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Effect of spray-dried porcine plasma (SDPP) and plasma fractions on performance of weaned pigs challenged with Salmonella typhimurium

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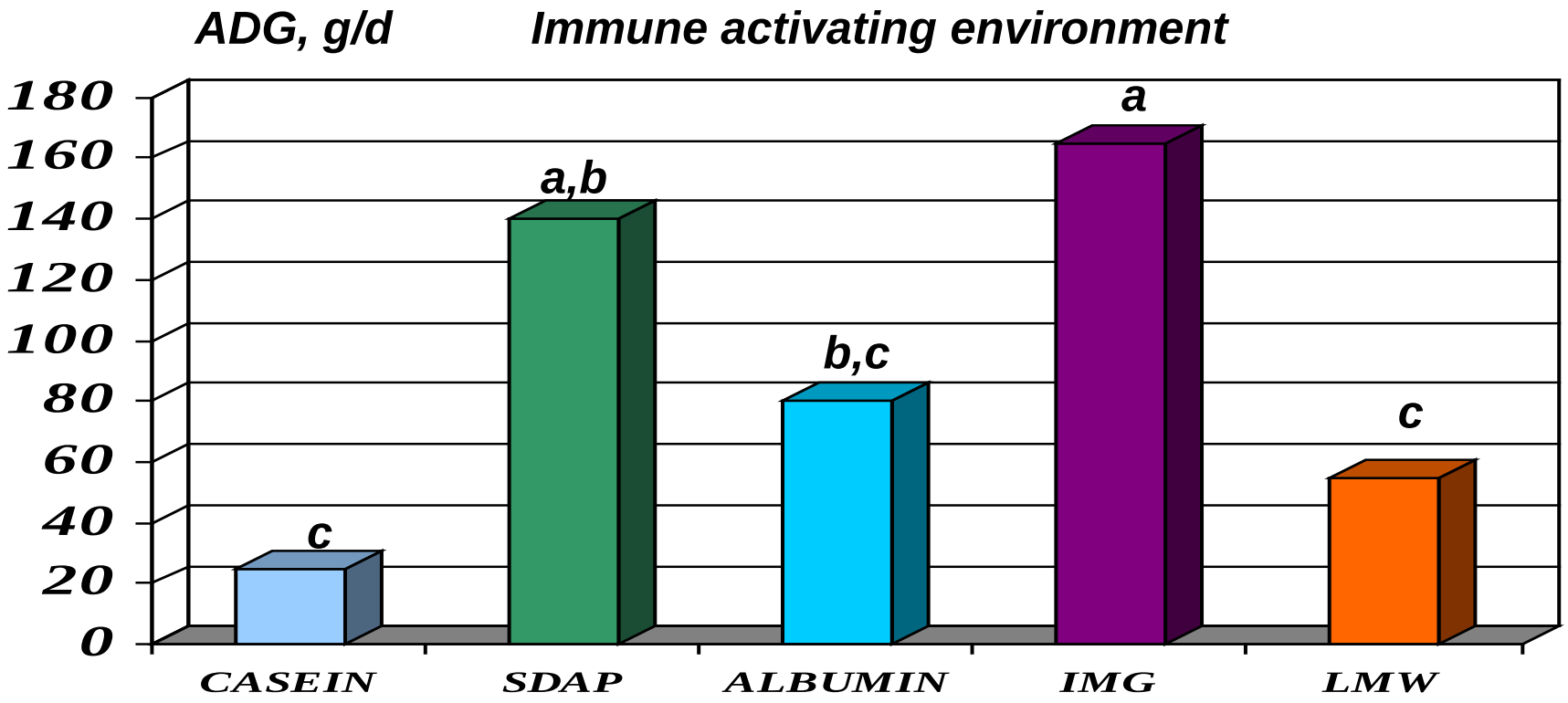
Mode of Action of Plasma

- Different theories about how plasma work:
  - Improve palatability of the diets (Ermer et al. 1994).
  - The IgG fraction main responsible for plasma effect (Gatnau & Zimmerman 1991; Weaver et al. 1995; Pierce et al. 2005).
  - Glycoprotein's presents in plasma are main responsible for plasma effect (Sanchez et al., 1993; Nollet et al., 1999).
  - Plasma improve the health status of the animals and therefore improve the performance parameters (Torrallardona et al., 2003).
  - Plasma reduce overstimulation of immune system (Touchette et al., 2002; Perez-Bosque et al., 2008)

