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Physiologically Studied Appropriate Broiler Diets for Better Chicks

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Abstract
The inclusion of low phytate grains in poultry diets will scale back the phosphorus (P) content of poultry feces; however their influence on fecal P composition isn't well established. To assess this, a hundred male broiler chicks (21 days old) were fed dietary treatments supported either a wild-type barley or one among 3 low salt mutant grains with 59, 62 & 99 reductions in phytate P, compared with the regular barley diet. The birds were housed in raised-floor battery cages with mesh grate floors above fecal collection trays with 4 birds per pen and 4 pens per treatment. The birds were fed for 9 days and faeces were collected twice every day throughout the last 2 days of the experiment. Total P concentrations were 10-20% lower in stool from birds fed low phytate barley diets compared with those fed the traditional barley diet. Phosphorus digestibleness increased (P = 0.05) as salt within the barley diet decreased. Phosphate was the main P fraction within the feces (69-75% extracted P) despite the sort of barley fed. Phytate constituted solely 3-12% of the P within the faeces, indicating its hydrolysis in the bird. Overall, these results recommend that feeding low-phytate barley diets will scale back P concentrations in poultry faeces while not inflicting vital changes in P composition.
Keywords: low-salt grain; chicks; feces

INTRODUCTION

Salts of phosphate is the primary storage type of phosphorus (P) in cereal grains.' Poultry are inefficient in utilizing phytate P as they do not produce intestinal phytase, a digestive protein needed to unleash the P from phytate. 2 As a result, inorganic P is usually added to poultry diets to forestall P deficiency, though over supplementation will cause high concentrations of P in poultry feces. The P afterwards accumulates in soil and may contribute to the eutrophication of water bodies. 3 consequently, there's significant interest in developing dietary manipulations which will decrease the P concentration of poultry excretion." One approach is that the development of mutant grains that to soil. Alteration of the P composition of excretion through dietary manipulation might influence the transport of P to water bodies following land application.' VI Poultry litter (feces mixed with bedding material) and manure will contain high concentrations of phytate. For instance, Maguire et al. 4 reported that litter from broilers and turkeys fed corn-based diets contained between 22 and 46% of total P as phytate, whereas Leytem et al. [17] reported that salt concentrations in manures from layers fed corn primarily based diets ranged from 30 to 70%h of total P.

However, recent analyses of pigs fed diets containing numerous cultivars of barley unconcealed that solely trace amounts of phytate were excreted, regardless of the phytate concentration of the initial feed." Clearly, our understanding of the metabolism of phytate in monogamy animals is limited and knowledge is required on the P composition of feces obtained from a good range of animals and diets. The target of this experiment was to quantify changes in fecal 'P' composition from poultry fed diets containing completely different kinds of low-phytate barley.

MATERIALS AND METHODS

All birds during this experiment were cared for under the rules of the Canadian Council on Animal Care. Contain considerably less salt content than the wild-type equivalent. [6,7] Feeding these grains has been shown to enhance P utilization in poultry. Additionally to reducing the P concentration of feces, dietary modification has the potential to change the forms during which P is excreted. This might have necessary implications for the fate of fecal P within the setting following land application. 12 Phosphate is comparatively soluble in soil, whereas phytate is preserved strongly and is unlikely to be lost in run-off. 13 - 15 as a result the phytate content of manures will exert a powerful influence on phosphate solubility following application

Table 1. Ingredient composition and chemical analysis of diets using normal and low-salt grains trial

Composition/analysis Diet formulation (g kg -1 as fed)	Grain used			
	Common	Type1	Type2	Type3
Traditional Grain	900.7	900.7	900.7	900.7
Canola oil	10	10	10	10
Table salt	5.0	5.0	5.0	5.0
Vitamin/mineral mix3	5.0	5.0	5.0	5.0
Chromic oxide	2.5	2.5	2.5	2.5
Choline chloride	0.8	0.8	0.8	0.8
Chemical composition (g kg-1 as fed)				
Moisture	90	91	93	87
Crude protein	125	128	122	124
Ash	31	30	31	31
Ether extract	32	34	33	37
Neutral detergent fiber	131	165	140	150
Total phosphorus13	3.5	3.0	3.0	3.0
Salt	3.2	1.2	1.1	trace

