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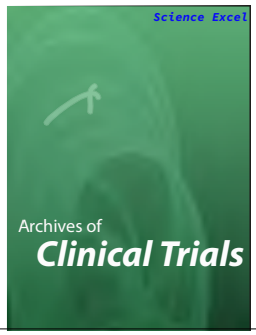

Efficacies of two medicinal plants [Goma Guar Walmart (Cyamopsis tetragonolobus L.) and Cinnamon (Cinnamomum verum)] versus efficacy of allopathic treatment [Sil–Norboral (Glibenclamide 5 mg/Metformin 1000 mg plus Janumet (Sitagliptin 50 mg/Metformin 850 mg)] as hypoglycemic agents in patients with type 2 diabetes mellitus

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Abstract

The objective of this study was to statistically compare –using the One–Way Analysis of Variance and Dunnett's multiple comparisons test– the efficacy of *Cyamopsis tetragonolobus L.* and *Cinnamomum verum* versus the efficacy of the allopathic treatment Sil–Norboral (Glibenclamide 5 mg/Metformin 1000 mg) + Janumet (Sitagliptin 50 mg/Metformin 850 mg) as hypoglycemic agents in patients with type 2 diabetes mellitus who attend the "Dr. Agustin O'Horán" General Hospital for medical care. The epistemological approach is quantitative, probabilistic or positivistic. The study design corresponds to that of a therapeutic experimental epidemiological study (therapeutic clinical trial) with prospective temporality. Forty–eight patients with type 2 diabetes mellitus were studied. The 48 patients were randomly assigned to three groups: two experimental groups and one control group. Each group was made up of 16 patients. The first experimental group was given *Cyamopsis tetragonolobus L.* (twelve dry leaves of *Cyamopsis tetragonolobus L.* and 500 ml of hot water); pour the 500 ml of hot water into a container and add the twelve dry leaves of *Cyamopsis tetragonolobus L.*; take 250 ml in the morning and 250 ml at night); the second experimental group was given *Cinnamomum verum* (two g of dry leaves of *Cinnamomum verum* and 500 ml of hot water; pour the 500 ml of hot water into a container and add two g of dry leaves of *Cinnamomum verum*; take 250 ml in the morning and 250 ml at night); and the control group was given the Sil–Norboral allopathic treatment (Glibenclamide 5 mg/Metformin 1000 mg) + Janumet (Sitagliptin 50 mg/Metformin 850 mg). In ascending numerical order, the arithmetic means of the hematic glucose values corresponded to the following treatments: *Cyamopsis tetragonolobus L.* (84.06 mg/100mL); *Cinnamomum verum* (88.63mg/100mL); and Sil–Norboral (Glibenclamide 5 mg/Metformin 1000 mg) + Janumet (Sitagliptin 50 mg/Metformin 850 mg) (122.25 mg/100mL). The One–Way Analysis of Variance reported a value of F= 56.03 with a value of p= 0.0000, which indicates a statistically significant difference between a pair or between more than one pair of arithmetic means. Dunnett's multiple comparisons test showed statistically significant differences between the treatment with the medicinal plant *Cyamopsis tetragonolobus L.* and the allopathic treatment Sil–Norboral + Janumet: p= 0000. Likewise, Dunnett's multiple comparisons test showed a statistically significant difference between the treatment with the medicinal plant *Cinnamomum verum* and the allopathic treatment Sil–Norboral + Janumet: p= 0.0000. It is concluded that *Cyamopsis tetragonolobus L.* is, from a numerical and not a statistical point of view, the best hypoglycemic agent for the treatment of type 2 diabetes mellitus.

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Introduction

Type 2 diabetes mellitus is a chronic disease that occurs when the pancreas does not produce enough insulin or when the body does not effectively use the insulin it produces. Insulin is a hormone that regulates blood glucose. The effect of uncontrolled type 2 diabetes mellitus is hyperglycemia, which over time severely damages organs and systems, especially nerves and blood vessels. In 2014, 8.5% of adults had type 2 diabetes mellitus. In 2015, 1.6 million people died as a direct consequence of type 2 diabetes mellitus, and high blood glucose levels were the cause of another 2.2 million deaths in 2012. Type 1 diabetes mellitus is characterized by impaired insulin production and requires daily administration of this hormone. Its symptoms consist, among others, of thirst (polydipsia), constant hunger (polyphagia), excessive excretion of urine (polyuria) especially at night (nocturia), weight loss, visual disturbances and tiredness. These symptoms may appear suddenly. Type 2 diabetes mellitus is due to ineffective utilization of insulin. Type 2 diabetes mellitus accounts for the majority of cases worldwide and is largely due to excessive body weight and lack of physical activity. Symptoms can be similar to those of type 1 diabetes mellitus, but often less intense. Consequently, the disease can be diagnosed only after several years of evolution and complications have appeared. Until recently, type 2 diabetes mellitus was only seen in adults, but now it is also manifesting in children. Gestational diabetes is characterized by hyperglycemia that appears during pregnancy and reaches values that, despite being higher than normal, are lower than those established to diagnose type 2 diabetes mellitus. Women with gestational diabetes are at greater risk of complications during pregnancy. pregnancy and childbirth. In addition, both they and their children are at increased risk of developing type 2 diabetes mellitus in the future. It is usually diagnosed through prenatal tests, rather than because the patient reports symptoms. Impaired glucose tolerance and impaired fasting blood glucose are transition states between normal and type 2 diabetes mellitus, and sufferers are at increased risk of progressing to type 2 diabetes mellitus, although this is not inevitable. Over time, type 2 diabetes mellitus can damage the heart, blood vessels, eyes, kidneys, and nerves. Adults with type 2 diabetes mellitus have a two to three times increased risk of cardiovascular disease and stroke [1].

