

“Hypoglycaemic response of *C. tamala* in patients of maturity onset (Insulin independent) Diabetes”

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*The paper reports of effect of *Cinnamomum tamala*, known in Ayurvedic parlance as Tejpatra, in cases of diabetes. The paper has dealt with effect of *C.tamala*, on fasting blood sugar in diabetes. Glucose tolerance of patients suffering from diabetes in addition to assessing the immediate response of *C.tamala* as evaluated by bio-chemical study in about two hours after administration. The lead may help to look deeper and may help in bringing out a herbal remedy whose need is acutely felt today inspite of a number of synthetic and other preparations available in the market.*

Introduction :

The discovery of insulin marked a new era in the advancement of knowledge and therapeutics of

diabetes mellitus. It provided new hopes in the field of diabetes where there had been only despair. But very soon it was observed that many cases may be insensitive or resistant to insulin therapy. Further insulin therapy being a parenteral one, a need for oral hypoglycaemics agents was felt-consequently today we have sulfonylureas, biguanides etc. supposed to be insulin promotoros on the scene. With the discovery of these drugs it was anticipated that the problem of the management of diabetics can be completely overcomed, but however, recent studies of Mackaness (1971), Farid *et al*, (1973) have revealed newer facts that cell-mediated immunity is disturbed by treatment of insulin and insulin promotoros, which may lead to any new complications of diabetes. On this basis it is being inferred that the administration of insulin and insulin

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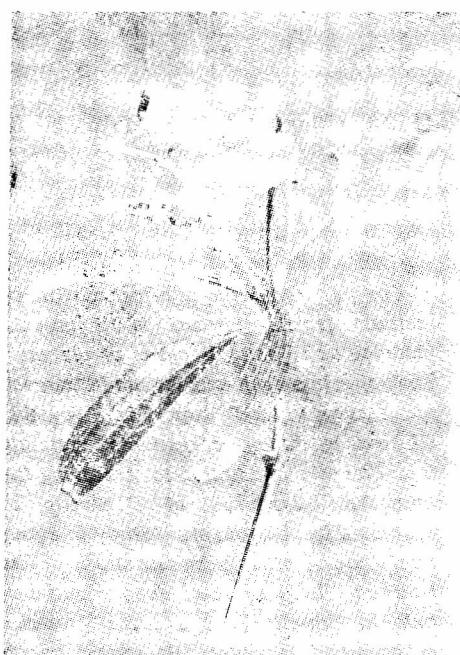
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promotors is not the only approach to correct the hyperglycaemia, the real and the correct approach may be something other than this, since the real deficiency of insulin is not the problem in many cases.

The discovery of glucagon and the search for its physiologic function has given a new dimension to the management of diabetes. The hypothesis that glucagon is essential for the development of hyperglycaemia has been advanced. It is based on studies on somatostatin. Somatostatin is a potent inhibitor of insulin, glucagon and growth hormone secretion, while at the same time lowers blood glucose in normal and diabetic patients.

The syndrome of diabetes mellitus has been largely covered in Indian Medicine under the heading of *Prameha* and ancient Indian physician have tried to advance philosophy regarding the etiology, pathogenesis and the treatment of the disease in a greater detail. Many herbal and herbomineral drugs have also been recommended. *C. tamala* is one of the ingredients of such a compound; in a few experimental and preliminary clinical studies by earlier workers from our department this trial showed a promising lead to consider further studies. In this study authors have attempted to confirm the earlier finding and to draw

more precise and conclusive, inferences. With this objective three sets of clinical experiments have been done and the hypoglycaemic response of *C. tamala* has been consistently observed.



Material and Methods

Experiment No. I : "To study the effect of *C. tamala* on fasting blood sugar in diabetes".

Selection of the cases : A series of 32 diabetic patients attending out patient department were selected. Glucose tolerance test and the examination of urine was done in every case and only cases confirmed diabetes mellitus by glucose tolerance test with maturity onset history were selected for the study.