One hundred, 21-day-old male broiler chicks (Saskatchewan), weighing a mean of 1098 ± 35 g, were utilized in a very randomized block design and fed one in every of four dietary treatments developed using totally different types of barley. The chicks were housed in raised-floor battery cages (80.8 cm x 40.7 cm x 25.5 cm (Ft. Aknson, USA) with mesh grate floors higher than faecal collection trays. there have been 5 birds per pen and 5 replicate pens per treatment. Feed and water were available ad lib throughout the 9-day experiment. The battery brooder was maintained at 23 °C. Incandescent lighting (20 h light, 1 h dark) was given a lighting intensity of 10 lux.
The barleys utilized in the diets were a wild-type barley (cv. Copeland) and 3 low-phytate mutant grains with 56, 65, and 90 reductions in phyate-salt 'P', respectively, compared with the traditional barley diet (Table 1). More details relating to the barley varieties are often found in Dorsch et al. [7]. The experimental diets are shown in Table 1. No supplemental calcium or 'P' was utilized in formulating the diets however comfortable alternative vitamins and minerals were added to fulfill or exceed the amount suggested by the 0. 2°. The experimental diets were provided in mash type.
The broilers were given a week period to adapt to the experimental diets. Following the difference period, clean feces (free from feathers and feed) were collected twice every day (twice) for 2 consecutive days from plastic liners placed within the fecal collection trays under every pen. Putting the samples into an aluminum pan and stirring with a rubber spatula pooled the fecal samples from the four collections. The pooled samples were then frozen. Before analysis, the samples were dried in a forced air oven at 50 °C for 70+ h, followed by fine grinding. Apparent digestibleness coefficients for dry matter and P were calculated using the equations for the indicator methodology represented by Schneider and Flatt.[8].wherever DM and P are dry matter and phosphorus digestibleness, respectively; and 'C' feed are the amounts of chromic compound in feeds and feces, severally, in g kg -1. And 'P' feces are the amounts of phosphorus within the feeds and feces, respectively, in g kg-1.

Chemical analysis

Samples of the experimental diets and feces were analyzed consistent with the ways of the Association of Official Analytical Chemists.[22] Analyses were conducted for moisture , crude protein , ash and ether extract (AOAC method 920.39). Neutral detergent fiber was analyzed using the strategy of Van Soeest et al. [23] Total P determined using the wet-ash nitric-perchloric acid technique with phosphate detected calorimetrically (Pharmacia LKB, Cambridge, UK) employing a molybdovanadate reagent (AOAC method 965.17). [24] The ferric precipitation technique was used to extract and precipitate the phytate P and therefore the ensuing extracts were analyzed for phytate by the colorimetric assays of Raboy et al. [25] and chen et a1.[26] Chromic oxide determined by the strategy of Fenton and Fenton.
The P composition of the feed and feces determined by NaOH-EDTA extraction and solution 30P spectroscopy as delineated by Turner.28 3 of the 5 replicates per treatment were every which way designated for analysis. Briefly, P was extracted in triplicate by shaking 3.00 ± 0.01 g of dried feed or feces with 40 ml of a solution containing 0.5 mol L -1 NaOH and 0.05 mol-1 EDTA for 5 h at 22 °C. Extracts were centrifuged at 1000 x g for 20 min and aliquots were analyzed for total 'P' by inductively coupled plasma optical emission spectrum analysis (Perkin Elmer, USA). The remaining solutions from the triplicate extracts were combined, frozen quickly at -70 °C, freeze-dried, and ground to a fine powder.
Freeze-dried extracts were re-dissolved in 0.1 ml of D2 0 (for signal lock) and 0.9 ml of a solution containing 1

mol-1 NaOH and 0.1 mol-1 EDTA, then transferred to a 5-mm tube. solution 31 P nmr spectra were obtained employing a Bruker Avance spectrometer (Rhinestetten, Germany) operative at 200.45 mhz for thirty one P. Samples were analyzed employing a 5 Rs pulse (45°), a delay time of 5.0 s, an acquisition time of 0.8 s, and broadband proton decoupling. The number of scans varied between 5000 and 15000, and spectra were aforethought with a line broadening of 1 hz. Chemical shifts of signals were determined in elements per million relative to 85th H3PO4 and assigned to individual P compounds or useful teams supported literature values.[29] Signal areas were calculated by integration and 'P' concentrations were calculated by multiplying the proportion of the full spectral area assigned to a particular signal by the whole 'P' concentration (g P kg-1 dry feces) within the original extract. This procedure detects concentrations of P compounds of roughly 0.1 mg P kg-1 of dry feces. [22]

Statistics statistical analysis of the info was performed using PROC procedures of the statistical Analysis System Institute.[20] Student-man-Keul's multiple range tests were accustomed determine important variations between treatment means. an easy regression analysis was used to relate P digestibleness to the phytate content of the feed. The slope of the line and intercept were generated using Microsoft® Excel.