Diabetic retinopathy is a major cause of blindness and is the consequence of damage to the small blood vessels of the retina that accumulates over time. Diabetic neuropathy of the feet combined with reduced blood flow increases the risk of foot ulcers and infection and ultimately amputation. 2.6% of global cases of blindness are a consequence of type 2 diabetes mellitus [2].

For this reason – in addition to preventive measures and the use of drugs aimed at reducing blood glucose – it is important that they present few adverse effects. In this sense, the use of phytotherapy in the treatment of diabetes mellitus can be useful in combination with conventional therapy, since there are medicinal plants with proven hypoglycemic activity, effective and with a low incidence of adverse effects in prolonged treatments.

Diabetes mellitus is defined as the set of metabolic alterations that occur with chronic hyperglycemia as a consequence of deficient insulin secretion or activity.

Type 2 diabetes mellitus has a high prevalence and is one of the leading causes of morbidity and mortality due to its medium and long term complications. The most frequent complications that occur are retinopathies –with possible loss of vision– peripheral nephropathies with the risk of foot ulcerations, amputations and Charcot joints; neuropathies with symptoms of gastrointestinal, genitourinary and cardiovascular involvement and sexual dysfunction.

The vast majority of diabetes are included in two groups, type 1 and type 2. In the former there is a total deficiency of insulin secretion. In the second category, type 2, the cause is a combination of resistance to insulin action sufficient to maintain homeostasis.

Treatment of type 1 diabetes mellitus is based on diet and insulin. In patients with type 2 diabetes mellitus, it is necessary to start a dietary treatment accompanied by physical activity adapted to the age and, if after 3–6 months the response is not adequate, it is recommended to start treatment with an oral hypoglycemic agent. In this case, sulfonylureas are considered the drug of choice if there is no excess weight; in obese patients, a biguanidine such as metformin is usually recommended.

There are numerous plant species with possible hypoglycemic activity. Some of them are being extensively studied and, although it is necessary to carry out a greater number of controlled clinical trials, the results of the works carried out in recent years are very positive due to the efficacy that emerges from them and due to the low dose toxicity. recommended, so they could be used for long periods.

Among the many plant species with possible hypoglycemic activity, some are known and have been used in Western countries for centuries, such as *Goma Guar* and *Fenugreek*; others are less well known and come from different traditional medicines, especially Chinese and Ayurvedic, such as *Momordica charantia*, *Gymnema sylvestre*, and *Anemarrhena asphodeloides* Bunge.

The development of the Analysis of Variance (ANOVA) is mainly due to the work of R.A. Fisher whose contributions to statistics spanning the years from 1912 to 1962 have been highly influential on modern statistical thought [3].

ANOVA has its widest application in the analysis of data obtained from experimental designs. The principles of design of experiments are extensively discussed in several books [4-12].

The objective of this study was to statistically compare –using the One–Way ANOVA and Dunnett's multiple comparisons test– the efficacy of *Cyamopsis tetragonolobus L.* and *Cinnamomum verum* versus the efficacy of the allopathic treatment Sil–Norboral + Janumet as agents. hypoglycemic drugs in patients with type 2 diabetes mellitus who attend the General Hospital "Dr Agustin O'Horán" for medical care.

The null hypothesis (H_0) was that treatment with *Cyamopsis tetragonolobus L.* and *Cinnamomum verum* did not significantly reduce fasting blood glucose levels in patients with type 2 diabetes mellitus.

The alternative hypothesis (H_1) was that treatment with *Cyamopsis tetragonolobus L.* and *Cinnamomum verum* significantly lower fasting blood glucose levels in patients with type 2 diabetes mellitus.

