

Development of a risk assessment scale for diabetes

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ABSTRACT

Health of all is an enduring vision that recognizes the oneness of humanity and, therefore, there is a need to promote health universally. In view of alarming increase in the prevalence of non-communicable diseases and their high therapeutic cost it was thought necessary that the vast pool of existing knowledge be made available to the ultimate beneficiaries. In phase I, risk assessment tool for diabetes was formulated. For the development of tool information was gathered from two equally important sources viz., actual survey of 100 diabetic patients and extensive scanning of the available literature. On the basis of results obtained through reviews and survey, the risk factors causative to the occurrence of the disease were identified, enlisted and each component of the tool were scored uniformly. The maximum attainable score (64) was then categorized into three categories (Low, Medium and High risk). The components which were featured in the risk assessment tools were age, sex, anthropometric measurements, family history, health habits and dietary pattern. The risk assessment tool so developed was then judged for its reliability and validity. In phase II, the reliability of the tool was tested. For testing reliability, the recent biochemical reports of the patients were matched with that of risk scores obtained by administering the developed risk assessment on 10 subjects and it was found that the two matched perfectly with each other which justify the reliability of the tools.

Paliwal, Renu and Sankhala, Aarti (2011). Development of a risk assessment scale for diabetes, *Food Sci. Res. J.*, 2 (2) : 100-106.

Key Words : Diabetes, Non-communicable diseases, Risk assessment toll

INTRODUCTION

Good health is a major resource and an important dimension of the quality of life. But today changes in lifestyle and dietary pattern stemming from rapid modernization and urbanization favored an increase in the occurrence of NCDs such as diabetes, heart diseases and osteoporosis. The observed rapid rise in NCDs threatens economic and social development as well as lives and health of millions of people. With the rising prevalence of these diseases people are not only getting health conscious but also started demanding personalized attention. Looking to the technological trends and today's consumers need, the present work was undertaken to help the users in prevention as well as control to the disease.

METHODOLOGY

The methodology followed during the course of conduction of work has been explained under the following heads:

Locale of the study:

The study was conducted within the municipal limits of Udaipur city to ensure maximum contact with the

subjects.

Study population:

To accomplish the objectives of present piece of work, study population was selected separately for two different stages mentioned below:

Stages of sample selection:

- Formulation of Risk Assessment tool (100 patients)
- Reliability testing of Risk Assessment tool (10 healthy adults)

Sample selection criteria:

Subjects were selected purposively for each stage and criteria taken into account for have been mentioned here below:

- Subject above the age of 30 years.
- Subject of either sex.
- Subject suffering from diabetes
- Subject willing to participate and cooperate

In view of different purpose and differences in selection criteria, subjects for each stage were contacted separately at different places viz., hospitals, parks, health

clubs.

For stage (b) healthy adult subjects (not suffering from any of the disease or unaware if any) from health camps, parks as well as known friends, relatives or neighbors who had their recent biochemical/biophysical reports with them and fulfilling the predetermined criteria in addition to above mentioned top two and fourth criteria were selected.

After selecting the subjects at each stage they were briefed about the purpose of the study and were assured of maintaining the confidentiality of information.

Operational design:

Phase I: Development of risk assessment tool:

Due to unavailability of standard risk assessment tools covering all the factors which are making individual prone to the disease, suitable in Indian context, it was thought worthwhile to develop the risk assessment tool for diabetes. For the development of tool, data was gathered from two equally important sources namely actual survey of patients suffering from diabetes and the other source was extensive study of available information on each particular causative factor, for a particular disease. Before conducting a survey, a DCT was developed by the investigator to gather information about the subjects.

Development of a ‘data collection tool’:

DCT was developed by the investigator covering questions on general profile (name, sex, age, religion, education, occupation, food habits and family income), disease history (duration of disease, relative suffering from disease), health habits (smoking, alcohol, tea, coffee, exercise habits), anthropometric measurements [(height, weight, BMI, waist circumference, hip circumference, WHR and dietary pattern (food habits, fruit/ oil, vegetable intake)].

Survey:

Information was collected with the help of structured DCT.