RESULTS

The analysis of the barley diets confirmed that there was a reduction within the phytate content of the mutant barley varieties (Table 1). The wild-type barley diet (Copeland) contained 3.2 g kg -1 phytate P, whereas the mutant grain diets contained salt concentrations of 1.5 and 1.1g, kg-1 , respectively. The M955 barley diet contained solely trace amounts of phytate. Total P concentration ranged from 3.0 g kg -1 within the mutant barley diets to 3.5 g kg-1 within the Copeland diet. Solution 31P NMR spectra of feed extracts are shown in Fig. 1. Extraction with NaOH-EDTA recovered > 67% of the entire feed P. Phytate, which provides signals at more or less 5.9, 5.0, 4.7 and 4.5 ppm within the ratio 1:2:2:1 in alkaline solution, accounted for the most variations in P composition of the feeds. Because the phytate content within the feeds attenuated, the phosphate content of the feed inflated as shown by a relative increase within the signal at 6.1 ppm. The choice for reduced phytate content didn't seem to appreciably alter the chemical composition of the barley diets as crude protein, moisture, ash,

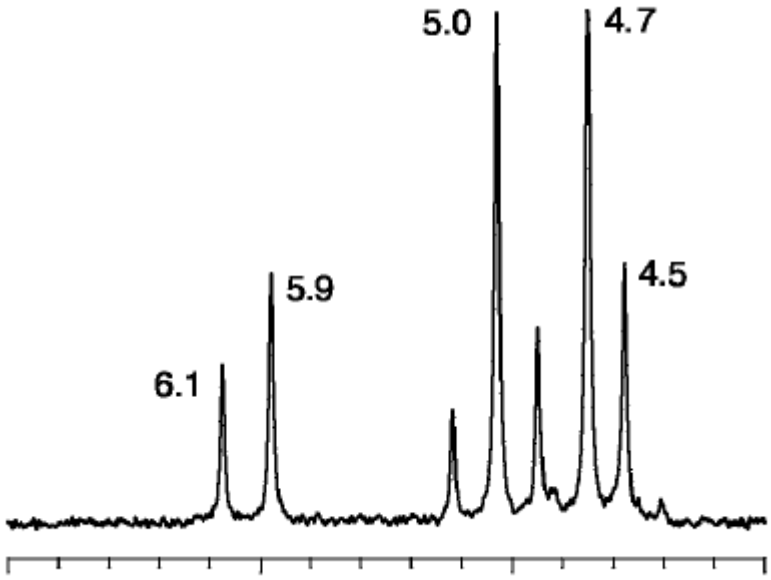

Figure 1. Solution of NaOH-EDTA extracts of feed fed to broiler chicks and low-salt grain.

and ether extract contents were not dramatically completely different between the mutant and wild-type barley diets (Table 1). There was a rise in neutral detergent fiber within the mutant barley diets. The sole vital distinction (P < 0.05) in apparent digestibleness of dry matter was between the highest (58.0%) and lowest (48.9%) values (Table 2). There was no vital increase (P= 0.02) in apparent 'P' digestibility because the level of phytate within the barley diets decreased with the exception whose 'P' digestibility value was considerably bigger than the other 3 barleys (Table 2).

The relationship between the phytate content of the diet and apparent P digestibility was delineated by a linear regression model: the apparent P digestibility = 2 1. 60-32. 8 (% salt); r2 = 0.35; P = 0.07; n = 10. Total fecal P concentrations ranged between 4.84 and 6.41 g P kg-1 (Table 3). For mutant barley diets, total fecal P

concentrations were 10-20% under those from birds fed the conventional barley diet. The best reduction in fecal P concentration was for birds fed the grain diet. Solution spectra of fecal extracts are shown in Fig. 2. Extraction with NaOH-EDTA recovered 92% of the entire fecal 'P'. Most of the extracted P was phosphate, as indicated by the sturdy signal at approximately 6.1 ppm (Fig. 2).