Figura 1. *Goma Guar Walmart (Cyamopsis tetragonolobus L.). Source. Google images*

Goma Guar Walmart (*Cyamopsis tetragonolobus L.*)

Goma Guar Walmart is the product obtained by grinding the endosperms of *Cyamopsis tetragonolobus L.* seeds. It is a galactomannan, that is, a branched heterogeneous polysaccharide made up of D–mannose chains and D–galactose units.

Goma Guar Walmart is indicated as hypoglycemic, hypocholesterolemic and also as a mechanical laxative.

In Mexico, its use is authorized in the adjuvant treatment of type 2 diabetes mellitus associated with dietary or pharmacological treatments.

The hypoglycemic effect is mainly due to the viscosity reached by the mucilage in contact with water, capable of slowing the absorption rate of carbohydrates and delaying gastric emptying, which leads to a better use of endogenous insulin, decreasing the hyperglycemia and postprandial insulinemia. Likewise, it also contributes to lowering cholesterol, mainly LDL–Cholesterol.

On the other hand, Goma Guar Walmart, like other mucilages, is an intestinal regulator, so it can be used in some cases of diarrhea. In addition, it produces a feeling of satiety, which is why it is also used in slimming diets.

It is recommended to administer an initial dose of 4.5 g/day of Goma Guar Walmart at breakfast, a dose that can be increased at weekly intervals up to 4.5 g/8 h at main meals. It should be administered immediately before food or mixed with it with plenty of liquid, never dry. Daily consumption of up to 20 g/day of partially hydrolyzed Goma Guar Walmart is considered safe.

The administration of Goma Guar Walmart can cause flatulence, nausea and a bloated feeling. Its use is contraindicated in case of intestinal or esophageal obstruction. There are no specific studies on its use during pregnancy and lactation, but in general it is considered that as it is not absorbed it should not cause problems. It can interfere with other drugs, which would decrease its plasma values, so it is advisable to separate its administration over time.

Canela (Cinnamomum verum)

Cinnamon comes from the bark of the cinnamon tree, a tropical evergreen tree native to Sri Lanka that releases an aromatic resin rich in iron. There are two species: *Cinnamomum aromaticum* or *Cinnamomum cassia* (currently the most commercialized) and *Cinnamomum zeylanicum* or *Cinnamomum verum*.

To obtain cinnamon, every two years the inner bark is extracted where its antiseptic and digestive compounds are found. It is left to ferment for 24 h and the outer layer is scraped off. What remains, the inner layer, is rolled up and left to dry.

In this drying process (which can be in the sun) it takes on its characteristic color. This "cinnamon stick" is then used as is or, more often, in powder form.

Cinnamon is consumed in small quantities; therefore, it does not provide nutrients in significant doses. The most interesting thing about cinnamon are the aromatic compounds.

The aromatic essential oil constitutes up to 2.5% of its composition. The main compounds are cinnamic aldehyde (65–70%), eugenol and cinnamic alcohol.

In a smaller proportion are trans–cinnamic acid, hydroxycinnamic aldehyde, ortho–methoxycinnamic aldehyde, cinnamic acetate and the terpenes linalool and diterpene, as well as tannins, β–carotene, mucilage and proanthocyanidins, coumarins, minerals and vitamins A, C and vitamin B complex. The synergistic action of these components provides an invigorating, appetite–stimulating, carminative, healing, antispasmodic, antiseptic and antiviral effect.

All these substances add a great anti–inflammatory and antioxidant power. In a comparative study with 26 other spices, carried out at the University of Hong Kong, cinnamon showed the highest antioxidant capacities over superfoods such as oregano and garlic. In fact, it is so powerful that cinnamon can be used as a natural preservative.

Cinnamon (*Cinnamomum zeylanicum*) is not only a highly appreciated spice throughout the world, but it has a long tradition in Indian Ayurvedic medicine and has been used for centuries in China to relieve colds and digestive problems, as well as gynecological complaints. .

Today it is mainly used as an anti–inflammatory to improve cognitive function and as a regulator of metabolism.

In small doses, cinnamon stimulates salivary secretion and glandular activity. It is therefore excellent in gastrointestinal disorders. It is effective against dyspepsia, insufficient gastric juices, gases and nausea.

In addition, it mitigates diarrhea thanks to its astringent and regulating effect on the intestinal flora.

Figura 1. *Cinnamon (Cinnamomum verum). Source. Google images*

To regulate digestion, cinnamon extract is taken: a quarter teaspoon with water, two or three times a day; it is also encapsulated, alone or in digestive formulas: 2.5 to 3.0 mg daily. The infusion or "cinnamon tea" is an option for those who prefer the ritual of its preparation: half a cup after meals is enough.

