NON-STARCH POLYSACCHARIDES AND PHYTATE PHOSPHORUS CONTENT OF COMMONLY AVAILABLE POULTRY FEED INGREDIENTS*

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ABSTRACT

A study was conducted to find out the Non-starch polysaccharides (NSP) in terms of cellulose, hemicellulose, Neutral Detergent Fibre (NDF), Acid Detergent Fibre (ADF) and phytate phosphorus content of locally available poultry feed ingredients in and around Namakkal area. The mean NDF (%) of feed ingredients varied from 9.55 in maize and 11.64 in soyabean meal (SBM) to 45.88 in sunflower meal (SFM) and 53.54 in deoiled rice bran (DORB). While the ADF (%) content was higher in SFM (33.08) and DORB (24.06), it was lower in others. SFM contained highest cellulose content of 21.85 %. The mean NDF and ADF contents of broiler starter and finisher diets were 16 and 2 % respectively. The mean hemicellulose content of broiler starter and finisher diets were 13.59 % and 14.24 % respectively. The mean phytate phosphorus content of DORB was 1.39 % while that of SFM was 0.73 %.

Key words: Non-starch polysaccharides, Phytate phosphorus and feed ingredients

INTRODUCTION

The major feed ingredients used in poultry feeds are of vegetable origin, which contain considerable amount of non-starch polysaccharides (NSP) and phytate. Earlier NSP were generally termed as crude fibre, but it has become an archaic term now. It does not truly represent the unavailable portion of the carbohydrate due to the defects in the estimation techniques and is now termed as non-starch polysaccharides. Non-starch polysaccharides are the cell wall constituents mostly made of cellulose, hemicellulose and pectin (Smits and Annison, 1996). Cellulose is a polymer of D-glucose units linked together by b-1, 4 glycosidic bonds. b-glycans found in certain cereals such as wheat, barley etc., are also polyglycans with b-1,4 glycosidic linkages, but they also contain branches of b-1,3 glycosidic linkages (Smits and Annison, 1996). Hemicellulose forms the part of the matrix polysaccharides. It is a hetero polysaccharide, predominantly containing xyloglucan, a chain of b-1,4 linked D-glucose units, with terminal branches of a-1,6 linked xylose units (Maynard *et al.*, 1978). Further, varying levels of arabinoxylans, arabinogalactans, galactomannans and xyloglucans form the part of hemicellulose (Smits and Annison, 1996).The ingestion of soluble NSP like b- glycans increases the digesta viscosity in broiler chicken (White *et al.*, 1983; Choct and Annison, 1992).

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The viscous properties can impair the diffusion and convective transport of lipase, oils and bile salt micelles within the gastro intestinal contents. The viscosity may reduce the contact intensity between potential nutrients (fats) and digestive secretions (lipase, bile salts) and may impair the transport to the epithelial surface (Smits and Annison, 1996).

Phytate or phytic acid is a naturally occurring organic complex found in plants and 60-80 % of phosphorus found in the cereal grains and oilseeds exists as phytic acid (Simons and Versteegh, 1990). The availability of phytate phosphorus ranges from zero (Nelson, 1976) to a maximum of 56 % (Edwards, 1983). Under normal conditions phytate phosphorus can be considered mostly unavailable to non-ruminants. Phytate, a reactive anion forms stable complex with minerals like calcium, zinc, copper etc., in the gut thereby reducing their solubility and availability (Erdman, 1979). Phytate reacts with proteins and form phytate protein complex, which are resistant to proteolytic digestion in chickens. Cheryan (1980) reported that at low pH phytate being negatively charged and protein being positively charged form insoluble complexes. However, at high pH, both phytate and protein are negatively charged and multivalent cations like calcium are involved in forming phytate protein complexes (O dell and De Boland, 1976) which leads to lowering the digestibility of the proteins. The use of feed enzyme preparations will help to enhance the utilization of NSP and phytates and alleviate the antinutritive activity of NSP and phytates.