Formulation of ‘risk assessment tools’:

On the basis of results obtained from the survey and the information gathered through reviews, the risk factors causative to the occurrence of diabetes were identified, enlisted and were arranged sequentially. For more help doctors, nutritionists and statisticians were also consulted and then the scoring pattern was finally decided to be of uniform scoring (five point scales). The components which featured in the risk assessment tools were sex, age, anthropometric measurements, family history, health habits

and dietary pattern. Each concept was awarded a score and a total score of 64 was obtained.

Phase II: Reliability testing of ‘risk assessment tool’:

In order to judge the reliability 10 healthy subjects were selected using criteria mentioned above. DCT was used to gather the information about general profile, disease history, health habits, anthropometric measurements and dietary pattern. Recent biochemical/ biophysical reports for blood glucose levels, lipid profile and bone mineral densities were then collected from the subjects and were then matched with the scores obtained from the risk assessment index.

Standard normal values used to interpret the results for diabetes (Table a).

Table a : Interpretation values for diabetes: (ADA,2007)		
Stages	Fasting blood glucose (mg/dl)	Post prandial blood glucose (mg/dl)
Normal	<100	<140
Impaired glucose tolerance	100-125	140-200
Diabetic	>125	>200

OBSERVATIONS AND ASSESSMENT

The results obtained from the present investigation are presented below :

Phase I: Development of risk assessment tools:

Survey and reviewing the literature:

Risk assessment tools were developed utilizing information generated from two equally important sources i.e. survey as well as extensive scanning of the available literature.

Information about patients:

General profile:

Table 1 shows that majority of the diabetic (60 per cent) were females. In the same milieu American Diabetic Association (2000) revealed higher prevalence of diabetes among women.

Table 1 : Distribution of subjects on the basis of gender	
Gender	Diabetic patients
Male	40(40.00)
Female	60(60.00)
Total	100

Table 2 shows that more than half of the diabetic (58 per cent) were falling in the age range of 40-60 years with females predominating the scene. These findings are

Age group (Years)	Diabetic patients		Total
	Male	Female	
31-40	3 (7.50)	4(6.66)	7 (7.00)
41-50	13 (32.50)	15 (25.00)	28 (28.00)
51-60	10 (25.00)	20 (33.00)	30 (30.00)
61-70	10 (25.00)	14 (23.30)	24 (24.00)
71-80	4 (10.00)	3 (5.00)	7(7.00)
Total	40	60	40

Note: Values in parentheses denote percentage

in line with those reported by Bamji *et al.* (2003), Khanna *et al.* (2003) and Deepashree and Prakash (2007) who reported that the prevalence of diabetes rose markedly above the age of 35 years and the maximum incidence was seen between the age of 40-60 years.

Disease history:

Subjects when classified on the basis of the family history of the disease Table 3 shows that 64 per cent of diabetics reported positive family history with either I/ II degree relative as being sufferer. While 36 per cent responded negatively to the history. These findings are in accordance to those reported by Mohan *et al.* (2003) who reported that the prevalence of diabetes as well as impaired glucose tolerance was significantly higher among subjects with either single or both parents as being diabetic as compared to those with no family history. In addition to the family history, other factors such as sedentary lifestyle, faulty dietary habits also play important role in the occurrence of non-communicable diseases in the population.

Family history	Diabetic patients		Total
	Male	Female	
No family history	16 (40)	20 (33.33)	36 (36.00)
Positive FH	24 (60)	40 (66.66)	64 (64.00)
II degree relative	12 (50.00)	18 (45.00)	30 (46.80)
One parent	8 (33.30)	17 (42.50)	25 (39.06)
Both parents	1 (4.16)	4 (10)	5 (7.81)
Brother/Sister	3 (12.50)	1 (2.50)	4 (6.25)
Total	40	60	100

Note: Values in parentheses denote percentage

It is evident from Table 4 that majority of the study population was leading a sedentary lifestyle (79 per cent) whereas remaining patients reported to be leading life with moderate (19 per cent) activity. Only 3 per cent of the diabetic patients reported that they were involved in one or the other heavy natured activity. Similar findings were revealed by Malini *et al.*(2003) in a research study

Nature of work pattern	Diabetic patients		Total
	Male	Female	
Sedentary	31(77.50)	48(80.00)	79(79.00)
Moderate	8 (20.00)	11(18.33)	19 (19.00)
Heavy	1(2.50)	1(1.66)	2 (2.00)
Total	40	60	100

Note: Values in parentheses denote percentage

conducted on working women of Behrampur depicting sedentarianism (adoption of sedentary behavior) as now a days a next important factor driving the epidemic of diabetes and cardio vascular disease.