Cinnamon has been shown in scientific studies to improve the sensitivity of cells to insulin and has a significant effect on blood glucose levels, even in people with type 2 diabetes mellitus.

In addition, cinnamon reduces the negative consequences of eating foods rich in fat and thus, together with the action on sugar, it can promote weight loss.

There is yet another way that sugar helps you lose weight: use it to replace sugar. A dose of 1 g is enough to obtain a positive effect on glucose levels.

It also acts on LDL–Cholesterol levels and on triglycerides. One study concluded that positive effects can be achieved with just 120 mg daily.

In addition, in animal studies it has been seen to reduce blood pressure.

All these factors combined significantly reduce the risk of suffering a heart attack.

In addition to relieving various intestinal disorders, it invigorates and helps fight infections. Small studies have shown some positive action in disorders such as Alzheimer's, multiple sclerosis and chronic wounds.

Suck on cinnamon to heal canker sores. In case of abrasions on the tongue or oral mucosa, a sucked cinnamon stick soothes the pain and helps heal.

Due to its richness in iron and invigorating effect, it helps to overcome states of asthenia. To take advantage of its revitalizing power, it is taken as a tincture: 20 drops dissolved in water three times a day; this solution is also effective against colds.

The extract and essential oil are powerful bactericides, antivirals and antifungals.

Due to its heating effect, it is ideal for activating circulation in people prone to cold hands and feet.

It stimulates the uterus and promotes menstrual bleeding. It is not recommended during pregnancy.

Cinnamon – especially the *cassia* variety – contains a small amount of coumarin. This substance, in extremely high doses, can cause some dangerous side effects.

However, when used as a condiment it would be very rare for someone to ingest amounts large enough to suffer any negative side effects.

Cinnamon essential oil is used topically as an anti–inflammatory without risk, but its internal use must be controlled by a professional.

You have probably sprinkled cinnamon on rice pudding or added it to other desserts, cookies, or cakes, but there are other delicious ways to incorporate cinnamon into your diet.

Many traditional cuisines —such as Indian, Mexican, Middle Eastern, and North African— use cinnamon as the main spice in savory dishes (Cinnamon: all the properties and benefits for health (www.cuerpomente.com).

Cinnamon, native to India and Sri Lanka, adds to its excellent taste very useful medicinal properties in type 2 diabetes mellitus. The part used is the bark of the young branches.

It is considered digestive, stimulant, carminative, hypoglycemic and antiseptic.

It is easy to keep a small supply of this aromatic spice in your pantry. Using it in the kitchen or in baking is also convenient if there are diabetics at home. Cinnamon helps stabilize blood sugar level. By stimulating insulin receptors, they enhance the metabolic action of this hormone that lowers the glycemic index naturally.

It is advisable not to subject it to long cooking because it would lose much of its therapeutic value. It is taken in powder to season food, but also in decoction, tincture and liquid extract.

The essential oil should not be taken internally [13].

Sil–Norboral (Glibenclamide 5 mg/Metformin 850 mg)

Like all sulfonylureas, glibenclamide stimulates the islet tissue to secrete insulin. It causes degranulation of ß cells, a phenomenon associated with increased secretion of insulin. It is ineffective in pancreatectomized patients and in insulin–dependent diabetics. During chronic administration, peripheral tissues become more sensitive to insulin, probably due to an increase in the number of receptors for the hormone.

Metformin significantly increases the incorporation of glucose into lipids and improves the efficiency of glucose utilization. It increases skeletal muscle glycogen synthesis without modifying renal or hepatic glycogen synthesis through potentiating the actions of endogenous insulin. Reduces body weight in obese patients without changing the weight of thin patients. Decreases postprandial hyperglycemia, since it increases glucose uptake by skeletal muscle adipocytes; this possibly decreases appetite and helps reduce weight in obese diabetic patients. It lowers triglycerides, total cholesterol and LDL–Cholesterol and increases HDL–Cholesterol. Decreases fasting plasma glucose and insulin, plasma levels at total glucose tolerance, and plasma lipid levels independently of changes in body weight; it improves total glucose tolerance, increases glucose uptake in obese patients and slightly decreases or does not modify it in lean diabetic patients. It lowers plasma glucose and insulin levels and increases the binding of insulin to its receptor (in erythrocytes and adipocytes). Metformin increases the basal

Figura 3. *Sil–Norboral (Glibenclamide 5 mg/Metformin 1000 mg). Source. Google images*

Figura 4. *Janumet (Glibenclamide 5 mg/Metformin 850 mg). Source. Google images*

rate of glucose transport, possibly by increasing the sensitivity of transport to glucose. Increases fibrinolytic activity. This effect is produced by a decrease in plasma levels of plasminogen activator inhibitor–1. There is evidence that indicates that the relationship between depressed fibrinolysis and vascular disease is due to high levels and there are reasons to believe that the decrease in plasminogen inhibitor–1 may be beneficial, since it also decreases platelet adherence [14].