Administration of drug and doses : Leaves of *C. tamala* known as *Teipatra* were purchased from the local market for purpose of trials. The leaves were dried and pulverized, and filtered through a fine mesh and packed in 100 gm. plastic packets. Patients were advised to take orally two heap tea spoonfuls of the above *C. tamala* powder four times a day, half an hour before breakfast, lunch, tea and dinner for one month.

Diet : The patients were allowed to continue with 1800 calories of diet with restriction of sugar, potato and rice.

Assessment of results : For the assessment of result fasting blood sugar was done before and after one month treatment with *C. tamala* in the patients of diabetes mellitus and the difference has been statistically analysed to establish the efficacy. For the purpose of comparing of results with the control study, a series of 8 diabetic patients were not administered any treatment and they were convinced that their disease may improve only with 1800 calories of diet, hence they were put on the same diet.

Experiment No. 2 : "To study the effect of *C. tamala* on Glucose Tolerance Test in patients of diabetes mellitus".

Selection of the cases : This experiment has been designed to

evaluate the effect of *C. tamala* on the challenge of glucose load in diabetes mellitus. Twenty-five G.T.T. proved cases of diabetes mellitus were selected for this trial.

Administration of Drug and Doses : (As described in previous experiment).

Diet : The patients were allowed to continue with 1800 calories of diet with restriction of sugar, potato and rice.

Assessment of Results : At the outset fasting as well as two post-prandial blood sugar samples at one hour interval after 100 gm. oral glucose load were collected and estimated by Asatoor and King's method. Then patients were treated with *C. tamala* powder for a period of one month and again glucose tolerance test was done after one month treatment. The difference of blood sugar level at different points have been compared for a better statistical view.

Experiment No. 3 : "Assessment of the immediate response of *C. tamala* on fasting blood sugar in diabetes upto two hours after administration of the drug."

Selection of the cases : In a series of seven proved patients of diabetes mellitus this experiment was designed. The criteria of selection of the patients was same as described in previous experiments.

Administration of Drug and Dose :
Powder of *C.tamala* in the dose of 20 gm. has been orally administered after the collection of fasting blood sample.

Assessment of Results : For the assessment of the result fasting blood sugar was estimated and then

after oral administration of 20 gm. *C. tamala* powder, four samples were collected at an half-hourly interval upto two hours for the estimation of blood sugar. It is in order to assess the effect of the drug on blood glucose immediately after the administration of the drug.

Observations and Results

Experiment No. 1

TABLE-1 : Showing the effect of *C. tamala* on fasting blood sugar in mg% before and after one month treatment in a series of 32 patients of diabetes mellitus.

S. No.	Name	Age in years	Sex	Fasting Blood Before treatment	Sugar in mg% After treatment	Difference in mg%.
1.	HRM	67	M	280.0	258.0	22.0
2.	LMM	45	F	120.0	65.0	55.0
3.	MPC	40	M	220.0	170.0	50.0
4.	NKPS	49	M	114.0	84.0	30.0
5.	SPD	35	F	140.0	112.0	28.0
6.	NNR	52	M	200.0	135.0	65.0
7.	VN	35	M	205.0	170.0	35.0
8.	GMS	47	M	112.0	100.0	12.0
9.	MY	70	M	137.0	116.0	21.0
10.	RNS	55	M	250.0	120.0	130.0
11.	JP	68	M	130.0	8 .0	42.0
12.	RSS	52	M	110.0	70.0	40.0
13.	ML	36	M	126 0	94.0	32.0
14.	ML	40	M	142.5	77.0	65.5
15.	KPS	42	M	118.0	90.0	28.0

(Contd.)