Stress contributes significantly to the increased blood glucose levels, it antagonizes the action of insulin (Mitra, 2008). Data in Table 5 point out that 10 per cent of the diabetic patients reported themselves as being calm and relaxed most of the time, 17 per cent diabetic patients experienced occasional stress in their life whereas more or less equal number of patients (42 per cent) reported that they face stress situation quite frequently. Leading a consistently stressful life was reported by remaining 29 per cent of diabetic patients.

Stress	Diabetic patients		Total
	Male	Female	
Calm and relaxed most of the time	2 (5.00)	8 (13.33)	10 (10.00)
Occasionally stressed	14 (35.00)	3 (5.00)	17 (17.00)
Frequently stressed	11 (27.50)	34 (56.66)	45 (45.00)
Always stressed	13 (32.50)	15 (25.00)	28 (28.00)
Total	40	60	100

Note: Values in parentheses denote percentage

Dietary details:

When subjects were enquired about the food habits, it was found that nearly three fourth of the diabetic (72 per cent) patients were vegetarians. Those who were non vegetarians in their dietary habit constituted of 22 per cent diabetic and remaining 6 per cent patients reported themselves as being ovo vegetarians (Table 6).

Dietary habit	Diabetic patients		Total
	Male	Female	
Vegetarian	28 (70)	44 (73.33)	72(72)
Non Vegetarian	8(20)	14 (23.33)	22(22)
Ovo- Vegetarian	4(10)	2 (3.33)	6(6)
Total	40	60	100

Table 7 exhibits that the majority of the patients (61 per cent diabetics) were consuming much higher amount of oil/ghee as compared to the values recommended for healthy adults (20 g). These findings are in accordance to the results revealed by Doosta (2003) who revealed that the higher the fat intake, the higher will be the risk of non-communicable diseases. Srilakshmi (2003) reported that low fat diet increases insulin binding and also reduces LDL and VLDL levels and in turn reduces the incidence of atherosclerosis and heart diseases.

Table 7: Distribution of subjects on the basis of oil consumption pattern

Oil cons. pattern	Diabetic patients		Total
	Male	Female	
20 g /<4 tsp)	2 (5.00)	2 (3.33)	4 (4.00)
21-40 g/5-8 tsp	16 (40.00)	19 (31.66)	35 (35.00)
40 g/>8 tsp	22 (55.00)	39 (65.00)	61(61.00)
Total	40	60	100

Note: Values in parentheses denote percentage

Anthropometric measurements:

Table 8 exhibits that majority of diabetic (84 per cent) were on the basis of BMI. These findings are in alignment with those reported by Malini *et al.* (2009) who also found that 75 per cent of diabetes in the study group were having BMI more than 25 kg/m² and the prevalence of diabetes or impaired glucose tolerance increase with the increase in BMI. In contrast to these findings and the general belief that obesity is an important risk factor for NCDs, 19 per cent patients under present study had BMI less than equal to 23 (normal grade).

Table 8: Distribution of subjects on the basis of BMI

BMI (Kg/m ²)	Diabetic patients		Total
	Male	Female	
<18.5	0 (0.00)	0 (0.00)	0 (0.00)
18.6-19.9	5 (12.50)	1 (1.66)	6 (6.00)
20-22.9	4 (10.00)	6 (10.00)	10 (10.00)
23-24.9	9 (22.50)	10 (16.60)	19 (19.00)
25-29.9	20 (50.00)	37 (61.66)	57 (57.00)
>30	2 (5.00)	6 (10.00)	8 (8.00)
Total	40	60	100

Note: Values in parentheses denote percentage

Formulation of a risk assessment scale:

On the basis of the information generated from the survey and reviewing the literature, risk assessment parameters contributing to the occurrence of disease were identified, enlisted and were arranged in series. The components which were featured in the risk assessment tools were sex, age, smoking habit, alcohol consumption,

tea/coffee consumption, stress, work/ activity pattern, exercise performance, duration of exercise, dietary habit, intake of vegetable, fruit, milk, oil, and table salt and anthropometric measurements. Each parameter was awarded a score based on the data obtained from the two sources. Maximum attainable score of 64 was obtained.

