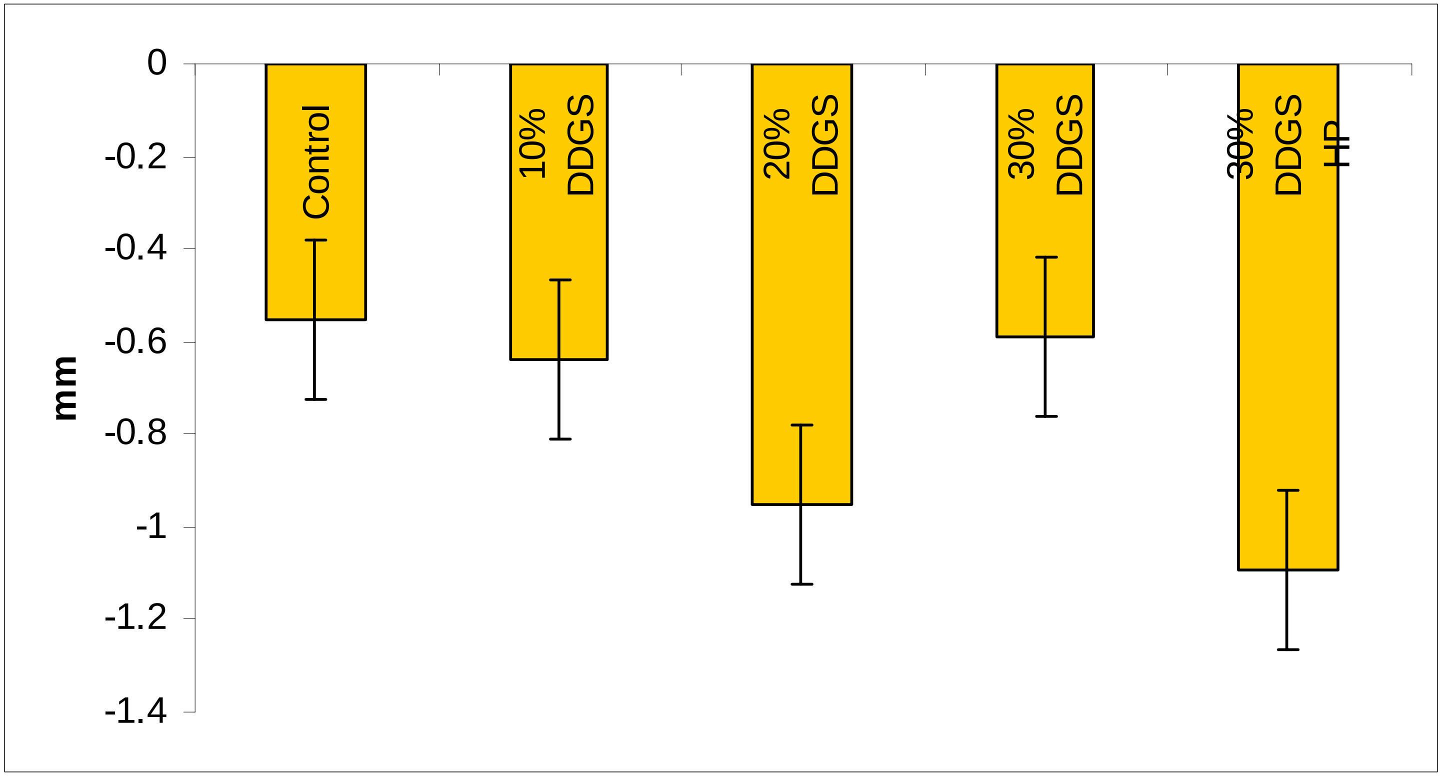
No significant difference (P = 0.10)

Effect of Increasing Dietary DDGS Level on Sow Body Weight Change



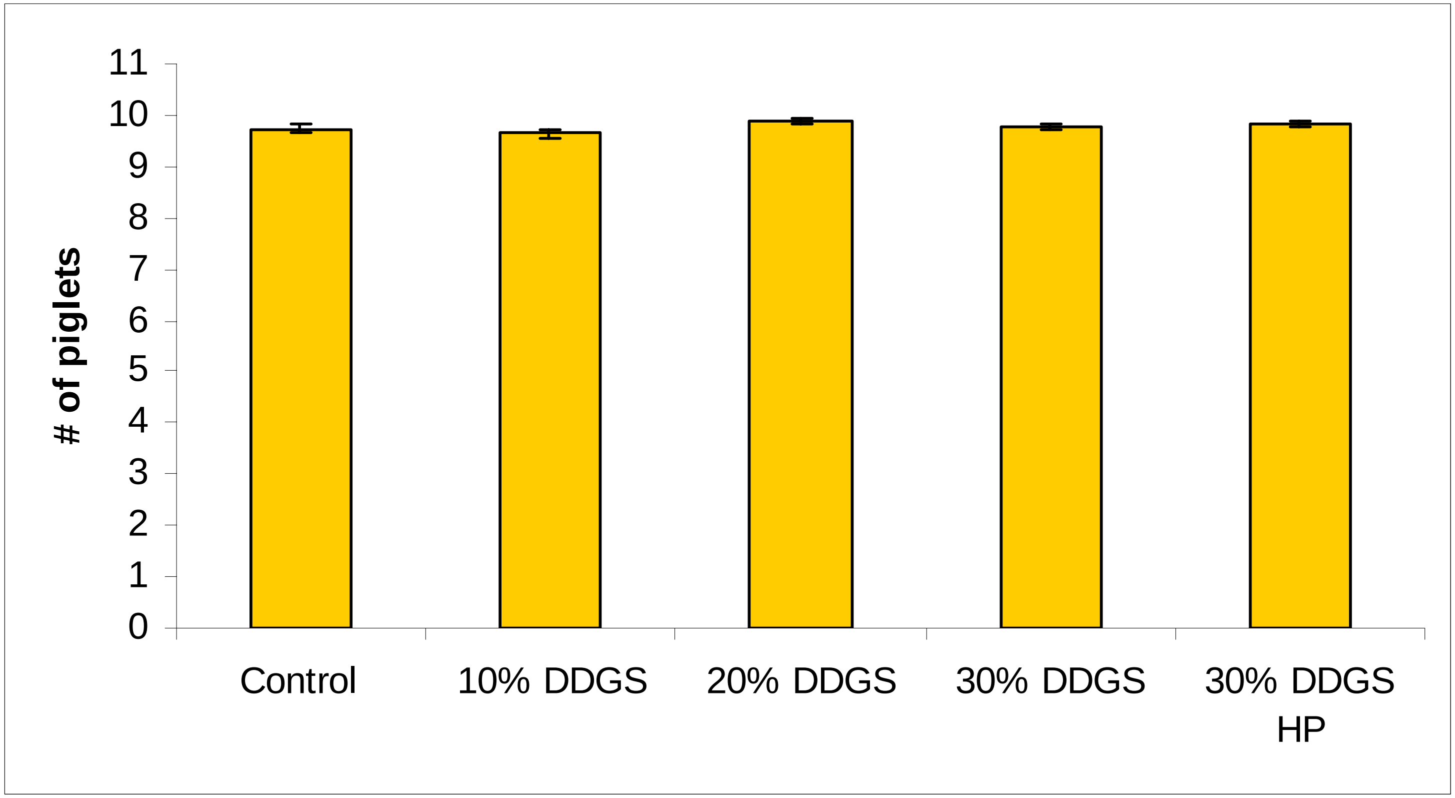
[a,b] Means with different superscripts are significantly different ($P < 0.05$)

Effect of Increasing Dietary DDGS Level on Sow Backfat Depth Change During Lactation