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16.	BNP	45	M	118.0	91.0	27.0
17.	KL	50	M	180.0	94.3	85.7
18.	RCP	60	M	185.0	138.2	46.8
19.	AJ	60	M	157.0	91.4	65.6
20.	CNR	64	M	143.0	100.0	43.0
21.	JCS	40	M	170.0	106.0	64.0
22.	RSS	45	M	115.7	100.0	15.7
23.	DM	50	M	170.0	150.0	20.0
24.	PNS	51	M	135.0	110.0	25.0
25.	SNE	53	M	157.0	83.0	74.0
26.	RSS	54	M	137.0	97.0	40.0
27.	RN	65	M	116.0	100.0	16.0
28.	HMS	65	M	115.0	94.0	21.0
29.	JBV	45	M	126.0	103.0	23.0
30.	AP	50	M	114.0	97.0	17.0
31.	SD	60	M	257.0	221.0	36.0
32.	RSS	53	M	110.0	80.0	30.0
Total				4910.2	3604.9	1305.3
Mean				153.44	112.65	40.79
S.D.						±24.63
S.E.						± 4.35
't'						9.37
P						<0.001
						Highly significant

TABLE-2 : Control Study :

S. No.	Name	Age in years	Sex	Fasting blood Before T/t	Sugur in mg% Treated/with Diet Control alone	Difference in mg%
1	VV	45	M	116.0	91.0	25.0
2.	GP	50	M	118.0	105.7	12.3
3.	NKS	42	M	157.0	239.0	-82.0
4.	TR	50	M	120.0	94.3	25.7
5.	BDP	39	M	225.0	218.0	7.0
6.	JK	40	M	160.0	180.0	-20.0
7.	RSU	46	M	137.0	160.0	-23.0
8.	SKL	50	M	218.0	225.0	-7.0
Total				1251.0	1313.0	-62.0
Mean				156.37	164.12	-7.75
S.D.						±34.12
S.E.						±12.06
't'						5.14
P						<0.01
						Significant

Comments : The above tables reveal that all the patients had abnormal fasting blood sugar. The mean fasting blood sugar was 153.44 mg%. Thus all of them were mild and moderate cases of diabetes mellitus of maturity onset. After one month treatment the fasting blood sugar is reduced to 112.65 mg%, which is almost within normal limits. On the analysis of individual data it is obvious that excepting in seven cases, in remaining 25 cases,

the blood sugar has fallen down to below 120 mg. i.e. within physiological range. On statistical analysis the difference in fasting blood sugar level is highly significant ' t '=9.37 and $P<0.001$.

Comparison with Control : As mentioned earlier the effect of *C. tamala* has been compared with the result of a series kept on control diet. The observations are as follows :

The control group has been kept on 1800 calories of diet as mentioned earlier. It has been observed that instead of fall in blood sugar there is a minor rise in blood sugar in this group and rise in the blood sugar is statistically significant ($t'=5.14$; $P>0.01$). On the other hand in treated group there is a significant fall in fasting blood

sugar ($t'=9.37$, $P<0.001$).

Thus it may be inferred from this experiment that *C. tamala* is effective remedy in reducing the blood sugar in patients having mild and moderate degree of diabetes mellitus. The fall in blood sugar level is about 40.79 mg% and the response is significant as compared to diet control.

Experiment No. 2 :

TABLE 3 : Showing the effect of *C. tamala* on fasting and post-prandial blood sugar in mg% before and after one month treatment in a series of 25 patients of diabetes mellitus.

S. No.	Name	Age in years	Sex	Before treatment			After treatment		
				Fasting Blood S. in mg.%	PP in mg.%	Blood sugar in mg% 1 hr. 2 hrs.	Fasting blood S. in mg.%	PP in mg.%	Blood sugar in mg% 1 hr. 2 hrs.
1.	LMM	45	F	120.0	300.0	208.0	65.0	100.0	120.0
2.	GMS	47	M	112.0	210.0	237.0	100.0	270.0	210.0
3.	MY	70	M	137.0	190.0	280.0	116.0	266.0	211.0
4.	RSS	52	M	110.0	290.0	200.0	70.0	130.0	110.0
5.	RNS	55	M	250.0	360.0	430.0	120.0	292.0	260.0
6.	ML	36	M	126.0	240.0	166.0	94.0	206.0	157.0
7.	ML	40	M	142.5	287.5	200.0	77.0	217.0	158.0
8.	KPS	42	M	118.0	255.0	216.0	90.0	170.0	128.0
9.	BNP	45	M	118.0	211.0	148.0	91.0	200.0	80.0
10.	KL	50	M	180.0	330.0	287.0	94.3	183.0	177.0
11.	RCP	60	M	185.0	337.0	285.0	138.2	273.5	253.0

