



Original Article

## Experimental Study to Assess the Effectiveness of Curry Leaves in Reducing Blood Sugar Among Type II Diabetes Clients in Selected Rural Areas in Haryana

Priyanka Gupta<sup>1</sup>, \*Dr. Suman<sup>2</sup>, Sonia Devi<sup>3</sup>, Shilpa Rani<sup>4</sup>, Shalika Sandal<sup>5</sup>, Anju Rani<sup>6</sup>, Charu Chugh<sup>7</sup>, Dr. Gargee Karadkar<sup>8</sup>

<sup>1</sup>Professor cum HOD (Medical Surgical Nursing), SBDS College of Nursing, Ratia (Haryana)

<sup>2</sup>\*Professor (Community health nursing) Maharishi Markandeshwar Deemed to be University, Mullana, Ambala (Haryana)

<sup>3</sup>Associate Professor (Mental Health Nursing) Maharishi Dayanand Institute of Nursing, Hisar (Haryana)

<sup>4</sup>Associate Professor (Mental Health Nursing) SBDS College of Nursing, Ratia (Haryana)

<sup>5</sup>Tutor (Child Health Nursing) Maharishi Markandeshwar Deemed to be University, Mullana, Ambala (Haryana)

<sup>6</sup>MNS (Military Hospital, Ambala (Haryana)

<sup>7</sup>Tutor (Medical Surgical Nursing), Maharishi Dayanand Institute of Nursing, Hisar (Haryana)

<sup>8</sup>Associate Professor (Medical Surgical Nursing) Bharati Vidyapeeth Deemed to be University, Navi Mumbai (Maharashtra)

 OPEN ACCESS

### ABSTRACT

#### Corresponding Author:

**Dr. Suman**

Professor (Community health nursing) Maharishi Markandeshwar Deemed to be University, Mullana, Ambala (Haryana) Corresponding author

**Email:** -

[sumanmoun60@gmail.com](mailto:sumanmoun60@gmail.com)

Received: 25-02-2026

Accepted: 22-3-2026

Available online: 07-04-2026

Copyright © International Journal of Medical and Pharmaceutical Research

**Background and aim:** An experimental study to assess the effectiveness of curry leaves in reducing blood sugar among type ii diabetes clients in selected rural areas at Haryana. The research aimed assess the blood sugar level in type II Diabetic clients in both the experimental and control groups, and effectiveness of curry leaves on the blood sugar level in the experimental group. **Materials and Methods:** This Quantitative study was used in which included designed is Experimental Pre-test, Post-test research design. The sample size 60 type II DM patients in which 30 patients in the experimental and 30 in the control. The sample are type II DM patients in Haryana. Sampling technique was used random sampling. The study result was found the analysis reveals the pretest level of blood glucose among Type II Diabetic patients in the experimental and control groups. In the experiment group blood glucose level in pretest is 204.90 and in the control it is 170.83. Statistical analysis using student independent t-test. In the experiment group post prandial blood glucose level is 183.50 and in control it is 169.53. The findings implies was a significant difference in blood glucose level before and after intervention. On comparing the pre and post-blood glucose levels in relation to curry the obtained mean difference is 10.44% and 0.76%, respectively. **Conclusion** of study analysis revealed a significant effect of curry leaves powder on reduction of blood sugar level of Type II Diabetic clients.

**Keywords:** effectiveness, diabetes, experimental, blood sugar, rural area.

### INTRODUCTION

Diabetes is a group of diseases characterized by increased levels of glucose in the blood resulting from defects in insulin secretion, insulin action, or both. Normally, a certain amount of glucose circulates in the blood. The major sources of this glucose are absorption of ingested food in the gastrointestinal tract and formation of glucose by the liver from food substances. Insulin, a hormone produced by the pancreas, controls the level of glucose in the blood by regulating the production and storage of glucose. In diabetes, the cells may stop responding to insulin or the pancreas may stop producing insulin entirely. This may leads to hyperglycaemia, which may result in acute metabolic complications. Long term effects of hyperglycaemia contribute to macro vascular complications. India leads the world with largest number of diabetic subjects earning the dubious distinction of being termed the "diabetes capital of the world". India is now the country with the most diabetic people, and Indian migrants in many parts of the world have a higher frequency of diabetes than the indigenous population has. There has been a progressive rise in the prevalence of diabetes in India since the 1970, with