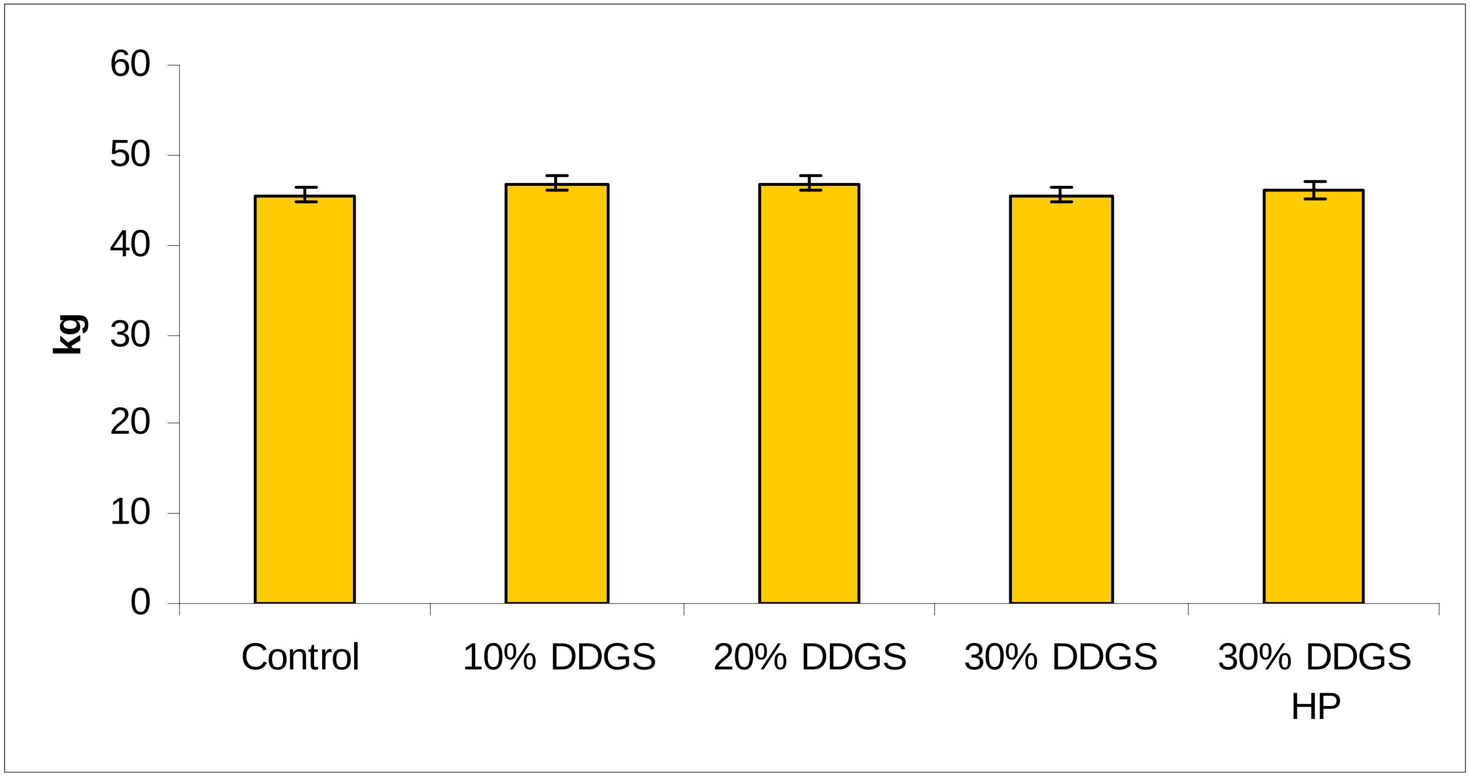
No significant difference (P = 0.21)

Effect of Increasing Dietary DDGS Level on Litter Size at Weaning



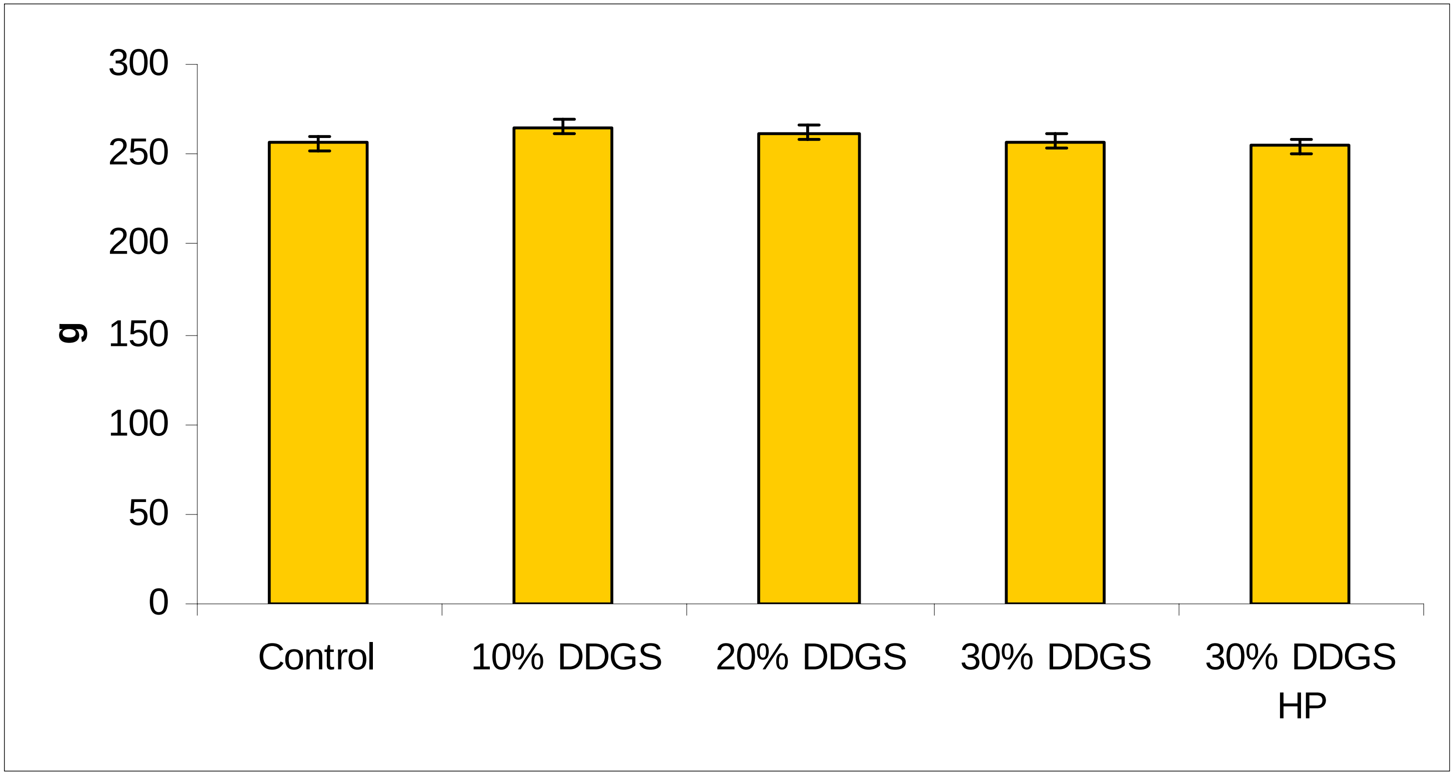
No significant difference (P = 0.31)

