

New herbal health drinks

**Opportunity in Singapore
using traditional rākau
rongoā plants**



Southeast Asia
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Executive summary

Singapore has one of the highest rates of diabetes within Southeast Asia, with projected growth in the number of clinically diabetic Singaporeans from 400,000 currently to over 1,000,000 by 2050. While the primary methods for diabetes management in Singapore are diet and exercise, supplements are gaining popularity in preventing the disease.

Rākau rongoā, traditional Māori healing, relies on three important endemic New Zealand plants that have potential preventative benefits against diabetes: karumu (*Coprosma robusta* Raoul); kūmarahou (*Pomaderris kumeraho* A.Cunn.); and kawakawa (*Macropiper excelsum* G.Forst.Miq.). The high regard Singaporeans have for New Zealand products, as well as the similarity between rākau rongoā and traditional Chinese medicine (TCM), which has a strong following in Singapore, suggests there may be a significant potential market opportunity for these products in Singapore.

This report evaluates the market opportunity in Singapore for a herbal drink incorporating rākau rongoā plants that treat pre-diabetic symptoms. The product would leverage the connection to Traditional Chinese Medicine (TCM) with its emphasis on reducing *shanghuo* (excessive body heat) as a contributor to poor health. We also discuss key factors that need to be considered for the opportunity to succeed, including competition in the health beverages market, strict regulation, and the need to respect and engage iwi from the outset as the owners of the intellectual property.

The report concludes with a preliminary implementation plan. We recommend an initial structure that enables distribution via a local partner before building relationships with local buyers for more direct distribution. The product can be sold on both physical and digital platforms. The target market is customers who are looking for a product to treat pre-diabetic symptoms and prefer natural health remedies. We recommend promotional incentives (e.g., value-added gifts) and social media campaigns as key aspects of the marketing strategy.

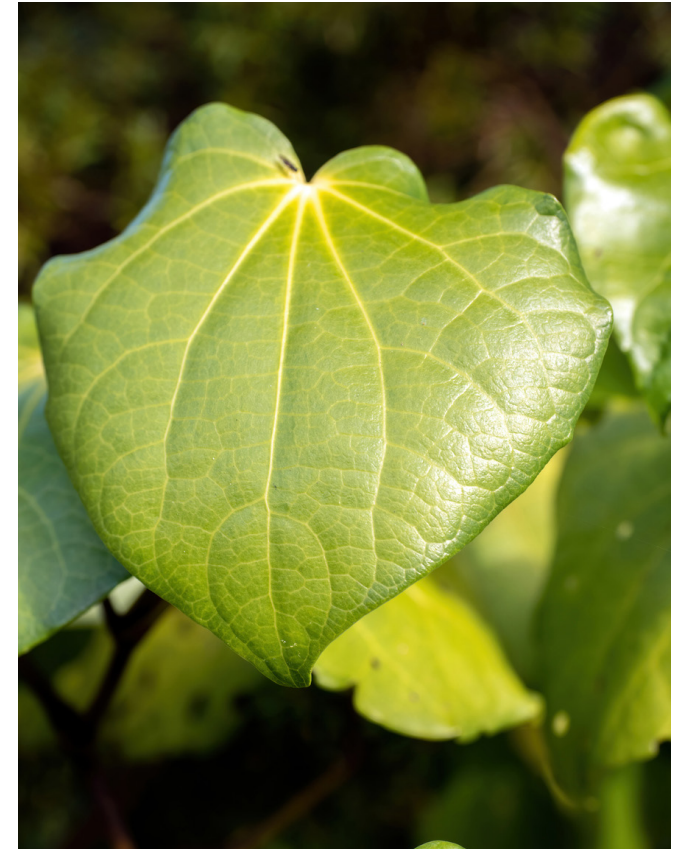




Table of contents

Executive summary	2
Introduction	6
Diabetes and prediabetes	6
Health effects	8
Economic effects of diabetes in Singapore	8
Rākau rongōā	10
Karumu	11
Kūmarahou	12
Kawakawa	13
Factors for consideration	15
Mātauranga Māori	15
Competition	16
Regulations	18
Sources of native plants	19
Implementation plan	20
Market entry into Singapore	20
Māori engagement	22
Conclusion	23
References	24

Introduction

The food and production sectors in Singapore and New Zealand are vastly different in some ways. Factors such as geographic location, land usage, and traditional farming mean the two countries' capabilities and expertise contrast in many ways. For years, these differences have allowed for mutual trade benefits and have shaped the relationship between the two nations.