Signals between 3.5 and 5.0 ppm were assigned to phytate and phosphate monoesters, which constituted between 24 and 33rd of the extracted P. Of these, phytate accounted for less than a little proportion of the entire P (5-10%). Signals at 5.0 and 5.2 ppm were assigned to p-glycerophosphate and phosphatidic

Table 2. Apparent digestibility coefficients for dry matter and phosphorus from diets comprised of normal and low-phytate varieties of barley

Digestibility		
Grain used	Dry matter (%)	Phosphorus (%)
Traditional	50.7 ± 2.5^{ab}	12.0 ± 4.0^{b}
L22	45.9 ± 4.2^{b}	11.5 ± 5.4^{b}
L33	52.5 ± 2.6^{ab}	18.4 ± 4.8^{b}
L55	56.0 ± 6.3^{a}	22.8 ± 6.2^{a}

acid, correspondingly. These compounds are breakdown products of phosphatidyl choline in alkaline solution[29]. There were noteworthy differences between diets for NaOH-EDTA extractable 'P', phosphate, and phytate P ($P < 0.05$).

DISCUSSION

The experimental diets utilized in this experiment were developed to quantify changes in fecal 'P' composition from poultry diets containing totally different forms of low phytate barley, free from the influence of alternative contradictory 'P' sources. As a result, they were deliberately developed without further 'P' sources like soybean meal and dicalcium phosphate as inclusion of those further 'P' sources would have hindered our ability to observe variations in 'P' excretion for broilers fed the various barley varieties. Our diets contained over 95% barley and are so atypical of diets that may be fed commercially to broiler chicks.

The dry matter apparent digestibility of the barley primarily based diets was slightly lower than alternative reported values for barley, however not out of line based on diet formulation. Marquardt et al. thirty one reported a dry matter digestibility of 65.5% for broilers fed barley-based diets, however their diets solely included regular grains, whereas the rest of the diet was soybean meal, soybean concentrate, corn starch and tallow that are all extremely digestible thereby increasing the digestibility of their diets. The lower apparent dry matter digestibility for birds fed the high quality diets are often attributed to the higher neutral detergent fiber content of this diet.

Fiber isn't totally digestible by poultry and its presence impairs the digestibility of energy and alternative nutrients contained within the grain. It's thought that dietary fiber reduces nutrient digestibility because of its physicochemical properties, resulting in a additional speedy rate of passage, so limiting the number of time out there for nutrient breakdown. Apparent 'P' digestibility was somewhat low however was in line with knowledge from other studies. Li et al. reported a 'P' digestibility of 25% from broilers fed a traditional barley diet. [9] However, this diet contained dicalcium phosphate and 0 -glucanase which might greatly improve P digestibleness. Fan and Sauer 30 found that the P digestibleness of barley fed to growing finishing pigs was solely 20%, which might be expected to be abundant higher than for poultry. The development in 'P' utilization from feeding low-phytate barley diets agrees with previous studies within which low-phytate barley improved P digestibleness in poultry." Feeding low-phytate corn additionally improved P utilization for poultry. Since poultry do not absolutely digest phytate within the gut, it's normally assumed that poultry feces contain undigested phytate. Indeed, characterization of broiler litters and manures by resolution spectroscopy showed as much as 70% salt in manures from birds fed corn-based diets. So, we expected to search out large concentrations of salt in the feces of broiler chicks fed the wild-type grain diet, and lower salt concentrations within the feces generated from the mutant barley diets. However, our results clearly demonstrate that small phytate was excreted within the feces of birds fed barley-based diets, which the majority of P was excreted as phosphate, regardless of the phytate content of the diet. Phytate is very stable within the alkaline conditions of the analytical procedure used here; therefore the results are not a methodological artifact. [29]

There are many potential explanations for the marked distinction between this and former studies that reported high phytate contents in poultry litter and manures. There are massive variations in grain phytase activity between corn and barley, that may influence phytate hydrolysis within the bird: corn has an average of 30 units phytase kg-1 whereas barley has an average of 550 units phytase kg-1.41 There could be an influence of bird age, since most previous studies examined litter and manure from mature birds and therefore the present study was performed with younger chicks. However, there's very little proof that age alters specific phytase activity within the digestive tract of poultry.