Effect of Increasing Dietary DDGS Level on Litter Weight Gain



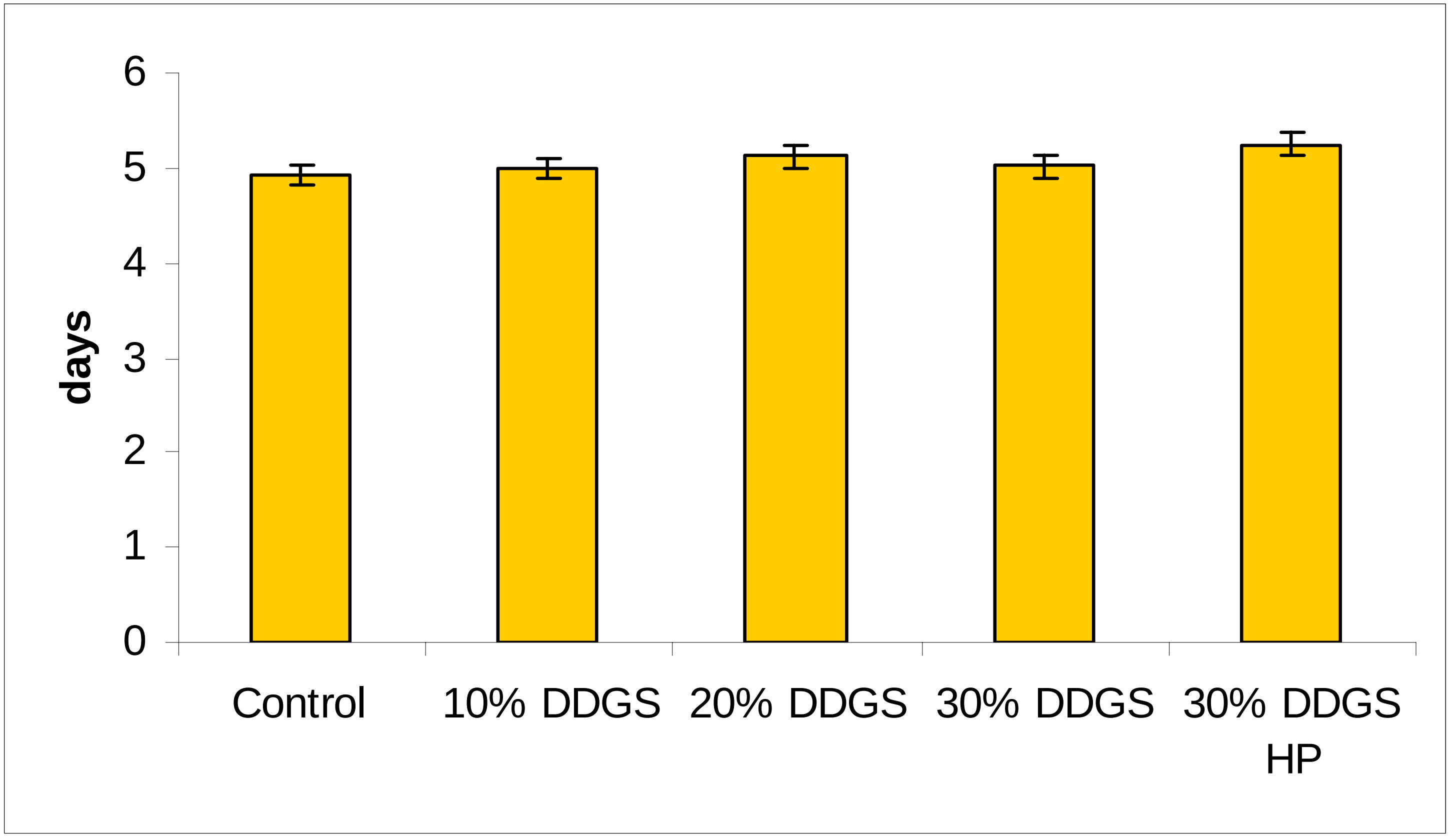
No significant difference (P = 0.67)

Effect of Increasing Dietary DDGS Level on Average Daily Piglet Weight Gain



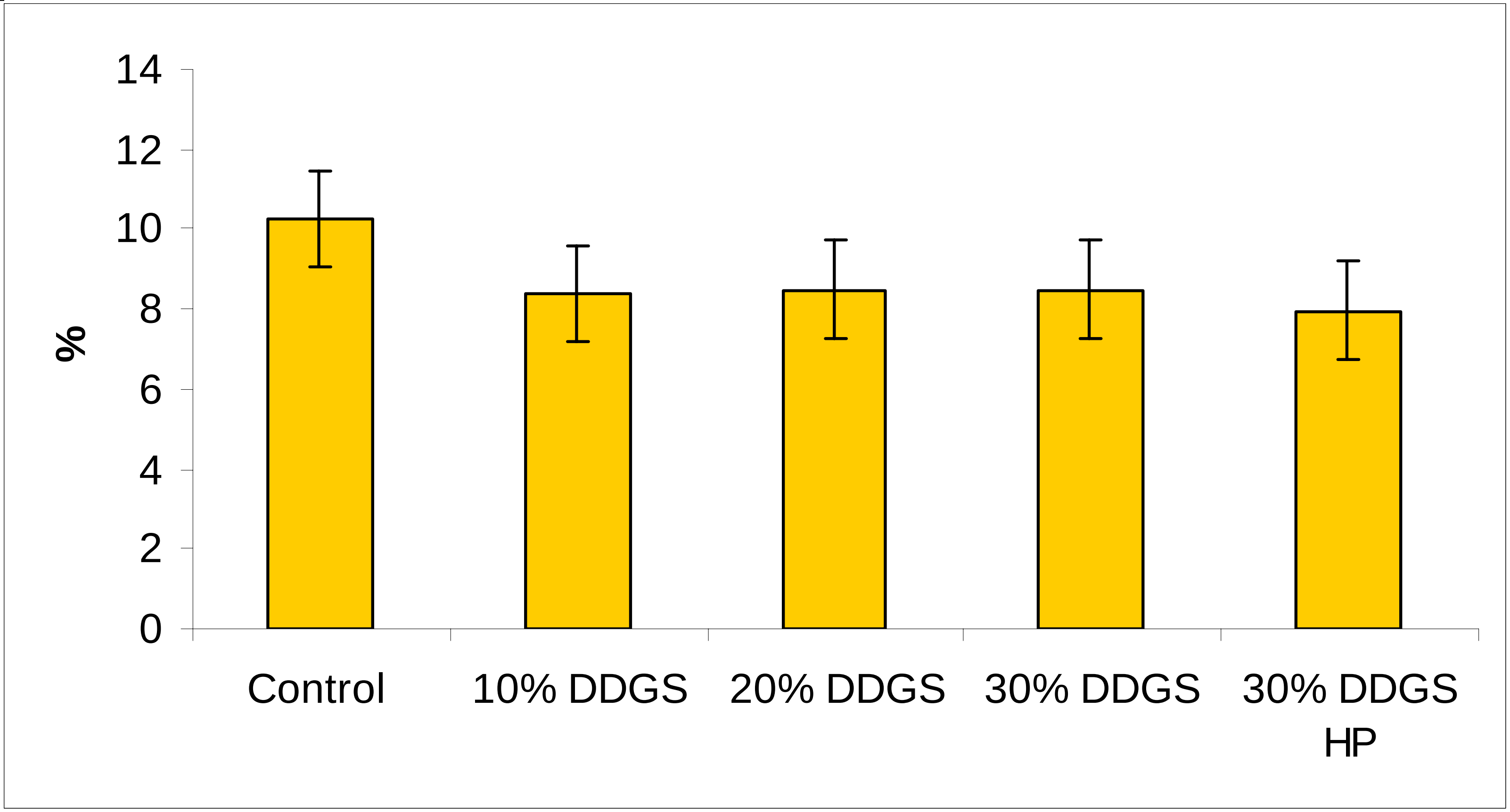
10, 20, and 30% DDGS vs. 30% DDGS HP (P < 0.1)
10, 20, and 30% DDGS vs. Control (P < 0.1)

