Effect of microbial phytase on apparent digestibility of amino acids and minerals in diet of female broiler chickens

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Introduction Phytic acid is the main storage form of P in grains and seeds. Cereals and grain legumes that are commonly used as poultry feed ingredients have similar phytate levels, approximating 0.25 percent of dry matter (Ravindran et al., 1995). There is not enough phytase activity in the digestive tract of chickens to digest phytate (Maenz and Classen, 1998). Phytate contributes to environmental pollution by reducing mineral and N bioavailability. The capacity of phytic acid to bind minerals reduces the utilization of P, Ca, Zn, Fe and N from plant ingredients by chickens (Sell et al., 2000). Phytate may form complexes with proteases, such as trypsin and pepsin in the gastrointestinal tract (Singh and Kricorian, 1982). These complexes may reduce the activity of digestive enzymes with a subsequent decrease in the digestibility of dietary proteins. It has been reported that microbial phytase improves the utilization of amino acids (Ravindran et al., 1999) and minerals in broiler chicks. The objective of the present study was to evaluate the effect of microbial phytase on the apparent digestibility of amino acids (AA) and some minerals in the diet of female broiler chickens.

Materials and methods 240 day-old female chicks of a commercial strain (Ross 308) were wing banded**,** weighed and randomly allocated to six treatment groups with four replicates of 10 chicks in each floor pen. The treatments involved supplementation of 0, 250, 500, 750, 1000 and 1250 FTU microbial phytase/kg of a commercial diet from 0 – 28 days of age. Ca, available and total P levels in the diet were 1.0, 0.46 and 1.0 % respectively. During days 21 to 24, excreta from 4 birds of each replicate were totally collected after transferring to battery cages. The excreta were freeze-dried, weighed and ground through a 1 mm mesh screen. Excreta and feed samples were hydrolyzed for 24 h with 6 M HCl at 110C for the determination of AA by HPLC using the Pico-Tag system. Ca, Fe and Zn levels were determined by atomic absorption spectrophorometry after wet acid digestion with concentrated HNO_3. Total P levels were determined by spectrophotometry at 400 nm after digestion with H_2SO_4. Analysis of variance and Duncan's new multiple range test were conducted using the GLM procedure of SAS (SAS Inc., 1988) appropriate for a completely randomized design.

Results Microbial phytase had a significant effect (P<0.05) on apparent digestibility of nondispensable amino acids (except threonine, alanine and valine), Fe and Zn. As shown in Table 1, 250 and 500 FTU of phytase/kg of diet, significantly increased apparent digestibility of amino acids but higher levels of phytase caused poorer digestibility. Phytase had no significant effect (P>0.05) on P and Ca apparent digestibility but increased apparent digestibility of Fe and Zn at the level of 250 FTU.

Table 1 Effect of microbial phytase on apparent digestibility of amino acids and minerals in female broiler chickens

Phytase	Amino acids (%)									Minerals (%)			
(FTU)	LYS	LEU	ILE	HIS	THR	ARG	ALA	VAL	PHE	Ca	P	Fe	Zn
0	88.1^{b}	86.4^{b}	84.3^{b}	88.0^{d}	86.0	91.4^{c}	86.2	79.8	87.2^{b}	54.5	77.4	70.6^{b}	62.7^{b}
250	92.2^{a}	90.4^{a}	89.1^{a}	92.4^{ab}	88.0	95.1^{ab}	85.7	84.1	91.4^{a}	56.0	80.0	79.3^{ab}	72.7^{ab}
500	93.1^{a}	90.8^{a}	89.5^{a}	93.2^{a}	88.6	96.0^{a}	85.7	84.3	91.8^{a}	55.1	81.4	78.7^{ab}	71.3^{ab}
750	90.1^{ab}	88.1^{ab}	86.0^{ab}	89.7^{cd}	84.2	92.4^{bc}	82.9	83.3	89.1^{ab}	54.9	79.3	76.8^{ab}	72.2^{ab}
1000	91.4^{ab}	88.5^{ab}	86.1^{ab}	90.8^{abc}	86.4	94.5^{ab}	82.1	83.0	90.3^{ab}	55.8	78.6	78.7^{ab}	71.2^{ab}
1250	90.7^{ab}	88.9^{ab}	87.1^{ab}	90.0^{bcd}	86.9	93.7^{abc}	88.5	83.9	90.4^{ab}	57.2	80.0	86.3^{a}	74.4^{a}
SE	0.99	0.96	1.10	0.81	1.73	0.83	3.24	1.98	1.03	1.2	1.6	3.9	3.3

^{abc} Means in the same column with a different superscript are significantly different (P<0.05)

Conclusions The results under the conditions of this study indicated that supplementation of 250 FTU phytase/kg of a commercial diet increased apparent digestibility of more essential amino acids, Fe and Zn in female broiler chickens.

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