Another chance is that the current study had no supplemental calcium added to the diets, which may inhibit phytate hydrolysis in broiler chicks. Tamin et al found that addition of 0.5% calcium to a broiler diet resulted in a reduction in ileal phytate hydrolysis. Maenz et al. found that mineral-phytate complexes reduced the hydrolysis of phytate by microbic phytase which the efficiency of inhibitors was within the order of 'Zn' at neutral pH scale. Additionally, a ternary complex of phytate, calcium and protein is also formed. The shortage of extra calcium within these diets might have allowed the broilers to hydrolyze the phytate within the grains and thus there was very little phytate excreted in the manures.

Assays of phytase activity in several sections of the digestive tract of chickens have shown that hindgut micro-organisms have a very important impact on salt hydrolysis. Thus, it's seemingly that the salt degradation determined within the present experiment was additionally expedited by micro floral salt activity within the hindgut of broilers in a similar manner to it reported antecedently for swine fed barley. [18] In monogamist animals, there are 2 primary mechanisms concerned in phosphate absorption: particularly, an active transport system and a passive transport system. Active transport happens primarily within the proximal gut whereas passive transport happens primarily within the small intestine and ileum. Thus, any P liberated as a result of phytate hydrolysis within the hindgut can not be used and, as indicated by our digestibility knowledge, is solely excreted. This finding doesn't negate the potential advantages from as well as phytase within the diet of poultry, as dietary phytase hydrolyzes phytate in this portion of the digestive tract (crop and proventriculus) wherever absorption of P can still happen and benefit the bird.

CONCLUSION

This study indicates that there's very little phytate excreted from broilers fed both regular and low phytate barley diets. Broilers fed low phytate barley versus a standard barley diet excrete less total 'P', however the composition of P is that the feces are comparable. Our results highlight the importance of getting info on the P composition of feces when assessing the impact of an animal's diet on the solubility and environmental fate of P in feces. Extra info is currently needed for different monogamic animals fed a variety of diets.

REFERENCES

1 Lott JN, Ockenden I, Raboy V and Batten GD, Phytic acid and phosphorus in crop seeds and fruits: A global estimate. Seed Sci Res 10:11-33 (2000).
2 McCuaig LW, Davies MI and Motzok I, Intestinal alkaline phosphatase and phytase of chicks: Effects of dietary magnesium, calcium, phosphorus and thyroactive casein. Poult Sci 51:526-530 (1972).
3 Sims JT, Edwards AC, Schoumans OF and Simard RR, Integrating soil phosphorus testing into environmentally based agricultural management practices. .7 Environ Qual 29:60-71 (2000).
4 Maguire RO, Sims JT, Saylor WW, Turner BL, Angel R and Applegate TJ, Influence of phytase addition to poultry diets on phosphorus forms and solubility in litters and amended soils. J Environ Qual 33:2306-2316 (2004).
5 Smith DR, Moore PA, Miles DM, Haggard BE and Daniel TC, Decreasing phosphorus runoff losses from land-applied poultry litter with dietary modifications and alum addition. .7Environ Qual 33:2210-2216 (2004).
6 Raboy V, Gerbasi PF, Young KA, Stoneberg SD, Pickett SG, Bauman AT, et al, Origin and seed phenotype of maize low phytic acid 1-1 and low phytic acid 2-1. Plant Physiol 124:355-368 (2000).
7 Dorsch JA, Cook A, Young KA, Anderson JM, Bauman AT, Vollanann CJ, et al, Seed phosphorus and inositol phosphate phenotype of barley low phytic acid genotypes. Phytochemistry 62:691-706 (2003).
8 Li YC, Ledoux DR, Veum TL, Raboy V, Zyla K and Wikiera A, Low phytic acid barley improves performance, bone mineralization, and phosphorus retention in turkey poults. .7 Appl Poult Res 10:178-185 (2001).
9 Li YC, Ledoux DR, Veum TL, Raboy V, Zyla K and Wikiera A, Bioavailability of phosphorus from low phytic acid barley. 9 Appl Poult Res 10:86-89 (2001).
10 Jang DA, Fadel JG, Klasing KC, Mireles Jr AJ, Ernst RA, Young KA, et al, Evaluation of low-phytate corn and barley on broiler chick performance. Poult Sci 82:1914-1924 (2003).
11 Klunzinger MW, Roberson KD and Charbeneau RA, Confirmation of phosphorus availability in low-phytate and highprotein corn to growing-finishing large white toms. .7 Appl Poult Res 14:94 -105 (2005).
12 Turner BL, Paphazy M, Haygarth PM and McKelvie ID, Inositol phosphates in the environment. Philos Trans R Soc London Ser B 357:449-469 (2002).
13 Anderson G, Williams EG and Moir JO, A comparison of the sorption of inorganic orthophosphate and inositol hexaphosphate by six acid soils. j Soil Sci 25:51-62 (1974).
14 Leytem AB, Mikkelsen RL and Gilliam JW, Sorption of organic phosphorus compounds in Atlantic Coastal Plain soils. Soil Sci 167:652-658 (2002).
15 Celi L and Barberis E, Abiotic stabilization of organic phosphorus in the environment, in Organic Phosphorus in the Environment, ed. by Turner BL, Frossard E and Baldwin DS. CABI Publishing, Wallingford, pp. 113-132