Effect of Increasing Dietary DDGS Level on Wean to Estrus Interval



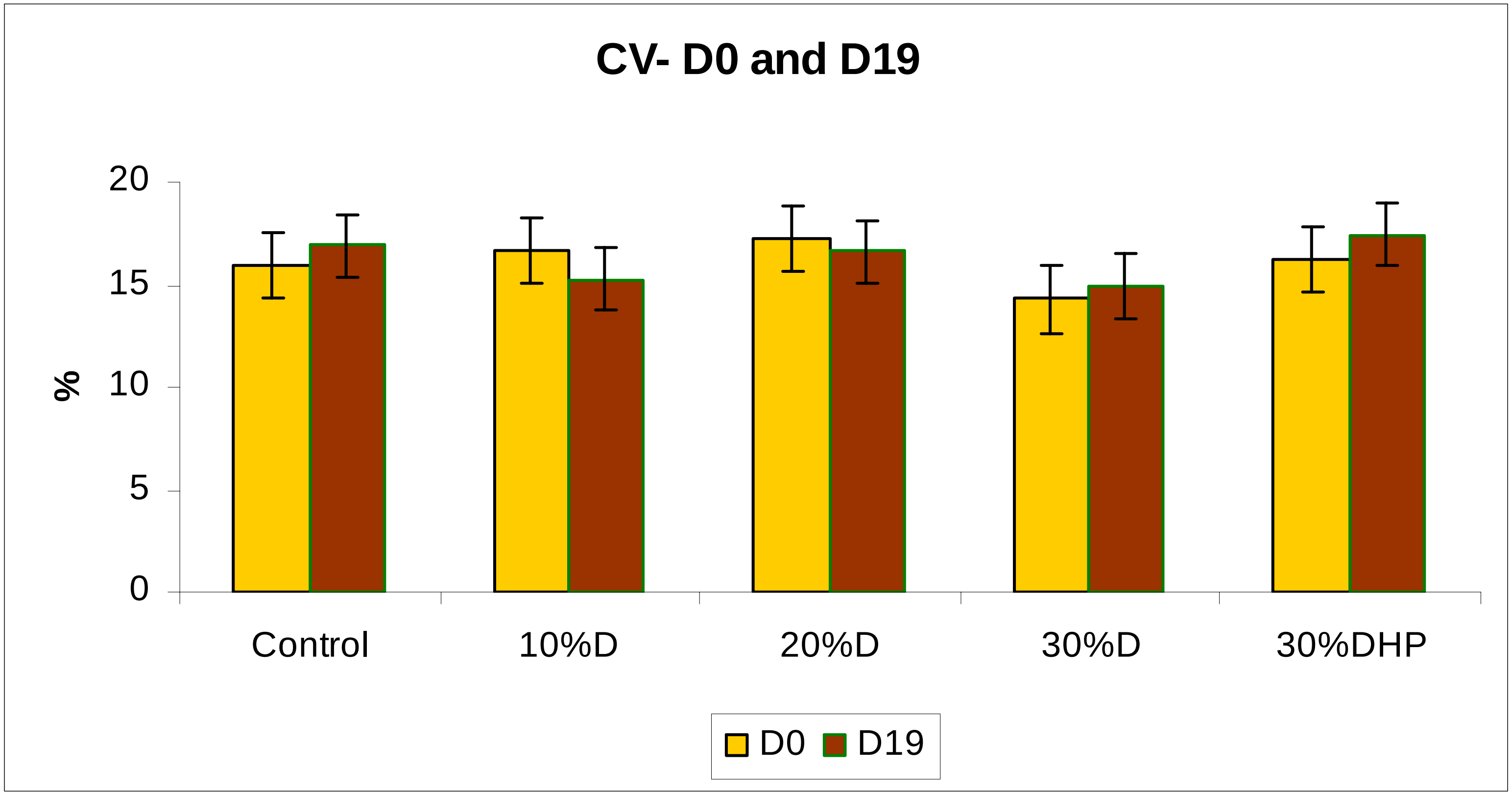
No significant difference (P = 0.35)

Effect of Increasing Dietary DDGS Level on Pre-Weaning Mortality



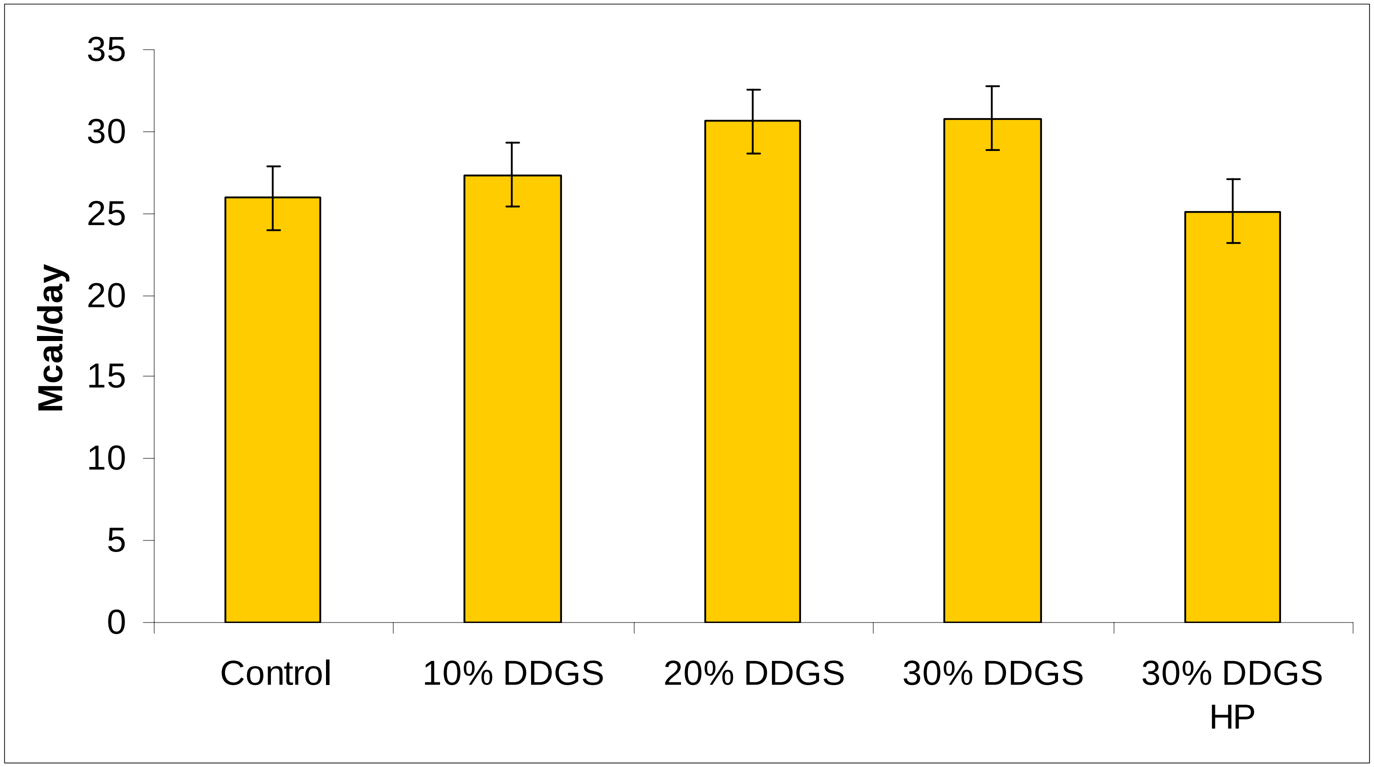
No significant difference (P = 0.71)

Effect of Increasing Dietary DDGS Level on Coefficient of Variation of Individual Pig Weight within Litters



