

Hong Kong Student Science Project Competition 2022

Team Number: SBBC016

Project Title: "Peel" Off Diabetes

Project Type: Investigation

To our best knowledge and after thorough literature research, as at 26/6/2022, there are similar works. The reference links are as below:

https://www.researchgate.net/publication/329505029_Evaluation_of_probiotic_candidate_in_combinationwith_tuber_extract_s_from_coralloccarpus_epigaeus_ArnCl_forassessment_of_in_vitro_alpha_amylase_inhibition_activity

The enhancement our project has made for the existing related products or research is summarized as below:

Both the research article by *Bhumika R Geloth et. al.* ^[1] and our project investigated the synergistic effect between the combination of plant extracts and probiotics. We expanded our study to bacterial species such as *Streptococcus faecalis*, *Lactobacillus bulgaricus* etc. and replaced the tuber extract, *Coralloccarpus epigaeus*, with ginger peel, so as to investigate any possible presence of synergistic effect between the two.

I. Background

Type II diabetes is a common chronic disease in Hong Kong. Metformin as a common medication prescribed to diabetic patients, however, is often associated with side effects. Studies ^[2] have indicated spices as potential plant-based amylase inhibitors. It was also reported that a combination of probiotic bacteria and plant extracts shows a synergistic effect on α -amylase inhibition. We aim to investigate the anti-diabetic potential of natural food sources, to reduce side effects brought by medication, and fill the research gap of whether ginger peel and various probiotics' combinations are able to exert synergistic inhibitory effects on α -amylase as derived from other studies.

II. Objectives

1. To compare the effect of different spices and probiotics sources on α -amylase activity
2. To compare the effect of storage time and concentration of ginger peel extract on α -amylase inhibition
3. To determine the combined effect of ginger peel and probiotics on α -amylase activity

III. Hypothesis

Most spices and probiotics are anti-diabetic as they contain natural α -amylase inhibitors. When plant extracts and probiotics are consumed together, a synergistic effect on α -amylase inhibition can be observed. Juice extracted from plants and probiotics could effectively lower blood glucose level, and help manage diabetes. Iodine tests can be used to see if the natural food sources reduce α -amylase activity.

IV. Methodology

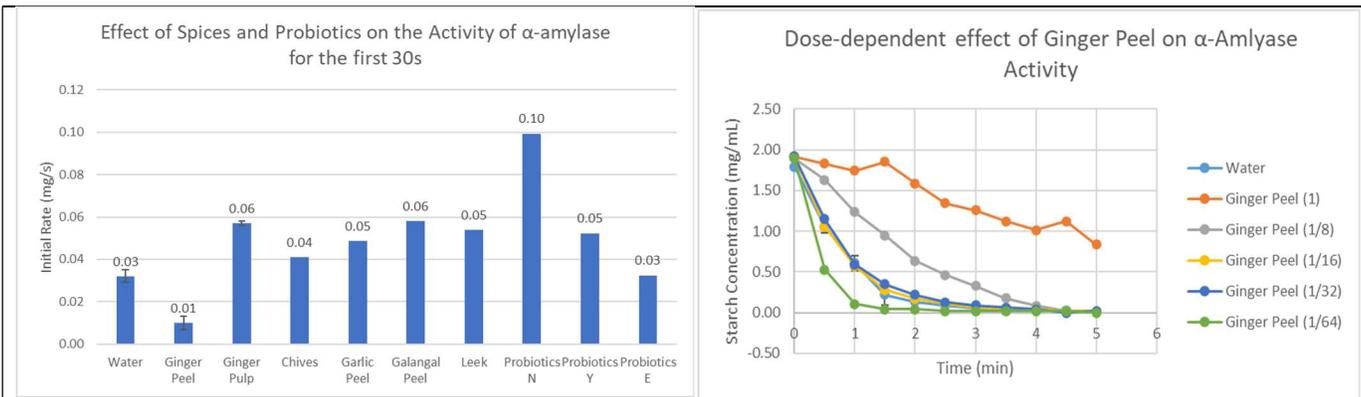
Iodine test was used to compare the change in starch concentration and α -amylase activity when different samples were added, as it is an accessible method to measure the rate of starch digestion in school laboratories. Materials involved are: 0.2% amylase solution, 0.5% starch solution, 1M hydrochloric acid, iodine solution, plant extract, probiotics extract, centrifuge, colorimeter, common laboratory apparatus.