increase from about 2% to 12% in urban populations. Diabetes is an "Iceberg" disease. Although there is increase in both prevalence and incidence of non-insulin dependent diabetes globally, it have been especially dramatic in newly industrialized countries and in developing countries. The prevalence of diabetes for all age-groups worldwide was estimated to be 2.8% in 2000 and 4.4% in 2030. The total number of people with diabetes is projected to rise from 171 million in 2000 to 366 million in 2030. The prevalence of diabetes is higher in men than women, but there are more women with diabetes than men. The urban population in developing countries is projected to double between 2000 and 2030. The most important demographic change to diabetes prevalence across the world appears to be the increase in the proportion of people above 65 years of age. The prevention and control of the diabetes pandemic and its complications is a major public challenge, but there is hope for the future. The progress of research in all fields of diabetes therapeutics from diabetes treatment to continuous glucose monitoring systems to novel insulin delivery system has been spectacular. Recently There are different modalities of treatment for Diabetes Mellitus. Among them, in India alternative medicine plays an important role, e.g.: Ayurveda, Homeopathy, Siddha, yoga, naturopathy etc. In Ayurveda herbal extracts from plant roots, leaves ,flowers etc are commonly used as a mode of treatment. The role of Ayurveda in control of diabetes is under exploration. Some studies reveals the effectiveness of curry leaves in reducing blood sugar. Pharmacological properties *Murraya koenigii* has been mentioned in the traditional medicinal system Ayurveda (Sathyavati et al., 2011), Bark, root, leaves, fruits and fruit pulp of *Murraya koenigii* (Curry leaves) are widely used in the treatment of diabetes. The aqueous extract of these leaves may be prescribed as adjunct to dietary and drug treatment for controlling diabetes mellitus. This findings create an inspiration for the investigator to conduct this study in urban community area where she found more diabetic clients. This curry leaves can easily available and affordable by the community people .

### MATERIAL AND METHODS:

Research approach was used a quantitative research. Research design The study designed chosen for the study is Experimental Pre-test, Post-test research design. It is represented as: O1: Pretest assessment of Blood Glucose Level. X: Intervention on Curry leaves (10gms of curry leaves powder along with their routine treatment) NO2: Post-test assessment of Blood Glucose level.

In this study the independent variables refers to the curry leaves powder. Dependent variable is the variable that the researcher is interested in understanding, explaining or predicting. In this study the dependent variable refers to the level of blood glucose The population of the present study consists of type ii diabetes mellitus patients who will be willing to participate. In this study the sample are type ii diabetes mellitus patients in a selected area Punjab. The sample size of the study consists of 60 type ii diabetes mellitus patients in which 30 patients were selected in experimental and 30 were selected in the control group and the random sampling technique was used. Conducted at selected areas in Haryana.

### RESULTS:

Frequency and percentage distribution of demographic variables of Type II Diabetic patients in experimental and control group

**Table-1 Distribution of demographic variables of type II diabetic clients. N-60**

Demographic variables		Experiment Group (30)		Control Group (30)		Chi square test
		F	%	f	%	
Age	40-45yrs	6	20.0	4	13.3	$\chi^2=5.148$ P=0.161
	46-50 yrs	11	36.7	6	20.0	
	51-55 yrs	6	20.0	14	46.7	
	56-60yrs	7	23.3	6	20.0	
Sex	Male	10	33.3%	13	43.3	$\chi^2=0.$ P=0.42
	Female	20	66.7	17	56.7	
Religion	Hindu	25	83.3	23	76.7	$\chi^2=2.483$ P=0.478
	Muslim	1	3.3	0	0	
	Christian	4	13.3	6	20.0	
	Others	0	0	1	3.3	
Education	Illiterate	9	30.0	3	10.0	$\chi^2=9.095$ P=0.10
	Primary	10	33.3	9	30.0	
	Secondary	1	3.3	7	23.3	
	Higher secondary	6	20.0	4	13.3	
	Graduate	1	3.3	3	10.0	

