Differences in Intestinal Absorptive Capacity of Chickens for D-Xylose

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Abstract:

BACKGROUND: According to literature, there are differences among different species of animals in respect to absorption of D-xylose. **OBJECTIVES:** In two experiments, the differences that might exist in absorptive capacity of small intestine for D-xylose, in different types of chicken were tested. **METHODS:** In experiment one, 2 groups of nine adult layer type males (48 weeks) and females (58 weeks), and in experiment two, 4 groups of ten young (4 week) broiler type or layer type male or female chickens were dosed D-xylose solution (50 mg/mL, 500 mg/kg BW), orally. One blood sample before, and 5 others immediately after the administration of D-xylose solution, were taken from wing vein of the birds at 30 minute intervals for 150 minutes, and the concentration of D-xylose in plasma was measured. **RESULTS:** In experiment one, D-xylose concentration reached its peak at 60 to 90 min in both adult males and females, and followed a quadratic trend with time (r^2 for adult males = 0.735 and adult females = 0.801). In experiment two, D-xylose concentration reached its peak at 60 min for all experimental groups and followed a quadratic trend with time (r^2 for broiler type male = 0.681, broiler type female = 0.850, layer type male = 0.695 and layer type female = 0.748). **CONCLUSIONS:** D-xylose test was shown to be a sensitive tool for the evaluation of intestinal absorption capacity of chicken. This test revealed that there were some differences in absorption function of intestine among the birds with different breeds, sexes, ages, and nutritional demands.

Introduction

Literature indicates that there are some differences in metabolisable energy (ME) values and digestibility coefficients of a same dietary ingredient between broiler and table egg layer strains of chickens (Spratt and Leeson, 1987) as well as between broilers of different ages (Flores et al, 1994; Wiseman and McNab, 1997; Zelenka, 1997). These differences might, in part, be due to differences in intestinal absorption rate of a nutrient among birds with different dietary needs and/or physiological and environmental status.

D-xylose absorption test has proven to be a useful indicator of intestinal absorptive function in animals (Sorensen et al., 1997; Rutgers, 2005; Semrad, 2005). In healthy animal, D-xylose passes the intestinal brush border membrane via trans-cellular pathway as well as diffusion and/or solvent drag through para-cellular pathway (Sadowski and Meddings, 1993, Scharrer and Grenacher, 2000; Chediack et al., 2003; Chang and Karasov, 2004; Chang et al., 2004). Small intestine of chicken absorbs D-xylose almost completely, thus any change in plasma concentration of D-xylose over a 3-h period is quite indicative of absorption capacity of intestinal tract (Schutte et al.,

1991; Doerfler et al., 2000).

The objective of the study presented here was to demonstrate the differences that might exist in the absorptive function of small intestine for D-xylose between broiler and layer type chickens. The existence of a difference in absorptive function of small intestine explains, at least in part, the difference in ME values and digestibility coefficients of dietary ingredients among the broiler and layer type chickens, laying hens and adult cockerels.

Materials and Methods

This study was conducted in two consecutive experiments at the Poultry Station, Veterinary Research Institute, Faculty of Veterinary Medicine, University of Tehran, Tehran - Iran.

The experimental procedure was approved by the Animal Research Committee of the University of Tehran.

The experiment one had two groups of adult birds (Group 1): Nine 48-wk-old layer-type males (ALTM) (Hy-Line W36), with mean body weight of 2057g ± 166 and Group 2: Nine 58-wk-old layer females (ALTF) (Hy-Line W36), with mean body weight of 1595g ± 202. All birds were kept individually in raised floor wire cages, 30×40×40 cm in dimension, 7 days before sampling in order to adapt to the new environmental condition. Both groups had free access to fresh water and their respective commercial maize-soy meal based diets (Table1). Diets were formulated according to the nutrient requirements of white laying type males or females (NRC, 1994) and met or exceeded all nutrient requirements of the birds.

