

# In vivo study of homoeopathic preparation of *Gymnema sylvestre* mother tincture, 30C and 200C on streptozotocin-induced diabetic rats

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## Abstract

**Introduction:** *Gymnema sylvestre* (GS) is a medicinal plant commonly used in complementary medicine to treat diabetes mellitus. This plant is proven scientifically to reduce blood glucose levels in the diabetic condition. However, till date, only little literature is published about the efficacy of GS prepared homoeopathically. **Objective:** In this study, we assessed the efficacy of homoeopathic preparation of GS (HPGS) in Q, 30C and 200C potencies in streptozotocin-induced diabetic rats. **Materials and Methods:** Diabetic rats were administered with 4.7 mL/kg of HPGS mother tincture (Q) for anti-hyperglycaemic efficacy on daily bases over a period of 14 days and HPGS Q, HPGS 30C and HPGS 200C potencies for dose-dependent testing on daily basis for 90 days. **Results:** On completion of treatment period, HPGS Q and HPGS 200C significantly reduced the blood glucose levels in diabetic rats ( $P < 0.05$ ). **Conclusion:** Current research findings showed that HPGS mother tincture and HPGS 200C have the ability to lower blood glucose levels in diabetic rats, suggesting its efficacy *in vivo*.

**Keywords:** Diabetes mellitus, *Gymnema sylvestre*, Homoeopathy, Sprague–Dawley rats

## INTRODUCTION

Diabetes mellitus is presently the most common non-communicable disease worldwide and was reported as the ninth leading cause of death globally by the World Health Organization (WHO) in 2019.<sup>[1]</sup> Diabetes mellitus is a chronic endocrine metabolic disorder resulting from pancreatic beta cell dysfunction and insulin resistance.<sup>[2]</sup>

According to the WHO, the prevalence of diabetes mellitus in adults above 18 years old has increased from 4.7% in 1980 to 8.5% in 2014, a statistic that has almost doubled. This trend is growing faster in middle- to low-income countries including Malaysia. The National Health and Morbidity Survey in Malaysia demonstrated that the prevalence of diabetes mellitus has doubled from 1996 to 2015, in just two decades.<sup>[2]</sup> This is a worrying trend and a huge public health issue as diabetes mellitus can leave the individuals with complications and less work productivity. The risk factor contributing to the rising prevalence of diabetes mellitus involves unhealthy eating. Malaysian Adult Nutrition Survey

shows that Malaysian consumption of the recommended three servings of vegetables daily has dropped to 10%. Malaysian population has a generally poor achievement (below 20%) of the recommended serving for the major food groups, especially fruits, vegetables, legumes and nuts.<sup>[2]</sup> The data showed that Malaysians have less intake of major nutrients, reflecting that the population resorts to less healthy food such as processed food, which generally has higher sugar and calorie content.

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*Gymnema sylvestre* (GS) is a well-known medicinal plant documented in Ayurvedic traditional medicine and has been studied extensively as a treatment for diabetic mellitus. One of the interesting characters of this plant is its anti-sweet property.<sup>[3-6]</sup> The main chemical group in this plant is gymnemic acid, which can suppress sweet taste sensation in humans.<sup>[5]</sup> The individuals consuming GS are proven to experience less sweet taste intensity and have lesser tendency towards sweet food.<sup>[5]</sup> This characteristic of GS perhaps explained scientifically the prescription of GS in homeopathic practice and its functionality, at least partially.<sup>[7,8]</sup>

In general, homeopathy uses small doses of substances to stimulate auto-regulatory and self-healing processes. Chewing the leaves of GS is known to destroy one's ability to taste sweetness; similar condition is experienced when diabetes patients have blunt taste response, leading to even high sugar intake.<sup>[7,8]</sup>

This study aimed to validate the usefulness of GS prepared homeopathically. Homeopathic preparation involves a different methodology than conventional pharmaceutical processes, yielding a different formulation, although the same natural product is utilized.<sup>[9]</sup>

In this study, we aimed to assess the efficacy of different potencies of homeopathic preparation of GS (HPGS) *in vivo* by analysing the anti-diabetic effect of different doses of HPGS available commercially in streptozotocin (STZ)-induced rats.