Occupation	Diploma	3	10.0	4	13.3	$\chi^2=4.940$ P=0.176
	Homemaker	19	63.3	12	40.0	
	Private employee	5	16.7	8	26.7	
	Govt Employee	1	3.3	5	16.7	
	Self-employee	5	16.7	5	16.7	
Family members	<2	11	36.7	7	23.3	$\chi^2=4.056$ P=0.25
	3-4	11	36.7	13	43.3	
	4-5	6	20.0	10	33.3	
	>5	2	6.7	0	0	
Income	<4726	0	0	1	3.3	$\chi^2=1.822$ P=0.610
	Rs4727-7877	9	30.0	6	20.0	
	Rs7878-11816	13	43.3	13	43.3	
	>11817	8	26.7	10	33.3	
Dietary Habit	Vegetarian	7	23.3	7	23.3	$\chi^2=0.00$ P=1.00
	Non-vegetarian	23	76.7	23	76.7	
Non-veg how often	Daily	3	10.0	2	6.7	$\chi^2=2.490$ P=0.646
	Weekly once	14	46.7	17	56.7	
	Once in a week	4	13.3	4	13.3	
	Once in month	2	6.7	0	0	
If vegetarian How often-fried items, sweets	Daily	0	0	0	0	$\chi^2=2.333$ P=0.211
	Weekly once	5	16.7	7	23.3	
	Once in a week	2	6.7	0	0	
	Once in month	0	0	0	0	
Perform exercise	Yes	8	26.7	11	36.7	$\chi^2=0.6393$ P=0.005
	No	22	73.3	19	63.3	
If yes, type of exercise	Walking	4	13.3	7	23.3	$\chi^2=1.038$ P=0.792
	Jogging	1	3.3	1	3.3	
	Cycling	3	10.0	3	10.0	
How often you will perform exercise	Once daily	1	3.3	2	6.7	$\chi^2=2.953$ P=0.813
	Twice daily	3	10.0	3	10.0	
	Twice weekly	4	13.3	6	20.0	
What is the use of curry leaves in your food	Good for eyesight	12	40.0	14	46.7	$\chi^2=2.271$ P=0.602
	Good for hair	18	60.0	16	53.3	
	Good for DM	0	0	0	0	

**Table -2 Clinical variables of Type II Diabetic clients**

Clinical variables		Control group		Experimental group		Chi square
		f	%	f	%	
Family history	Yes	8	26.7	13	43.3	$\chi^2=1.832$ P=0.1
	No	22	73.3	17	56.7	
Relationship	Father	5	16.7	7	23.3	$\chi^2=1.974$ P=0.37
	Mother	3	10	6	20	
Duration	<1year	0	0	1	3.3	$\chi^2=1.034$ P=0.59
	2-3years	15	50	15	50	
	4-5years	15	50	14	46.7	

<b>Symptoms</b>	Giddiness	1	3.3	2	6.7	X <sup>2</sup> =3.861 P=0.14
	Excessive thirst	2	6.7	7	23.3	
	Not known	27	90	21	70	
<b>Duration of treatment</b>	<1 year	15	50	8	26.7	X <sup>2</sup> =10.165 P=0.006
	2-3 years	0	0	8	26.7	
	4-5 years	15	50	14	46.7	
<b>Regular treatment</b>	Yes	30	100	27	90	X <sup>2</sup> =3.158 P=0.076
	No	0	0	3	10	
<b>Type of treatment</b>	Allopathic	30	100	30	100	Constant Value
<b>Medication</b>	Metformin	9	30	10	33.3	X <sup>2</sup> =0.253 P=0.96
	Daonil	7	23.3	7	23.3	
	Glimipride	3	10	2	6.7	
	Glipizide	11	36.7	11	36.7	
<b>Symptom of low sugar</b>	Giddiness	6	20	7	23.3	X <sup>2</sup> =0.393 P=0.82
	Palpitation	16	53.3	17	56.7	
	Profuse sweating	8	26.7	6	20	
<b>Complication</b>	Eye problem	13	43.3	14	46.7	X <sup>2</sup> =5.608 P=0.06
	Renal problem	5	16.7	0	0	
	Foot ulcer	12	40	16	53.3	