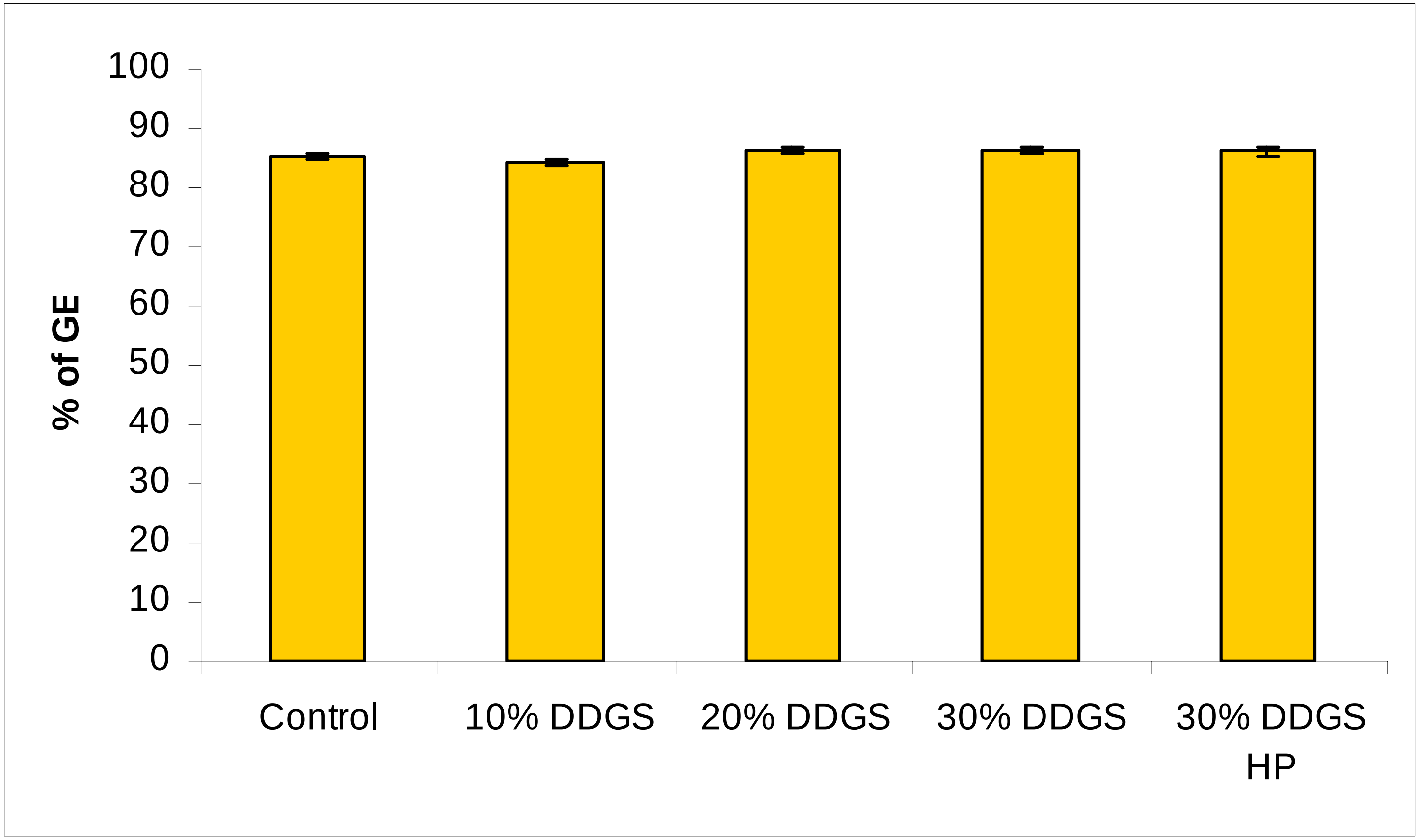
No significant difference on Day 0 (P = 0.85) and Day 19 (P = 0.53)

Effect of Increasing Dietary DDGS Level on Gross Energy Intake



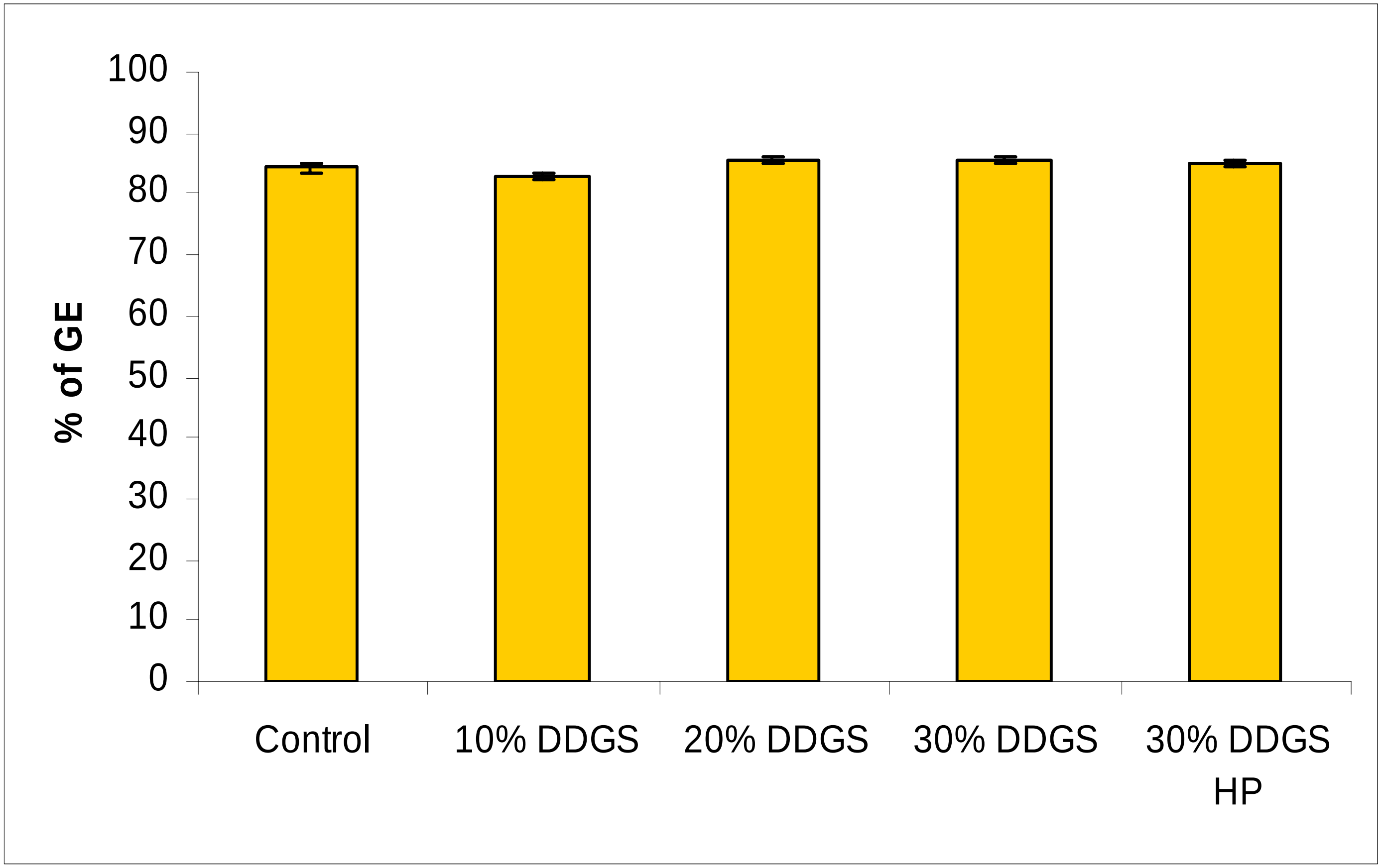
No significant difference (P = 0.23)