## MATERIALS AND METHODS

### Homeopathic preparation of *Gymnema sylvestre*

HPGS manufactured by Dr Wilmar Schwabe India Pvt. Ltd. (GmbH, Germany) and imported by Global Homeopathic Centre (Subang Jaya, Malaysia) was used. In this study, GS mother tincture (HPGS Q), potency 30c (HPGS 30c) and potency 200c (HPGS 200c) were used. All the three potencies tested were supplied by Dr Wilmar Schwabe India Pvt. Ltd., India, in the liquid form. Metformin tablets were purchased from Healol Pharmaceuticals Sdn. Bhd., Kuala Lumpur, Malaysia (Lot No. 3008022 and Batch No. PGR0153). The physical properties of these products are shown in Table 1.

### Experimental animals

Sixty male Sprague–Dawley rats were obtained from Prima Nexus Sdn. Bhd., Kuala Lumpur, Malaysia. All rats were

about 4–6 weeks old weighing between 200 and 300 g. They were kept in Animal House in University of Cyberjaya (UoC), formerly known as Cyberjaya University College of Medical Sciences (CUCMS). The experimental model was approved by the CUCMS Ethics Committee of Animal Care and Use at ethical committee meeting number CACUC/1/2019/2 dated 14 November 2019. All the animal handling protocols were performed in accordance with the guidelines issued by the CUCMS Ethics Committee. The rats were acclimatized to the laboratory environment for a week. They were kept two animals per cage, at room temperature between 20°C and 32°C with 12-h light/dark cycle, and had free access to commercial pellet and water *ad libitum* throughout the research period.

### Exploratory testing of homeopathic preparation of *Gymnema sylvestre* Q in streptozotocin-induced diabetic rats

Twenty-four male Sprague–Dawley rats were randomly divided into four groups of 6 rats each. Normal healthy rats without induction of diabetes were designated as sham group (Group 1). In rest of the 18 rats, diabetes was induced by administering 50 mg/kg STZ intravenously (freshly dissolved in normal saline). The fasting blood glucose level was measured after 7 days using Accu-Chek Glucometer (Roche, Germany), and the rats with the blood glucose level of 10 mmol/L or more were considered as diabetic and included in the study.

After induction of type-2 diabetes, 18 rats were randomly categorized into three groups and were named as control group diabetic rats which were treated with normal saline vehicle (Group 2), reference group diabetic rats which were treated with metformin (Group 3) and test group diabetic rats were treated with 4.7 mL/kg HPGS Q (Group 4). Metformin at a dose of 200 mg/kg body weight was given to Group 3 and HPGS Q was given at the dose of 4.7 mL/kg to Group 4. Group 1 (non-diabetic healthy rats) and Group 2 (diabetic rats which were not treated either with metformin or HPGS Q) received only normal saline vehicle. The treatments were given orally through force feeding via oral gavage for a duration of 14 days. After the study period, diabetic rats were sacrificed by euthanizing with an anaesthetic overdose of 100 µL of a 10:1 (mg: mg) ketamine: xylazine solution by intravenous route.<sup>[10]</sup>

**Table 1: Physical properties of homeopathic preparation of *Gymnema sylvestre* Q, 30C and 200C**

Item	Details		
Name	<i>G. sylvestre</i> Q	<i>G. sylvestre</i> 200CH	<i>G. sylvestre</i> 200CH
Lot/batch number	0094927	0170130	0170130
Expiry date	July 2021	September 2023	September 2023
Physical appearance	Liquid	Liquid	Liquid
Colour	Brown	Crystal clear	Crystal clear
Storage	Ambient	Ambient	Ambient

*G. sylvestre*: *Gymnema sylvestre*

Sham group rats (Group 1) were to ensure that an unknown variable is not adversely affecting the rats in the experiment and also to show that the blood glucose levels of reference and test group rats were similar as that of sham group rats after treatment with metformin and HPGS Q, respectively. Control group rats (Group 2) that were diabetic acted as a standard against Group 3- and Group 4-treated diabetic rats to measure the differences in blood glucose levels among the experimental groups.<sup>[11]</sup>