Janumet (Sitagliptin 50 mg/Metformin 850 mg)

Film–coated tablets. Each tablet contains sitagliptin phosphate monohydrate equivalent to 50 mg sitagliptin and 850 mg metformin hydrochloride. Pink, oval shaped, film–coated tablet debossed with "515" on one side.

Janumet is indicated as an adjunct to diet and exercise to improve glycemic control in patients who are not adequately controlled on their maximum tolerated dose of metformin monotherapy or in patients already being treated with the combination of sitagliptin and metformin. Janumet is indicated as an adjunct to diet and exercise in combination with a sulfonylurea (i.e., triple combination therapy) in patients who are inadequately controlled on dual combination therapy consisting of their maximum tolerated dose of metformin and a sulfonylurea. . Janumet is indicated as an adjunct to diet and exercise along with a peroxisome proliferator–activated receptor gamma (PPARγ) agonist (i.e., a thiazolidinedione) as triple combination therapy in those patients inadequately controlled on therapy. combination drug consisting of your maximum tolerated dose of metformin and a PPARγ agonist. Janumet is also indicated as add–on therapy to insulin (i.e., triple combination therapy) as an adjunct to diet and exercise, to improve glycemic control in those patients for whom a stable dose of insulin and metformin alone do not provide adequate glycemic control (Janumet, INN–sitagliptin/metformin HCl (europa.eu).

Material and methods

Epistemological approach

Quantitative, probabilistic or positivistic [15].

Study design

Therapeutic experimental epidemiological study (therapeutic clinical trial) with prospective temporality [16].

Universe of study

Forty–eight patients with type 2 diabetes mellitus were studied in the period from February 1 to July 31, 2021. The 48 patients were randomly assigned to three groups: two experimental groups and one control group. Each group was made up of 16 patients. Before starting the study, the 48 patients underwent diagnostic tests in order to determine if they were indeed patients with type 2 diabetes mellitus. The tests used were the following: 1. Fasting glucose; 2. Postprandial glucose; and 3. Glucose tolerance test. It was found that the 48 patients had type 2 diabetes mellitus.

The first experimental group was given *Cyamopsis tetragonolobus L.*; the second experimental group was given *Cinnamomum verum*; and the control group was given the allopathic treatment Sil–Norboral + Janumet.

The 48 patients were studied for six months.

Both the two medicinal plants and the allopathic treatment were taken three times a day: with the first bite of breakfast, with the first bite of lunch, and with the first bite of dinner.

Daily, fasting, blood glucose levels were determined.

Techniques and procedures

As a hypothesis test or statistical significance test, the One–Way Analysis of Variance was used. For the comparison of two arithmetic means, the Student t test and non–parametric procedures such as the Mann–Whitney test or the Wilcoxon test are used. But when there are more than two groups, it is not correct to use the Student's t test, since this would mean doing several tests in pairs, increasing the error rate globally. The One–Way Analysis of Variance is the indicated test, then, to compare the arithmetic means of 3 and more groups. One–Way Analysis of Variance is a parametric method and requires the following three assumptions to be met: 1. The populations (probability distributions of the dependent variable corresponding to each factor) are normal; 2. The K samples on which the treatments are applied are independent; and 3. The populations all have equal variance (homoscedasticity). When the three assumptions mentioned above are not met, a non–parametric technique is available, which is the Kruskal–Wallis test.

From the English ANalysis Of VAriance the abbreviation ANOVA has remained. Its name can be misleading, leading one to mistakenly think that it is used to compare variances, but One–Way Analysis of Variance does not compare variances, but rather arithmetic means. Its null hypothesis (Ho) establishes the equality of three and more arithmetic means.

The One–Way Analysis of Variance tests the null hypothesis that the three or more populations from which the groups come have identical arithmetic means. The alternative hypothesis is not that a specific group is superior to another, but simply that the groups are different from each other (heterogeneity of arithmetic means).

Is it a one–tailed or two–tailed test? In the One–Way Analysis of Variance, this distinction does not exist, since it is never evaluated as an alternative hypothesis if a specific group is greater than another, but simply if the groups are different from each other. All One–Way Analysis of Variance tests include both alternative hypotheses. It is as if they were always in two queues. A one–way Analysis of Variance produces a p–value that answers the following question: if the null hypothesis were true, what would be the probability that the arithmetic means of the samples differed as much or more than what was observed?

It is answered by providing a p–value. To obtain it, a quotient is calculated between:

Effect due to group membership / Dispersion due to chance (random error).