Experiment 2 had four groups of 10 individually identified one-day old chicks as follows: Group 1 and 2, broiler type males and females (YMTM, YMTF) (Ross 308) with mean body weight of 42g ± 2, Group 3 and 4, layer type male and females (YLTM, YLTF) (Hy-Line W36) with mean body weight of 33g ± 2. All birds had free access to fresh water and the same commercial maize-soy meal based diet with 2970 kcal/kg ME and 200g/kg crude protein, from day one (Table 1). The D-xylose absorption test was carried out on day 28.

All experimental birds were apparently healthy and survived the experiment.

D-Xylose Administration and Measurement in Plasma: Food and water were removed from each group of birds 12h prior-to the first collection of blood. All birds were weighed individually and given D-xylose solution (50mg/ml of de-ionized water, Fluka BioChemika 95731, Fluka Chemie AG, Buchs, Switzerland.) at the dose of 500 mg/kg of body weight via an oral gavage. One-blood sample before, and 5 others after the administration of the test material, were collected by wing (ulnar) vein puncture using heparinized micro-haematocrit capillary tubes (Code - No 9100260, Hirschmann Laborgerate Techcolor, Germany), at 30 minute intervals for 150 minutes. All tubes were centrifuged and plasma was collected. The concentration of D-xylose in plasma was measured according to the method of Eberts et al. (1979) and modified by Goodwin et al. (1984), using a spectrophotometer (Model 6100, Jenway LTD, Felsted, Dunmow, Essex, England, UK), set at 554nm.

Statistical Analysis: Analysis of data was carried out using one-way analysis of variance (ANOVA) of Minitab system (Minitab 13.2 statistical package, Minitab Inc. State College, 2000). Polynomial regression analysis was used to investigate the relationship between D-xylose level and time using the following model (Kaps and Lamberson, 2004):

$Yi = \beta 0 + \beta 1xi + \beta 2x2i + \varepsilon i$

Where:

Yi = observation i of dependent variable Y (D-xylose level)

xi = observation i of independent variable x (time)

$\beta 0, \beta 1, \beta 2$ = regression parameters

εi = random error

All statements of significance were based on a probability of $p<0.05$.

Results

In experiment one, the plasma concentration of D-Xylose in both ALTM and ALTF reached its peak at 60 to 90 min after the administration of the test material. Absorption of D-xylose showed a quadratic trend with time in both ALTM and ALTF ($r^2 = 0.735$ and 0.801, respectively). However, ALTF had a higher trend of absorption.

In experiment two, the plasma D-xylose concentration reached its peak 60 minutes after the

Table 1. The ingredients and chemichal composition of the diets. (*) Vitamin and mineral premix supplied per kg of diet; Vit A (Retinyl Acetate) 17.6mg, Vit D3 (Cholecalciferol) 5mg, Vit E (Alfa-Tocopherol Acetate) 22mg, Vit B1 (Thiamine Mononitrate) 1.5mg, Vit B2 (Riboflavin) 4.0mg, Vit B3 (Niacin) 35mg, Vit B5 (Calcium Panthotenate) 8mg, Vit B6 (Pyridoxine HCL) 2.5mg, Vit B12 (Cyanocobalamin) 0.01mg, Biotin 0.15mg, Folic Acid 0.48mg, Cholin Chloride 400mg, Vit K3 2.2mg, Manganese 75mg, Iron 75mg, Zinc 64.8mg, Copper 6.0mg, Iodine 0.87mg, Selenium 0.2mg. (**) The vitamin and mineral premix supplied per kg of diet; Vit A A (Retinyl Acetate) 24mg, Vit D3 (Cholecalciferol) 6mg, Vit E (Alfa-Tocopherol Acetate) 36mg, Vit B1 (Thiamine Mononitrate) 1.8mg, Vit B2 (Riboflavin) 6.6mg, Vit B3 (Niacin) 30mg, Vit B5 (Calcium Panthotenate) 10mg, Vit B6 (Pyridoxine HCL) 3mg, Vit B12 (Cyanocobalamin) 0.015mg, Biotin 0.1mg, Folic Acid 1.0mg, Cholin Chloride 500mg, Vit K 2mg, Manganese 99.2mg, Iron 50mg, Zinc 84.7mg, Copper 10mg, Iodine 1mg, Selenium 0.2mg.