(2005).
16 Vadas PA, Meisinger JJ, Sikora LJ, McMurty JP and Sefton AE, Effect of poultry diet on phosphorus in runoff from soils amended with poultry manure and compost. .7 Environ Qual 33:1845-1854 (2004).
17 Leytem AB, Smith DR, Applegate TJ and Thacker PA, The influence of manure phytic acid on phosphorus solubility in calcareous soils. Soil Sci Soc Am j 70:1629-1638 (2006).
18 Leytem AB, Turner BL and Thacker PA, Phosphorus composition of manure from swine fed low-phytate grains: Evidence for hydrolysis in the animal. .7 Environ Qual 33:2380-2383 (2004).
19 Canadian Council on Animal Care, Guide to the Care and Use of Experimental Animals, vol. 1, 2nd edition. CCAC, Ottawa (1993).
20 National Research Council, Nutrient Requirements of Poultry, ninth revised edition. National Academy Press, Washington, DC (1994).
21 Schneider BH and Flan WP, The Evaluation of Feeds Through Digestibility Experiments. University of Georgia Press, Athens, GA (1975).
22 Association of Official Analytical Chemists, Official Methods of Analysis, 15th edition. AOAC, Washington, DC (1990).
23 Van Soest PJ, Robertson JB and Lewis BA, Methods for dietary fiber, neutral detergent fiber, and non-starch polysaccharides in relation to animal nutrition. .7 Dairy Sci 74:3583-3597 (1991).
24 Zasoski RJ and Burau RG, A rapid nitric-perchloric acid digestion method for multi-element tissue analysis. Commun Soil Sci Plant Anal 8:425-436 (1977).
25 Raboy V, Dickinson DB and Neuffer MG, A survey of maize kernel mutants for variation in phytic acid. Maydica 35:383-390 (1990).
26 Chen PS, Toribara TY and Warner H, Microdetermination of phosphorus. Anal Chem 28:1756-1758 (1956).
27 Fenton TW and Fenton M, An improved procedure for the determination of chromic oxide in feed and faeces. Can 9 Anim Sci 59:631-634 (1979).
28 Turner BL, Optimizing phosphorus characterization in animal manures by phosphorus-31 nuclear magnetic resonance spectroscopy. J Environ Qual 33:757-766 (2004).
29 Turner BL, Mahieu N and Condron LM, Phosphorus-31 nuclear magnetic resonance spectral assignments of phosphorus compounds in soil NaOH-EDTA extracts. Soil Sci Soc Am j 67:497-510 (2003).
30 Statistical Analysis System Institute, SAS/STAT User's Guide, version 6, 4th edition. SAS Institute Inc., Cary, NC (1999).
31 Marquardt R, Boros D, Guenter W and Crow G, The nutritive value of barley, rye, wheat and corn for young chicks as affected by use of a Trichoderma reesei enzyme preparation. Anim Feed Sci Tech 45:363-378 (1994).
32 Mangold E, The digestion and utilization of crude fibre. Nutr Abs Rev 3:647-656 (1934).