Health and Safety in the Consumption of *Brassica rapa*: a Nutraceutical Vegetable

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INTRODUCTION

Current diet is composed by a variety of food adapted to modern living habits. However, recent studies classify some of these meals as undesirable for human health and have produced a growing concern about what we eat and its safety. This is the case of *Brassica rapa*, a vegetable consumed since antiquity for its wholesome properties but now branded as not recommended due to the toxic effects of some of their constituents. Surprisingly, glucosinolate molecules seem to be the responsables of both effects.

MAT & MET

In order to elucidate the toxicity of this species, we have selected the *In Vivo Drosophila melanogaster* system as a well proved method to reproduce the human food ingests and the effect of nourishment in the genome.

With this purpose, two *B. rapa* lines (143N5 and 163N7) selected for their different glucosinolate content were assessed in the *Somatic Mutation and Recombination Test* (S.M.A.R.T.), as well as gluconapin, the most abundant *B. rapa* glucosinolate.

RESULTS

• Glucosinolate (GSL) profile

HPLC analysis of *B. rapa* leaves revealed the existence of the same 5 glucosinolates in both lines (GNA: gluconapin; PRO: progoitrin; GBN: glucobrassicinapin; GST: gluconasturtin; GBS: glucobrassicin) (Fig. 1).

Gluconapin-GNA (3-butenyl-glucosinolate) was predominant in *B. rapa* leaves and the glucosinolate selected for analysis. Also, the glucosinolate content and abundance profile was different for 143N5 and 163N7 lines with a distinct glucosinolate proportion in samples:

143N5 (8.58 μ mol/g dry weight): GNA>PRO>GST>GBN>GBS
163N7 (60.88 μ mol/g dry weight): GNA>GBN>GST>GBS>PRO

However, GNA was the most abundant in both lines.

• Toxicity

In simple treatments (*D. melanogaster* larvae feeding with lyophilized *B. rapa* leaves) (Fig. 2), we found differences being 163N7 treatments less toxic than those of 143N5. In this sense, highest assayed concentration (black column) of *B. rapa* 163N7 did not affect *Drosophila* survival while intermediate assayed concentration (dark-gray column) of *B. rapa* 143N5 was the most toxic treatment (larvae survival reduction ~ 50%).

However, no dose effect appeared in *B. rapa* treatments. Contrarily, GNA treatments resulted in a marked dose effect from 61 to 96 % of survival (lowest and highest assayed concentration respectively) but only highest concentration was over the toxicity limit (black line).

It is remarkable that 143N5 intermediate and highest concentrations reduced *D. melanogaster* survival exceeding the toxicity limit. This could be explained by the GSL profile of this line which presented a different pattern respect to 163N7 line.

• ANTI -Toxicity

In combined treatments (*D. melanogaster* larvae feeding with lyophilized *B. rapa* mixed with the toxicant H₂O₂) (Fig. 3), we observed that almost all treatments offset the individual survival reduction by this toxicant along the assayed concentration ranges.

This experiment showed that the addition of the toxicant H₂O₂ to the *Drosophila* feed medium reduce significantly *D. melanogaster* survival except in some *B. rapa* treatments, highlighting the protective effect of this plant in feeding and their role as reactive oxygen species scavenger.

Otherwise, *Drosophila* survival effect in GNA treatments is significantly at all assayed concentration but the highest one is the only that reached the antitoxicity limit (dashed line). This fact confirms the GNA dose-dependent action as antioxidant, requiring a specific concentration to exert this healthy function.

• Genotoxicity & ANTI - Genotoxicity

Figures 4, 5 and 6 show the results obtained for genotoxicity (simple treatments) and antigenotoxicity (combined treatments) of *B. rapa* and gluconapin samples in the S.M.A.R.T. (Somatic Mutation And Recombination Test). Graphic bars represent the genotoxic activity of *B. rapa* 143N5 (green bars), *B. rapa* 163N7 (violet bars) and gluconapin (gray bars), as well as the antigenotoxicity activity (samples mixed with H₂O₂) (red bars) expressed as mutation (spot) frequency corrected to control.

B. rapa samples with less gluconapin content (143N5) resulted genotoxic in the S.M.A.R.T. test. Contrarily, 163N7 samples were evaluated as antigenotoxic together with gluconapin.

CONCLUSIONS

The *B. rapa* toxic properties as edible vegetable have been related to the glucosinolate content of the plant. *B. rapa* leaves with higher gluconapin content exert DNA protection properties and could be recommended for human consumption as safe and healthy.