

On the Toxicity of a Cu^{++} -treated Rapeseed Meal

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Introduction

Rapessed meal could be a good animal feed due to the high biological value of the protein. Because of antinutritional compounds, in rapeseed which cause toxic effects in animal and human, world wide search for procedures to remove this constituents were carried out.

Metal ions, as Fe^{++} and Cu^{++} inhibit the myrosinase system and prevent the formation of toxic compounds (Kirk, 1971; McLeod, 1936). Simultaneous the destruction of previously generated splitting products is achieved by metal ions.

The drawback of this procedure in the high intake of Cu^{++} . It was the aim of our investigation to prove the toxicological consequences resulting from a 12 weeks feeding test to rats. The use of Cu^{++} -salt for incrustation should be a model for inhibition of myrosinase on the way for developing food processing with special emphasis to human nutrition.

Material and methods

Rapessed meal

Rapeseed (Marinus) was incrustated with CuCl_2 -solution to an end-concentration of 1 %. After defatting with n-hexane the rapeseed meal was pelleted with a standard diet (5, 10 and 15 % rapeseed meal) supplied with vitamins and minerals.

For determination of VOT 2 g of the defatted incrustated meal were 3 times extracted with chloroform. The dried extract was concentrated to 1 ml and analysed for VOT by TLC. Progoltrin was analysed after splitting with myrosinase. Other breakdown products were determined by GC/MS.

Feedingtest

Male and female outbred rats, (show/wist, body weight about 60 g at the beginning) were kept in VELAZ-typ III cages. One control group (15 animals) received basic diet (VTD 1), Three groups basic diet with 5, 10 and 15 % untreated rapeseed meal and three groups with 5, 10 and 15 % respectively, copper-treated rapeseed meal. All groups received water ad libitum. The animals were housed three/Cage. After 12 weeks the animals were killed by decapitation. The enzymes and other values of toxicological interest were measured by standard techniques (Lewerenz, 1983).

Results and discussion

- A Cu-incrusted rapeseed meal is free of VOT and glucosinolates.
- The well known effect of rapeseed meal on body weight gain is significant diminished by copper in general. In the 5 % group no difference to the standard diet is notable in both, male and female. Even in the 10 % group female, the body weight gain is the same like control.
- The thyroid mass of the Cu-treated groups is more less increased in comparison to the groups receiving untreated rapeseed meal. In case of 5 % supply even no differences were visible. The relative liver weight was higher in the groups with untreated feed. In both sexes significant increased kidney weights occur, Probably due to a damage by the hight copper intake.
In all three groups, receiving copper-treated rapeseed meal anaemia was induced.
- In the 15 % groups hyperglycemia was induced
- The increased urea excretion caused by a renal failure by feeding normal rapeseed meal did met occur in the Cu-groups. Same influence was on cholesterol and bilirubin.
- The enzyme pattern of ASAT and AAP was significant different in 15 % Cu-treated group (male), indicating a lesion of the kidney tubuli.

Conclusion

Supplementation of feed at a 10 and 15 % level leads to kidney lesions, 5 % Cu-treated substitution is tolerable and would be a possible limit for supplementation.

The inhibition of the myrosinase system by toxicologically acceptable compounds could be a possible way for improving the quality of rapeseed meal.

References

L. D. Kirk, G. C. Mustakas and E. L. Griffin, 1971.

Crámbe Seed Processing: Decomposition of Glucosinolates with chemical Additives.

JAACS, 48, 845

A. J. MacLeod and J. T. Rossiter, 1986

Non-Enzymatic Degradation of 2-Hydroxy-but-3-Enylglucosinolate (Progoitrin) Phytochemistry, 25, 855.

H.J. Leberenz, 1985

Doctoral Thesis, Berlin.