(Contd)

12.	AJ	60	M	157.0	243.0	286.0	91.4	157.0	177.0
13.	CNR	64	M	143.0	286.0	206.0	100.0	206.0	170.0
14.	JCS	40	M	170.0	257.0	217.0	106.0	224.0	180.0
15.	RSS	45	M	115.7	206.0	131.4	100.0	200.0	105.7
16.	DM	50	M	170.0	228.6	286.0	150.0	200.0	251.4
17.	PNS	51	M	135.0	262.5	225.0	110.0	216.2	194.5
18.	SNE	53	M	157.0	325.0	300.0	83.0	270.0	230.0
19.	RSS	54	M	137.0	223.0	200.0	97.0	200.0	130.0
20.	RN	65	M	116.0	216.0	256.8	100.0	151.5	163.0
21.	HMS	65	M	115.0	156.0	210.0	94.0	114.0	143.0
22.	JBV	45	M	126.0	248.6	200.0	103.0	172.0	132.0
23.	AP	50	M	114.0	218.0	211.0	97.0	200.0	163.0
24.	SD	60	M	257.0	369.0	394.6	221.0	343.2	275.6
25.	RSS	53	M	110.0	217.0	123.0	80.0	211.0	85.7
Total				3621.2	6466.2	5903.8	2587.9	5172.4	4264.9
Mean				144.84	258.64	236.15	103.51	206.89	170.59

TABLE 4 : Showing the statistical comparison of blood sugar values treated with *C. tamala*.

S. No.	Name	Fasting Blood sugar difference in mg% before treatment and after treatment.	Post-Prandial Difference in mg.% before and after treatment in 1 hr.	Blood Sugar Diffence in mg.% before and after treatment in 11 hr.
1.	LMM	55.0	200.0	88.0
2.	GMS	12.0	-60.0	27.0
3.	MY	21.0	-76.0	69.0
4.	RSS	40.0	160.0	90.0
				(Contd.)

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5.	RNS	130.0	68.0	170.0
6.	ML	32.0	34.0	9.0
7.	ML	65.5	70.5	42.0
8.	KPS	28.0	85.0	88.0
9.	BNP	27.0	11.0	68.0
10.	KL	85.7	147.0	110.0
11.	RCP	46.8	63.5	32.0
12.	AJ	65.6	86.0	109.0
13.	CNR	43.0	80.0	36.0
14.	JCS	64.0	33.0	37.0
15.	RSS	15.7	6.0	25.7
16.	DM	20.0	28.6	34.6
17.	PNS	25.0	46.3	30.5
18.	SNE	74.0	55.0	70.0
19.	RSS	40.0	23.0	70.0
20.	RN	16.0	64.5	93.8
21.	HMS	21.0	42.0	67.0
22.	JBV	23.0	76.6	68.0
23.	AP	17.0	18.0	48.0
24.	SD	36.0	25.8	119.0
25.	RSS	30.0	6.0	37.3
	Total	1033.3	1293.8	1638.9
	Mean	41.33	51.75	65.55
	S.D.	±27.74	±58.92	±36.36
	S.E.	±5.548	±11.78	± 7.27
	't'	7.45	4.93	9.01
	P	<0.001	<0.001	<0.001
		Highly significant	Highly significant	Highly significant.