MODE OF ACTION OF PLASMA
ADG, g/d 0-15 days



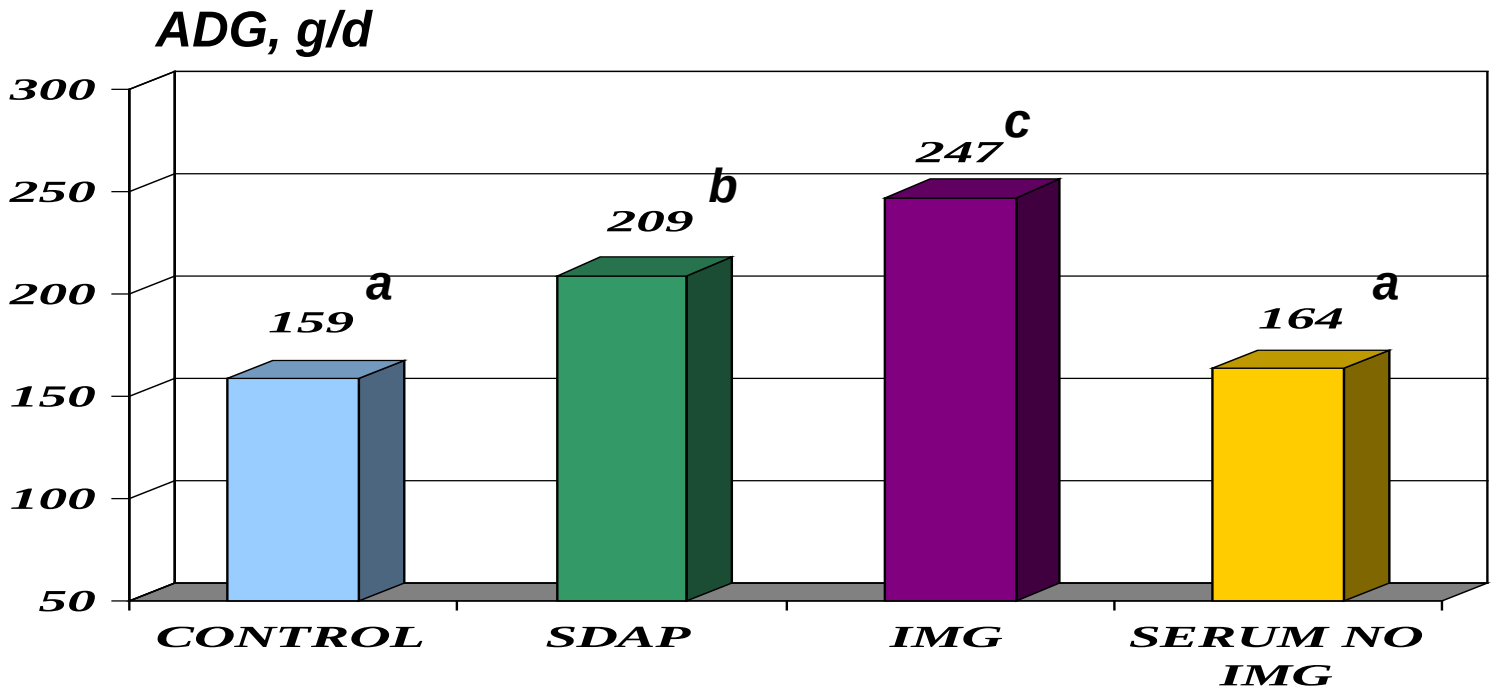
IMG = Globulin fraction
LMW = Low molecular weight fraction

