The analysis of non-starch polysaccharides in Australian wheat and their relationship with AME

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The accumulated evidence regarding the detrimental physiological effects of non-starch polysaccharides in broiler diets has led to further research in developing methods to investigate the levels of pentosans in different cereals such as wheat, barley and rye. Researchers employ various extraction procedures to isolate and purify pentosans and to study their anti-nutritive effects in monogastrics and pigs. The generally accepted method for quantifying the pentosans has been the alditol acetate-glc method (Annison, 1991; Choct, 1995).

Here we report an alternative method, which is simple and rapid. Soluble pentosans are initially extracted from wheat (Annison, 199 1) and are refluxed with 12% HCl. The product (Furfural) is distilled off and injected into the HPLC. A recovery of 80% from commercially purified pentosans was obtained. Wheat samples supplied by M. Choct (UNE) were extracted and analysed according to the described procedure and also by the GLC method. The results in Table 1 indicate that comparable levels of total pentosans (soluble + insoluble) were obtained by the two methods. However, lower levels of soluble pentosans were detected by using the HPLC method. This difference is due to the variations in the extraction procedures and the controversy regarding the defmition of the soluble non-starch polysaccharides.

The Australian Wheat Board conducted nationwide surveys of wheats during the 94/95 and 95/96 harvests. The wheats were assayed for their AME using classical feeding trials conducted by the Pig and Poultry Production Institute at SARDI. A total of 89 wheats (49 varieties, 24 sites) were collected during the 94/95 harvest. Twenty nine samples with an AME range of 11.36 to 15.4 1 MJ/kg DM were selected and analysed for pentosans using the HPLC method. The levels of soluble pentosans were between 4.4 and 8.0 g/kg DM A significant negative correlation was found with the AME of the wheats and the levels of soluble pentosans from the 94/95 harvest ($r = -0.44$, $P < 0.05$). During the 95/96 harvest, 94 wheats were collected (46 varieties, 52 sites). Seventy one samples with an AME range of 11.56 to 15.92 MJ/kg DM were selected and analysed for pentosans using the same procedure. The levels of soluble pentosans found were between 4.2 and 6.8 g/kg DM. No significant correlation was found for the 95/96 harvest. However, a significant positive correlation was found between the extract viscosity of 42 wheat samples selected from the above and their soluble pentosan content ($r = 0.53$, $P < 0.001$). The viscosity values ranged between2.3 and 10.1 mPa.s.

This present study indicates that the correlation between soluble pentosans and AME is not consistent. This is probably due to the wide range of environmental variations and growing conditions that exist for Australian wheats. Our understanding of the chemical and physical nature of non-starch polysaccharides and their complex physiological effects is still quite limited and further research is required to study these compounds not only in a quantitative manner but also qualitatively.

Table 1 A comparison of the levels of pentosans (as is basis) in wheats using the GLC and HPLC methods.

	Total soluble pentosans (g/kg)	Total (soluble + insoluble) (g/kg)
HPLC Method	4.10	42.70
GLC Method	14.07	46.92

References

Annison, G. (199 1). Relationship between the levels of soluble non-starch polysaccharides and the apparent metabolisable energy of wheats assayed in broiler chickens. *Journal of Agricultural Food Chemistry, 39* (7), 1252-1256.

Choct, M. (1995). Role of soluble and insoluble fibre in broiler nutrition. Chicken Meat Research and Development Council. *Final Report on Project CSN*