The dosage was calculated with respect to the human daily dose intake, as the human equivalent dose (HED) from the clinical experience is a maximum of 60 drops/day which converts into 3 mL (20 drops = 1 mL). Therefore, HPGS Q dose translation for 4.7 mL/kg based on body surface area was calculated as shown below.<sup>[12]</sup>

$$\text{HED (mg/kg)} = \text{Animal dose (mg/kg)} \times (\text{Animal } K_m / \text{Human } K_m)$$

$$K_m \text{ for humans} = 37; K_m \text{ for rats} = 6.$$

$$\text{Animal dose (mL/kg)} = (3 \text{ mL/kg} \times 37) / 6 = 18.5 \text{ mL/kg.}$$

An average of weight of the rats in this study is 257 g (0.257 kg).

$$\text{Volume required per rat} = 18.5 \text{ mL/kg} \times 0.257 \text{ kg} = 4.7 \text{ mL.}$$

### Dose-dependent study of homeopathic preparation of *Gymnema sylvestre* Q, 30c and 200c in streptozotocin-induced diabetic rats

Thirty-six male Sprague–Dawley rats were randomly divided into six groups of 6 rats each. The six groups were the sham group rats (Group 1), control group diabetic rats treated with normal saline (Group 2) and reference group diabetic rats treated with metformin (Group 3). Test group diabetic rats were treated with HPGS Q (Group 4 – test 1), HPGS 30c (Group 5 – test 2) and HPGS 200c (Group 6 – test 3). Diabetes was induced as mentioned above to 30 rats in all 5 groups excluding the 6 rats in sham group (with the same inclusion criteria to qualify as diabetic rats).

Metformin at a dose of 200 mg/kg was given to Group 3. HPGS Q, HPGS 30c and HPGS 200c were given at a dose of 4.7 mL/kg to Groups 4, 5, and 6, respectively. Groups 1 and 2

only received normal saline which was used as a vehicle. The difference in these two groups was sham group rats (Group 1) were healthy non-diabetic rats and control group rats (Group 2) were STZ-induced diabetic rats. These two groups were given the same vehicle to show that the vehicle did not have any effect on blood glucose level. Hence, Group 1 non-diabetic rats were served as a standard against diabetic-induced rats and Group 2 diabetic untreated rats were served as a standard against diabetic-treated rats (Groups 3, 4, 5 and 6) for the comparison of differences in the blood glucose levels before and after treatment. The dose calculation for HPGS was explained earlier and the treatments were given orally through force feeding via oral gavage for a duration of 90 days. At the end of the study, rats were sacrificed using the same procedure as explained earlier section.

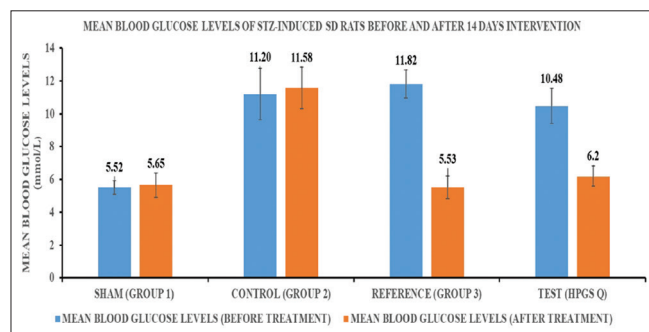
### Statistical analysis

Statistical analysis was performed using Statistical Package for the Social Science computer program, Version 16.00 (SPSS Inc.233 South Wacker Drive, Chicago, IL 60606-6412, USA). All the results were expressed as mean ± standard deviation (SD) The data were analysed statistically by repeated measures analysis of variance. A  $P < 0.05$  was considered as a statistically significant difference.