Effect of Increasing Dietary DDGS Level on Digestible Energy



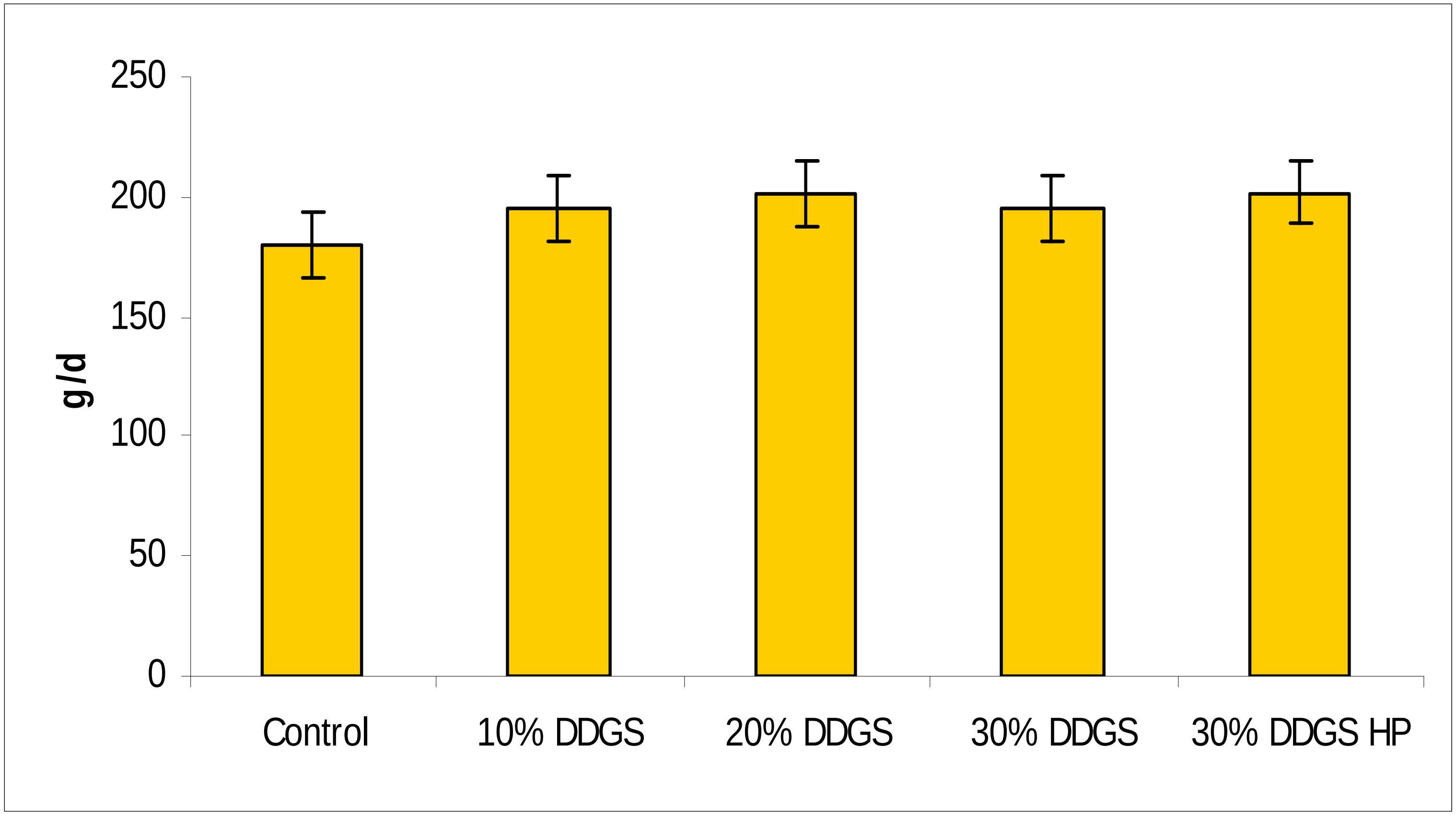
No significant difference (P = 0.66)

Effect of Increasing Dietary DDGS Level on Metabolizable Energy



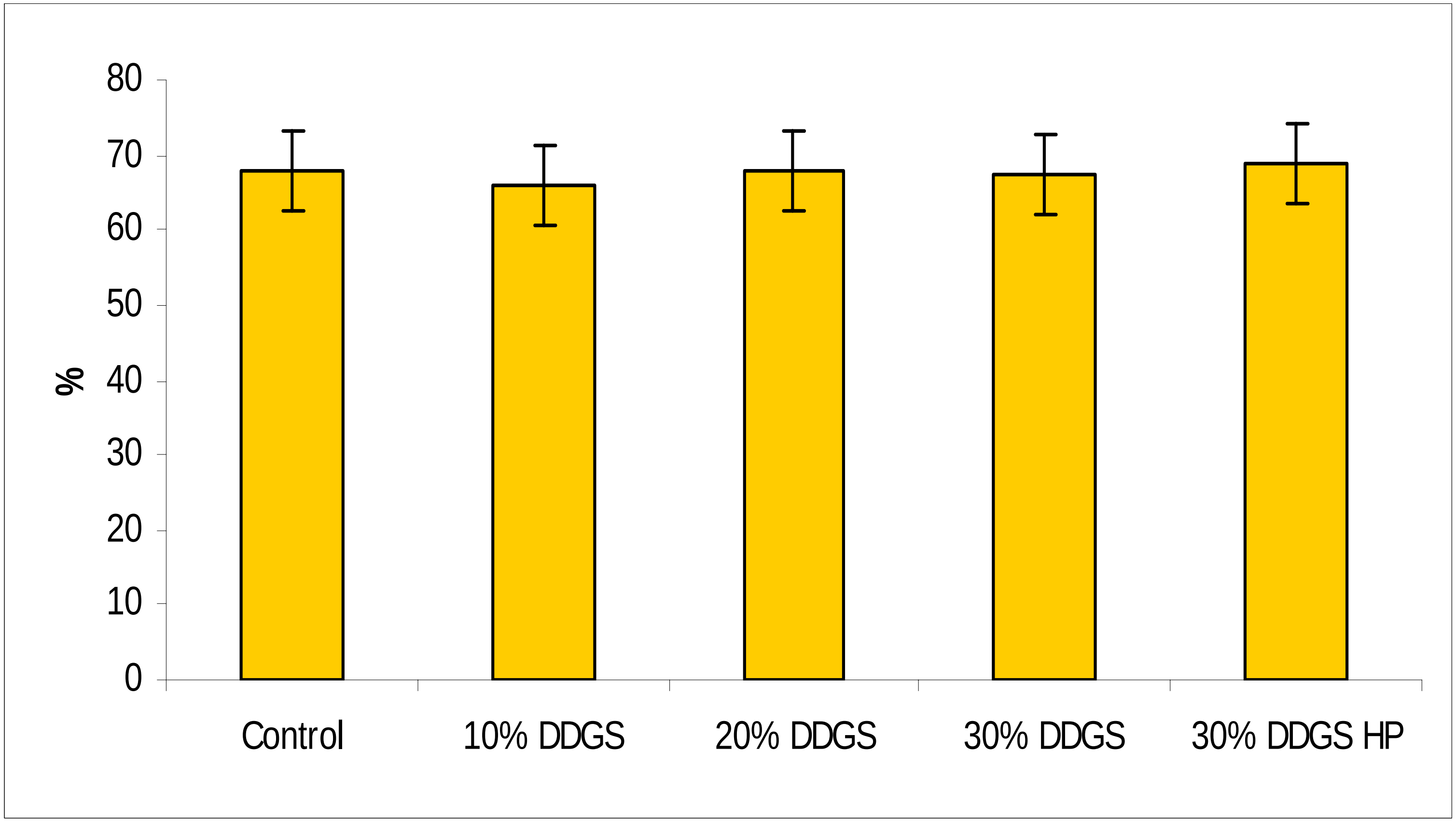
No significant difference (P = 0.37)

