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Syncretic Diabetes Management in Mexico: Towards Equitable Health Outcomes

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BIOMEDICINE AND TRADITION: DIABETES TREATMENT IN MEXICO

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WHAT IS DIABETES?

Insulin is a hormone that tells the body when to absorb energy from food. Diabetes occurs when someone doesn't produce enough insulin, or if they become resistant to the insulin that they do produce. Then, they can't get as much energy from their food, so they feel weak and tired, as well as experiencing weight gain and feelings of hunger and thirst.

Because the body can't digest food (already broken down into smaller energy units called glucose), glucose builds up in the blood, where it causes high blood sugar that can lead to secondary effects like the buildup of fat in the liver—when there is too much glucose to use, it is converted to lipids (fat).

The concentration of fat in internal organs also can lead to insulin resistance (Joslin).

Developing insulin resistance also causes an increase in the release of insulin from the pancreas, to compensate for the resistance and attempt to maintain normal levels of glucose in the blood.

DIABETES IN MEXICO

Diabetes is the largest and fastest growing chronic disease in Mexico. Increased rates of obesity and the prevalence of diabetes has been attributed to an increase in the consumption of "sugars, animal products, and vegetable oils" over the last 50 years in Mexico; this increase is related to "the relative price increase of healthy food compared to processed food, and the lack of control over the grocery market" (Moreno-Altamirano et al).

The Mexican health system underwent big changes starting in 2000. The goal of the changes was to expand access to care for the 52 million Mexican citizens previously without insurance. The way that Mexico decided to approach this goal was in increasing the scope of their social security program (Frenk). This has improved access to care and verification of the caregiver credentials, but the care is distributed unequally (Frenk, Flores-Hernández).



Figure 1
Epidemiological distribution of knowledge about herbal medicinal plants in Mexico highlighting that fieldwork to establish the use of medicinal plant species has been carried out only in Nuevo Leon, Veracruz, Oaxaca, Chiapas, and Yucatan states (Valdivia-Correa et al).

The north of México has more clinics than the south, which makes it easier to address the diabetes epidemic in urban areas. The quality of diabetes treatment is directly related with time spent in the clinic (Flores-Hernández), leaving many without access highly disadvantaged. In the southern, rural parts of Mexico, many people still rely on traditional herbal treatments to manage diabetes symptoms.

ACTIVE INGREDIENTS

Many of the traditionally medical plants contain **flavonoids**, **alkaloids** and **terpenes** as their active ingredients. Flavonoids effectively "increase the secretion of insulin, decrease apoptosis [cell death], and promote the proliferation of pancreatic β cells [that create insulin], reduce insulin resistance, inflammation, and oxidative stress in the muscles, and promote the translocation of GLUT4 [protein that permits insulin entry into cells]" (Vinyagam et al).

Researchers testing a concentration of **triterpene Saponins** found that terpenes inhibited the α -glucosidase and α -amylase enzymes, which functionally decreased blood glucose levels, which can prevent the nerve damage caused by constant inflammation from hyperglycemia [too much blood sugar]. Also, the extract was not toxic in an overdose, which could realistically happen if the extract was being prepared at home without standardized methods (Kumar et al).

TRADITIONAL REMEDIES

Traditional Mexican views on health include religious and community aspects that are ignored in biomedical models. In addition, Mexican traditional practices have used effective treatments for diabetes symptoms for hundreds, if not thousands, of years, before biomedicine even knew what diabetes was. Many plant-based remedies have similar effects to biomedical remedies, with less secondary effects, and can be used alongside biomedical remedies as well.

Danger to the patient occurs through dosing, where repetitive use of traditional plant-based remedies puts stress on the liver. Overuse occurs because "many individuals believe that herbal medicines are harmless and represent a more 'natural' means of managing or preventing disease," (Valdivia-Correa et al) when in some cases they can cause damage as severe as Drug-Induced Liver Damage. However, the most commonly used medicinal plants are more traditional foods, like guava, ginger, and jasmine which are prepared in manners that don't dramatically increase alkaloid concentration.



METHODS OF ACTION

In biomedicine, there are two primary ways to address diabetic symptoms.

- Adding more insulin, from a synthetic hormone injection, or, if insulin resistant,
- Decreasing the production of sugar in the liver, through medications like Metformin

These two tactics decrease blood glucose levels, and increase the metabolism (digestion) of glucose. Plants used in traditional remedies achieve the same results that medications do, but with only a ~30% efficiency of reducing glucose tolerance (Román-Ramos). I investigated the mechanism and efficacy of alkaloids, exploring the similarity and difference in the method of action of their anti-diabetic effects with biomedical treatments.



To solve the problems of access, treatment compliance, and cost, it is important to integrate traditional methods of healing along with biomedicine. Ignoring thousands of years of tradition, or writing it off as "rural" or "folk" medicine devalues the importance of these healing practices. Additionally, it's important to keep in mind that most diabetic patients in rural areas are already using these methods, and to keep drug interaction and liver toxicity in mind when prescribing new medications.