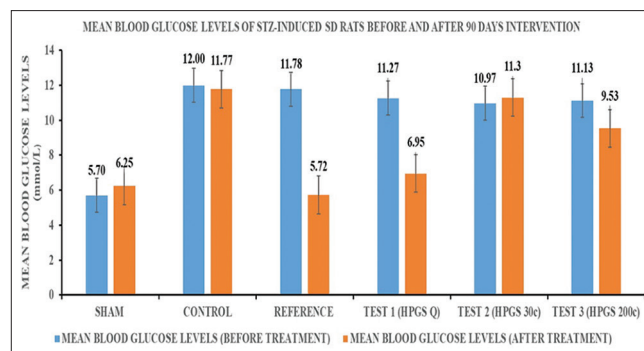
## RESULTS

### *In vivo* efficacy of homeopathic preparation of *Gymnema sylvestre* Q in streptozotocin-induced diabetic rats

The mean blood glucose level results for antihyperglycemic efficacy of HPGS Q is shown in Table 2 and schematic profile of mean blood glucose levels is shown in Figure 1. The ‘0’ day results (pre-dose blood glucose levels) were taken before the treatment of rats with normal saline (vehicle), reference (metformin) and test (HPGS Q). On the injection of streptozotocin, on the day ‘0’, rats in 3 groups (Groups 2, 3 and 4) showed significant increase of blood glucose level ( $\geq 10$  mmol/L) compared to sham group at 5.52 mmol/L ( $P < 0.05$ ). It demonstrated that 50 mg/kg STZ was adequate for development of diabetic condition in all groups, except sham group.



**Figure 1:** Mean blood glucose levels of sham, control, reference and test groups for anti-hyperglycaemic efficacy of homeopathic preparation of *Gymnema sylvestre* Q. Mean ± standard deviation,  $n = 6$



**Figure 2:** Dose dependency testing of homeopathic preparation of *Gymnema sylvestre* on the blood glucose levels in streptozotocin-induced diabetic rats over 90 days. Mean ± standard deviation,  $n = 6$

After 2 weeks of the study, it was found that diabetic rats treated with metformin (Group 3) demonstrated significant reduction in the blood glucose levels from 11.82 mmol/L on the day '0' to 5.53 mmol/L on the day 14 ( $P < 0.05$ ). Further, diabetic rats treated with HPGS Q (Group 4) showed significantly lower ( $P < 0.05$ ) blood glucose levels from 10.48 mmol/L (day '0') to 6.2 mmol/L compared to Group 2, diabetic control group rats (11.58 mmol/L) and significantly similar blood glucose levels (5.53 mmol/L) to rats treated with metformin ( $P > 0.05$ ) on the day 14 of intervention.

This data demonstrated that HPGS Q as mother tincture formulation improved the blood glucose profiles of STZ-induced diabetic rats within 14 days of intervention, comparable to that of standard hypoglycaemic agent metformin. Furthermore, the data demonstrated that GS prepared in homoeopathically offers similar effect with respect to the formulations reported scientifically in various published literature.<sup>[13-21]</sup> At the perspective of science, this suggests that the active compounds are retained in adequate amount under homoeopathic pharmacy preparation of Q, to offer such biological activity.

### Dose-dependent study of homoeopathic preparation of *Gymnema sylvestre* Q, 30c and 200c in streptozotocin-induced diabetic rats

The mean blood glucose levels of dose dependent study of HPGS is shown in Table 3 and schematic profile of mean blood glucose levels is shown in Figure 2. The effect of different potencies of HPGS, namely HPGS Q, 30c and 200c, in controlling the blood glucose profile in diabetic rats was studied. The principle of homoeopathic therapy was studied where highly diluted medicine can exert medicinal effects. This study was carried out *in vivo* using STZ-induced diabetic rats.

After 90 days without treatment intervention, control group diabetic rats (Group 2) demonstrated consistently higher blood glucose levels at 11.77 mmol/L. Diabetic rats treated with metformin (Group 3) had significantly improved the blood

glucose profiles from 11.78 mmol/L on the day '0' to 5.72 mmol/L on the day 90 ( $P < 0.05$ ). The blood glucose levels of reference group diabetic rats treated with metformin are statistically in similarity to sham group healthy non-diabetic induced rats ( $P > 0.05$ ) on the day '0' (5.70 mmol/L) and day 90 (6.25 mmol/L).