Comments : The table shows that there is homogeneous fall in fasting blood sugar value in all the cases. However, in the post-prandial reading at the end of 2nd hour blood sugar level after treatment, has been registered significantly to be low in all the cases as compared to initial values. Of course mean blood sugar level is low at fasting as well as in post-prandial samples after treatment as compared to before treatment.

For the purpose of statistical comparision of the results difference in mg% before and after

treatment in blood sugar readings has been calculated at all points.

The above table reveals that mean difference in blood sugar at fasting level was 41.33 mg%, S.E. \pm 5.548 and at 1 hour after glucose load it was 51.75 mg%, S.E. \pm 11.78 and after 2 hour 65.55, S.E. \pm 7.27. On statistical analysis this fall is significant ($P < 0.001$). Thus the leaves of *C. tamala* seems to improve the glucose utilisation and reduction of blood sugar levels. No significant side reactions or toxicity has been reported by the patients.

Experiment No. 3

TABLE 5 - Showing the immediate effect of *C. tamala* on fasting blood sugar in a series of 7 patients of diabetes mellitus.

S.No.	Name	Age in years	Sex	Fasting blood S. in mg%	Effects of <i>C. tamala</i> treatment			
					1/2 hr.	1 hr	1½ hr.	2 hrs.
1.	NNR	52	M	200.0	180.0	150.0	143.0	132.0
2.	JP	68	M	130.0	125.0	120.0	102.0	100.0
3.	GMS	47	M	114.0	110.0	106.0	94.0	86.0
4.	B.Ch.	35	M	300.0	285.0	255.0	220.0	200.0
5.	J.S.	45	M	100.0	95.0	88.0	76.0	69.0
6.	DH	46	M	200.0	190.0	188.0	170.0	166.0
7.	RSS	54	M	120.0	116.0	112.0	108.0	103.0
Total				1164.00	1101.0	1019.0	913.0	856.0
Mean				166.28	157.28	145.57	130.42	122.28

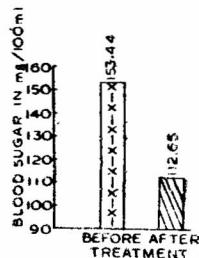
TABLE 6 -

S.N.	Name	Age	Sex	Fasting in blood yrs.	Effect of <i>C. tamala</i> treatment on blood sugar in mg.%			
					1/2 hr. Diff. in mg%.	1 hr. Diff. in in mg.%	1½ hr. Diff. in mg.%	2 hrs. Diff. in mg.%
1.	NNR	52	M	200.0	20.0	50.0	57.0	68.0
2.	JP	68	M	130.0	5.0	10.0	28.0	30.0
3.	GMS	47.	M	114.0	4.0	8.0	20.0	28.0
4.	B.C.h.	35	M	300.0	15.0	45.0	80.0	100.0
5.	J.S.	45	M	100.0	5.0	12.0	24.0	31.0
6.	IH	46	M	200.0	10.0	12.0	30.0	34.0
7.	RSS	54	M	120.0	4.0	8.0	12.0	17.0
Total				63.0	145.0	251.0	308.0	
Mean				9.0	20.71	35.85	44.0	
S.D.				±5.85	±17.06	±22.22	±27.14	
S.E.				±2.21	± 6.46	± 8.41	±10.28	
't'				4.07	3.20	4.26	4.28	
P				<0.01	<0.02	<0.01	<0.01	

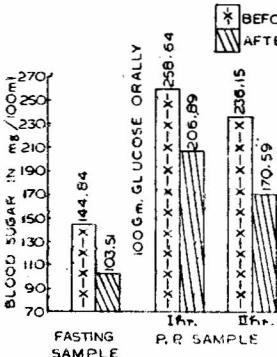
Comments : The mean fasting blood sugar was observed to be 166.28 mg%. After the administration of drug, a gradual fall has been observed in all the samples. Ultimately at the end of second hour it has reached to 122.28 mg%. For statistical analysis difference in mg% in blood sugar readings has

been calculated and at the end of 2 hr ($t=4.28$, $P<0.01$). So it can be inferred that *C. tamala* has immediate hypoglycaemic action in diabetes mellitus, as no other stimulus excepting this drug has been given to the patients and there is gradual fall in the blood sugar.