With Mexico's expansion of biomedicine and treatment centers fighting to keep up with the increasing rates of diabetes in urban and rural areas throughout the country, medical syncretism could help to facilitate the introduction of biomedical care. A combined natural and pharmaceutical approach could help increase patient treatment compliance and trust in biomedicine.

HIGHLIGHT: ALKALOIDS

In one survey, "almost 50% of the... pharmaceutically and biologically significant" plant products were alkaloids (Giovanni et al). Alkaloids are a class of molecules that contain a nitrogen atom and a ring structure, and vary wildly in effect from puffer fish toxin (tetrodotoxin), to opium, to caffeine, and nicotine (Cordell et al). Specifically, the alkaloids that carry anti-diabetic effects are mainly pyrrolizidines, which fight inflammation (Moreira et al) that is a secondary effect of chronic hyperglycemia.

Right: Night Jasmine, a popular remedy in teas. Photo from Hello Hello Plants and Garden Supplies.
Far Right: *Aristolochia odoratissima*, aka "Fragrant Dutchman's Pipe." Photo from user Scampardale on Flickr.

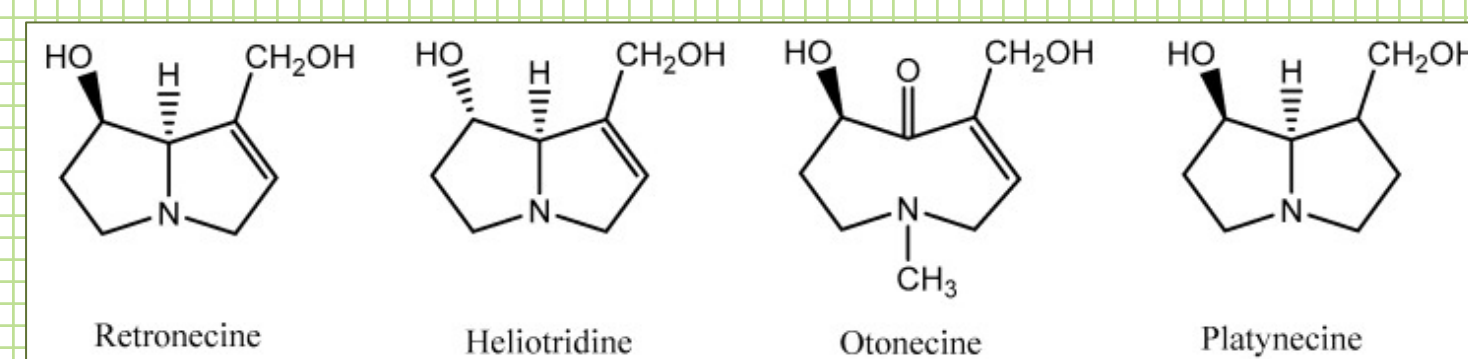
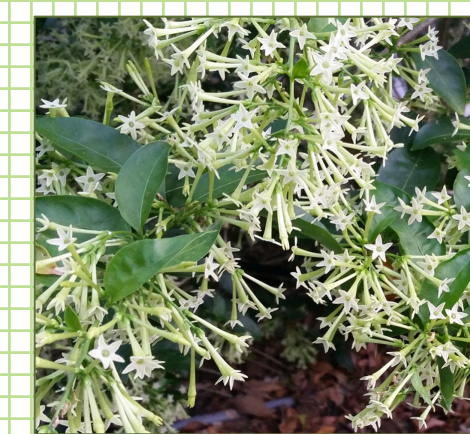


Figure 2: Groups of Pyrrolizidine Alkaloids, according to the necine base (Moreira et al).

Alkaloids are difficult to metabolize, and are often activated in the liver, which makes it the organ most prone to toxic effects. This is not a risk with mild or moderate use, but if the patient is also on other medications that metabolize slowly, or is a heavy smoker/drinker, or uses drugs, this can increase the risk of liver injury.

In many, if not all plants, alkaloids often occur alongside other chemicals such as "polyacetylenes, sesquiterpene lactones, monoterpenes, diterpenes, phenolic compounds (including flavonoids)" (Giovanni et al). This combined effect can increase both the plant's efficacy, and the risk of liver damage. Saponins and Flavonoids are two other compounds commonly found in anti-diabetic plants.

In Alkhalidy et al's research, a flavonoid was capable of limiting glucose production by the liver, which resulted in an increase in glucose elimination and utilization as energy. In Yu et al's research, a concentration of Saponins decreased blood sugar levels, increased insulin levels, and counteracted insulin resistance.

TAKE AWAY: MEDICAL SYNCRETISM

FUTURE QUESTIONS

When researching, it was difficult to find information on the specific plants that are commonly used in Mexico. I was able to look up data about individual active ingredients, but am interested in the **combined effects of multiple compounds? Do differing levels of each compound change their interaction? How do they interact with pharmaceuticals like Metformin, or other drugs commonly prescribed to combat secondary effects of diabetes?**