PG-04

Metabolomic and Chemometric Approaches Provide Insights To Differential Chemical Profiles of Sprouting White Lupine (Lupinus albus L.) Bioactive Metabolites

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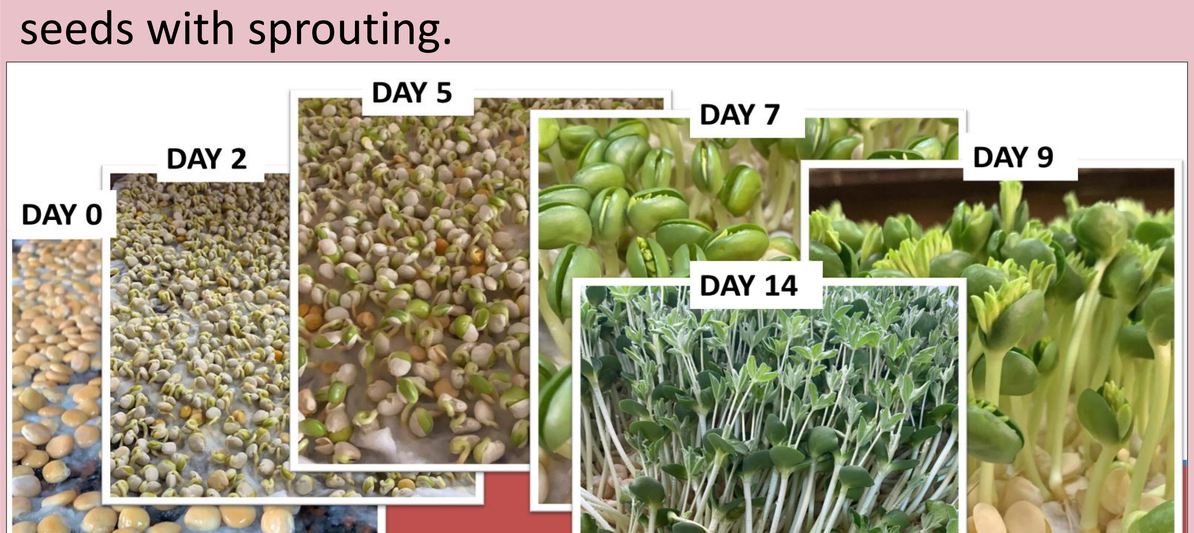
Introduction

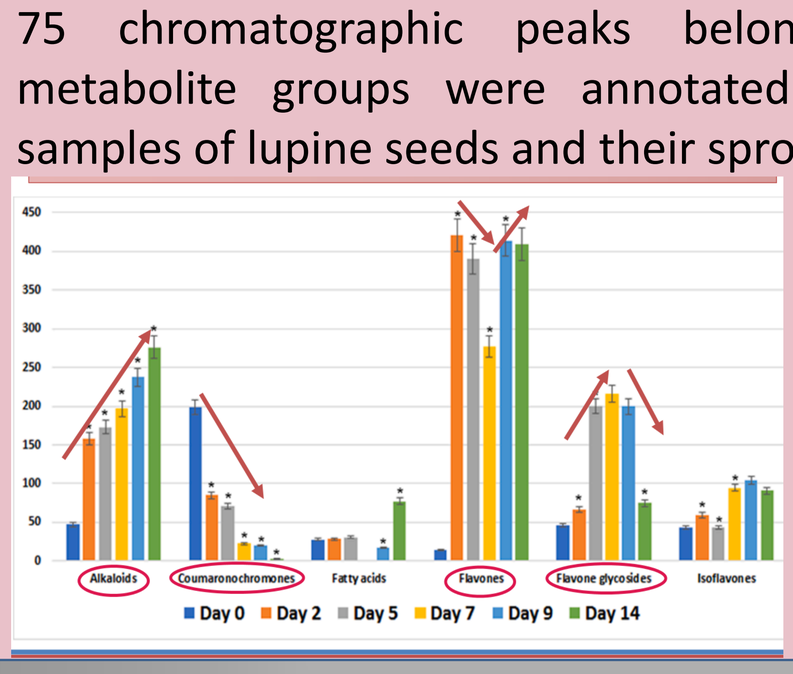
Since Pharos, seed germination has been employed to increase the nutritional or therapeutic value of plant material. The sprouting of legume seeds is widely practiced in many countries, due to the popularity of legume sprouts among consumers. Multiple studies examining the germination of lupine seeds have revealed that it can impact the accumulation of various primary and secondary metabolites. This plant products have traditionally been used in the treatment of diabetes, where historical figures such as Hippocrates (3rd century BCE) and the Persian physician Ibn Sina (1000 CE) have recognized the therapeutic benefits of lupine in controlling blood sugar levels. In vivo studies showed that the ingestion of lupine seeds appears to have a favorable impact on glucose metabolism where lupine alkaloids including lupanine and multiflorine, possess hypoglycaemic activity when adminstrede to mice with streptozocin- induced diabetes.