At the same time, the similarities between traditional Māori medicine and Traditional Chinese Medicine (TCM) may be the key to alleviating one of Singapore's biggest health concerns: diabetes reduction and prevention. Diabetes is a global health concern (Dhinakaran et al., 2021), but it is especially prevalent in Singapore, which has a higher rate of diabetes (13.7%) than the rest of Southeast Asia (regional average of 8.5%; Seng et al., 2020). Currently, over 400,000 Singaporeans are clinically diabetic, and this rate is forecast to rise to more than one million by 2050 (Ow Yong & Koe, 2021).

Diabetes and prediabetes

In 2016, the Singapore Ministry of Health declared a war on diabetes (Ow Yong & Koe, 2021). Diabetes is the result of the body's inefficient use of the hormone insulin or in many cases, the body's inability to produce insulin at all. The purpose of insulin in the human body is to help glucose move from the bloodstream into cells, which is required for bodily functions. When this does not occur, a state of hyperglycaemia is reached, where high levels of glucose are present in the bloodstream (Diabetes New Zealand, 2022).

There are two types of diabetes. Type 1 diabetes is an autoimmune condition that cannot be prevented and must instead be managed. Diagnosis usually occurs during childhood, and without proper management, it can be detrimental to a person's overall long-term health. In contrast, Type 2 diabetes may be caused by lifestyle factors such as poor eating choices and lack of active movement. Most people develop Type 2 diabetes in their 30s or 40s, although it is becoming increasingly prevalent in younger people and even teenagers.

Research has found a clear link between individuals with hypertension (high blood pressure) and/or dyslipidaemia (abnormal levels of cholesterol) and Type 2 diabetes. In order for someone to be considered clinically diabetic, their blood sugar levels must exceed 125 mg/dL, compared to normal levels below 70mg/dL (Higuera, 2021).

Prediabetes is the condition in which a person's blood sugar levels exceed what is considered healthy and normal for everyday functioning but are below the clinical threshold. Factors such as excess body fat will prevent the transmission of insulin to key organs and tissues. Prediabetes is also commonly called impaired glucose tolerance (IGT), which technically is when glucose levels are much higher than normal after eating. Impaired fasting glucose (IFG) is the state in which blood sugar levels are increased before breaking fast in the morning. Both states are considered in determining the likelihood and severity of becoming diabetic and/or developing associated health risks such as heart disease. An individual is considered prediabetic when their blood sugar levels are 100-125 mg/dL.

Health effects

Consistently high blood sugar levels that commonly lead to diabetes pose many health risks. Symptoms may vary, but common secondary effects include an increased risk of strokes, heart disease, infections, and high blood pressure. Further consequential effects may include nerve damage, ketoacidosis (the use of alternative hormones building up and becoming toxic to the body), damaged blood vessels, fatigue, loss of consciousness, and visual impairments (Watson, 2022).

Economic effects of diabetes in Singapore

Finding preventions and treatments for diabetes that appeal to the population is a top priority for the Singapore government and its healthcare sector. The cost of treatment for the effects of diabetes is placing a major strain on the country's health system. In 2017, S\$940 million (NZ\$1.1 billion) of funding was dedicated to diabetes alone (Government of Singapore, 2019). Singapore currently has the highest rate of kidney failure directly related to diabetes in the world (Greene, 2020).