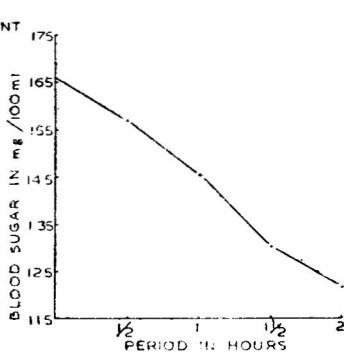
BAR DIAGRAM SHOWING THE RESPONSE OF ONE MONTH TREATMENT WITH C. TAMALA ON FASTING BLOOD SUGAR IN A SERIES OF 32 PATIENTS OF DIABETES MELLITUS



BAR DIAGRAM SHOWING THE RESPONSE OF ONE MONTH TREATMENT WITH C. TAMALA ON FASTING AND P.P. BLOOD SUGAR IN A SERIES OF 25 PATIENTS OF DIABETES MELLITUS



GRAPH SHOWING THE IMMEDIATE EFFECT OF C. TAMALA ON FASTING BLOOD SUGAR IN A SERIES OF 7 PATIENTS OF DIABETES MELLITUS



Discussion : In this study attempt has been done to establish the role of *C. tamala* as an hypoglycaemic agent particularly in the patients of diabetes mellitus and to assess that how far it can be helpful in the management of diabetes mellitus. To achieve this object three experiments have been designed. In experiment No. 1 the effect of *C. tamala* has been studied on fasting blood sugar with encouraging results. The mean difference is about 40.79 mg% and the effect is statistically significant ($P < 0.001$). In the second experiment the effect of *C. tamala* has been studied on fasting as well as post-prandial samples. It is to assess that how far this drug is capable to modulate the challenge of glucose load. Again by this experiment it has been established that apart from its effect on fasting blood sugar it lowers down the blood sugar level after glucose load. Thus the efficacy of

the drug seems to be more important and its use in the management of diabetes mellitus becomes more genuine.

The hypoglycaemic action of *C. tamala* after one month treatment has been compared with the result of the diet control with 1800 calories which has been recommended for both the treated and control groups. The study has revealed that this degree of diet control has no role in the control of blood sugar in the patients of diabetes mellitus. As only in few cases the blood sugar has been reduced and in the rest of the cases there is a rise in blood sugar values. Thus the hypoglycaemic action of the drug is proved beyond doubt. Anyhow as it is a response after one month treatment and any other unforeseen factors including psychosomatic, may have influence as the study is not double blind. Hence the third

experiment has been designed to see the immediate effect of *C. tamala* on fasting blood sugar. It is interesting that after the oral administration of the drug the fall in blood sugar has started within half an hour and it went on increasing upto 2 hours and the fall in blood sugar is significant at all points ($P < 0.01$). However, it is notable that the degree of fall is just above the physiological range i. e. it has not fallen below the physiological range. This effect may be more pronounced with the increasing of the dose. As regards the result of one month treatment is concerned fasting blood sugar level could reach to 112.65 mg% i. e. within the physiological range but on the glucose load though the blood sugar has fallen significantly, the post-prandial blood sugar level remains the just above the physiological range.

Conclusion :

Thus the hypoglycaemic effect and its role in the management of diabetes mellitus is established with this study. Of course a comparative study with the known drug has to be conducted and few more experiments have to be designed to clinch the mode of action of *C. tamala*. Different fractions of *C. tamala* may also be studied to isolate and characterised the active principle in this drug.