Ingredients (g/kg)	Female Layer Diet	Male Layer Diet	Chick Diet
Corn	548	400	600
Barley	0	390	0
Soy-Bean Meal (44% CP)	270	115	315
Corn Gluten (60% CP)	10	5.5	10
Wheat Gluten (72% CP)	4	2	9.8
Wheat Bran	0	52	0
Vegetable Fatty Acid	40	0	28
Oyster Shell	103	13	15
Methionine (99%)	1.3	0.5	1.3
Lysine Hydrochloride (78%)	0.7	0	0.3
Mono-Calcium Phosphate	10.5	10	10
Calcium carbonate	3.8	2.5	1.75
salt	2.55	2.55	2.9
Na Bicarbonate	1.0	0.8	0.8
Vit+Min Premix	5*	5*	5**
Phytase	0.15	0.15	0.15
Nutrient Composition (Calculated)			
Metabolisable Energy (kcal/kg)	2820	2710	2970
Crude Protein	161	132	200
Total Fat	41.4	26.1	43.0
Crude Fiber	29.2	47.2	36.4
Methionine	4.5	3.2	4.9
Lysine	8.3	6.2	11.3
Methionine + Cysteine	7.3	5.5	8.3
Total Calcium	41.8	9.1	9.6
Total Phosphorus	5.5	5.8	5.8
Available Phosphorus	4.5	4.5	4.5
Sodium	1.8	1.7	1.7

Table 2. plasma D-xylose concentration (mg/dl) of adult layer type male (48 weeks old) and female chickens (58 weeks old) after an administration of D-xylose solution (500 mg/kgBW), on 30min intervals, for 150min. *, Mean ± Standard Error of the Mean (n=9); ALTM, Adult Layer Type Males; ALTF, Adult Layer Type Females; 1, Regression coefficient value for the quadratic fitted line.

	0min	30min	60min	90min	120min	150min
ALTM	0	25.1±2.61*	37.5±2.20	33.4±1.81	30.2±2.11	25.7±2.40
ALTF	0	21.3±2.07	44.8±2.70	45.9±2.92	38.1±2.57	37.0±3.21

Statistical Significance (Polynomial Regression Line Plot)							
	Linear		Quadratic		Cubic		
	F ratio	p value	F ratio	p value	F ratio	p value	R2 value1
ALTM	12.2	0.001	96.8	0.001	42.1	0.001	0.735
ALTF	27.8	0.001	109.1	0.001	14.3	0.001	0.801

Table 3. plasma D-xylose concentration (mg/dl) of young meat and layer type male and female chickens (28 days old) after an oral administration of D-xylose solution (500 mg/kgBW), on 30min intervals, for 150min. *, Mean ± Standard Error of the Mean (n=10); YMTM, Young Meat Type Males; YMTF, Young Meat Type Females; YLTM, Young Layer Type Males; YLTF, Young Layer Type Females; 1, Regression coefficient value for the quadratic fitted line.

	0min	30min	60min	90min	120min	150min	
YMTM	**0**	**69.0±2.5***	**70.5±3.51**	**58.2±4.17**	**52.2±3.03**	**39.6±2.39**	
YMTF	**0**	**44.1±4.56**	**61.2±3.00**	**60.9±4.46**	**53.1±4.37**	**41.0±2.03**	
YLTM	**0**	**49.0±3.36**	**53.8±2.20**	**40.2±1.34**	**34.7±1.70**	**23.5±1.28**	
YLTF	**0**	**60.4±5.33**	**77.8±3.87**	**58.1±3.02**	**41.2±2.20**	**26.8±2.17**	
Statistical Significance (Polynomial Regression Line Plot)							
	Linear		**Quadratic**		**Cubic**		
	F ratio	**p value**	**F ratio**	**p value**	**F ratio**	**p value**	**R2 value1**
YMTM	**4.4**	**0.043**	**77.5**	**0.001**	**62.4**	**0.001**	**0.681**
YMTF	**17.0**	**0.001**	**137.6**	**0.001**	**10.9**	**0.002**	**0.850**
YLTM	**1.2**	**0.280**	**98.8**	**0.001**	**82.1**	**0.001**	**0.695**
YLTF	**0.6**	**0.436**	**128.3**	**0.001**	**68.7**	**0.001**	**0.748**

