DIPLOMA THESIS

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Effects of Apple Pomace on Starch Digestibility of White Bread

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Apple pomace contains high nutritional value due to its high polyphenol content, which studies have found to be concentrated in the apple peel. However, apple pomace becomes an environmental hazard if left near the processing facility due to its high moisture content, leaving it susceptible to microbial growth and decay. Transporting bulk apple pomace can also be costly. Because of this, we want to determine how to utilize apple pomace as a nutritional component using a simple valorization technique that can be implemented in industrial settings.

This study aims to identify a simple and effective valorization technique to process apple pomace to influence carbohydrate digestion. To determine the effect of apple pomace the in vitro Infogest digestion protocol with a semi-dynamic gastric phase was used when consumed with white bread. We also wanted to account for the effect by determining which bioactive component can affect the release of glucose during digestion.

The apple pomace sample was dried and homogenized before extraction. Freeze-drying was done to remove moisture from the apple pomace. The dried apple pomace was ground and homogenized to increase the surface area and reduce the diffusion path for solvents, resulting in greater extraction efficiency.

After obtaining the apple pomace powder, two sample preparation procedures were used to extract possible bioactive components present in the pomace that can affect digestion: water suspension and acetone extract. The proanthocyanidin content of each apple pomace sample was measured. Lastly, the bread sample was co-digested with the apple pomace samples using a semi-dynamic Infogest in vitro digestion protocol.

Various researches have revealed that proanthocyanidin is one of the major phenolic components present in apple pomace. The proanthocyanidin concentrations of the apple pomace water suspension and acetone-extracted apple pomace were calculated from the measured absorbance and the use of the calibration curve. The tannin equivalent for the water-suspended sample is 0.028 mg/g and 0.127 mg/g for the acetone-extracted one. The measured tannin contents were lower than the literature values. Acetone-extracted apple pomace gave higher tannin equivalent values, while the water suspension sample produced significantly lower tannin.

Co-digestion of the water suspension sample with bread shows that apple pomace has high inherent glucose that should be adjusted or removed first to see the effect on the glucose release of bread. Therefore, the glucose content of the apple pomace water suspension was measured by HPLC-RID. The measured glucose was 18.23 mg/g. However, when subtracted from the above data, the same pattern was observed and no difference from the initial result was noted. We inferred that apple pomace likely contains some oligo-, polysaccharides which provide additional glucose released during digestion, which was not initially available but was generated through hydrolyzation during the experiment. Therefore, we proceeded to measure the release of glucose from apple pomace during digestion. Although the glucose release was lowered after subtracting the inherent glucose, the effect may still not be sufficient to say that apple pomace water suspension effectively lowered the glucose release when co-consumed with bread.

The acetone-extracted apple pomace was used and co-digested with bread after the acetone was removed. Compared to the water suspension, this trial exhibited a more promising result with a significantly different and lower glucose release during all time points in the digestion compared to the digestion of bread alone. Overall, the acetone extract is successful in lowering the glucose release at all time points of digestion compared to bread alone, also after accounting for the inherent glucose.

Returning to the tannin equivalent for the water-suspended sample, which is 0.028 mg/g and 0.127 mg/g for the acetone-extracted one. Therefore, we can conclude that one of the possible reasons behind the changes in glucose release could be that the higher amount of condensed tannin lowers the postprandial glucose of bread, particularly during the gastric phase.

As discussed above, the acetone-extracted apple pomace showed the most significant effect during the digestion of bread. This suggests that apple pomace can decrease salivary

α-amylase activity in the gastric phase, and possibly the enzymatic activities in the intestinal phase as well, because of the significant lowering throughout the digestion process.

Finally, we can say that acetone extraction of apple pomace is effective in valorizing bioactive components like procyanidin, which lowers the post-prandial glucose release in white bread.