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TOPSIS ANALYSIS FOR THE PREDICTION OF DIABETES BASED ON GENERAL CHARACTERISTICS OF HUMANS

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Keywords:

Multi-criteria decision making (MCDM), TOPSIS, Normalized decision matrix (NDM), Positive ideal solutions (PIS), Negative ideal solutions (NIS), Relative closeness (RC)

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ABSTRACT: Worldwide diabetic patients are very common. This paper studies spread of diabetes in human living in Lahore, Pakistan. Data is collected from two local hospitals of Lahore and TOPSIS is applied to draw the results of the study. The study points out the people who are more likely to have diabetes due to various parameters like age, weight, height, body mass index (BMI), systolic blood pressure (SBP), diastolic blood pressure (DBP), urinary creatinine, albuminuria and albumin creatinine ratio (ACR) *etc.*

INTRODUCTION: In recent time, classical methods are used to solve different problems which are faced in medical sciences, engineering, social sciences *etc*. Many theories like fuzzy set theory (FST), probability theory, rough set theory *etc*. are used to solve these uncertainties, but these theories have their own problems which were attensioned by Zadeh. First of all Zadeh initiated the concept of fuzzy sets (FS) by the extension of classical notion on sets [1]. Nowadays FST is rapidly progressing, but in particular cases we face some limitations such as how to adjust the membership functions in this theory. Molodtsov proposed a new tool for solving the uncertainty problems which is known as soft set (SS) [2]. He introduced many applications on SS such that smoothness of functions, game theory, Operation research, Riemann integration theory of measurement and many more. In these days, mathematician play a vital role in the SS fuzzification. After fuzzification of SS a new theory was introduced which is known as fuzzy soft set (FSS) with different types and properties [3]. The SS theory was reviewed by Maji *et al*., and they used this theory for decision making [4]. They also introduced different types of SS with examples and defined some operations such as And-operation, Or-operation, union, intersection, complement *etc*. on SS [5].

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After some time the work on SS was extended by using the definition of parameterization reduction [6] and has been used in decision making problem. Some new notions on SS are introduced by Ali *et al*., such as restricted union, restricted intersection, restricted difference and extended intersection with examples and properties [7]. Zulqarnain M and Saeed M, proposed and proved the credibility of IVFSM in decision making and discussed its different properties [8]. They also studied FSM and IVFSM and redefined the product of IVFSM.

They used IVFSM and FSM in decision making problem with examples and compare the results and saw that FSM method is more appropriate for decision making. They proposed some new definitions on IVFSM which were known as And-Product and Or-Product of IVFSM with examples and discussed their properties [9]. They proved commutative laws, associative laws and De-Morgan laws by using And-Operation and Or-Operation on IVFSM [10]. They proposed interval valued fuzzy soft max-min decision making method (IVFSMmDM) by using interval valued fuzzy soft max-min decision making function. They also applied IVFSMmDM method for decision making to solve those problems which were involving uncertainties by using imprecise data.

Yeşim *et al*., used the fuzzy TOPSIS method to select a supplier out of three suppliers in a garment factory operating in Turkey [11]. Jahanshahloo *et al*., extended the approach of TOPSIS method for decision making by the help of fuzzy data [12]. They also introduced a new concept of normalized fuzzy numbers by the help of α-cuts and applied this proposed concept on numerical problem. We faced many problems for the selection of new car due to their specifications and we needed a selection procedure required to overcome these problems. Srikrishna S *et al*., worked on these problems and overcome these problems by using TOPSIS method technique [13]. In 2015, S. Eraslan agreed that TOPSIS method is very appropriate to choose externally determined alternatives [14]. He applied this method on SST and introduced a new decision making method on SST and used this method for decision making.

TOPSIS method used to select the best suppliers who were more suitable for buyer with high quality products at right time and right price. He calculated the weights for each supplier on the base of Analytic Hierarchy Process (AHP) and entered these weights in TOPSIS method to check the rank of each supplier [15]. Hwang and Yoon discovered that alternatives can be categorized on the basis of maximum distance from NIS and minimum distance from PIS [16].

Diabetes is becoming as a huge disease in the world due to its multiple factors coming in all type of persons and in every age of humans. Diabetes is a long-lasting disease that needs ongoing medical dealing, patient self-controlling education to avoid severe problems and to decrease the danger of time-consuming problems. The patient having diabetes is multifaceted and needs to solve many matters to be addressed. A large body of sign exists that ropes a range of interferences to recover diabetes results.

These criteria of patient are planned to deliver clinicians, patients, researchers and other involved persons with the mechanisms of diabetes enduring, treatment areas, and gears to assess the quality of patient. While discrete preferences, commodities and other patient issues may need alteration of goals or marks that are wanted for maximum patients having diabetes are provided. These values are not planned to prevent more general assessment and handling of patients is required by other specialist if needed. Diabetes is a disease in which patients have high blood sugar, diabetes attacks on any person when the production level of insulin is decreased in the body or cells of body do not control the insulin level in body. Due to these problems diabetes is big problem in the world, we have to save ourselves and others by giving some attention to it. If we know that at what time diabetes attack will be extreme then in these situations we can save ourselves by taking a little care.