\*Significant---p≤0.05

\*\*Highly Significant--p≤0.001

\*\*\*Very Highly Significant--p≤0.0001

The above table shows about the medical related information of the study participants Majority of the Type II Diabetic Patients 73.3% (22) in experimental and 56.7% (17) in control group have no family history of Type II Diabetic mellitus. Those with family history of Type II Diabetes mellitus 16.7% (5) in experimental and 23.3% (7) in control group, Fathers have Type II Diabetic mellitus.

On the basis of duration of illness equal percentage of the clients 50.0% (15), were with in 2-3 years and 4-5 years in experimental group. Half of them 50% (15) were between 2-3 years and 46.7% (14) were between 4-5 years and in control group. 100% in experimental and 90% in control group study participants were on regular treatment. All of the study participants in both groups were following (100%) Allopathy treatment. Majority of the participants in both groups are taking Tab. Glipizide (36.7%). Around 53.3% in experimental and 56.7% in control group clients are having palpitation symptom on hypoglycemic state. When assessing the knowledge on awareness about complication of diabetes mellitus 100.0% (30) of the patients both in experimental and control group were aware of the complications. According to them 43.3% in experimental and 46.7% in control group assumes that DM will cause eye complications. About 40% in experimental and 53.3% in control group assumes that DM will cause foot ulcers.

**Table: 2 Comparison of The level of blood sugar among Type II Diabetic clients before and after the intervention in experimental group**

S. no	Blood sugar level	N	Mean	S D	Student Paired t-test
1.	Pre test	30	204.90	91.2	t-3.437 df-29 p=0.002**

2.	Posttest	30	183.50	66.3	
----	----------	----	--------	------	--

\*Significant-- $p \leq 0.05$

\*\*Highly Significant-- $p \leq 0.001$

\*\*\*Very Highly Significant-- $p \leq 0.0001$

The above table reveals that the blood sugar level in post assessment is reduced when comparing with the pre assessment of blood sugar level among Type II Diabetic client in experimental group. The mean score of pre assessment is 204.90 and post assessment is 183.50. this shows the hypothesis of the study was proved. the t value is 3.437 with  $df=29$  and  $p=0.002$ . is statistically significant.

**Table 3. Comparison Of The Level Of Blood Sugar Among Type II Diabetic Clients Before And After The Intervention In Control Group.**

S. no	Blood sugar level	N	Mean	SD	Student Paired t-test
1.	Pre test	30	170.83	12.54	t-0.75 df=29 p=0.462
2.	Posttest	30	169.53	14.37	

\*Significant-- $p \leq 0.05$

\*\*Highly Significant-- $p \leq 0.001$

\*\*\*Very Highly Significant-- $p \leq 0.0001$

The above table shows the blood sugar level in post assessment is not reduced when comparing with the pre assessment of blood sugar level among Type II Diabetic client in control group. The mean score of pre assessment is 169.53 and post assessment is 170.83. the  $p=0.4$  and it is statistically not significant.

**Table 4. Comparison Of The Level Of Blood Sugar in both Experimental and Control Group**

	Group	N	Mean	Standard Deviation	Student Paired t-test
Pretest	Experimental group	30	204.90	91.204	t=2.03 df=58 p=0.25
	Control group	30	170.83	12.540	
Post test	Experimental group	30	183.50	66.310	t=1.13 df=58 p=0.04*
	Control group	30	169.53	14.366	

\*Significant-- $p \leq 0.05$

\*\*Highly Significant-- $p \leq 0.001$

\*\*\*Very Highly Significant-- $p \leq 0.0001$

The above table shows the blood sugar level between experimental and control group. The post assessment of blood sugar reveals that there is a mark reduction in the mean value of blood sugar level in experimental group and the  $p= 0.04$  is statistically significant ( $t= 1.13$ ).