Furthermore, the high rate of diabetes affects not only the cost of healthcare but also the economic strength of the nation. A study in 2010 showed that the average working age diabetic patient posed an annual economic cost of S\$7,908 (NZ\$9,233) to the Singapore government, 58% of which was related directly to losses in productivity (Ee Png et al., 2016).



Rākau rongōā

Preventative health using natural products has a long history in both Māori culture and Singapore's Chinese culture. Two well-known examples from TCM are Asian ginseng (*Panax ginseng*) for improving physical stamina and stimulating immune function, and thunder god vine (*Tripterygium wilfordii*) for rheumatoid arthritis and multiple sclerosis (United States National Center for Complementary and Integrative Health, 2022).

Due to its long history of geographical separation from other land masses, New Zealand has a varied and unique native flora with many species only found in New Zealand. The indigenous Māori people have for centuries used the unique properties of native plants for medicinal purposes. They have taken strong guardianship (kaitiakitanga) of this flora and view native plants as a treasure (taonga), which has led to what is known as rākau rongōā, traditional Māori healing.

This practice encompasses herbal remedies, physical therapies, and spiritual healing. Three native plants that have been used for traditional healing and that early research shows have active ingredients that prevent diabetes are karuma (*Coprosma robusta* Raoul), kūmarahou (*Pomaderris kumeraho* A.Cunn.) and kawakawa (*Macropiper excelsum* G.Forst. Miq.).

Karumu

Karumu is a large shrub that grows up to six metres tall and is endemic to New Zealand. It is commonly found in coastal and lowland habitats in both the North and South Islands and is also naturalised on the Chatham Islands (New Zealand Plant Conservation Network, 2014).

Traditionally, Māori have used the leaves of karumu for treatment of kidney problems and the bark for treating stomachaches and vomiting (New Zealand Manaaki Whenua Landcare Research, 2020). Karumu has also been shown to potentially help with diabetes (McGowan, 2010).

Early evidence suggests many *Coprosma* species are rich in asperuloside (S.G. et al., 1963; Bianca, 2016), which has been shown to regulate gut microbiota and help with the prevention of obesity and Type 2 diabetes (Nakamura, 2020). Asperuloside has also been shown to reduce a number of pro-inflammatory indicators that inhibit insulin action, which can prevent the development of prediabetes (Qiu et al., 2016). The leaves of the *Eucommia* plant also possess asperuloside and have a long history of use in TCM to increase health and longevity.



Kūmarahou

Kūmarahou is a large shrub endemic to the North Island, where it is naturally found in coastal to lowland habitats, with a preference for nutrient-poor soils and full sunlight. The origin of its English name, gumdigger's soap, comes from the discovery of saponins in the flower heads, which early nineteenth century gumdiggers rubbed together to create soap.

While unremarkable for most of the year, the shrub bursts into colour with clusters of creamy yellow flowers during spring. Traditionally, this morphological change signalled to Māori that it was time to plant the staple kūmara crop (The Meaning of Trees, 2017). Māori also made tea from kūmarahou leaves as a general tonic to treat a variety of ailments, especially chest complaints, bronchitis, and colds. It is also said to have favourable effects on the kidneys (Agnes, 1958).

The early literature has a few reports of kūmarahou being used successfully in the treatment of diabetes (Phytomed, n.d.). Phytochemical studies have also shown the species potentially contains chemicals such as quercetin, kaempferol, saponins, and ellagic acid – all of which may help prevent diabetes (Cain & Cambie, 1959).

Quercetin is a bitter plant flavonol with well-documented antioxidant and anti-inflammatory activities. Quercetin has been suggested to have a protective effect against the development of Type 2 diabetes (Yao et al., 2019). Similarly, flavonol kaempferol has been shown to potentially reduce the risk of diabetes by ameliorating glycoprotein abnormalities (Chandramohan et al., 2015). In another study, Zang et al. (2015) demonstrated that diabetic mice fed kaempferol glycoside showed decreased fasting blood glucose and improved insulin resistance associated with lower diabetes risk.