By carrying out iodine tests, we measured the absorbance of the solutions at different time points. With our experimental results, we plotted a standard curve of absorbance against starch concentration, then used the equation generated to calculate the change in starch concentration and initial rate of amylase activity when different plants and probiotics samples are added. The figures generated were compared with water at solvent control. A smaller decrease in starch concentration and a lower amylase activity compared to the control experiment indicates possible inhibitory effect.

V. Results

1. Screening of Spices:

Ginger peel show the greatest inhibitory effect (-0.02mg/s), while other spices promote α -amylase activity. Results proved that ginger peel (-0.02mg/s) has a greater inhibitory effect on α -amylase activity than ginger pulp (+0.03mg/s).

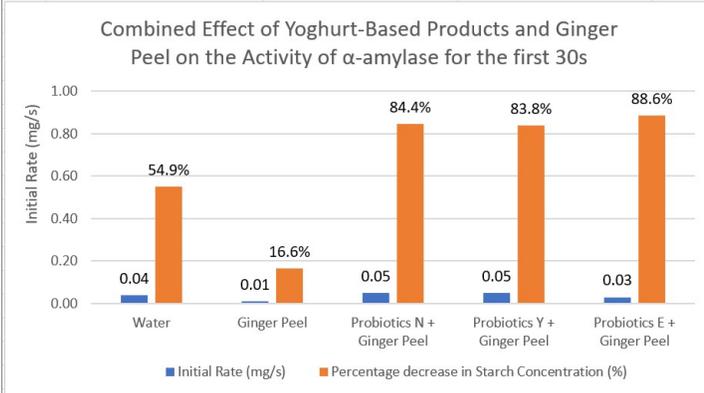


2. Dose-dependent Effect of Ginger Peel; Effect of Yoghurt-based Products:

The higher the concentration of the extract, the higher its inhibitory effect. Overall, **probiotics from yoghurt-based products promote α -amylase activity.**

3. Combined effect of Probiotics and Ginger peel:

Results show that **ginger peel alone has the greatest inhibitory effect on α -amylase (-0.03mg/s).** A synergistic effect cannot be observed.



Discrepancy between our results and other studies is due to different solvent, bacterial species and phyla of plant extract used in our experiment. However, **α -amylase activity is lower than probiotics alone** and is similar to that of water.

This can be implied to real problems faced by diabetic patients. Consumption of yoghurt alone will promote α -amylase activity and cause spikes in blood glucose levels. Our research on inhibitory effects of ginger peel on α -amylase can help diabetic patients in managing diabetes.

Limitations of our experiment include **inability to extract all α -amylase inhibitors present in spices and probiotics due to their insolubility in water.** Also, actual **concentration of starch is not measured directly**, but based on calculations with the absorbance of solutions, which may not be accurate.

4. Conclusion

Our project successfully investigated the inhibitory effects of different species on α -amylase activity. Among them, ginger peel alone was found to have the greatest α -amylase inhibitory effect, which increases with concentration and decreases with storage time. Although no synergistic effect can be found between ginger peel and probiotics, **we suggest diabetic patients to drink a cup of freshly prepared ginger peel juice alongside the consumption of yogurt-based drinks** to reduce spikes in blood glucose levels, since consumption of most probiotics alone promotes α -amylase activity. In order to mimic the real-life scenario, we would like to investigate the inhibitory effect of ginger peel on **salivary amylase** in the future. Furthermore, we would like to investigate the effect of heating on ginger peel's inhibitory effect, and develop more convenient ways to consume ginger peel extracts.

[1] Bhumika R Gehloth, & Kalpesh Ishnava. (2018, December). (PDF) Evaluation of probiotic candidate in combination with tuber extracts from *corallocarpus epigaeus* (Arm.)Cl. for assessment of in vitro Alpha-amylase inhibition activity. ResearchGate.

[2] Ramya P, & Lavanya Krishnadhas. (2021, July). A Review on Anti-diabetic Activity of Medicinal Spices. International Journal of Pharmaceutical Sciences Review and Research.