

Assessment of Protein Quality in High Protein Lines from an Oat Mutagenized Population Using Amino Acid Analysis

Yi Ren¹, Bindu A Sunilkumar^{1,2}, Rickard Öste² and Olof Olsson^{2,3}

¹CropTailor AB, Department of Pure and Applied Biochemistry, Lund University, Box 124, S-22100 Lund, Sweden, ²Department of Applied Nutrition and Food Chemistry, Lund University, Box 124, S-22100 Lund, Sweden, ³Department of Pure and Applied Biochemistry, Lund University, Box 124, S-22100 Lund, Sweden,



LUND
UNIVERSITY



Background

Cereals are an important source of protein for human nutrition. Oat (*Avena sativa* L.) is distinct among cereals with a high protein concentration and a favorable amino acid composition closer to the FAO recommended standard than in other cereal (Table 1). However, lysine levels are in general low in oat and threonine and isoleucine can sometimes also be limiting.

Objectives

Recently we identified a number of oat lines from a mutagenized oat population with protein levels around 20% (see Poster by Sunilkumar et al). The aim of the present study was to determine the amino acid profiles in these high protein lines.

Methods

Total protein percentage was calculated by measuring total nitrogen content in an elemental particle analyser. The amino acid profiles for both essential and nonessential amino acids except sulphur containing amino acid were determined by acid hydrolysis followed by separation in an amino acid analyzer. Tryptophan was separately assayed by a fluorimetric method after enzyme hydrolysis. To determine cysteic acid and methionine levels, performic acid oxidation were carried out prior to acid hydrolysis.

Age(yr)	His	Ile	Leu	Lys	SAA	AAA	Thr	Trp	Val
0.5	20	32	66	57	27	52	31	8.5	43
1-2	18	31	63	52	25	46	27	7.0	41
3-14	16	30	61	48	23	41	25	6.6	40
15-18	16	30	60	47	23	40	24	6.3	40
>18	15	30	59	45	22	38	23	6.0	39
oat lines	15.0-25.8	23.3-43.3	48.9-82.1	27.5-45.5	40.4-98.2	56.4-93.2	23.9-43.8	8.7-13.7	28.8-58.6

Table 1. Recommended daily intake of essential amino acids at different ages, according to FAO (2007). The average value for the high protein oat lines is shown at the bottom. SAA, sulphur amino acid; AAA, aromatic amino acid

Results

Altogether 31 lines, that ranged in seed flour protein level from 17.40 to 24.50%, were selected for further analysis. The Belinda variety, from which the mutagenized population was derived, has ca 12% protein and was used for comparison.

The total amino acid content ranged from 119.9 to 196.8 g/kg flour (Fig. 1). There was a great variability for each amino acid and several lines (marked with *) had both a higher content and a better balance of total essential amino acids than Belinda. They were only limited in one amino acid, lysine. However, in one line the lysine level reached 46.4 g/kg, which is higher than the minimum recommended FAO level for adults (Fig. 1 and Table1).

Conclusions

Several of the high protein oat lines presented here showed a well balanced amino acid profile with elevated lysine levels. Interestingly, the 5 amino acids previously shown to contribute to a low Glycemic Index (GI) were also higher in some of the high protein lines analyzed.

These lines will therefore be an important resource for a further development of commercial oat varieties with enhanced protein nutritional qualities. Such varieties would be an important part of novel food products based on oat.

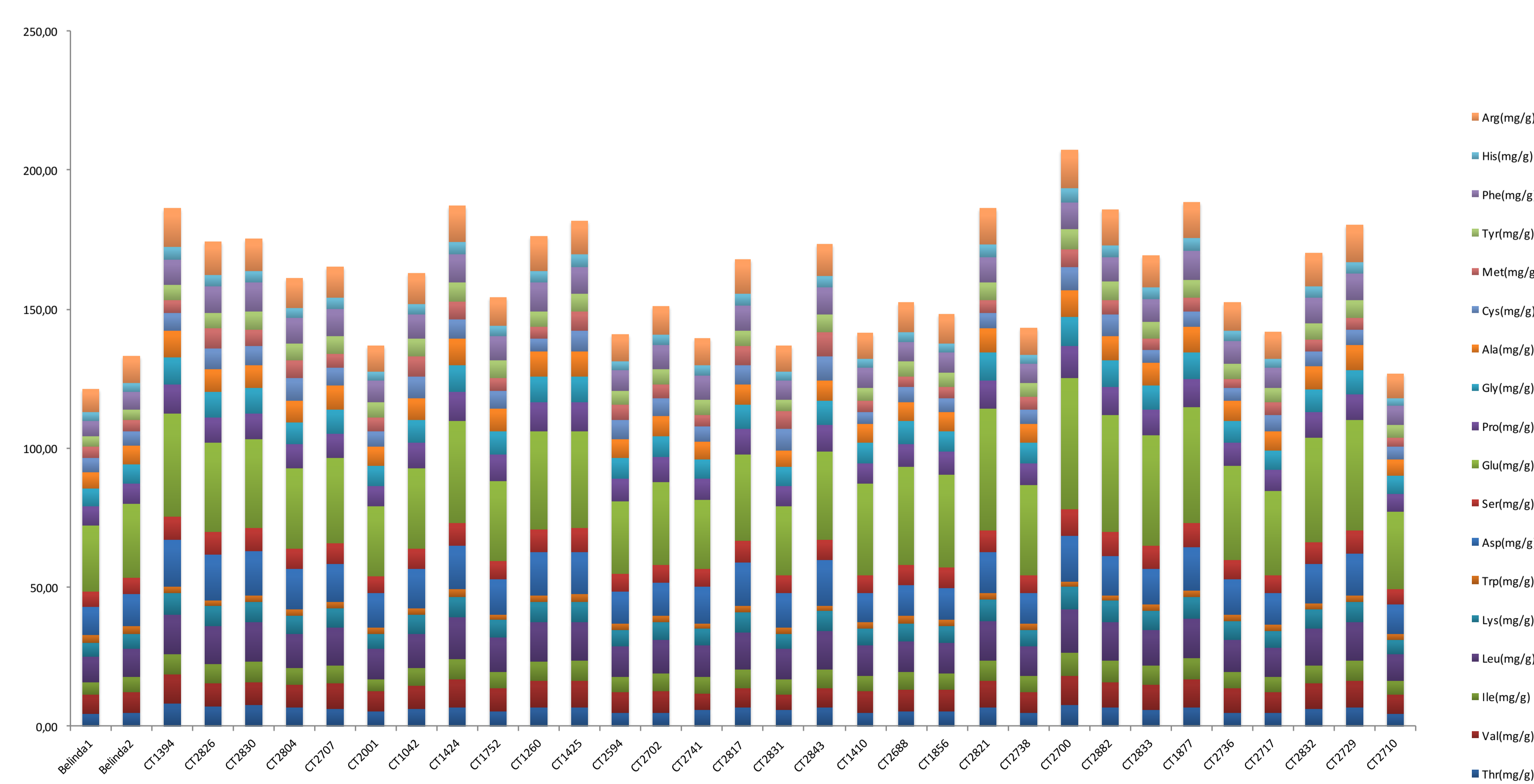


Fig. 1 Amino acid composition in grains in high protein lines.

% of total protein is indicated on the y-axis and name of CT lines are on the x-axis. Color codings for the different amino acids measured are indicated to the right.