Kawakawa

The bitter-tasting saponins in kūmarahou may also help in diabetes prevention due to their reported hypoglycemic activity. This will help regulate plasma glucose levels and in cases of existing diabetes, could reduce symptoms due to antioxidant activity (Elekofehinti, 2015).

Finally, the polyphenol ellagic acid in kūmarahou has been shown to have anti-hyperglycemic potential by decreasing blood glucose levels (Farbood et al., 2019). Another study by Ghadimi et al. (2021) showed the administration of 180mg of ellagic acid for eight weeks significantly decreased participants' blood sugar, insulin, and insulin resistance.

All parts of the kawakawa plant—the leaves, fruit, roots, and bark—have been well documented for use in therapeutic settings, with the plant being known as a universal rongoā due to the range of health conditions it is used to treat. Russell and Fenemore (1973), in a phytochemical study, showed the leaves of kawakawa have compounds such as iayangambin or Lirioresinol-C dimethyl ether, excelsin, epiexcelsin, and emethoxyexcelsin.

The glycosides vitexin and isovitexin are the active compounds in kawakawa that have been shown to have preventative potential against diabetes. Isovitexin is an isotope of vitexin and only exhibits slight differences in molecular structure. Both chemicals have long been used as active components in Traditional Chinese Medicine. The administration of isovitexin and vitexin in diabetic rats showed a reduction in blood glucose and in vivo inhibition of alpha-glucosidase (Choo et al., 2012).



Factors for consideration

Bringing a product to market has many significant considerations. This report focuses on mātauranga Māori, market competition, cultural respect, and regulations. It will be important to successfully navigate these areas to ensure the best chance for success.

Mātauranga Māori

Māori have through time developed a rich understanding of their environment and how to survive in it. This knowledge, which has been recorded and passed down through generations, is known as mātauranga Māori, which literally translates as Māori knowledge. This broad term encompasses language (te reo Māori), education (mātauranga), traditional environmental knowledge (taonga tuku iho, mātauranga o te taiao), and traditional knowledge of cultural practices, including healing and medicines (rongoā), fishing (hī ika) and cultivation (mahinga kai; Mātauranga Māori and Science, 2017).

Rongoā Māori still forms a key aspect of Māori healing practices and represents a continuation of culture, knowledge, and history. During the development of a herbal drink product, it will be crucial to promote and aid in kaitiakitanga (guardianship and protection) of mātauranga Māori, because the plants being used are key components of rongoā Māori due to their chemical properties and health benefits. The business must also respect the principles of Te Tiriti o Waitangi, and specifically Tino Rangatiratanga in article 2, which ensures that Māori, iwi and hapū have control over their resources.

As a result, it will be vital to engage meaningfully with iwi at the outset of the project to better understand rongoā Māori and how to respect Māori knowledge and cultural customs. For example, correct harvesting times and methods will be necessary to maximise the harvest without losing quality. It is beyond the scope of this project to detail the nature of the business-iwi relationships except to emphasise their criticality to the success of the commercial opportunity.

Competition

There are several ways people typically manage their diabetes, including regular monitoring, insulin therapy, dieting, exercise, and medication. Since diabetes is prevalent across so many age groups and ethnicities and can be treated in many ways, there are currently many products available in Singapore for prevention and treatment. Most of the products are dietary supplements, blood glucose supplements, sugar alternatives, low glycemic index products, and carbohydrate blends. Herbal remedies make up a much smaller portion of the market, even though in Singapore, there is a growing awareness of 'natural' foods and herbal formulas that contain organic ingredients with nutritional benefits.

Herbal supplements may also be more attractive to people who use TCM, given their similarities. For example, a drink used in TCM known as leung cha (涼茶) or "cooling tea" is believed to reduce shanghuo (上火), or excessive body heat, which TCM considers to contribute to poor health (Wang et al., 2021). Cooling teas are believed to prevent the excessive heat and "dampness" caused by diabetes (xiao ke 消渴 or "wasting and thirst disease"; Tan and Cai, n.d.).