3 trials, 45 pigs/ trial, 135 pigs, 19 days, 6 kg, 8 % SDAP

^{abc} P<0.05

Gatnau et al., 1995 ISU

MODE OF ACTION OF PLASMA
ADG, g/d 0-15 days



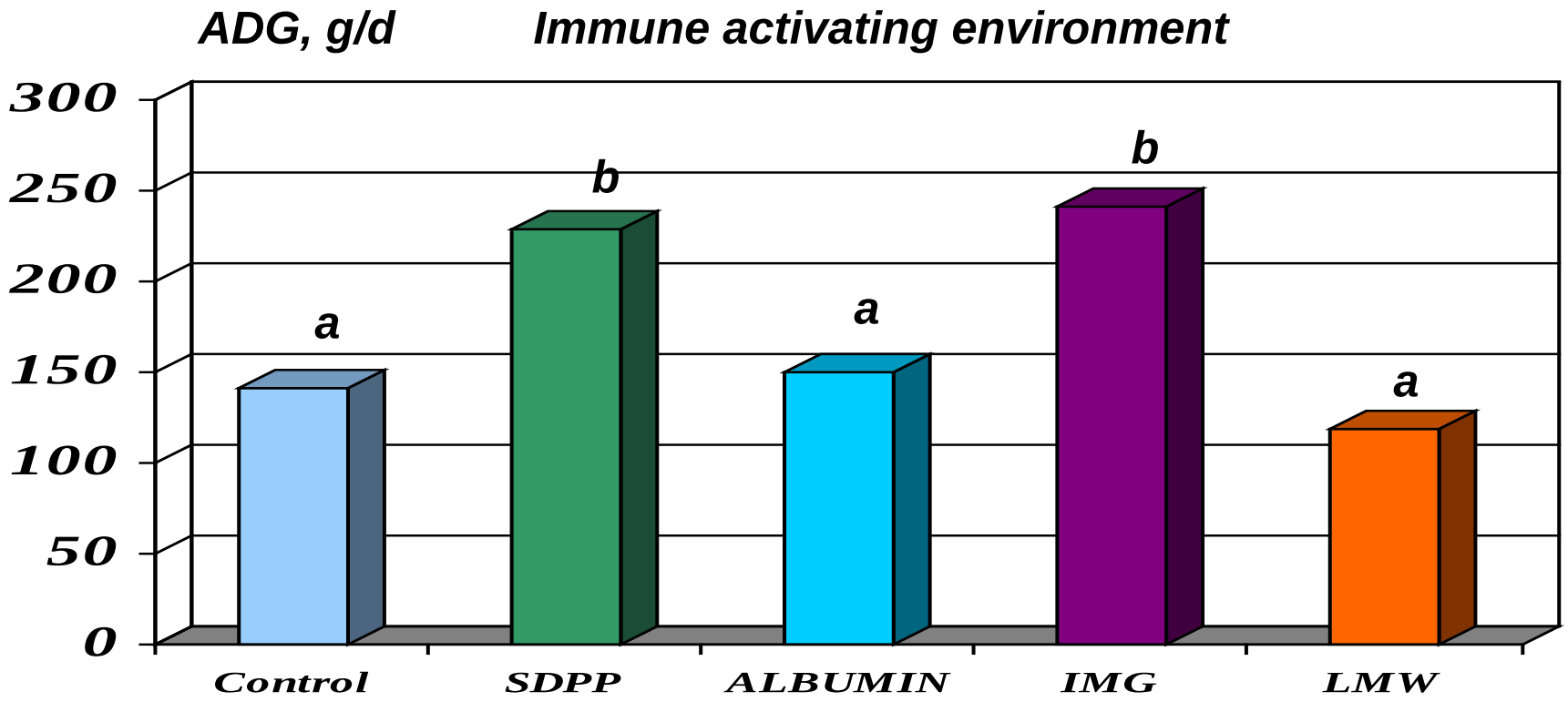
IMG = Globulin fraction

48 individual pigs, 25 days

^{abc} P<0.05

Cain and Zimmerman, 1997; ISU

MODE OF ACTION OF PLASMA
ADG, g/d 0-7 days



IMG = Immunoglobulin fraction
LMW = Low molecular weight fraction

16 pigs/ trt, 80 pigs, 21 days, 5.6 kg, 8 % SDAP

^{abc} P<0.05

Pierce et al., 2005 JAS 83:2876-85

Material and Methods

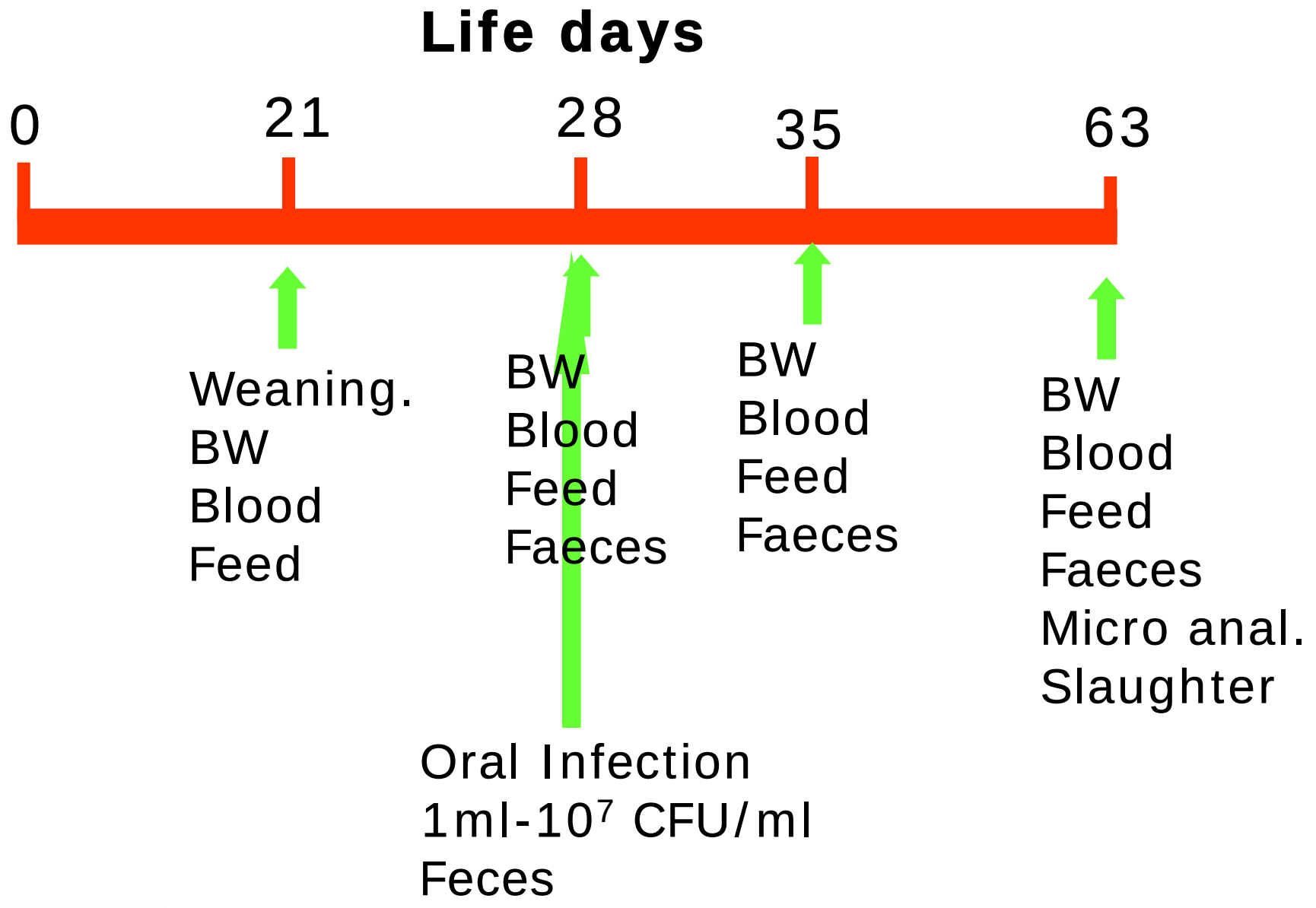
- European Eureka Project Immucon E!2452 between APC Europe and Nutrition Sciences N.V. (Vitamex group).
- Trial performed at pig experimental farm of Ghent University
- Experimental units:
  - Number of treatments: 5 groups:
    - Group Negative Control: Control diet (Wheat Gluten, WG) without Salmonella Challenge.
    - Group Positive Control : Control diet + Salmonella challenge
    - Group SDPP: SDPP (5%) replacing WG + Salmonella Challenge
    - Group Immunoglobulins Concentrate (IC): IC (0.7%) + Salmonella Challenge