Effect of Increasing Dietary DDGS Level on Nitrogen Intake



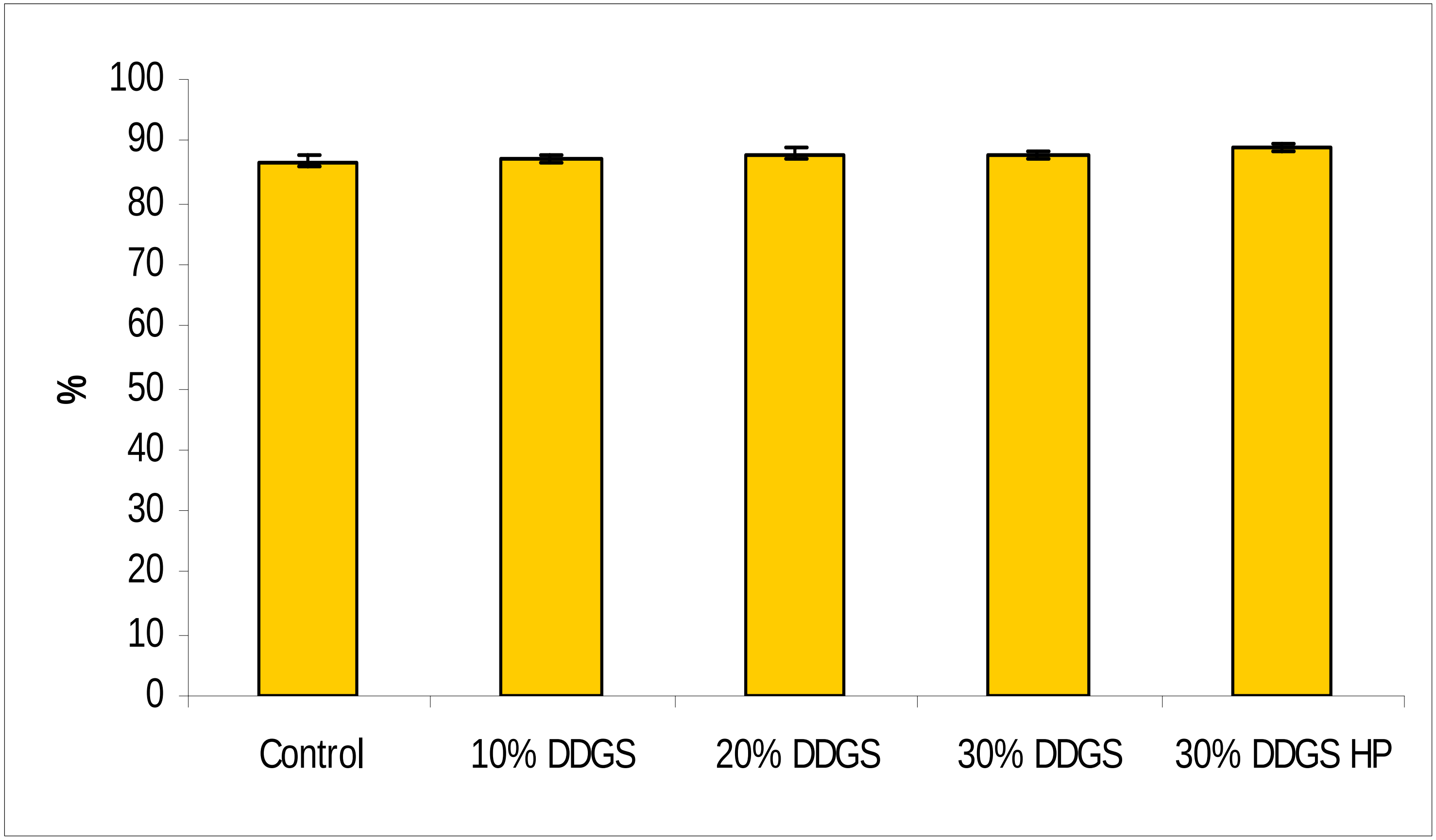
No significant difference (P = 0.52)

Effect of Increasing Dietary DDGS Level on Nitrogen Retention



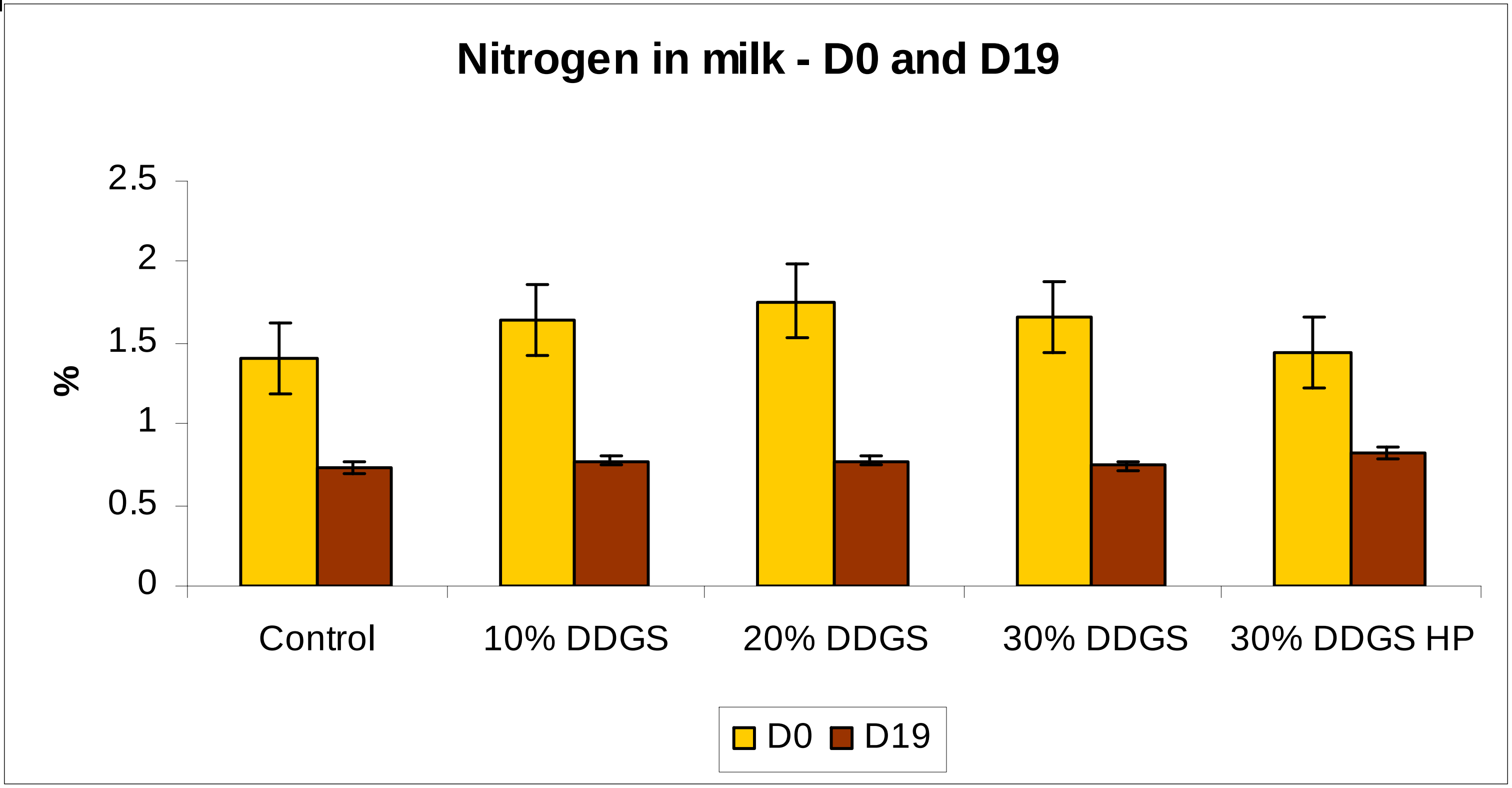
No significant difference (P = 0.91)