The herbal drinks market, which includes tea, is expected to reach US\$703.40 million in revenue in 2022 in Singapore, with the market expected to grow annually by 4.72% (CAGR 2022-2025; Statista, n.d.). The target market for this herbal drink product is 18-60 year olds. People over 60 are more inclined to consume supplements, while people under the age of 18 are more likely to live at home and consume products bought by their parents. The product will be suitable for any age group and may be bought by consumers in the target market for their elderly parents or their children. The drink will be marketed to consumers who suffer from prediabetes and Type 2 diabetes, as this accounts for 95% of the diabetes population (Type 1 Diabetes Mellitus, 2021).



Regulations

Food regulations in Singapore are very specific, dictating what ingredients can be used and what claims can be displayed on the label. The drink will have to be registered with the Director General of Singapore Food Agency before it is able to be imported and sold in Singapore. The Singapore Food Agency Sale of Food Act must be followed and states that without prior approval *“a label must not include any claim or suggestion in relation to food that implies — (a) the food has therapeutic or prophylactic action; (b) the food will prevent, alleviate or cure any disease or condition affecting the human body; or (c) that health or an improved physical condition may be achieved by consuming the food. (3) A label must not include any claim or suggestion that may be interpreted as advice of a medical nature from any person whatsoever.”*

Applications can be made to the Agri-Food and Veterinary Authority of Singapore to get new claims approved (Asia Pacific Food Law Guide, 2022), but how the drink is marketed and labelled must adhere to these stipulations in order to avoid any recalls or fines.

In addition, the drink will need to meet the diabetes general provision 250 of the Food Regulations:

250.—(1) Diabetic food shall be special purpose food that is particularly suitable for diabetics.

(2) Every package of diabetic food shall be labelled with a nutrition information panel in the form specified in the Twelfth Schedule or in such other similar form as may be acceptable to the Director-General, and such nutrition information panel shall include a statement as to the nature of the carbohydrates present in the food.

For New Zealand native plants to be included as ingredients, they must be certified with the Food Regulations Singapore Statutes and be proven to be safe and not cause any harm to humans.

Any medicinal claims will also need to be backed up by clinical trials with proven results. This will be an expensive process, but government agencies could subsidise the cost and if several companies are making the same health claims, they can do the clinical trials together, which can decrease the cost for each party.

Sources of native plants

All three native species grow well in coastal to lowland habitats, and significant amounts of karumu and kawakawa grow on Banks Peninsula (New Zealand Department of Conservation, 2021). Kūmarahou requires a much warmer climate, and so Northland or the Auckland region may be more suitable for cultivating or harvesting this species.

Currently, none of these three species is grown commercially. All three plants are harvested through foraging (Welch, 2021), which may be feasible for the preliminary stages of a business, but a more robust production method would be required for the business to scale. Thus, the sourcing and harvesting of significant quantities of the plants will need careful investigation, with analysis of the financial, cultural, and social constraints.

Implementation plan

Market entry into Singapore

New Zealand and Singapore have a well-established trade relationship, with various free-trade agreements. The New Zealand-Singapore Enhanced Partnership, which includes new commitments around trade in goods, frameworks to enable regulatory cooperation, competition and consumer protection rules, and work-arounds for food safety and future foods (MFAT, n.d.), creates a favourable environment for new food export products from New Zealand.

We recommend that an initial trading structure for this opportunity should include incorporating a representative office in Singapore, which would allow a New Zealand company to explore the market and manage company affairs without needing to conduct profitable business activities. The entity would be registered through Enterprise Singapore and would allow companies to distribute products either directly or indirectly.

Direct distribution allows for more control of the business, as you work directly with local buyers and pay no intermediary fees, but substantial investment and infrastructure are needed. On the other hand, indirect distribution utilises a local partner's consumer base without the risk of investing in stock or resources, but maintaining good relationships with business partners and intermediaries is critical.

We recommend that this business use indirect distribution initially. Once the company has a better understanding of the market and is financially secure, it could at that stage set up a branch or subsidiary.