**Table 4. Comparison of pretest & post-test blood sugar level among Experimental and Control group**

Group	N	Pretest Mean $\pm$ SD	Posttest Mean $\pm$ SD	Student Paired t-test
Experimental Group	30	204.90 $\pm$ 91.20	183.50 $\pm$ 66.31	t-3.44 df=29 p=0.002***
Control Group	30	170.83 $\pm$ 12.54	169.53 $\pm$ 14.366	t-0.75 df=29 p=0.46

The above table reveals the mean and SD between the experimental and control group blood sugar level. In Experimental group the value in pretest is 204.90  $\pm$  91.20 and in posttest it is 183.50  $\pm$  66.31. In Control group the value in pretest is 170.83  $\pm$  12.54 and in posttest it is 169.53  $\pm$  14.366. The  $p=0.002$  ( $t=3.44$ ) in experimental shows the result was statistically significant.

**Table 5. Score of post-test blood sugar level among Type II Diabetic clients in both experimental and control group**

Score	Control group		Experimental group		Chi square
	N	%	N	%	
No decrease	20	66.7	0	0	
Decrease>10	4	13.3	13	43.3	
Decrease10-19	4	13.3	10	33.3	
Decrease Above20	2	6.7	7	23.3	

\*Significant--- $p \leq 0.05$

\*\*Highly Significant-- $p \leq 0.001$

\*\*\*Very Highly Significant-- $p \leq 0.0001$

Table above table shows the decrease level of blood sugar levels in both experimental and control group. Among this there is about 66.7 % in control group comes under no decrease blood sugar level. About 23.3% of study participant's blood sugar level reduced above 20mg in experimental group. About 33.3% of participant's blood sugar level reduced between 10-19 mg in experimental group. The analysis was done with Chi square test and the value is Chi- 30.1 ( $P=0.001$ ) and it is  $<0.05$  it is statistically significant.

**Table 6. Mean difference of effectiveness of curry leaves**

Group	N	Mean difference	Standard deviation	Paired t test
Experimental Group	30	21.40	34.10	t-3.12 df=58
Control Group	30	1.3	9.56	p=0.003 **

\*Significant--- $p \leq 0.05$

\*\*Highly Significant-- $p \leq 0.001$

\*\*\*Very Highly Significant-- $p \leq 0.0001$

The above table shows that there is mean difference of 21.40 when comparing the pre and post assessment of blood sugar level in experimental group and the mean difference is only 1.3 in control group blood sugar level reduction. Thus, the hypothesis of this study was proved.

**Table 7. Effectiveness of the study in % (with 95% confidence interval)**

Group	Assessment	Mean score	Mean difference	Mean difference with 95% CI
Experimental group	Pretest	204.90	21.4 (8.94—33.86)	10.44% (4.361% -16.53%)
	Posttest	183.50		
Control group	Pre test	170.83	1.3 (-2.2—4.8)	0.76% (-1.29% --2.81%)
	Posttest	169.53		

The above table shows the effectiveness of the study in 95% CI; it reveals that the effectiveness of curry leaves in reducing blood sugar level is high among the experimental group than the control group. The mean difference is 21.4 and it is 10.44% In 95 % CI.

The association between the clinical variables and the reduction of blood sugar level in experimental group. Less duration of illness and less duration of treatment for Diabetes mellitus are having more reduction in blood sugar level.

It reveals that in the duration of illness 2-3years ( $X^2=4.19$ ,  $P=0.005$ ) and according to the duration of treatment to the illness less than five years ( $X^2=12.38$ ,  $P=0.015$ ) are reduced more post prandial blood sugar level than others. This study analysis revealed that there is a significant effect of curry leaves powder on reduction of blood sugar level among Type II Diabetic clients.