When the Ho is rejected, it is already known that there are differences between groups, but then it is necessary to continue delving to know specifically between which groups there are differences. Procedures for comparing groups after One–Way Analysis of Variance are called contrasts. When instead of using the One–Way Analysis of Variance, the non–parametric Kruskal–Wallis method is used, subsequent comparisons should be made by pairs based on the Mann–Whitney U test but penalizing them to avoid the artificial increase of the error overall alpha.

If the One–Way Analysis of Variance reports statistically significant results, Dunnett's multiple comparisons test is used in order to find out between which pair or between which pairs of arithmetic means there is a statistically significant difference. Dunnett's method compares a set of groups, one by one, all against a single mean, that of a single group that is taken as a control. It is the indicated procedure when this is the experimental situation [17,18].

Data processing

The data was reviewed (information quality control); classified (on qualitative and quantitative scales); computerized (Minitab 18 software for Windows was used); presented (in Tables and Graphs); summarized (corresponding summary measures were used for data ranked on qualitative and quantitative scales); analyzed; and interpreted. For the elaboration of Graph 1, the Microsoft Office Excel 365 software was used. To estimate the existence of statistically significant differences between the three arithmetic means corresponding to the three treatments, the One–Way Analysis of Variance was used using the Minitab 18 software to Windows. In the event that the One–Way Analysis of Variance reported statistically significant results, Dunnett's multiple comparisons test was used in order to find out between which pair or between which pairs of arithmetic means there is a statistically significant difference. Dunnett's test should be used when you want to compare the arithmetic mean of the control group with the arithmetic means of the experimental groups. Dunnett's test calculation method is similar to Student's t–test and Scheffe's test. Dunnett uses a single critical difference to perform the multiple comparisons..

Results

Table I presents the One–Way Analysis of Variance according to the sources, the degrees of freedom, the sums of squares, the variances, the value of $F_{Calculated}$ and the value of *p*.

The sample sizes, arithmetic means, standard deviations and estimation intervals at the 95% confidence level according to the control group (Sil–Norboral + Janumet) and the experimental groups (*Cyamopsis tetragonolobus L.* and *Cinnamomum verum*) are presented in the Table II.

Table III shows the pairwise comparisons using Dunnett's method at the 95% confidence level.

Level difference, arithmetic mean difference, standard error of differences, 95% confidence intervals, t–values, and Dunnett's multiple comparisons adjusted *p*–values are presented in Table IV.

Graph 1 shows medicinal plants versus allopathic treatment according to blood glucose levels (in mg/100mL) in ascending order.

Bartlett's test of equality of variances hypothesis reported Bartlett= 2.52; *p*= 0.284, that is, there is no statistically significant evidence at the significance level or the 5% significance level to conclude that the three variances are not equal.

The Kolmogorov–Smirnoff normality hypothesis test reported KS= 0.128; *p*= 0.0500, that is, there is no statistically significant evidence at the level of significance or the 5% level of significance to conclude that the data do not follow the normal distribution.

The three groups compared are independent.

Consequently, the three assumptions for carrying out the One–Way Analysis of Variance are fulfilled.

Table 1. *One–Way Analysis of Variance according to sources, degrees of freedom, sums of squares, variances, Value of* $F_{Calculated}$ *& p–value.*

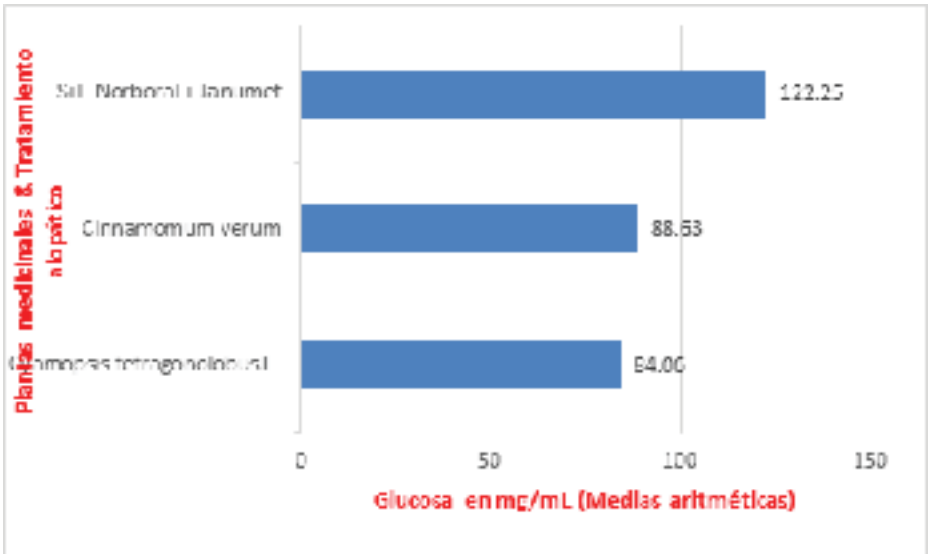
Sources	Degrees of freedom	Sums of squares	Variances	Value of $F_{Calculated}$	p–value
Between groups	2	13919	6959.3	56.03	0
Residual	45	5590	124.2		
Totals	47	19508			