administration of test material. The trend of absorption showed a quadratic correlation with time for all experimental groups (r^2 = 0.850 for YMTF, r^2 = 0.748 for YLTF, r^2 = 0.695 YLTM and r^2 = 0.681 for YMTM). However, YMTM and YLTF had the highest, and YLTM had the lowest trend of D-xylose absorption.

Discussion

The results of experiment one and two showed differences in the concentration of plasma D-xylose between layer type males and females (Table 2,3), indicating the existence of a variation in absorptive capacity of intestinal epithelial cells for D-xylose. This variation might be due to a number of factors such as type of diet, sex, age and more importantly, higher demand of females for dietary nutrients because of egg production.

Type of diet might have an important role on the absorption capacity of intestine in experiment one as the diet for ALTF had higher ME (2820 versus 2710 kcal/kg) and crude protein (161 versus 132g/kg) and lower crude fiber (29.2 versus 47.2 g/kg) than ALTM diet. Type and amount of dietary fiber affects the ME values, digestibility coefficients and intestinal absorption rates of nutrients including glucose and fructose in chicken (Longe and Ogedegbe, 1989; Jorgensen et al. 1996). Yaghobfar (2001) determined the differences in the energy utilization of adult hens and cockerels of a layer (Rhode Island Red) and a broiler line (Cornish). The author showed that females of both genetic lines utilized the energy content of maize more efficiently than males.

The possible influence of dietary type on the absorption capacity of intestine was excluded in experiment 2, and all experimental groups received the same dietary ration. It was noted that YMTM and YLTF had higher trends of D-xylose absorption when compared with YLTM, suggesting the level of demand for dietary nutrients had a major impact on absorptive function of small intestine. The higher trend of absorption of ALTF in experiment one, and YMTM and YLTF in experiment two, was likely related to the higher nutritional demands for fast body growth or egg production. On the other hand, ALTM in experiment one as well as YLTM in experiment 2 had lower trends of absorption compared to the other groups. This was possibly due to the lower nutritional demands for body growth and/or sperm production and mating.

Age might also be responsible for the variations in intestinal absorption capacity of D-xylose, to some extent. Although no statistical analysis was carried out between, experiment one and two, the experimental groups in experiment one had lower trends of D-xylose absorption when compared with the similar groups in experiment two.

Age affects the xylose and glucose absorption rates in rats, mice, dogs and horses, as after the administration of D-xylose, younger animals have a higher concentration level of plasma D-xylose than older animals (March and Biely, 1971; Chen et al., 1990; Ferraris, 1997; Weber et al., 2002; Semrad,

2005). It is possible that the carrier-mediated transport of D-xylose in older birds is less active than that of younger birds. Yuasa et al. (1995a,b, 1997) in a series of studies on the effect of ageing on the gastrointestinal absorption in rat, reported that the carrier-mediated transport of the sugar declined with ageing. The small intestinal transit time in old rats (171 min) was about twice that in young rats (78 min). So, if it is true for birds, it may be concluded that shorter intestinal transit time in younger birds leads to earlier absorption of orally administered D-xylose.

In conclusion, D-xylose test was shown to be a sensitive tool for the evaluation of intestinal absorption capacity of chicken. This test showed some variations in absorption function of intestine among the birds with different breeds, sexes, ages, and nutritional demands. Variations in the absorptive function of small intestine explains, to some extent, the differences in ME values and digestibility coefficients of dietary ingredients in different types of chickens.