## DISCUSSION

Major Findings: Frequency and percentage distribution of demographic variables of Type II Diabetic Patients in experimental and control group were as follows: Majority of the Type II Diabetic Patients 66.70% (20) were females and 33.3% (10) were males in the experimental group and 56.7% (17) were females and 43.3%(13) were males in the control group. Majority of the diabetic patients 83.3%(25) were Hindus, 13.3% (4) were Christians in the experimental group and 76.7% (23) were Hindus 20%(6) were Christians in the control group. Majority of the Type II Diabetic Patients 73.3% (22) in experimental and 56.7% (17) in control group have no family history of Type II Diabetic mellitus. Those with family history of Type II Diabetes mellitus 16.7% (5) in experimental and 23.3%(7) in control group, Fathers have Type 2 Diabetic mellitus. On the basis of duration of illness equal percentage of the clients 50.0%(15), were within 2-3 years and 4-5 years in experimental group. Half of them 50%(15) were between 2-3 years and 46.7%(14) were between 4-5 tears and in control group. Majority of the participants in both group are taking Tab. Glipizide (36.7%). When assessing the knowledge on awareness of complication of diabetes mellitus 100.0% (30) of the patients both in experimental and control group were aware of the complications. According to them 43.3% in experimental and 46.7% in control group assumes that DM will cause eye complications. About 40% in experimental and 53.3% in control group assumes that DM will cause foot ulcer. The first objective of the study is to identify the blood sugar level in type II Diabetic clients by routine blood sugar examination. In this study, the analysis reveals the pretest level of blood glucose among Type II Diabetic patients in experimental and control group. In experiment group blood glucose level in pretest is 204.90 and in control it is 170.83. Statistical calculation was assessed using student independent t-test. In experiment group post prandial blood glucose level is 183.50 and in control it is 169.53. Statistical calculation was done using student independent t-test.

The second objective of the study is to evaluate the effectiveness of curry leaves on blood sugar level among the clients in the experimental group. On comparing the pre and posttest blood glucose level in relation to curry leaves powder among Type II Diabetic Patients in experimental group. The obtained "t" value of blood glucose level reduction was 3.12 from the base line which is significant at  $p<0.003$  levels and the difference between pretest and post test score was analyzed using mean difference with 95% confidence interval. The findings implies that there was a significant difference in blood glucose level before and after intervention. The mean score of postprandial blood glucose level was 204.90, 183.50 and 170.83, 169.53 respectively from pre intervention to post intervention, depicts the effectiveness of the interventions, as the mean score decreased.

The third objective of the study is to compare the effectiveness of curry leaves in control of blood sugar levels in post test result between control and experimental group. On comparing the pre and post blood glucose level in relation to curry leaves among Type II Diabetic patients in experimental group and control group, the obtained mean difference is 10.44% and 0.76% respectively. The finding implies that there is a significant difference between post- prandial blood glucose level in experimental and control group.

The fourth objective is to associate certain demographic and clinical variables with the reduction of blood sugar level in experimental group. Less duration of illness and less duration of treatment for Diabetes mellitus are having more reduction in blood sugar level. It reveals that in the duration of illness 2-3years ( $X^2=4.19$ ,  $P=0.005$ ) and according to the duration of treatment to the illness less than five years ( $X^2=12.38$ ,  $P=0.015$ ) are reduced more post prandial blood sugar level than others. This study analysis revealed that there is a significant effect of curry leaves powder on reduction of blood sugar level among Type II Diabetic clients. The overall finding of the study showed that the curry leaves was effective in reducing blood glucose level among Type II Diabetic clients in experimental group. Thus, as a community health nurse the researcher has educated the community people about the benefits of curry leaves in daily diet at the end of the study. The assumption of the study was curry leaves may have some effect on blood glucose level is hereby accepted because the present study results also have proved that overall, 10.44% of Type II Diabetic patients with high blood glucose levels in experimental group have improvement in reduction of blood glucose after the intervention of curry leaves for 14 days.