Source. Minitab 18 for Windows

Table 2. *Groups, sample sizes, arithmetic means, standard deviations and estimation intervals at the 95% confidence level according to control group (Sil–Norboral + Janumet) and experimental groups (Cinnamomum verum and Cyamopsis tetragonolobus L.).lue of* $F_{Calculated}$ *& p–value.*

Groups	Sample sizes	Arithmetic means	Standard deviations	Estimation intervals at the 95% confidence level
Sil–Norboral + Janumet	16	122.25	11.58	116.64→127.86
Cinnamomum verum	16	88.63	12.89	83.01→94.24
Cyamopsis tetragonolobus L.	16	84.06	8.5	78.45→89.67

Source. Minitab 18 for Windows



Graph 1. *Medicinal plants versus allopathic treatment according to blood glucose levels (in mg/100mL).*
Source. Table 2

Table 3. *Dunnett's multiple comparisons with a control. Information pooled using Dunnett's method and a confidence level of 95%.*

Groups	Sample sizes	Arithmetic means	Group
Control group: (Sil–Norboral + Janumet)	16	122.25	A
Experimental Group: Cinnamomum verum	16	88.63	
Experimental group: Cyamopsis tetragonolobus L.	16	84.06	

Source. Minitab 18 for Windows
Interpretation.– The arithmetic means not labeled with the letter A are significantly different from the arithmetic mean of the control group.

Table 4. *Dunnett's Multiple Comparisons Tests for Level Arithmetic Means – Control Mean.*

Level difference	Difference of arithmetic means	Standard error of the differences	Estimation intervals at the 95% confidence level	T–value	Adjusted p–value
2 – 1	–33.63	3.94	–42.62, –24.63	–8.53	0
3 – 1	–38.19	3.94	–47.19, –29.19	–9.69	0

1= Sil–Norboral + Janumet;2= Cinnamomum verum; 3= Cyamopsis tetragonolobus L.
Source. Minitab 18 for Windows

Discussion

The arithmetic means of blood glucose levels in the 16 patients that make up each group was obtained, resulting in the following:

The arithmetic means, in ascending numerical order, of the blood glucose values indicated the following treatments: *Cyamopsis tetragonolobus L.* (84.06 mg/100 mL), *Cinnamomum verum* (88.63 mg/100 mL) and Sil–Norboral + Janumet (122.25 mg/100 mL). The One–Way Analysis of Variance reported a value of F= 56.03 with a value of *p*= 0.0000, which indicates a statistically significant difference between a pair or between more than one pair of arithmetic means. Dunnett's multiple comparison test revealed statistically significant differences.

When the arithmetic mean of the blood glucose variable of the control group (122.25 mg/100 mL) was compared to the arithmetic mean of the blood glucose variable of the *Cinnamomum verum* experimental group (88.63 mg/100 mL), a statistically significant difference was found: T= –8.53; *p*= 0.0000.

When the arithmetic mean of the hematic glucose variable of the control group (122.25 mg/100 mL) was compared to the arithmetic mean of the hematic glucose variable of the experimental group *Cyamopsis tetragonolobus L.* (84.06 mg/100 mL), a statistically significant difference was also found. : T= –9.69; *p*= 0.0000.

More however, when comparing the arithmetic mean of the hematic glucose variable of the experimental group

Cinnamomum verum (88.63 mg/100 mL) versus the arithmetic mean of the hematic glucose variable of the experimental group *Cyamopsis tetragonolobus L.* (84.06 mg/100 mL) no statistically significant difference was found.

Conclusions

The efficacy of the treatment corresponding to the *Cyamopsis tetragonolobus L.* experimental group is significantly better than the efficacy of the treatment corresponding to the control group.

The efficacy of the treatment corresponding to the *Cinnamomum verum* experimental group is significantly better than the efficacy of the treatment corresponding to the control group.

In descending numerical order, the arithmetic means of the experimental treatments *Cinnamomum verum* and *Cyamopsis tetragonolobus L.* are, respectively, 88.63 mg of glucose/100 mL and 84.06 mg of glucose/100 mL.