References

1. Chang, M.H., Karasov, W.H. (2004) How the house sparrow Passer domesticus absorbs glucose. J. Exp. Biol. 207: 3109-3121.
2. Chang, M.H., Chediack, J.G., Caviedes-Vidal, E., Karasov, W.H. (2004) L-glucose absorption in house sparrows (Passer domesticus) is nonmediated. J. Comp. Physiol. (B). 174: 181-188.
3. Chediack, J.G., Caviedes-Vidal, E., Fasulo, V., Yamin, L.J., Karasov, W.H. (2003) Intestinal passive absorption of water-soluble compounds by sparrows: effect of molecular size and luminal nutrients. J. Comp. Physiol. (B). 173: 187-197.
4. Chen, T.S., Currier, G.J., Wabner, C.L. (1990) Intestinal transport during the life span of the mouse. J. Gerontol. 45: 129-133.
5. Doefler, R.E., Cain, L.D., Eden, F.W., Parkhurst, C.R., Qureshi, M.A., Havenstein, G.B. (2000) D-Xylose absorption as a measurement of malabsorption in poult enteritis and mortality syndrome. Poult. Sci. 79: 656-660.
6. Eberts, T.J., Sample, R.H.B., Glick, M.R., Ellis, G.H., (1979) A simplified, colorimetric micromethod for xylose in serum or urine, with phloroglucinol. Chem. 25: 1440-1443.
7. Ferraris, R.P. (1997) Effect of aging and caloric restriction on intestinal sugar and amino acid transport. Fron. Biosci. 2: 108-115.
8. Flores M.P., Castanon, J.I.R., McNab, J.M. (1994) Nutritive value of triticale fed to cockerels and chicks. Bri. Poult. Sci. 35: 527-536.
9. Goodwin, M.A., Latimer, K.S., Fletcher, O.J. (1984) Quantitation of intestinal D-xylose absorption in normal turkeys. Poult. Sci. 63: 1742-1747.
10. Jorgensen, H., Zhao, X.Q., Knudsen, K.E., Eggum, B.O. (1996) The influence of dietary fiber source and level on the development of the gastrointestinal tract, digestibility and energy metabolism in broiler chickens. Bri. J. Nutr. 75: 379-395.
11. Kaps, M., Lamberson, W.R. (2004) Biostatistics for Animal Science. CAB International, Wallingford, Oxfordshire, UK.
12. Longe, O.G., Ogedegbe, N.E. (1989) Influence of fibre on metabolisable energy of diet and performance of growing pullets in the Tropics. Bri. Poult. Sci. 30: 193-196.
13. March, B.E., Biely, J. (1971) Factors affecting the response of chicks to diets of different protein value: breed and age. Poult. Sci. 50: 1036-1040.
14. NRC, National Research Council. (1994) Nutrient Requirement of Poultry. 9th ed. National Academy Press, Washington, DC.
15. Rutgers, H.C. (2005) Malabsorption syndromes in small animals. In: Merck Veterinary Manual. Kahn, C.M. (ed.). (9^{th} ed.). Whitehouse Station, N.J. Co. Inc. Merck, USA. p. 339-346.
16. Sadowski, D.C., Meddings, J.B. (1993) Luminal nutrients alter tight- junction permeability in the rat jejunum: an in vivo perfusion model. Can. J. Physiol. Pharmacol. 71: 835-839.
17. Scharrer, E., Grenacher, B. (2000) Na+- Dependent transport of D- xylose by bovine intestinal brush border membrane vesicles (BBMV) is inhibited by various pentoses and hexoses. J. Vet. Med. 47: 617-626.
18. Schutte, J.B., Van Leeuwen, P., Lichtendonk, W.J. (1991) Ileal digestibility and urinary excretion of D-xylose and L-arabinose in ileostomized adult roosters. Poult. Sci. 70: 884-891.