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सारांश

तेजपत्र के प्रमेह प्रभावधन का अध्ययन :

प्रमेहधन प्रभाव के अध्ययन के लिए तेजपत्र के नाम से उपलब्ध पत्रों का बाजार से संकलन किया गया और इनका सूक्ष्म छूरण बनाकर लगभग २० ग्राम की मात्रा में प्रतिदिन चार भागों में विभक्त कर दोनों समय के भोजन तथा स्वल्पाहार के पूर्व दिया गया।

इस अध्ययन के अन्तर्गत तीन प्रयोग किए गए, जिनका सारांश निम्नांकित रूप से है।

प्रयोग संख्या १-तेजपत्र का प्रमेह के रोगियों में अभुत अवस्था की रक्तशर्करा पर प्रभाव -

३२ प्रमेही जिनका रोग विनिश्चय रक्तशर्करा परीक्षण द्वारा किया गया उन्हे एतदर्थ संग्रह किया गया और १ मास तक तेजपत्र का प्रयोग उपरोक्त मात्रा में किया गया। चिकित्सा के पश्चात् सभी रोगियों में प्रातः अभुत अवस्था की रक्त-शर्करा की पुनः परीक्षा की गई। परिणाम में ४०.७६ मि०ग्रा० प्रतिशत औसत रक्त-शर्करा में कमी पाई गई और लगभग सभी रोगियों में रक्तशर्करा का मान सामान्य स्तर

तक पाया गया। चिकित्सा के पूर्व एवं चिकित्सा के पश्चात् उपलब्ध रक्तशर्करा के मानों की सांख्यकी परीक्षा भी की गई जो महत्वपूर्ण पाई गयी। तुलनात्मक अध्ययन के लिए ८ रोगियों को केवल नियन्त्रित आहार पर ही रखा गया, इनमें रक्तशर्करा की कमी अत्यल्प ही रही।

प्रयोग संख्या २ :- तेजपत्र का प्रमेह के रोगियों में अभुक्त एवं भोजनोपरान्त अवस्थाओं की रक्त शर्करा पर प्रभाव।

इस अध्ययन में २५ प्रमेह के रोगियों का संकलन किया गया और उनमें चिकित्सा के पूर्व अभुक्त एवं भोजनोपरान्त की रक्तशर्करा का आंकलन किया गया। उन्हें तेजपत्र की चिकित्सा पर रखा गया और १ मास के पश्चात् अभुक्त एवं भोजनोपरान्त की रक्तशर्करा का पुनः आंकलन किया गया। चिकित्सा के पूर्व एवं पश्चात् के रक्तशर्करा के मान में पर्याप्त अन्तर पाया गया जो सांख्यकी दृष्टि से भी महत्वपूर्ण सिद्ध हुआ।

प्रयोग संख्या ३- तेजपत्र का प्रमेह के रोगियों में रक्तशर्करा पर सद्यः प्रभाव-

एतदर्थ ७ प्रमेह के रोगियों का संग्रह किया गया और प्रत्येक में अभुक्त अवस्था के रक्तशर्करा परीक्षण हेतु रक्त संग्रह करने के बाद तेजपत्र के घूर्ण के २० ग्राम की एक मात्रा जल से दी गई और तदनन्तर आवेद्य घण्टे के मध्यान्तर से चार रक्त के नमूने संग्रहीत किए। सभी नमूनों के आंकलन से ज्ञात हुआ कि रक्तशर्करा में लगातार कमी होती गई। घूर्ण देने के पूर्व रक्तशर्करा का औसत मान १६६.२८ मि०ग्रा० प्रतिशत था और २ घण्टे के पश्चात् चतुर्थ नमूने में इसका मान १२२.२८ मि०ग्रा० प्रतिशत तक आ गया। सांख्यकी दृष्टि से भी यह अन्तर महत्वपूर्ण पाया गया।

इन प्रयोगों से यह सिद्ध होता है कि तेजपत्र में प्रमेह के रोगियों की रक्तशर्करा कम करने की अद्भुत शक्ति है और इस आधार पर तेजपत्र की एक प्रमेहधन औषधि के रूप में स्वीकार किया जा सकता है।

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