**Conflict of interest:** The authors have no conflict of interest to declare.

## REFERENCES

1. Ann. M,(2012), Nursing theories and their work, (3rded), Philadelphia. Mosby publication.
2. Banerjee, S.R., (1995), Community and social pediatrics, (91st edition), New Delhi, jaypee brothers publications.

3. Ito C. Studies On Medicinal Resources of Rutaceous Plants And Development To Pharmaceutical Chemistry, *Natural Med.* 2021; 54: 117-122.
4. Iyer UM, Mani UV. Studies on the effect of curry leaves supplementation (*Murraya koenigi*) on lipid profile, glycosylated proteins and amino acids in non-insulin-dependent diabetic patients. *Plant Foods Hum Nutr.* 2021; 40(4):275-282.
5. Rajaei E, Jalali MT, Shahrabi S, Asnafi AA, Pezeshki SMS. HLA's in Autoimmune Diseases: Dependable Diagnostic Biomarkers? *Curr Rheumatol Rev.* 2019;15(4):269-276. [PubMed]
6. Klein BE, Klein R, Moss SE, Cruickshanks KJ. Parental history of diabetes in a population-based study. *Diabetes Care.* 1996 Aug;19(8):827-30. [PubMed]
7. Barnett AH, Eff C, Leslie RD, Pyke DA. Diabetes in identical twins. A study of 200 pairs. *Diabetologia.* 1981 Feb;20(2):87-93. [PubMed]
8. Diabetes Genetics Initiative of Broad Institute of Harvard and MIT, Lund University, and Novartis Institutes of BioMedical Research. Saxena R, Voight BF, Lyssenko V, Burtt NP, de Bakker PI, Chen H, Roix JJ, Kathiresan S, Hirschhorn JN, Daly MJ, Hughes TE, Groop L, Altshuler D, Almgren P, Florez JC, Meyer J, Ardlie K, Bengtsson Boström K, Isomaa B, Lettre G, Lindblad U, Lyon HN, Melander O, Newton-Cheh C, Nilsson P, Orho-Melander M, Råstam L, Sneliotes EK, Taskinen MR, Tuomi T, Guiducci C, Berglund A, Carlson J, Gianniny L, Hackett R, Hall L, Holmkvist J, Laurila E, Sjögren M, Sterner M, Surti A, Svensson M, Svensson M, Tewhey R, Blumenstiel B, Parkin M, Defelice M, Barry R, Brodeur W, Camarata J, Chia N, Fava M, Gibbons J, Handsaker B, Healy C, Nguyen K, Gates C, Sougnez C, Gage D, Nizzari M, Gabriel SB, Chirn GW, Ma Q, Parikh H, Richardson D, Ricke D, Purcell S. Genome-wide association analysis identifies loci for type 2 diabetes and triglyceride levels. *Science.* 2007 Jun 01;316(5829):1331-6. [PubMed]
9. Sladek R, Rocheleau G, Rung J, Dina C, Shen L, Serre D, Boutin P, Vincent D, Belisle A, Hadjadj S, Balkau B, Heude B, Charpentier G, Hudson TJ, Montpetit A, Pshezhetsky AV, Prentki M, Posner BI, Balding DJ, Meyre D, Polychronakos C, Froguel P. A genome-wide association study identifies novel risk loci for type 2 diabetes. *Nature.* 2007 Feb 22;445(7130):881-5. [PubMed]
10. Yasuda K, Miyake K, et al. Variants in *KCNQ1* are associated with susceptibility to type 2 diabetes mellitus. *Nat Genet.* 2008 Sep;40(9):1092-7. [PubMed]
11. Zeggini E, Scott LJ, Saxena R, et al. Meta-analysis of genome-wide association data and large-scale replication identifies additional susceptibility loci for type 2 diabetes. *Nat Genet.* 2008 May;40(5):638-45. [PMC free article] [PubMed]
12. Fajans SS, Bell GI, Polonsky KS. Molecular mechanisms and clinical pathophysiology of maturity-onset diabetes of the young. *N Engl J Med.* 2001 Sep 27;345(13):971-80. [PubMed]