    - Group Albumin fraction (AC): AC (2.41%) + Salmonella Challenge

Material and Methods

- Salmonella challenge on day 7 (1ml of a solution containing 7.7 x 10^7 cfu of *Salmonella Typhimurium*)
- Animals with experimental diets during the whole experimental period (42 days).
- Experimental diets: 17.5% Protein; 1.2% Lys; 0.7% Sulfur amino acids; 9.6 MJ/kg GE.
- Number of pens: 20 pens → 4 pens per treatment
- Number of piglets: 80 piglets → 4 per pen

Material and Methods

- Weaning:
  - At 21 days: Average initial weight of 6.93 kg per piglet.
  - Piglets were distributed according to their initial BW per treatments.
- Record keeping:
  - Individual weight of piglets and feed intake per pen: every week during the trial period:
    - ADG; ADFI, FCR and BW were determined for each period (7, 14 and 42 d)
  - Mortality
  - Faeces score
  - Serology : Presence of Ab against Salmonella
  - Salmonella shedding in faeces (rectal swabs from each animal twice a week)


Life days
0
21
28
35
63
Weaning.
BW
Blood
Feed
BW
Blood
Feed
Faeces
Oral Infection
1ml-10⁷ CFU/ml
Feces
BW
Blood
Feed
Faeces
BW
Blood
Feed
Faeces
Micro anal.
Slaughter

