SHORT COMMUNICATION

Apparent and standardized ileal digestibility of amino acids in yeast extract and spray dried plasma protein by weanling pigs[1]

C. D. Mateo[2] and H. H. Stein[3]

Department of Animal and Range Sciences, South Dakota State University, Brookings, SD 57007, USA.
Received 30 September 2006, accepted 25 May 2007.

Mateo, C. D. and Stein, H. H. 2007. **Apparent and standardized ileal digestibility of amino acids in yeast extract and spray dried plasma protein by weanling pigs**. Can. J. Anim. Sci. **87**: 381–383. The objective of this experiment was to measure the apparent (AID) and standardized (SID) ileal digestibility of crude protein (CP) and amino acids (AA) in yeast extract and spray dried plasma protein (SDPP) by weanling pigs. A casein-based diet, a casein-SDPP diet, a casein-yeast extract diet, and a N-free diet were formulated and fed to weanling pigs. Values for AID and SID in yeast extract and SDPP were calculated using the difference procedure. Results showed that the AID for CP and all AA with the exception of Cys and Ser are similar between yeast extract and SDPP. Likewise, no differences in SID for CP or AA were observed between yeast extract and SDPP. The current data demonstrate that both yeast extract and SDPP contain protein that is relatively well digested by young pigs.

Key words: Amino acids, digestibility, pigs, spray dried plasma protein, yeast extract

Mateo, C. D. et Stein, H. H. 2007. **Digestibilité apparente et uniformisée des acides aminés de la levure et du sang séché par pulvérisation dans l'iléon des porcelets sevrés**. Can. J. Anim. Sci. **87**: 381–383. L'expérience devait établir la digestibilité apparente (DA) et uniformisée (DU) des protéines brutes (PB) et des acides aminés de l'extrait de levure et du sang séché par pulvérisation (SSP) dans l'iléon des porcelets sevrés. À cette fin, les auteurs ont préparé une ration à base de caséine, une ration de caséine et de SSP, une ration de caséine et d'extrait de levure et une ration sans N qu'ils ont servies à des porcelets sevrés. Ensuite, ils ont calculé la valeur de la DA et de la DU pour l'extrait de levure et le SSP par soustraction. Les résultats indiquent que la DA des PB et des acides aminés sauf la Cys et la Ser est semblable pour l'extrait de levure et le SSP. Ils n'ont pas non plus relevé de variation entre l'extrait de levure et le SSP pour ce qui est de la DU des PB et des acides aminés. Les données actuelles révèlent que l'extrait de levure et le SSP contiennent des protéines relativement bien assimilées par les porcelets.

Mots clés: Acides aminés, digestibilité, porcs, sang séché par pulvérisation, extrait de levure

Spray dried plasma protein (SDPP) is a commonly used protein source in diets fed to weanling pigs (Cho et al. 1997; Chae et al. 1999). It is produced by adding an anticoagulant to the blood from slaughtered animals. The erythrocytes are separated from the plasma by centrifugation and the plasma obtained is then spray-dried to produce the final product called SDPP (Howell and Lawrie 1983). An alternative non-animal protein source that is currently being introduced to the market is yeast extract, which is derived from yeast cell contents by removing the cell wall from the yeast cells (Tibbets 2002). Yeast extract contains 48.8% crude protein (CP) and relatively high quantities of amino acids (AA) and nucleotides. The inclusion of yeast extract in diets fed to weanling pigs has been reported to improve pig performance and intestinal health (Maribo 2003; Carlson et al. 2005). It was also observed that subsequent grower and finisher performance was improved for pigs that were fed yeast extract during the nursery phase (Carlson et al. 2005). As a consequence, there is considerable interest in using SDPP and yeast extract in diets fed to weanling pigs. However, apparent (AID) and standardized (SID) ileal digestibility values for CP and AA in yeast extract have not been reported. Digestibility values for AA in SDPP have been reported on a few occasions (Cho et al. 1997; Chae et al. 1999; Gottlob et al. 2006), but these values were measured in growing pigs, and it is not known if they are also representative of values for AID and SID in weanling pigs. It was,

[1]*Financial support for the current work from Altech Inc., Nicholasville, KY, is greatly appreciated.*
[2]*Current address: Rural Technologies Inc., Brookings SD, 57006.*
[3]*Correspondence and current address: University of Illinois, Department of Animal Sciences, 1207 W. Gregory Dr. Urbana IL, 61801 (phone: 217-333-0013; fax: 217-333-7088; email: hstein@uiuc.edu).*

Abbreviations: **AA**, amino acids; **AID**, apparent ileal digestibility; **CP**, crude protein; **SDPP**, spray dried protein plasma; **SID**, standardized ileal digestibility

therefore, the objective of this experiment to measure AID and SID for CP and AA in yeast extract and SDPP fed to weanling pigs.