Tracking the changes in the chemical profile of lupine seeds in different sprouting days

The complex variety of metabolites in the several analyzed lupine samples was disentangled using UPLC-QqQ-MS/MS analysis. Each tested sample's relative amounts of metabolites were determined by semi-quantitating the identified chemicals using standards compounds. The relative amounts of each chemical class were depicted, which indicated the presence of a substantial variation in the chemical composition of the seeds with sprouting.

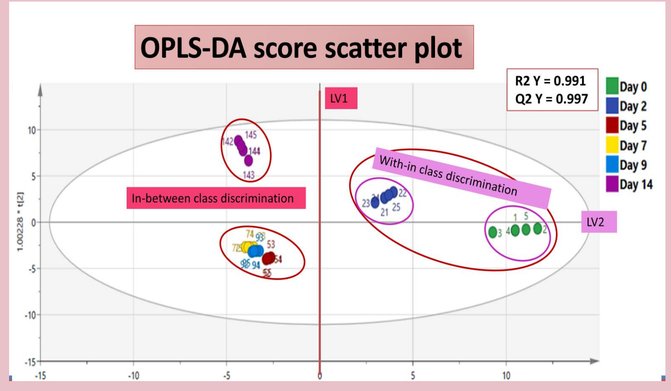


75 chromatographic peaks belonging to various metabolite groups were annotated in the different samples of lupine seeds and their sprouts. The most prevalent classes being alkaloids, coumaronochro-mones, flavones, flavone glycosides, isoflavones, fatty acids, amino acids and gibberellins



Chemical profiling of the changes induced by seed germination of lupine seeds

The score scatter plot showed in-between class discrimination along latent variable 1 between ungerminated seeds and day 2 sprouts samples, were clustered along the positive side of LV1, and day 5-day 14 sprouts samples, which were clustered along the opposite side. Further, within-class discrimination was observed between ungerminated seeds which were clustered along LV2's negative side, and day 2 sprout samples which were clustered along the positive side of LV2. Meanwhile, within-class discrimination was observed between day 14 spouts which were clustered along the positive side of LV2 and day 5, day 7 and day 9 spouts which were clustered along LV2's negative side.



In-vitro α-amylase and α- glycosidase inhibitory activity of seeds and sprouts of lupine and predicting inhibitory metabolites

The investigated extracts demonstrated inhibitory activity against both enzymes in a dose-dependent manner. In comparison to α-amylase, the investigated extracts showed stronger inhibition of α-glycosidase activity. Meanwhile, the coefficients plot portrayed that lupinalbin D and lupinalbin F, flavonoid glycosides, in addition to some alkaloids showed strong positive correlation to the α-amylase inhibitory activity of the tested samples while lupinalbin A, hydroxy ulexin B, lupinisoflavone, lupinic acid, termisine, multiflorine, aphylline and ammodendrine were positively correlated to the inhibition of α-glycosidase activity.

Conclusions

The level of alkaloids increased significantly after seed germination, and further increased along the study, reaching a max. in day 14 sprouts. Moreover, the results could help explain how seed germination affects the in-vitro antidiabetic activity of lupine seeds where the ungerminated seeds showed a pronounced acarbose-comparable inhibition of alpha- glycosidase followed by a gradual decline in the enzyme inhibition over the 9 days of the study. The results also concluded that seed germination had a much greater impact on the α -glycosidase inhibitory activity of seeds and sprouts than on their α -amylase inhibitory activity. Chemometric analysis of the data revealed the major bioactive compounds which are directly linked to α-amylase and α-glycosidase inhibitory activity.

References

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