Effect of Increasing Dietary DDGS Level on Nitrogen Digestibility



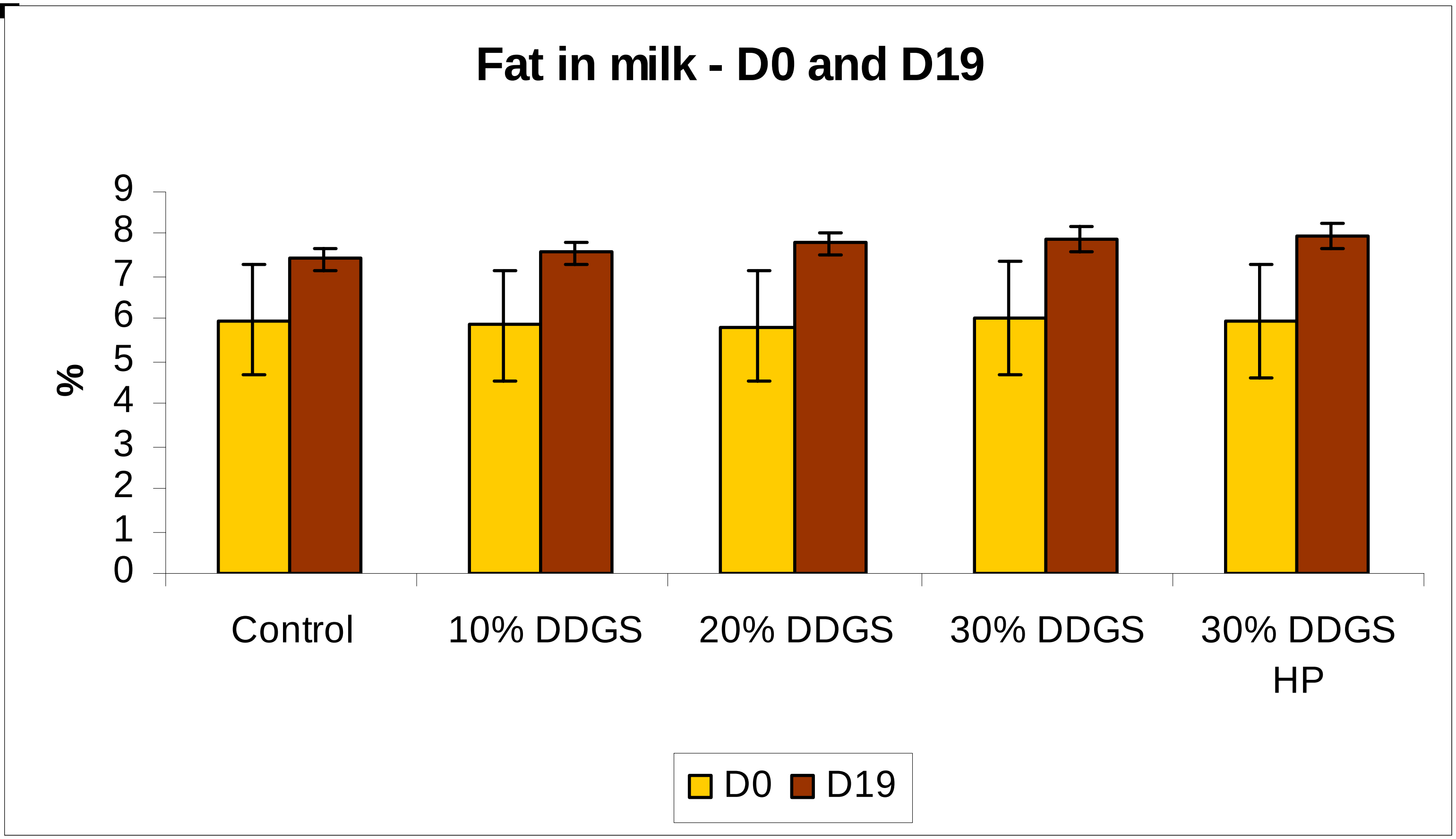
No significant difference (P = 0.29)

Effect of Increasing Dietary DDGS Level on Nitrogen Content of Sow Milk



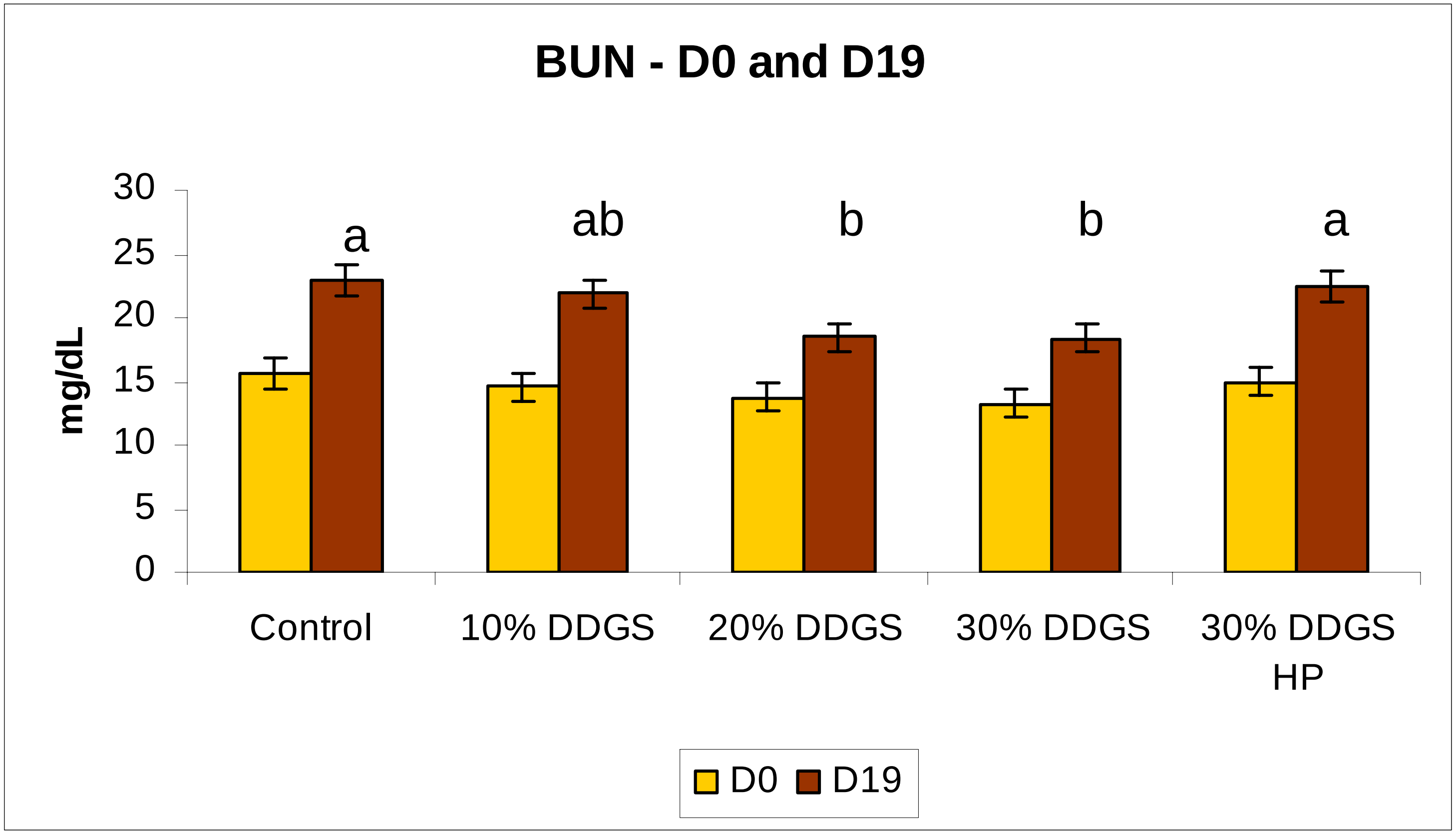
No significant difference at Day 0 (P = 0.73) and Day 19 (P=0.41)

Effect of Increasing Dietary DDGS Level on Fat Concentration in Sow Milk



No significant difference on Day 0 (P = 0.99) and Day 19 (P = 0.59)

Effect of Increasing Dietary DDGS Level on Blood Urea Nitrogen



[a,b] Means with different superscripts are different ($P < 0.05$)

Conclusion

- Inclusion of up to 30% DDGS in sow lactation diets did not affect:
  - Sow and litter performance
  - Digestible and metabolizable energy
  - Nitrogen retention and digestibility
  - Milk nitrogen and fat concentration
  - Blood urea nitrogen was lower for sows fed the 20 and 30% DDGS diets compared to the corn-soybean meal diet and the high protein 30% DDGS diet

Research Questions

- Litter size response
  - Is it repeatable?
  - Minimum dietary levels of DDGS?
  - Feeding strategy (when and how long)?

- Pig weight gain response
  - Is it repeatable?

- Can levels greater than 30% be fed to lactating sows without negative effects?

- Is high protein (BUN) a concern at high dietary inclusion rates?

- Can long-term feeding of DDGS
  - Reduce stereotypic behaviors?
  - Improve satiety?
  - Improve longevity?