Eight nursing barrows (13 d of age; initial BW: 5.0 ± 0.8 kg) originating from the matings of SP-1 boars to Line 13 sows (Ausgene International Gridley, IL) were surgically fitted with a T-cannula in the distal ileum. Following surgery and after a recuperation period of 12 h, pigs were returned to their dams and weaned at 21 d of age. They were then housed individually in 1.2 × 1.8-m pens with solid sidings and a slatted floor. Each pen was equipped with a feeder and a nipple drinker. Room temperature was maintained at 22°C. A heating lamp was installed in each pen allowing pigs to maintain a local temperature of 28–30°C. The experiment was reviewed and approved by the Institutional Animal Care and Use Committee at South Dakota State University (#04-A026).

Four experimental diets were prepared. These diets were formulated to contain 0.9% Ca and 0.7% P. One diet was based on 22.4% casein (Acid Casein®, Murray Goulburn Co-operative Co. Ltd. Melbourne, Australia). Two additional diets contained 11.4% casein and either 13.0% SDPP (Appetein®, American Protein Corporation, Inc., Ankeny, IA) or 20.3% yeast extract (NuPro™, Alltech, Inc., Nicholasville, KY). A N-free diet was formulated as well. All diets contained Solka floc (3%), dextrose (5%), sucrose (10%), lactose (20%), and soybean oil (3%). Cromic oxide (0.4%) was included in all diets as an inert marker, and vitamins and minerals were included at levels that met or exceeded current requirement estimates for 5–10 kg pigs (NRC 1998). Cornstarch was included in all diets at varying quantities to make all ingredients add up to 100%. The analyzed concentrations of CP in the four diets were 19.8, 19.1, 19.3, and 0.26% for the casein diet, the casein-SDPP diet, the casein-yeast extract diet, and the N-free diet, respectively. Feed and water were provided to each pig on an ad libitum basis throughout the experiment.

Following weaning, pigs were allowed a 1-wk adjustment period before the experiment was initiated. During this time, they were fed a casein-based experimental diet (20% CP). They were then allotted to a replicated 4 × 4 Latin square design with four periods and four animals in each square. Each period lasted 7 d. The initial 5 d of each period was considered an adaptation period to the diet, but ileal digesta were collected for 10 h on days 6 and 7 as described by Stein et al. (2006). At the conclusion of the experiment, ileal digesta samples were thawed and pooled within animal and diet, and a sub-sample was taken for chemical analysis. Samples of diets and digesta were analyzed for DM, CP, chromium, and AA using analytical procedures as described by Stein et al. (2006).

Values for AID were calculated for CP and AA in each of the protein containing diets as previously described (Stein et al. 2006). The basal endogenous losses were estimated from pigs fed the N-free diet, and values for AID were then corrected for endogenous losses to calculate SID for each diet

Table 1. Apparent (AID) and standardized (SID) ileal digestibility (%) of CP and AA in spray dried plasma protein (SDPP) and yeast extract fed to weanling pigs[z]