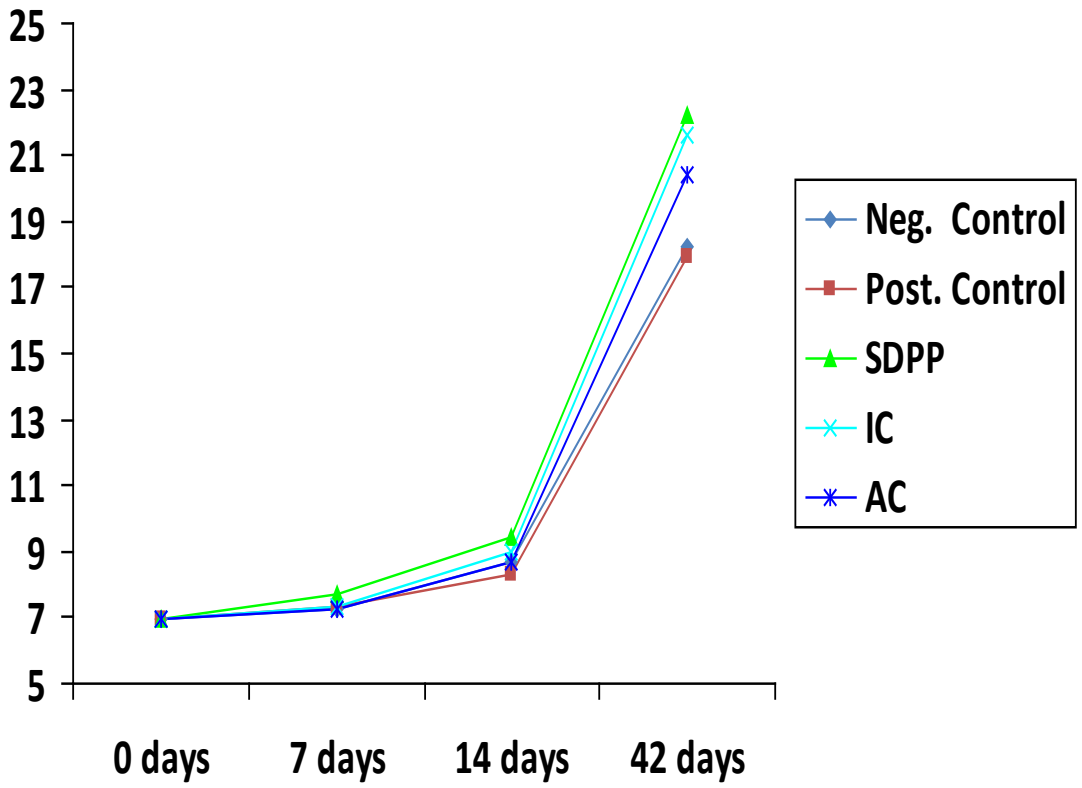
Composition of Blood Fractions

	SDPP	*AC*	*IC*
		Analysis nutrient g/kg	
Dry matter	946.1	946.4	950.9
Protein	764.8	765.4	868.8
Ashes	139.9	68.0	49.7
		Protein composition g/kg	
Albumin	260.8	541.9	34.8
Immunoglobulin	98.7	34.4	710.7

Ingredient, g/kg	*Control*	*SDPP*	*IC*	*AC*
Corn	277.67	277.67	277.67	277.67
Wheat meal	199.75	199.75	199.75	199.75
Barley	188.00	188.00	188.00	188.00
Soybean 45/5	155.1	155.1	155.1	155.1
Whey powder sweet	58.28	58.28	58.28	58.28
Wheat gluten	41.61	-	33.94	20.40
SDPP[a]	-	50.00	-	-
IC	-	-	6.94	-
AC	-	-	-	24.1
Choline 60	32.43	32.43	32.43	32.43
Limestone	10.78	13.56	10.91	10.68
Vegetable oil	8.84	8.84	8.84	8.84
l-lysine	6.56	3.38	5.88	4.93
l-threonine	2.27	1.22	2.13	1.79
dl-methionine	1.03	1.03	1.05	1.05
l-tryptophan	0.45	0.23	0.43	0.36
Salt	4.59	2.02	4.51	4.06
Mix Vit-Min.[b]	2.75	2.75	2.75	2.75

	Control	SDPP	IC	AC
Dry matter	892.0	890.1	891.8	891.2
Crude protein	174.0	175.0	174.1	173.5
Crude fibre	34.2	34.1	34.2	34.1
Fat	46.9	45.0	46.5	45.9
Ash	49.4	51.0	50.1	51.0
Starch	392.9	391.2	392.7	392.0
Sugars	68.2	68.2	68.4	68.2
ME (MJ kg^{-1})	13.6	13.5	13.6	13.6
Lys	12.0	12.3	11.9	12.1
Thr	7.9	8.4	8.0	8.2
Trp	2.3	2.5	2.3	2.4
Sulfur amino acids	6.8	7.3	6.9	7.0
Calculated plasma fractions, (g/kg):				
Albumin	0	13.04	0.24	13.06
Immunoglobulins	0	4.93	4.93	0.80