Diabetic rats treated with HPGS Q consistently demonstrated significant improvement in blood glucose profiles over the weeks from 11.27 mmol/L to 6.95 mmol/L after 90 days of treatment ( $P < 0.05$ ). Interestingly, HPGS Q is able to reduce the blood glucose level of diabetic rats close to baseline (5.70 mmol/L) of sham group rats ( $P > 0.05$ ).

Diabetic rats treated with HPGS 200c for a period of 90 days had reduced the blood glucose levels significantly from 11.13 mmol/L to 9.53 mmol/L ( $P < 0.05$ ). However, the blood glucose level was not comparable with the baseline glucose level of sham group rats (5.70 mmol/L). Interestingly, HPGS 200c has not demonstrated an improvement in the blood glucose levels on 14-day intervention (11.23  $\pm$  0.47 mmol/L) and 28-day intervention (11.48  $\pm$  0.53 mmol/L) [data were not shown in Table 3]. As the study progressed, a reduction in blood glucose levels were observed and a 90-day intervention showed a reduction of blood glucose levels to 0.53 mmol/L, suggesting a longer intervention time required for HPGS 200c to improve blood glucose profile in diabetic rats.

On the other hand, diabetic rats treated with HPGS 30c for 90 days showed an elevated blood glucose levels from 10.97 mmol/L (day '0') to 11.30 mmol/L. Although this increment is not significant statistically ( $P > 0.05$ ), rats were still found to be diabetic and HPGS 30c did not show therapeutic benefit in the reduction of blood glucose levels in a period of 90-day intervention.

## DISCUSSION

The attained results from anti-hyperglycaemic efficacy study of

**Table 2: Results of mean blood glucose levels of sham, control, reference and test groups for anti-hyperglycaemic efficacy of homoeopathic preparation of *Gymnema sylvestre* Q**

Time (days)	Mean blood glucose levels (mmol/L)			
	Sham (non-diabetic)	Control (diabetic)	Reference (metformin)	Test (HPGS Q)
0	5.52 $\pm$ 0.41	11.20 $\pm$ 1.57	11.82 $\pm$ 0.85	10.48 $\pm$ 1.07
14	5.65 $\pm$ 0.74	11.58 $\pm$ 1.27	5.53 $\pm$ 0.68	6.20 $\pm$ 0.61

Mean $\pm$ SD, n=6. GS: *Gymnema sylvestre*, HPGS: Homoeopathic preparation of *G. sylvestre*, SD: Standard deviation

**Table 3: Mean body glucose levels of dose-dependent study of homoeopathic preparation of *Gymnema sylvestre* in streptozotocin-induced diabetic rats over 90 days**

Time (days)	Mean blood glucose levels (mmol/L)					
	Sham (non-diabetic)	Control (diabetic)	Reference (metformin)	Test 1 (HPGS Q)	Test 2 (HPGS 30c)	Test 3 (HPGS 200c)
0	5.70 $\pm$ 0.22	12.00 $\pm$ 1.35	11.78 $\pm$ 0.54	11.27 $\pm$ 0.51	10.97 $\pm$ 0.90	11.13 $\pm$ 0.44
90	6.25 $\pm$ 0.50	11.77 $\pm$ 0.81	5.72 $\pm$ 0.43	6.95 $\pm$ 0.22	11.30 $\pm$ 0.45	9.53 $\pm$ 0.67