Procedure:	AID				SID[y]			
Item Ingredient	SDPP	Yeast extract	SEM	*P* value	SDPP	Yeast extract	SEM	*P* value
CP	78.8	75.9	4.16	0.62	86.5	85.4	4.01	0.85
Indispensable AA								
Arg	88.3	82.1	3.29	0.20	92.4	89.3	3.41	0.53
His	85.5	77.7	3.37	0.12	89.4	83.7	3.33	0.25
Ile	84.3	77.9	5.02	0.38	91.4	84.0	4.85	0.30
Leu	86.0	83.1	3.43	0.55	90.0	88.8	3.33	0.80
Lys	83.5	78.6	3.62	0.35	86.9	84.7	3.58	0.67
Met	85.1	86.3	5.53	0.87	90.9	91.0	5.42	0.99
Phe	86.7	83.4	3.19	0.47	91.0	89.3	3.11	0.70
Thr	78.1	68.4	4.39	0.14	82.6	76.5	4.18	0.31
Trp	79.1	70.6	3.08	0.07	83.7	80.4	2.78	0.41
Val	79.4	74.7	4.36	0.46	84.6	82.8	4.27	0.77
Dispensable AA								
Ala	72.0	68.2	3.30	0.43	78.9	77.7	3.14	0.79
Asp	74.1	70.4	4.33	0.55	78.8	77.9	4.28	0.88
Cys	73.7*a*	58.3*b*	2.46	0.01	79.0	78.9	2.34	0.97
Glu	75.8	81.6	5.26	0.45	80.2	85.6	5.10	0.46
Gly	66.7	63.5	3.36	0.51	83.7	85.3	3.49	0.74
Pro	82.3	75.1	5.05	0.33	100.8	96.4	7.91	0.69
Ser	77.8*a*	67.1*b*	3.33	0.04	83.0	77.1	3.13	0.20
Tyr	86.4	84.5	3.14	0.66	90.4	90.2	2.99	0.97

[z]Data are means of eight observations per treatment.

[y]Values for SID were calculated by correcting values for AID for basal endogenous losses that were measured at the following quantities (g kg^{-1} DMI): CP, 17.19; Arg, 0.51; His, 0.26; Ile, 0.53; Leu, 0.83; Lys, 0.66; Met, 0.17; Phe, 0.49; Thr, 0.76; Trp, 0.16; Val, 0.74; Ala, 0.74; Asp, 1.03; Cys, 0.19; Glu, 1.32; Gly, 1.20; Pro, 2.27; Ser, 0.66; Tyr, 0.41.

a, *b* Values within a row and a procedure lacking a common letter are different ($P < 0.05$).

(Stein et al. 2006). By subtracting the contributions from casein to the casein-SDPP and the casein-yeast extract diets, the AID and the SID for CP and AA in SDPP and yeast extract, respectively, were calculated using the difference procedure (Fan and Sauer 1995).

Data were analyzed using the PROC MIXED procedure in SAS (SAS Institute, Inc., Cary, NC). Data for the two ingredients were compared using an ANOVA. Ingredient was the fixed effect and pig and period were random effects. Least square means were calculated and separated using the PDIFF option in SAS. The pig was the experimental unit for all analyses and an alpha value of 0.05 was used to assess significance between treatments.

The AID for Cys and Ser in SDPP was greater ($P < 0.05$) than in yeast extract (73.7 vs. 58.3% and 77.8 vs. 67.1%, respectively), but for all other AA, no differences between the two ingredients were observed (Table 1). The low AID for Cys and Ser in yeast extract are probably caused by the low concentration of these AA in yeast extract. Values for SID of Lys, Met, Thr, and Trp were 86.9 and 84.7%, 90.9 and 91.0%, 82.6 and 76.5%, and 83.7 and 80.4% for SDPP and yeast extract, respectively. None of these values were different between the two ingredients. Likewise, for CP and the remaining AA, no differences in SID between SDPP and yeast extract were observed.

The values for AID obtained for most AA in SDPP were similar to values reported from previous studies (Cho et al. 1997; NRC 1998; Chae et al. 1999). The AID for Met in SDPP reported by NRC (1998) is only 64%, which is much lower than the value obtained in the present experiment (85.1%), but the AID for the remaining indispensable AA concur with the values reported by NRC (1998). However, the values for both AID and SID in SDPP obtained in the present experiments are lower than the values reported by Gottlob et al. (2006). The values presented by Gottlob et al. (2006) were measured in pigs that weighed more than 30 kg, but, in the present experiment, values were measured in weanling pigs. Endogenous AA losses decrease as pigs become older (Leterme and Thewis 2004), which results in lower calculated values for AID and SID in young pigs compared with older pigs. The reason for the lower values for AID and SID obtained in this experiment as compared with the experiment by Gottlob et al. (2006) may, therefore, be the difference in the weight of the pigs used in the two studies.

In conclusion, values for AID and SID in yeast extract and SDPP fed to weanling pigs were measured. Such values have never before been available. Results suggest that CP and AA in yeast extract and SDPP are relatively well digested by weanling pigs. For most AA, no differences between the two feed ingredients were observed.

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