Although there is no statistically significant difference between the arithmetic means of blood glucose levels of the experimental treatments *Cinnamomum verum* and *Cyamopsis tetragonolobus L.*, the treatment with the best numerical result corresponds to *Cyamopsis tetragonolobus L.*

The null hypothesis (H_0) is rejected and the alternate hypothesis (H_1) is accepted, which to the letter states: treatment with *Cyamopsis tetragonolobus L.* and *Cinnamomum verum* significantly decrease fasting blood glucose levels in patients with type 2 diabetes mellitus. two.

Recent studies indicate that around 80% of the Mexican population resorts, in different forms and reasons, to the help of traditional medicine. This is with those we know as herbalists, or, as we say in Maya, with the good H'men or healers, as well as with midwives. In light of the great advances in both infrastructure and conventional (allopathic) medical services, the frequency with which these consultations take place is impressive. In addition, the percentage implies that not only indigenous people use these services, but also people from different socioeconomic levels.

In the state of Quintana Roo, allopathic medical service has been provided to the community for many years. Only the Morelos Hospital in Chetumal was inaugurated on January 1, 1939 to serve the entire Territory. At that time, providing the service to the entire population was, obviously, in a figurative sense since the necessary road infrastructure did not exist to transport all the patients. However, it must be said that thousands of inhabitants, yesterday and today, have survived and are present in this world thanks to the great advances of traditional medicine in terms of medicinal plants and childbirth.

The recent generations throughout the country trained under the model of the scientific method can be organized into two groups. On the one hand, the group that needs evidence and scientific precision to dare to use medicinal plants to address health situations and, on the other hand, the group that is involved in a way of thinking, observing, perceiving, analyzing, interpret and decide, which does not require formal precision to use medicinal plants. For example, to use epazote to control intestinal parasites, the first group needs specifications such as the part of the plant to be used, its physiological maturity, the time of day to cut, the dilution in water to obtain the extract, its concentration, the time of exposure to the fire, the temperature to be used, among others; all are valid and perfectly measurable considerations with modern techniques and equipment; with this certainty, the result is guaranteed and the user is offered peace of mind. However, the second group does not lose the effectiveness of the effect of using the same plant without requiring the "scientific" precisions that the first group does demand. This second group develops observation skills and, especially, cultural immersion. In such a way that it "intuits" correctly what part of the vegetable to cut, when to cut it, how to dilute it, at what temperature the cooking will be done, the time of exposure to the fire, the dosage to the user, among others.

Of what has been described above, the second way, that of intuition, is no less valid than the first, that of accurate measurement. Examples abound. All those who did not have access to the Morelos Hospital in Chetumal and who are today "alive and kicking" are living proof of the effectiveness of the second method. It is true that there have been complicated cases, including morbidity, in the second form, but there are also cases in the first form. That is, the use of scientific medicine does not necessarily imply 100% efficacy; therefore, morbidity should not be an argument against traditional medicine.

The second effective way based on intuition is actually a highly sophisticated manifestation of processes of analysis and synthesis that people develop. Without the need to know the scientific method to support a decision. Finally, there is a decision involved when the epazote leaf or another plant for medicinal use is chosen and cut, diluted, exposed to fire, the extract is used and supplied.

The work that you have today, kind reader, aims to establish a bridge between the two forms of perception of the usefulness of traditional herbal medicine. It rescues intuition, values the processes of analysis and synthesis that have accumulated over hundreds of years and that support the efficacy of traditional medicine, presenting it in such a way that the same knowledge can be validated or, rather, ratified, by those interested in scientific support. In itself, this offers enormous value to the present work.

But the value of this work is also present with two other elements. One is that the information is presented in the context of the Nagoya Protocol; that is, the authors offer knowledge that awaits not only validation and dissemination, but respect and recognition of a tangible and intangible heritage developed by the local Mayan culture and exposed to the world. Hopefully this heritage is valued under the philosophy and methodology of the Nagoya Protocol of which Mexico is a part.

The other element is economic, a factor that should not go unnoticed. There is no economy in the world, and even less so in our country, to treat the diseases of 100% of the population with the allopathic approach, nor in human resources, infrastructure and/or medicines. There is not, because the underlying philosophy is one of cure and not prevention. Traditional medicine has been, and continues to be, a stronghold for solving health problems because its primary focus is disease prevention and not healing. This is important and to be clear, very clear. Herbalism and traditional medicine, including childbirth, are not synonymous with miracles. The culture that has made traditional medicine successful, underlying all the original cultures of the world; it is simply the culture of disease prevention. Along with traditional medicine, diets, gastronomy, natural resource management practices, among others, have been developed.

The authors put in your hands, kind reader, a work that summarizes an experience and potential. I am sure that, like us, you will know how to recognize it and take advantage of it.

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