19. Semard, S.D. (2005) Malassimilation syndromes in large animals. In: Merck Veterinary Manual. Kahn, C.M. (ed.). (9th ed.). Whitehouse Station, N.J. Merck Co. Inc, USA. p. 301-306.
20. Spratt, R.S., Leeson, S. (1987) Determination of metabolisable energy of various diets using Leghorn, dwarf, and regular broiler breeder hens. Poult. Sci. 66: 314-317.
21. Weber, M.P., Martin, L.J., Dumon, H.J., Biourge, V.C., Nguyen, P.G. (2002) Influence of age and body size on intestinal permeability and absorption in healthy dogs. Am. J. Vet. Res. 63: 1323-1328.
22. Wiseman, J., McNab, J.M. (1997) Nutritive value of wheat varieties fed to non-ruminants. HGCA Project Report, No. 111. Home Grown Cereals Authority.
23. Yaghobfar, A. (2001) Effect of genetic line, sex of birds and the type of bioassay on the metabolisable energy value of maize. Bri. Poult. Sci. 42: 350-353.
24. Yuasa, H., Kawanishi, K., Watanabe, J. (1995a) Effect of ageing on the oral absorption of D-xylose in rats. J. Pharma. Pharmacol. 47: 373-378.
25. Yuasa, H., Kawanishi, K., Watanabe, J. (1995b) Effect of ageing on the oral absorption of D-xylose in rats: Analysis of gastrointestinal disposition. J. Pharma. Pharmacol. 47: 576-580.
26. Yuasa, H., Soga, N., Kimura, Y., Watanabe, J. (1997) Effect of ageing on the intestinal transport of hydrophilic drugs in the rat small intestine. Biol. Pharmaceut. Bull. 20: 1188-1192.
27. Zelenka, J. (1997) Effects of sex, age and food intake upon metabolisable energy values in broiler chickens. Bri. Poult. Sci. 38: 281-284.

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اختلاف در توانائی جذب روده ای دی - زایلوز در ماکیان

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چکیده

زمینه مطالعه: براساس گزارش های موجود، بین گونه های مختلف حیوانات از نظر میزان جذب دی - زایلوز تفاوت هایی وجود دارد. **هدف:** در ۲ -آزمایش، احتمال وجود اختلاف در توانائی جذبی روده کوچک برای قند دی - زایلوز در گروه های مختلف ماکیان مورد امتحان قرار گرفت. **روش کار:** درآزمایش اول دو گروه ۹ قطعه‌ای خروس (۴۸ هفته) و مرغ بالغ (۵۸ هفته) تیپ تخمگذار و درآزمایش دوم ۴ گروه ۱۰ قطعه‌ای نیمچه های تیپ گوشتی و تخمگذار نر و ماده (۴ هفته) از طریق دهان محلول دی - زایلوز (۵۰mg/mL) براساس ۵۰۰mg برای هرکیلوگرم وزن بدن دریافت نمودند. یک نمونه خون قبل و ۵ نمونه دیگر بعد از دریافت محلول دی - زایلوز از طریق رگ بالی بر اساس هر ۳۰ دقیقه یک نمونه تا ۱۵۰ دقیقه گرفته شد و غلظت دی - زایلوز در پلاسما اندازه‌گیری گردید. **نتایج:** درآزمایش اول غلظت دی - زایلوز به بالاترین حد خود در ۶۰ تا ۹۰ دقیقه بعد از دریافت محلول در هر دو گروه‌آزمایشی رسید و دارای یک وابستگی درجه دوم با زمان بود (R^2=۰/۷۳۵ برای خروس و R^2=۰/۸۰۱ برای مرغ). درآزمایش دوم غلظت دی - زایلوز به بالاترین حد خود در ۶۰ دقیقه بعد از دریافت محلول در هر چهار گروه‌آزمایشی رسید و دارای یک وابستگی درجه دوم با زمان بود (R^2=۰/۶۸۱ برای نیمچه خروس گوشتی و R^2=۰/۸۵۰ برای نیمچه مرغ گوشتی و R^2=۰/۶۹۵ برای نیمچه خروس تخمگذار و R^2=۰/۷۴۸ برای نیمچه مرغ تخمگذار). **نتیجه‌گیری نهایی:** آزمایش دی - زایلوز نشان داد که روشی حساس برای ارزیابی عمل جذب روده در پرندگان با نژادها، جنس ها، سنین و نیازهای تغذیه‌ای متفاوت می باشد.

واژه‌های کلیدی: دی-زایلوز، ظرفیت جذبی، روده، مرغ.

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