GS: *Gymnema sylvestre*, HPGS: Homoeopathic preparation of *G. sylvestre*

HPGS Q demonstrated that mean blood glucose levels on day 14 for diabetic rats treated with metformin (Group 3 – reference) and HPGS Q (Group 4 – test) were lower than that of the control group diabetic rats (Group 2) and similar to that of normal sham group rats (Group 1). The control group rats showed hyperglycaemia throughout the study period for 14 days due to the low level of insulin and found to be statistically significant difference ( $P < 0.05$ ) when compared with the groups of sham, reference and test. An elevated blood glucose levels in reference and test diabetic rats were significantly ( $P < 0.05$ ) decreased compared to control group diabetic rats. Hence, the resultant data confirmed the anti-hyperglycaemic efficacy of HPGS Q in glycaemic control similar to a first-line anti-diabetic drug, metformin (reference standard) during the study period. At the same time, blood glucose levels did not differ significantly ( $P > 0.05$ ) between the sham non-diabetic group rats and reference and test diabetic rat groups after treatment with HPGS Q for 14 days. This indicated that the HPGS Q effectively reduced the blood glucose levels in the diabetic rats over a period of 2 weeks in similar to metformin, a reference product which confirms the traditional use of the GS plant. The phytoconstituents, 5,3',4'-trihydroxy-7-methoxy-4-phenylcoumarin 5-O-(6''-acetyl)-galactoside, allamandin, phytosphingosine and anacardic acid identified in HPGS Q through our liquid chromatography-mass spectroscopy (MS) and gas chromatography–MS analysis<sup>[22]</sup> might play a vital role in reduction of blood glucose levels in test group rats treated with HPGS Q and exhibited anti-diabetic potential. However, further studies identifying pathway of action and specific role of the phytoconstituents are needed.

Long-term dose-dependent blood glucose-lowering effect with different potencies of HPGS in diabetic rats over 90 days demonstrated that HPGS had a hypoglycaemic effect but not in a dose-dependent manner. Among the three potencies of HPGS, a maximum dose–response with a stable glucose control was observed in HPGS Q compared to HPGS 30c and 200c. The aforementioned bioactive constituents present in HPGS Q could be responsible for stimulation of insulin secretion and/or promotion of the regeneration of pancreatic  $\beta$ -cells for production of hypoglycaemic effect.<sup>[23]</sup> An ineffective level of bioactive constituents in HPGS 30c might be due to higher dilution with alcohol, which could be a possible reason for an elevated blood glucose levels in diabetic rats in these groups. The phenomena of relatively delayed onset of blood glucose lowering action of HPGS 200c in 90-day intervention might be depicted that the activity of HPGS 200c is amplified with time. Hence, the presence of any minute or undetectable amount of starting material in HPGS 200c might have taken time to achieve the adequate concentrations at the target tissues in the body to display blood glucose lowering action.<sup>[24]</sup> Based on attained results from the present study, the order of anti-diabetic potential of HPGS from highly effective to ineffective was HPGS Q > HPGS 200c > HPGS 30c. Hence, it was confirmed that HPGS Q (mother tincture)

and HPGS 200c have ability to lower blood glucose levels in diabetic rats, suggesting its efficacy *in vivo*. However, as the homeopathic principle deploys an approach to personalize the medication based on individual patient profile rather than the disease, personalization of individual profile is not possible under *in vivo* setting using rats as experimental models. This could be investigated on the human volunteers for accurate prediction of anti-diabetic potential of HPGS in diseased individuals.<sup>[25,26]</sup> Hence, this study may not be able to translate more personalized remedy to prove the concept at the limit of current technology, but research findings of the present research could serve as a resource for future research in Homoeopathy to identify the presence of nanoparticles in high potency homeopathic remedies and also to understand their gene regulatory mechanism in the management of diabetes mellitus.

## CONCLUSION

HPGS Q improved the blood glucose levels in STZ-induced diabetic rats over a period of 2 weeks in similar to a first-line anti-diabetic drug, metformin, which confirms the anti-hyperglycaemic efficacy of GS *in vivo*. However, remedial effect was found to be dose independent. A maximum dose–response with a stable glucose control was observed with HPGS Q and relatively delayed onset of action was observed with HPGS 200c at 90-days intervention.

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## Conflict of interest

None declared.

