Bioactive peptides from germinated soybean with antidiabetic potential by inhibition of DPP-IV, α-amylase and α-glucosidase enzymes

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INTRODUCTION & OBJECTIVES

• Diabetes mellitus (DM) is a metabolic disorder considered as one of the major health problems worldwide.
• DM is characterized by impaired insulin secretion, insulin resistance or a combination of both.
• Glucose Dependent Insulinotropic Peptide (GIP) and Glucagon-Like Peptide-1 (GLP-1) stimulate glucose-dependent insulin secretion in the pancreatic β-cells [1].
• GIP and GLP-1 are incretins hormones degraded by the action of dipeptidyl peptidase-IV (DPP-IV), thus inhibiting this metabolic route might be considered a novel therapeutic approach for managing DM [2].
• Blocking carbohydrate digestive enzymes such as α-amylase and α-glucosidase have been used for the control of glucose homeostasis in diabetic patients.
• Food bioactive peptides have been described as potential therapeutic agents because of their wide range of preventive effects against chronic diseases. Generally, these peptides are encrypted in food proteins but can be released by hydrolysis from original protein by means of enzymes during gastrointestinal transit or food processing.
• Previous studies have shown an increase in bioactive compounds of soybean at optimal germination conditions [3].
• The aims of this study were to identify bioactive peptides derived from six-days-germinated soybean protein concentrate digested under simulated gastrointestinal digestion, and to characterize their in vitro anti-diabetic properties as inhibitors of DPP-IV, α-amylase and α-glucosidase enzymes.

MATERIALS & METHODS

Glycerin
6 days germination at 30°C (darkness), 10 sec irrigation (8k)
Soybean protein - Simulation of gastrointestinal digestion protein (GIDP)
Peptide fractions (+10, 5-10, <5 kDa)
RP-HPLC purification (F1, F2, F3, F4)
HPLC-MS/MS peptide sequencing

RESULTS & DISCUSSION

Figure 1. a-Glucosidase and α-amylase inhibitory activity of six-days-germinated soybean protein concentrate digested under simulated gastrointestinal digestion (GSPD) and peptide fractions (+10, 5-10 and <5 kDa) obtained by ultrafiltration. Different letters indicate significant differences among mean values (ANOVA, p<0.05).

Table 2. DPP-IV inhibitory activity of GSPD and peptide fraction obtained by ultrafiltration. Different letters indicate significant differences among mean values (ANOVA, p<0.05).

Table 3. DPP-IV inhibitory activity of F1-F4 subfractions. Different letters indicate significant differences among mean values (ANOVA, p<0.05).

Figure 2. Fractionation by semi-preparative RP-HPLC of 5-10 kDa peptide fraction obtained from GSPD

Figure 3. α-amylase and α-glycosidase (control and malto) inhibitory activity of F4 subfraction. Peptides with higher inhibitory activity were found in fractions 5-10 kDa and <5 kDa.

Table 3. HPLC-MS/MS identification of peptide sequences from F2 and F3 subfractions

Figure 4. Evaluation of in vitro antidiabetic effects

DPP-IV inhibitory activity
H-Gly-Pro-p-nitroaniline hydrolysis by recombinant human DPP-IV.
Dipeptidyl A was used as positive control

α-amylase inhibition assay
Potato starch hydrolysis by saliva human α-amylase. Acrizobius was used as positive control

α-glucosidase inhibition assay
Maltose and sucrose hydrolysis by rat intestinal α-glucosidase. Acrizobius was used as positive control

CONCLUSIONS

• The potential of 6-day old germinated soybean proteins as precursors of antidiabetic peptides has been demonstrated.
• Gastrointestinal digestion of 6-day old germinated soybean proteins released peptides with the ability to inhibit starch, maltose and sucrose hydrolysis.
• A total of 11 fragments with molecular masses ranging from 600 to 1500 Da derived from glycine and β-ficlin were identified as the main contributors to the antidiabetic activity of germinated soybean proteins.
• These findings indicate that germinated soybean proteins could find promising application as ingredients for the development of functional foods towards the prevention and/or management of type-2 diabetes.

REFERENCES


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