Hence, NSP in terms of NDF, ADF, cellulose, hemicellulose and phytate phosphorus content of some commonly available poultry feed ingredients were estimated in the present study. Also, this study will help the farmers to understand the level of NSP and Phytate phosphorus present in the feed ingredients and accordingly they can prepare feed formulation based on the locally available feed ingredients.

MATERIALS AND METHODS

Samples of feed ingredients viz; maize, soyabean meal (SBM), deoiled groundnut cake (DOGNC), sunflower meal (SFM), rapeseed meal (RSM), deoiled rice bran (DORB) and compounded broiler starter and finisher diets were collected in ten different places of Namakkal district, Tamilnadu. The sample collection was followed with standard procedure. After collection, the samples were evaluated for fibre fractions viz. Neutral Detergent Fibre (NDF), Acid Detergent Fibre (ADF), hemicellulose, cellulose and lignin by Goering and Vansoest method (1970) using Fibretec equipment and Phytate phosphorus was estimated by Haugh and Lantzsh method (1993).

RESULTS AND DISCUSSION

Fibre fractions, phytate phosphorus content of the feed ingredients and compounded feed are presented in Table 1.

The mean NDF (%) values were low in maize (9.55) and SBM (11.64), and high in DOGNC (22.52), RSM (32.06), SFM (45.88) and DORB (53.54). The broiler starter (15.90) and finisher (16.38) diets had similar NDF values. The estimated mean NDF values of DORB, SFM, DOGNC and RSM were higher than the reported values (Mc Donald, 1995; NRC, 1994) by 15.76, 20.25, 20.07 and 7.98 % respectively and the estimated NDF values of SBM and maize were lowest by 6.88 and 18.37 % respectively.

The Mean ADF values (%) were low in maize (2.66), SBM (7.25) and high in DOGNC (13.88), RSM (17.86), DORB (24.06) and SFM (33.08). The Mean ADF values of the broiler starter and finisher diets were 2.31 and 2.14 % respectively. The estimated mean ADF values of maize, DORB, SBM, DOGNC, RSM were lower by 5.00, 12.51, 20.33, 4.90 and 13.36 % respectively, but the estimated ADF value of SFM was higher by 21 % when compared with the corresponding reported

value (Mc Donald, 1995 and NRC, 1994).

The estimated mean values of cellulose (%) were lower in maize (2.2), SBM (5.89) and higher in DORB (13.57) and SFM (21.85). The estimated mean cellulose content of broiler starter and finisher diets were very low. The estimated mean values of cellulose in maize and SFM were higher by 1.82 and 22.20 % respectively; it was lower in DORB, SBM, DOGNC and RSM by 33.84, 27.28, 20.59 and 32.30 % respectively when compared with the reported values (Mc Donald 1995; NRC, 1994).

The estimated mean hemicellulose (%) content was highest in DORB (29.53) when compared to other feed ingredients. The estimated mean values of hemicellulose in DORB, SBM, DOGNC, SFM and RSM were higher by 40.39, 21.48, 60.65, 53.78 and 37.32 % respectively, and in maize was lower by 25.58 % than the reported values (Mc Donald1995; NRC, 1994).

The estimated mean values of lignin in DORB, SBM, DOGNC, SFM and RSM were higher by 17.65, 14.53, 59.01, 17.88 and 59.26 % respectively, where as the mean value in maize was lower by 53 % than the reported value (NRC, 1994).

The mean phytate phosphorus content of maize, DORB, SBM, DOGNC, and SFM were 0.26, 1.39, 0.43, 0.43 and 0.73% respectively. The estimated values were consistent with the earlier reported values (Tyagi *et al.*, 1998 and Ravindran *et al.*, 1995).

From this study it was found that the highest levels of NSP and phytate phosphorus were present in SFM and DORB when compared to other feed ingredients. These feed ingredients may safely be included in poultry ration when supplementing feed enzymes. Hence, the estimation of NSP and phytate phosphorus content of locally available feed ingredients is essential to effectively utilize feed enzymes and to formulate nutritionally balanced least cost diets with improved nutrient digestibilities for the well being of birds.

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Table 1

Fibre fractions (%) and Phytate phosphorus (%) content of feed ingredients and compounded broiler starter and finisher

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