Distribution of scores was done on three categories (Low, Medium and High risk) ranging from minimum to maximum attainable scores in the tool for each disease (Table 9).

Table 9: Distribution of scores for different levels of risk in each disease

Risk	Diabetes
Low risk	1-21
Medium risk	22-42
High risk	43-64

Reliability testing of the risk assessment tool:

For testing the reliability of the tool, 10 healthy subjects were selected purposively as per the predetermined criteria. The developed risk assessment tool was administered to each subject and the risk scores were collected using developed tool. Then the biochemical profile reports of the subjects were collected. Finally the association between the biochemical profile and risk scores was worked out and checked for its accuracy.

Data collection for reliability testing:

Information about subjects:

Details regarding the general profile, disease history, health habits, dietary pattern and anthropometric measurements of the subjects were collected using the developed DCT.

General profile:

Table 10 shows the distribution of the subjects on the basis of gender and it was observed that 70 per cent subjects were females. In the same milieu subjects when classified on the basis of age it was found that 80 per cent of them were above the age of 40 years.

Table 10: Distribution of subjects on the basis of gender

Gender	Group A
Male	3(30.00)
Female	7(70).00
Total	10

Note: Values in parentheses denote percentage

Disease history:

Subjects when asked about the presence of diseases in their family 70 per cent reported with assent with either

I or II degree relative as being sufferer of diabetes. (Table 11).

Table 11: Distribution of subjects on the basis of family history

Family history	Healthy subjects		Total
	Male	Female	
No family history	1(33.333)	2(28.57)	3(30.00)
Positive FH	2(66.66)	5(71.42)	7(70.00)
II degree relative (Uncle/Aunt)	0 (0.00)	1(20.00)	1(14.20)
One parent	0(0.00)	2(40.00)	2(28.50)
Both parents	1(50.00)	2(40.00)	3(42.80)
Brother/Sister	1(50.00)	0 (0.00)	0 (0.00)
Total	3	7	10

Note: Values in parentheses denote percentage

Anthropometric measurements:

Ten healthy individuals purposively selected to workout the reliability of risk assessment tool when classified on the basis of their BMI, a high proportion of them (70 per cent) were either overweight or obese. Remaining few of them had their BMI either in chronic energy deficiency or under normal grade (Fig. 1).

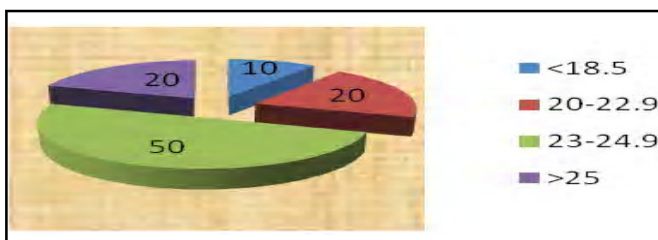


Fig. 1: Distribution of subjects according to BMI

The risk range related closely with the blood glucose values. Table 13 depicts the risk category obtained by the subjects after administering the developed risk assessment tool. Values so obtained when matched with that of

biochemical profile reports it was found that the two values were in same plane. The association between the two *i.e.* risk according to the risk assessment tool and biochemical levels shows that the tools developed for the purpose are highly reliable.

Risk assessment tools (Diabetes):

- Sex
 - Male 1
 - Female 2
- Age
 - <30 0
 - 31-40 1
 - 41-50 2
 - 51-60 3
 - >60 4
- Family history
 - No family history 0
 - II Degree relative 1
 - Single parent 2
 - Both parent 3
 - Brother/ Sister 4
 - Brother/ Sister + Parents 5
- Body weight
 - IBW for height 0
 - IBW to 10 per cent more 1
 - 11 per cent to 20 per cent more 2
 - 21 to 30 per cent more 3
 - 31 to 40 per cent more 4
 - >41 per cent 5
- BMI
 - 20-22.9 0
 - 23-24.9 1
 - 25-29.9 2
 - >30 3
- Waist measurement

Females		Males	
<.80 cm	0	<90	0
81-89 cm	1	90-99	1

Table 13: Blood glucose values of healthy subjects

Sr. No.	Fasting BG (mg/dl)	Postprandial BG (mg/dl)	Risk category on the basis of score	Risk category on the basis of Cut-offs
1.	110	147	Medium	IGT
2.	80	84	Low	Normal
3.	111	145	Medium	IGT
4.	122	165	Medium	IGT
5.	162	243	High	Diabetic
6.	103	190	Medium	IGT
7.	109	143	Medium	IGT
8.	128	192	Medium	IGT
9.	119	182	Medium	IGT
10.	86	92	Low	Normal