Since this product falls into the food and beverage category, we recommend contracting a New Zealand consolidator to help get the product to market. This will allow the business to evaluate how the product performs, as well as gain a good understanding of the market and build relationships with distributors.

In addition to selling the product in selected retail stores, we recommend selling online either through an independent website or through a third party.



Māori engagement

Because of the nature of the product and its connection with rongoā Māori, engaging with iwi about the initial concept and any further development is crucial. Iwi need to be actively involved in all aspects of development, including how plants are sourced and harvested, how the product is manufactured and marketed, and how profits are used and invested. A part of the business plan should be to use profits to invest back into Māori initiatives, according to the needs and direction of iwi involved. It will also be important to consider intellectual property protections, rights, and treatment for te reo Māori, cultural expressions, taonga species, and mātauranga Māori.

We recommend engaging with Te Taumata, a group of recognised Māori leaders in socio-economic and cultural fields who have many connections across Māoridom. They primarily engage with the Ministry of Foreign Affairs and Trade regarding trade policies and New Zealand's wider trade negotiating agenda, focusing on Māori priorities within these areas (Te Taumata, n.d.). Their purpose is to hold firm to past traditions in rongoā Māori on an international stage and respect the knowledge that has been passed down over generations. Their assistance will be critical to understand the prior and informed consent and access and benefit sharing for using genetic resources and traditional knowledge.

Additionally, as part of the Comprehensive and Progressive Trans-Pacific Partnership (CPTPP) agreement to which New Zealand and Singapore are signatories, the Plant Variety Rights Act 1987 gives New Zealand the right to adopt any measures necessary to protect indigenous plant species in fulfilment of its obligations under the Te Tiriti o Waitangi (MFAT, n.d.).

Conclusion

The Ministry of Health in Singapore has recognised that diabetes is a concern for the country's future health and economy if preventative steps are not taken now. New Zealand, as one of Singapore's major trading partners, has an opportunity to help combat the disease, using active ingredients sourced from indigenous plants. With approval and guidance of iwi, a unique beverage product could be produced that acknowledges and respects mātauranga Māori. Another key consideration will be the strict regulations around producing, labelling, and exporting the product, and the business will need to consider the costs of bringing a new herbal product to market.