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### स्ट्रेप्टोजोटोसिन-जनित मधुमेह पीड़ित चूहों पर जिमनेमा सिलवेस्ट्रे विलयन क्यू, 30 एवं 200 की होम्योपैथिक निर्मिति का अन्तर्जीव अध्ययन

**प्रस्तावना:** जिमनेमा सिलवेस्ट्रे एक औषधीय पौधा है जो मधुमेह मेलिटस का उपचार करने के लिए सामान्यतौर पर समपूरक दवाओं में इस्तेमाल होता है। मधुमेह से पीड़ित होने पर रक्त शर्करा स्तरों को घटाने में यह पौधा वैज्ञानिक तौर पर सिद्ध है। हालांकि, आज की तारीख तक होम्योपैथिक तौर पर निर्मित जिमनेमा सिलवेस्ट्रे की प्रभावोत्पादकता के बारे में बहुत कम साहित्य ही प्रकाशित हुए हैं। **उद्देश्य:** इस अध्ययन में, हमने स्ट्रेप्टोजोटोसिन-जनित मधुमेह पीड़ित चूहों पर जिमनेमा सिलवेस्ट्रे विलयन क्यू, 30 एवं 200 की होम्योपैथिक निर्मिति की प्रभावोत्पादकता का मूल्यांकन किया था। **पद्धति:** मधुमेह पीड़ित चूहों को दैनिक आधार पर 14 दिनों की अवधि में एंटीहाईपरग्लाइसिमिक प्रभावोत्पादकता के लिए एचपीजीएस क्यू की 47 एमएल/किग्रा खुराक दी गई तथा 90 दिनों तक खुराक आधारित परीक्षण के लिए एचपीजीएस क्यू, एचपीजीएस 30सी एवं एचपीजीएस 200 सी प्रायोगिक औषधियाँ दी गई थी। **परिणाम:** परीक्षण अवधि के पूरा होने पर, एचपीजीएस क्यू तथा एचपीजीएस 200सी ने मधुमेह पीड़ित चूहों के रक्त शर्करा स्तरों (पी < 0.05) को काफी हद तक कम किया था। **निष्कर्ष:** मौजूदा अनुसंधान निष्कर्षों ने दर्शाया था कि एचपीजीएस क्यू तथा एचपीजीएस 200सी में यह क्षमता है कि वे मधुमेह पीड़ित चूहों के रक्त शर्करा स्तरों को कम कर सकें, जो अन्तर्जीव में इसकी प्रभावोत्पादकता को बताता है।

### Etude in-vivo de préparation homéopathique de *Gymnema sylvestre* dilution Q, 30 et 200 sur des rats diabétiques induits par la streptozotocine

**Introduction:** Le *Gymnema sylvestre* est une plante médicinale couramment utilisée en médecine complémentaire pour traiter le diabète sucré. Il est prouvé scientifiquement que cette plante réduit les niveaux de glucose dans le sang chez les diabétiques. Cependant, à ce jour, peu de littérature est publiée sur l'efficacité du *Gymnema sylvestre* préparé par homéopathie. **Objectif:** Dans cette étude, nous avons évalué l'efficacité de la préparation homéopathique de *Gymnema sylvestre* (HPGS) dans les puissances Q, 30c et 200c chez des rats diabétiques induits par la streptozotocine. **Méthode:** Des rats diabétiques ont été administrés 4,7 ml/kg de HPGS Q pour une efficacité antihyperglycémique chaque jour sur une période de 14 jours et des puissances de HPGS Q, HPGS 30c et HPGS 200c pour des essais proportionnels à la dose sur une base quotidienne pendant 90 jours. **Résultats:** À la fin de la période de traitement, HPGS Q et HPGS 200c ont considérablement réduit les taux de glucose sanguin chez les rats diabétiques ( $p < 0,05$ ). **Conclusion:** Les résultats des recherches actuelles ont montré que HPGS Q et HPGS 200c ont la capacité d'abaisser les taux de glucose chez les rats diabétiques, suggérant son efficacité in-vivo.