>89	2	>100	2	4-8 tsp per day (moderate amount)	1
– Waist to hip ratio				>8 tsp per day (high amount)	2
Females		Males		– Sugar or sweets intake	
.80 cm	0	<.95	0	Never	0
.81-.85 cm	1	.96-1	1	Rarely	1
>.86	2	>1	2	Frequently	2
– Smoking				Daily	3
Non smoker			0	– Quantity of sweets per serving	
Ex-smoker			1	< 1 piece/ 1 bowl	0
Current smoker				2-4 piece/ 2-4 bowl	1
1-10 cig/day			2	> 4 piece/ > 4 bowl	2
> 10 cig/day			3	– Nature of work	
Tobacco + cig			4	Heavy	0
– Alcohol				Moderate	1
Non user			0	Sedentary	2
1-2 peg/day			1	– Means of travelling to workplace/ market	
3-4 peg/day			2	Walking/Cycling	0
>4 peg/day			3	Vehicle	1
– Stress				– Exercises	
Calm and relaxed most of the time			0	Yes	0
Occasionally stressed			1	No	1
Frequently stressed			2	– Exercise duration	
– Tea and coffee consumption pattern				> 1 hour/day	0
Non user			0	½ -1 hour/day	1
1-2 cup/day			1	15-20 min/day	2
3-4 cup/day			2	No exercise	3
>4 cup/ day			3	– Pace of exercise	
– Dietary habit				> 5 Km/ hr/Outdoor games	0
Vegetarian			0	4.1-5 Km/hr	1
Ovo – vegetarian			1	2.1-4 Km/hr	2
Non vegetarian			2	= 2 Km/hr	3
– Number of days of vegetable intake per week					
Every day			0		
5- 6 days			1		
2- 4 days			2		
<2 days			3		
– No. of servings of vegetables per day					
≥ 6			0		
2-5			1		
<2			2		
– Number of days of fruit intake per week					
Every day			0		
5- 6 days			1		
2-4 days			2		
<2days			3		
– No. of servings of fruits per day					
=6			0		
2-5			1		
<2			2		
– Daily oil consumption per person					
< 4tsp per day (low amount)			0		

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LITERATURE CITED

- ADA. (2000).** Nutritional recommendations and principle for individual with diabetes mellitus. *Diabetes Care*, **23**:43-46.
- ADA. (2007).** www.carediabetes.journals.org.

- Bamji, M.S., Rao, N.P. and Reddy, V. (2003).** *Text book of human nutrition*. Oxford and IBM publishing Co. Pvt. Ltd., New Delhi. pp. 315.
- Deepashree, B.N. and Prakash, J. (2007).** A study on nutritional status of diabetes and associated risk factors. *J. Human Ecol.*, **21**: 269-274.
- Doostan, F. (2003).** Comparative study of serum lipid and dietary fat intake in young adult males and females. Abstracts IX *Asian Congress of Nutrition. Proceedings*, **14**:103-339.
- Khanna, K., Gupta, S., Passi, S.J., Seth, R., Mahna, R. and Puri, S. (2003).** *Textbook of nutrition and dietetics*. Phoenix Publishing house Pvt. Ltd. New Delhi. pp. 288-316.
- Malini, S.D., Sahu, S., Mohapatro, S. and Tripathy, R.M. (2009).** Assessment of risk factors for development of Type II diabetes mellitus among women in Behrampur, Orrisa. *Indian J. Community Med.*, **34**:225-235.
- Mitra, A. (2008).** Diabetes and stress : A review. *Ethnomedicine*, **2**: 131-135.
- Mohan, V., Shanthirani, C.S. and Deepa, R. (2003).** Glucose intolerance (diabetes and IGT) in a selected South Indian population with special reference to family history, obesity and lifestyle factors—the Chennai Urban Population Study (CUPS 14). *J. Association Physicians India*, **51**:756-757.
- Srilakshmi, B. (2003).** *Diebetics*. New Age International Pvt. Ltd. New Delhi, pp. 253-276.