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References

- Agnes, F. (1958). Medical lore of the olden day Māori. *New Zealand Nursing Journal*. Retrieved from <https://rauoripihakaoranga.landcareresearch.co.nz/references/b9df3627-158c-4a7b-9f48-13d904dbc8cb>
- Baker McKenzie. (n.d.). Food product and safety regulation. *Asia Pacific Food Law Guide - Singapore*. Retrieved from <https://resourcehub.bakermckenzie.com/en/resources/asia-pacific-food-law-guide/asia-pacific/singapore/topics/food-product-and-safety-regulation>
- Bianca, D. (2016). Practical Isolation of Asperuloside from *Coprosma quadrifida* via Rapid Pressurised Hot Water Extraction. *Australian Journal of Chemistry*, 69(11), 1219 - 1222. Retrieved from <https://www.publish.csiro.au/CH/CH15743>
- Cain, B., & Cambie, R. (1959). Leaf extractives of *Pomaderris elliptica* Labill. *New Zealand Journal of Science*.
- Chandramohan, G., Al-Numair, K., Alsaif, M., & Veeramani, C. (2015). Antidiabetic effect of kaempferol a flavonoid compound, on streptozotocin-induced diabetic rats with special reference to glycoprotein components. *Progress in Nutrition*, 17(1), 50 - 57.
- Choo, C., Sulong, N., Man, F., & Wong, T. (2012). Vitexin and isovitexin from the leaves of *Ficus deltoidea* with in-vivo α -glucosidase inhibition. *Journal of Ethnopharmacology*, 142(3), 776 - 781.
- Dhinakaran, D., Sathish, T., Kowatsch, T., Griva, K., & Best, J. (2021). *Public perceptions of diabetes, healthy living, and conversational agents in Singapore: Needs assessment*. JMIR formative research. Retrieved from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8663498/>
- Ee Png, M., Phuong Phan, T., & Yoong, J. (2016). Current and future economic burden of diabetes among working-age adults in Asia: Conservative estimates for Singapore from 2010-2050. *BMC public health*. Retrieved from <https://pubmed.ncbi.nlm.nih.gov/26880337/#:~:text=Simultaneous%20increases%20in%20prevalence%20imply,represents%20a%20growing%20economic%20burden>
- Elekofehinti, O. O. (2015). Saponins: Anti-diabetic principles from medicinal plants – A review. *Pathophysiology*, 22(2), 95 - 103.
- Farbood, Y., Rashno, M., Ghaderi, S., Khoshnam, S., & Sarkaki, A. (2019). Ellagic acid protects against diabetes-associated behavioral deficits in rats: Possible involved mechanisms. *Life Science*, 15(225), 8 - 19.
- Ghadimi, M., Foroughi, F., Hashemipour, S., Nooshabadi, M., & Ahmadi, M. (2021). Decreased insulin resistance in diabetic patients by influencing Sirtuin1 and Fetuin-A following supplementation with ellagic acid: a randomised controlled trial. *Diabetology & Metabolic Syndrome*, 13(16).
- Greene, M. (2020). *The Asian-centric approach to diabetes*. GovInsider. Government Insider. Retrieved from <https://govinsider.asia/health/singapore-biodesign-healthcare-innovation-diabetes-disease-management/>
- Gu, S., & Pei, J. (2017). Innovating Chinese herbal medicine: From traditional health practice to scientific drug discovery. *Frontiers in pharmacology*. Retrieved from <https://doi.org/10.3389/fphar.2017.00381>
- Guo, X., Heinberg, M., & Zou, S. (2019). Enhancing Consumer Attitude Toward Culturally Mixed Symbolic Products from Foreign Global Brands in an Emerging-Market Setting: The Role of Cultural Respect. *Journal of International Marketing*, 26(3), 79-97.
- Hao, J., Li, D., Peng, L., Peng, S., & Torelli, C. (n.d.). *Advancing Our Understanding of Culture Mixing*. *Journal of Cross-Cultural Psychology*, 47(10), 1257-1267.
- Higuera, V. (2021). *Prediabetes: Symptoms, causes, and more*. Healthline. Retrieved from <https://www.healthline.com/health/type-2-diabetes/what-is-prediabetes#causes>
- McGowan, R. (2010). *Rongoa Maori: A Practical Guide to Traditional Maori Medicine*. Rakino Publishing.
- The Meaning of Trees. (2017). *Kūmarahou – Pomaderris kumeraho*. Retrieved from <https://meaningoftrees.com/2017/08/15/kumarahou-pomaderris-kumeraho/>
- Nakamura, A. (2020). Asperuloside Improves Obesity and Type 2 Diabetes through Modulation of Gut Microbiota and Metabolic Signaling. *iScience*, 23(9), 101522.