## Estudio *in vivo* de la preparación homeopática de la dilución Q de *Gymnema sylvestre*, 30 y 200 en ratas diabéticas inducidas por estreptozotocin/ streptozotocin

**Introducción:** *Gymnema sylvestre* es una planta medicinal comúnmente utilizada en medicina complementaria para tratar la diabetes mellitus. Esta planta se ha probado científicamente para reducir los niveles de glucosa en la sangre en la condición diabética. Sin embargo, hasta la fecha sólo se publica poca literatura sobre la eficacia de *Gymnema sylvestre* preparado homeopáticamente. **Objetivo:** En este estudio se evaluó la eficacia de la preparación homeopática de *Gymnema sylvestre* (HPGS) en Q, 30c y 200c potencias en ratas diabéticas inducidas por estreptozotocin/ streptozotocin. **Método:** Se administraron ratas diabéticas con 4,7 ml/kg de HPGS Q para una eficacia antihiper glucémica diaria durante un período de 14 días y potencias de HPGS Q, HPGS 30c y HPGS 200c para pruebas dependientes de la dosis diarias durante 90 días. **Resultados:** Al finalizar el período de tratamiento, HPGS Q y HPGS 200c redujeron significativamente los niveles de glucosa en la sangre en ratas diabéticas ( $p < 0,05$ ). **Conclusión:** Los hallazgos de la investigación actual mostraron que HPGS Q y HPGS 200c tienen la capacidad de disminuir los niveles de glucosa en la sangre en ratas diabéticas, lo que sugiere su eficacia *in vivo*.

## *In-vivo*-Studie zur homöopathischen Zubereitung der *Gymnema sylvestre*-Verdünnung Q, 30 und 200 an Streptozotocin-induzierten diabetischen Ratten

**EinleitungEinführung:** *Gymnema sylvestre* ist eine Heilpflanze, die häufig in der Komplementärmedizin zur Behandlung von diabetes mellitus. Diese Pflanze ist wissenschaftlich erwiesen, um den Blutzuckerspiegel im diabetischen Zustand zu senken. Bis heute wird jedoch nur wenig Literatur über die Wirksamkeit von homöopathisch zubereitetem *Gymnema sylvestre* veröffentlicht. **Ziel:** In dieser Studie untersuchten wir die Wirksamkeit der homöopathischen Zubereitung von *Gymnema sylvestre* (HPGS) bei Potenzen Q-, 30c- und 200c-Potenzen bei Streptozotocin-induzierten diabetischen Ratten. **Methode:** Diabetische Ratten wurden mit 4,7 ml/kg HPGS Q zur antihyperglykämischen Wirksamkeit auf täglicher Basis über einen Zeitraum von 14 Tagen und HPGS Q-, HPGS 30c- und HPGS 200c-Potenzen für dosisabhängige Tests verabreicht täglich für 90 Tage. **Ergebnisse:** Nach Abschluss des Behandlungszeitraums reduzierten HPGS Q und HPGS 200c den Blutzuckerspiegel bei diabetischen Ratten signifikant ( $p < 0,05$ ). **Schlussfolgerung:** Die aktuelle Forschungsergebnisse zeigten, dass HPGS Q und HPGS 200c die Fähigkeit haben, den Blutzuckerspiegel bei diabetischen Ratten zu senken, was auf eine Wirksamkeit *in vivo* hindeutet.

## 链脲佐菌素诱导糖尿病大鼠体内制备间质细胞生长素Q、30和200的研究

导言：匙羹藤是一种治疗糖尿病的常用补充药物。这种植物在糖尿病情况下被科学证实能降低血糖水平。然而，至今仅有少数文献报道过同种动物制备的钾盐裸甲藻的功效。目标：本实验对链脲佐菌素诱导的糖尿病大鼠体内顺势疗法治疗血清Q、30c和200c效价进行了评价。方法：糖尿病大鼠每天服用4.7mL/kg的HPGS Q抗高血糖药效14天，HPGS Q、HPGS 30c和HPGS 200c药效90天，每日进行剂量依赖性测试。结果：治疗期结束后，HPGS Q和HPGS 200c显著降低了糖尿病大鼠的血糖水平( $p < 0.05$ ) 结论：目前的研究结果显示，HPGS Q和HPGS 200c具有降低糖尿病大鼠血糖水平的能力，表明其在体内是有效的。