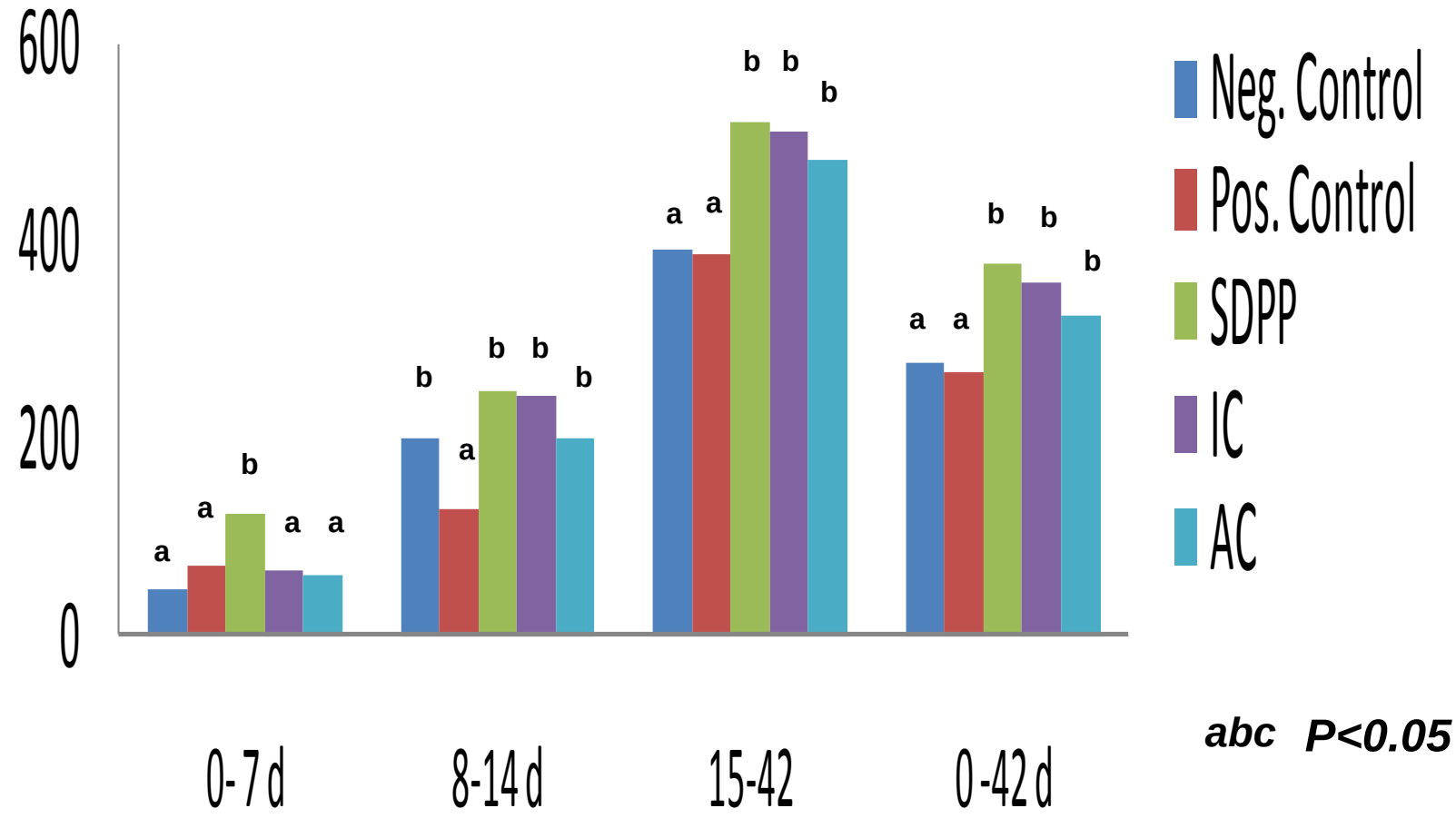
Body Weight Variation during the trial



- **Small differences observed at 14 days are much higher at 42 days**