- New Zealand Department of Conservation. (2021, May). *Native plants natural to Banks Peninsula*. Department of Conservation. Retrieved from <https://www.doc.govt.nz/our-work/motukarara-conservation-nursery/canterbury-native-plants-by-area/native-plants-natural-to-banks-peninsula/>
- New Zealand Manaaki Whenua: Landcare Research. (2020). *Coprosma robusta*. Karamū. Retrieved from <https://rauoripihakaoranga.landcareresearch.co.nz/names/f3aa98d2-d83c-42a1-9458-646c16cdd6f3>
- New Zealand Plant Conservation Network. (2014). *Coprosma robusta*. Retrieved from <https://www.nzpcn.org.nz/flora/species/coprosma-robusta/>
- Ow Yong, L. M., & Koe, L. M. (2021). War on diabetes in Singapore: A policy analysis - *health research policy and systems*. Retrieved from <https://health-policy-systems.biomedcentral.com/articles/10.1186/s12961-021-00678-1#:~:text=In%20Singapore%20over%20400%20000%20Singaporeans,million%20by%202050%20%5B1%5D>
- Phytomed. (n.d.). *Herbal Monograph: Kumerahou (Kumarahou)* (*Pomaderris kumerahou*; *P. elliptica*). Retrieved from <https://www.phytomed.co.nz/site/phytomed/Kumerahou%20monograph.pdf>
- Qiu, J., Chi, G., & Wu, Q. (2016). *Pretreatment with the compound asperuloside decreases acute lung injury via inhibiting MAPK and NF- κ B signaling in a murine model*. *Int Immunopharmacol*, 31(109).
- Russell, G., & Fenimore, P. (1973). New lignans from leaves of *Macropiper excelsum*. *Phytochemistry*, 12(7), 1799-1803.
- Science Learning Hub – Pokapū Akoranga Pūtaiao. (2014). *Mātauranga Māori and science*. Retrieved from <https://www.sciencelearn.org.nz/resources/2545-matauranga-maori-and-science>
- Seng, J., Kwan, Y. H., Lee, V. S., Tan, C. S., Zainudin, S. B., Thumboo, J., & Low, L. L. (2020). Differential health care use, diabetes-related complications, and mortality among five unique classes of patients with Type 2 diabetes in Singapore: A latent class analysis of 71,125 patients. Retrieved from American Diabetes Association. <https://diabetesjournals.org/care/article/43/5/1048/35746/Differential-Health-Care-Use-Diabetes-Related>
- S.G., B., B.F. C., & R.G. C. (1963). *A New Zealand Phytochemical Register - Part I*. Transactions of the Royal Society of New Zealand, 1(7), 62-87.
- Singapore Ministry of Health. (2019, May 7). *News Highlights. MOH | News Highlights*. Retrieved from <https://www.moh.gov.sg/news-highlights/details/percentage-of-spending-on-mental-health-diabetes-and-ageing-versus-total-healthcare-spending-in-2018-against-amount-budgeted-for-2019/>
- SingHealth. (2021). *Type 1 Diabetes Mellitus (T1DM)*. Retrieved from <https://www.singhealth.com.sg/patient-care/conditions-treatments/Type-1-diabetes-mellitus>
- United States Centers for Disease Control. (2021). *Prediabetes – Your Chance to Prevent Type 2 Diabetes*. Retrieved from <https://www.cdc.gov/diabetes/basics/prediabetes.html#:~:text=What%20is%20Prediabetes%3F,%20know%20they%20have%20it>
- United States National Center for Complementary and Integrative Health. (2022). *Herbs at a Glance*. Retrieved from <https://www.nccih.nih.gov/health/herbsataglance>
- Waikato Regional Council. (2012). *Kawakawa – the medicine plant*. Retrieved from <https://www.waikatoregion.govt.nz/assets/WRC/Services/regional-services/Beachcare/2012-Kawakawa.pdf>
- Watson, S. (2022). *Diabetes: Symptoms, causes, treatment, prevention, and more*. Retrieved from Healthline. Retrieved from <https://www.healthline.com/health/diabetes>
- Welch, M. (2021, July 16). *Everything You Need To Know About Kawakawa And 4 Unique Ways To Use It*. Wild Dispensary. Retrieved from <https://wilddispensary.co.nz/blogs/news/kawakawa>
- World Health Organization. (1986). *First International Conference on Health Promotion, Ottawa*. Retrieved from <https://www.who.int/teams/health-promotion/enhanced-wellbeing/first-global-conference>
- Yao, Z., Gu, Y., & Zhang, Q. (2019). Estimated daily quercetin intake and association with the prevalence of Type 2 diabetes mellitus in Chinese adults. *European Journal of Nutrition*, 58, 819 - 830.
- Zang, Y., Zhang, L., Igarashi, K., & Yu, C. (2015). *The anti-obesity and anti-diabetic effects of kaempferol glycosides from unripe soybean leaves in high-fat-diet mice*. *Food Functionality*, 6(3), 834 - 841.

