Influence of Germination on the Soluble Carbohydrates in Feed Legumes

María Felicia Díaz
Instituto de Ciencia Animal, Cuba

María A. Martín-Cabrejas
Universidad Autónoma de Madrid, Spain

Yolanda Aguilera
Universidad Autónoma de Madrid, Spain

Vanesa Benítez
Universidad Autónoma de Madrid, Spain

Esperanza Mollá
Universidad Autónoma de Madrid, Spain

See next page for additional authors

The XXI International Grassland Congress / VIII International Rangeland Congress took place in Hohhot, China from June 29 through July 5, 2008.

Proceedings edited by Organizing Committee of 2008 IGC/IRC Conference

Published by Guangdong People's Publishing House

Presenter Information

María Felicia Díaz, María A. Martín-Cabrejas, Yolanda Aguilera, Vanesa Benítez, Esperanza Mollá, and Rosa M. Esteban

Influence of germination on the soluble carbohydrates in feed legumes

María Felicia Díaz[1], María A Martín-Cabrejas[2], Yolanda Aguilera[2], Vanesa Benítez[2], Esperanza Mollá[2] y Rosa M Esteban[2].
[1] Instituto de Ciencia Animal, Carretera Central, Km 47,1/2, San José de las Lajas, La Habana, Cuba. mdiaz@ica.co.cu
[2] Departamento de Química Agrícola, Facultad de Ciencias, Universidad Autónoma de Madrid (UAM), 28049 Madrid, Spain. maria.martin@uam.es

Key words: germination, soluble carbohydrates, α-galactosides

Introduction Our research was carried out to evaluate the influence of germination on the profiles of oligosaccharides in four feed legumes *Vigna unguiculata* (cowpea), *Canavalia ensiformis* (jackbean), *Stizolobium niveum* (mucuna), *Lablab purpureus* (dolicho) as compared to the well known and legume *Glycine max* (soybean) *Glycine max*) in order to obtain legume flours with high nutritive value.

Materials and methods Germination procedure followed Blázquez, (1999), as modified by Díaz *et al*. (2004). Seeds were germinated under darkness (0 h-L), 12 hours of light daily (12 h-L) and daylight (24 h-L) conditions. In all cases, the germination was conducted at 25℃ during the 96 h germination period. The determination of soluble carbohydrates was conducted according to procedures described by Sánchez-Mata *et al*. 1998.

Results The raw legumes tested differed in total soluble sugars, ranging from 38.4 to 63.7 g/kg of DM. Mucuna had the greatest concentrations of total soluble sugars, sucrose and maltose being the main sugars (≅ 44% and 22% of the total sugar content, respectively). The raffinose family of oligosaccharides (RFOs) content (21.7 g/kgDM) was similar to that of dolichos and accounted for 34% of the total sugar content, lower than in the other legumes, jack bean (70%), cowpea (66%) and soybean (57%). Soybean exhibited also high level of total soluble sugars, similar to those of mucuna; however stachyose was the predominant sugar (45%) followed by sucrose (36%). The level of RFOs in soybean in this study (34.7 g/ kg DM) was low when compared to the other reported values. The rest of the legumes (cowpea, jack bean and dolichos) contained lower concentrations of total soluble sugars (55.0, 41.9 and 38.4 g/kg DM, respectively).

Germination produced a general increase in total soluble sugars (from 20 to 161%), together with a drastic decrease in the α-galactoside content (from 98 to 63%). The greatest increases of total soluble sugars were exhibited by dolichos, jack bean and mucuna. The effect of germination on RFOs concentration was most accentuated in jack bean and cowpea which underwent the largest reduction of α-galactosides, reaching to 98% and 94%, respectively, followed by dolichos (87%), soybean (86%) and mucuna (84%). Thus, germination was an efficient process to reduce the levels of α galactosides in all legumes although, its influence varies among legumes. The appreciable losses of oligosaccharides caused during germination are due to the increased activity of the enzyme α-galactosidase which hydrolyses the α-1-6-galatosidic linkages thereby, causing an increase in the total soluble sugar content.

Mono and oligosaccharides, other than α-galactosides, were also affected by the germination process resulting in an increase of sucrose, maltose, and maninotriose. In our research, glycodsidase reactions depend on germination conditions and type of legume. In cowpea, an increase of total soluble sugars in germinated seeds was shown (40%), but no differences were detected in total soluble sugar concentrations due to different light conditions during germination. However, mucuna, jack bean and dolichos demonstrated a different behaviour, the presence of light during germination led to greater levels of total soluble sugars (126%, 156% and 163%, respectively).

Conclusions The germination of these legumes under different light conditions changed in the carbohydrate fraction decreasing α-galactoside concentrations and increasing total soluble sugars. Thus, these changes contribute to the increase of the nutritional value of these legumes for animal and human nutrition.

References

Blázquez, I. 1999. Contenido de vitamina B1 y vitamina B2 en guisantes y lentejas. Efecto de los procesos de germinación y extracción alcohólico. *Tesis de Licenciatura en Ciencias Química*. Universidad Autónoma de Madrid. Madrid, 75 p.

Díaz, M. F., Torres, V., González, A., Noda Aída. 2004. Biotransformaciones en el germinado de *Vigna unguiculata*. *Revista Cubana de Ciencia Agrícola*, 38:91.

Sánchez-Mata, M. C.; Peñuela-Teruel, M. J.; Cámara-Hurtado, M.; Díez-Marqués, 20 C.; Torija-Isasa, E. 1998. Determination of mono-, di-, and oligosaccharides in legumes by high-performance liquid chromatography using an amino-bonded silica column. *J. Agric. Food Chem.* *46*, 3648-3652.