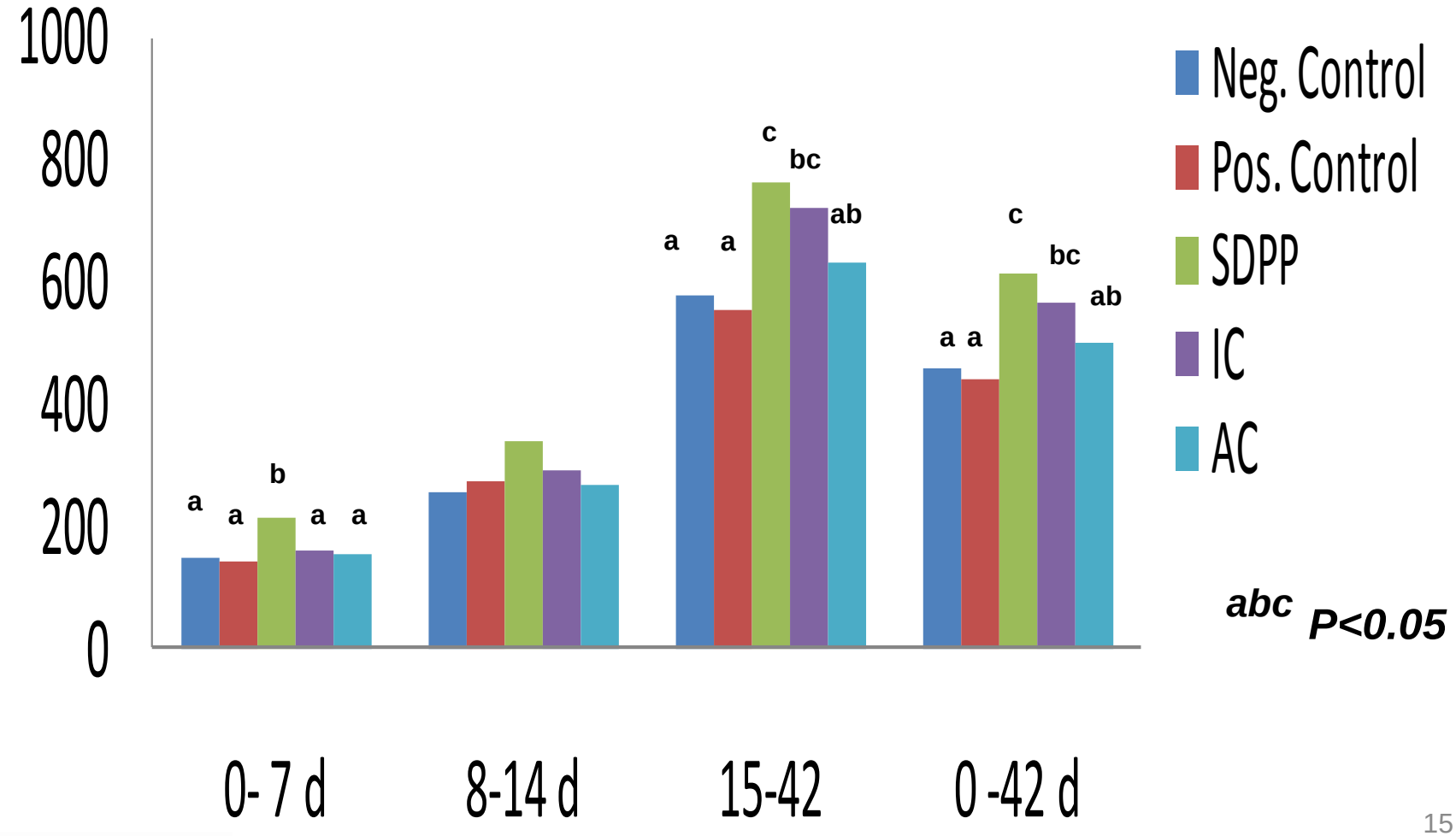
- **At 42 days, piglets in blood groups (SDPP, IC or AC) had between 3 to 4.5 Kg higher BW than control groups**

ADG (g/d) during experimental period

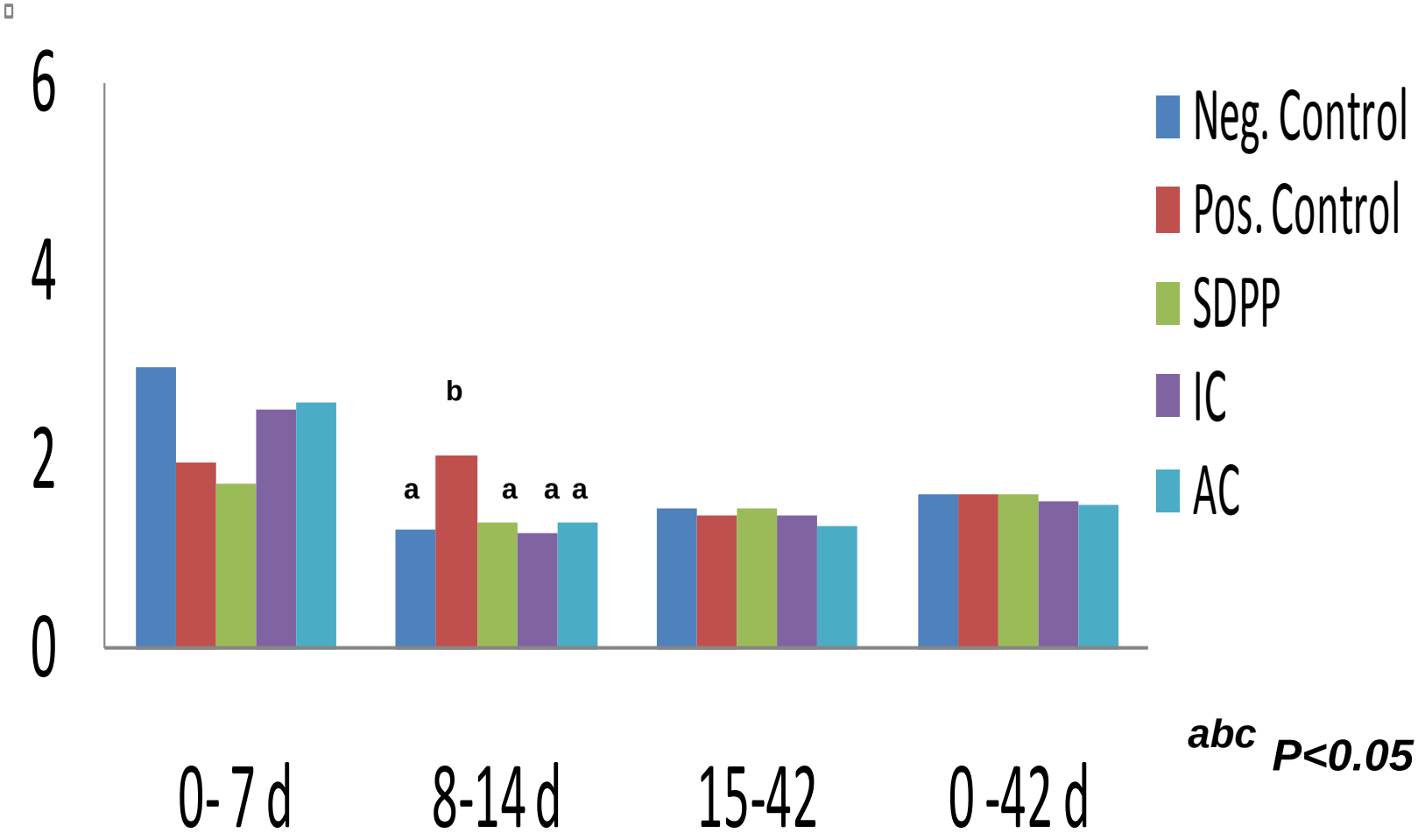


abc P<0.05

ADFI (g/d) during experimental period



FC (Feed/gain) during experimental period



Effect of IgG on the diets

	Without immunoglobulin	*With immunoglobulin*
Day 0 to 7		
ADG, g/d	59.9 1.3	92.4 2.3*
ADFI, g/d	147.2 1.5	180.5 3.2**
Feed:gain, g/g	2.46 0.3	2.04 0.4
Day 8 to 14		
ADG, g/d	173.1 2.4	245.9 2.2***
ADFI, g/d	254.4 4.8	312.9 6.6*
Feed:gain, g/g	1.47 0.18	1.27 0.06
Day 15 to 42		
ADG, g/d	420.8 3.6	515.9 3.3***
ADFI, g/d	587.1 5.1	745.0 6.3***
Feed:gain, g/g	1.39 0.09	1.44 0.08
Day 0 to 42		
ADG, g/d	290.9 2.3	367.2 3.9***
ADFI, g/d	465.9 3.8	587.7 8.3***
Feed:gain, g/g	1.60 0.03	1.60 0.03

Performance of weaning pigs fed diets in function of the presence of immunoglobulins in the diets (average ± SEM)
Comparison made by using Student *t*-test, *$P < 0.05$, ** $P < 0.01$, *** $P < 0.001$

Shedding of Salmonella in Faeces Over de Complete Trial

Group	*Positive*	*Negative*	*% Positive*
Negative Control	0	96	0
Positive Control	48	48	50
SDPP	8	88	8
IC	16	80	17
AC	24	72	25
X^2 All groups		$P < 0.001$	
SDPP vs IC		$P = 0.122$	
SDPP vs AC		$P < 0.001$	
IC vs AC		$P < 0.001$	

Bacterological and Serological Results

- No differences between treatments in Stomach, Ileum and Colon for:
  - Total Plate Count
  - Enterobacteriaceae
  - E.coli
  - Lactic acid bacteria

- None of the tested animals had antibodies againts *Salmonella* in their blood

Conclusions

- Blood products improve the performance parameters compare with the control treatments during the whole experiment.

- No differences for ADG comparing between blood products although numerically whole plasma was better than the other two fractions.

- Salmonella shedding was reduced by blood products. The higher reduction was obtained by SDPP followed by IC and AC.

Conclusions

- IgG is one of the key proteins responsible for plasma effect.
- Although, plasma effects is not only due to IgG fraction, other proteins and peptides present in plasma had effect on performance and improve health for piglets fed with SDPP.
- These data correlated with latest research that indicates that other proteins presents in plasma take a role on plasma effect. (Perez-Bosque et al., 2008)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