In this paper, we proposed new procedure to evaluate the result of diabetes patient and check that in which types of persons have more chances of diabetes by using ideal solution.

Preliminaries:

Definition: [2] A pair (F, E) on universal set U is called a SS, if there exist a mapping F from E to P (U). *i.e*.

$$F: E \rightarrow P(U).$$

Definition: [2] (F, A) and (G, B) are two SS on U, then (F, A) is soft subset of (G, B) if

(a). $A \subseteq B$, and

(b). For all $t \in A$, F (t) and G (t) are identical approximation.

It is denoted by $(F, A) \subseteq (G, B)$.

Definition: [5] (F, A) and (G, B) are called equal SS if they are subsets of each other. It can be written as

$$(F, A) = (G, B)$$

Definition: [5] Let E = $\{t_1, t_2, t_3, t_4, t_5, \ldots, t_n\}$ be the set of parameters. The not set of E is defined as

$\neg E = \{\neg t_1, \neg t_2, \neg t_3, \neg t_4, \neg t_5, \ldots \neg t_n\}$ where $\neg t_i$ means not t_i for all i = 1,2,3,4,5,…..,n.

Definition: [5] (F, A) be a SS then its Compliment is defined as

$$(F, A)^C = (F^C, \neg A),$$

where $F^C: \neg A \rightarrow P(U)$ is a mapping given by $F^C(t) = U - F(\neg t)$, for all $\neg t \in \neg A$.

Definition: [5] (F, A) be a SS then its Relative complement defined as

$$(F, A)^r = (F^r, A),$$

Where; $F^r(t) = U - F(t)$, for all $t \in A$.

Definition: [14] (F, A) and (G, B) are two SS over U, than their union (H, C) is defined as

$$(H, C) = \begin{cases} F(t), & t \in A - B \\ G(t), & t \in B - A \\ F(t)\, U\, G(t), & t \in A \cap B \end{cases}$$

Definition: [14] The intersection of two SS (F, A) and (G, B) is defined as

$$(F, A) \cap (G, B) = (H, C)$$

$$H(t) = F(t) \cap G(t), \text{ for } t \in C, \text{ where } C = A \cap B.$$

Definition: [5] The restricted difference of two SS (F, A) and (G, B) is defined as

$$(F, A) -_R (G, B) = (H, C)$$

Where $C = A \cap B$ and for $t \in C$, $H(t) = F(t) \cap G(t)$

Definition: [14] (F, A) is said to be a null SS if for all $e \in A$, $F(e) = \Phi$.

Definition: [2] (F, A) is called absolute SS if for all $e \in E$, $F(e) = U$.

TOPSIS Method [15] Yoon (1980) and Hwang and Yoon (1981) were the first who introduce the TOPSIS to solve the problems of MCDM. The PIS maximizes whereas the NIS minimizes the disease risk. The basic assumption is that each criterion needs to be minimized or maximized. For ranking alternatives and closeness to best answer we used TOPSIS. The process of TOPSIS is based on an optimum ideal solution. By using this method we obtained maximum level by choosing the better available alternative.

The ranking of ideal solution is done in such a way that the best alternative has rank one and bad alternative has zero. For every alternative there is an intermediate ranking between the best answer extremes. Identical set of choice criteria permits correct weighting of relative disease and therefore optimum disease is alarming which needs attention.

Here are presented the steps for the TOPSIS technique.

Step 1: Establishment of Decision Matrix (DM): First step in TOPSIS is to construct the DM that is as follows

$$DM = \begin{array}{c} \\ A_1 \\ A_2 \\ \vdots \\ A_p \end{array} \begin{array}{c} \begin{matrix} R_1 & R_2 & \cdots & R_q \end{matrix} \\ \begin{bmatrix} c_{11} & c_{12} & \cdots & c_{1q} \\ c_{21} & c_{22} & \cdots & c_{2q} \\ \vdots & \vdots & \ddots & \vdots \\ c_{p1} & c_{p2} & \cdots & c_{pq} \end{bmatrix} \end{array} \quad (1)$$

Where *l* is the alternative index (*l* = 1, 2,....,*q*); *n* is the number of potential sites and is m the criteria index (*m* = 1, 2,...., *p*).

The elements $R_1, R_2, \ldots R_q$ of the DM define the criteria while $A_1, A_2, \ldots, A_P$ define the alternatives. Elements of DM are related to the values of alternative *l* w. r. t criteria *m*.

Step 2: Calculation of the NDM: The NDM denotes the normalized values which represent the relative performance of the alternatives.

$$NDM = L_{lm} = \frac{c_{lm}}{\sqrt{\sum_{l=1}^{q} c_{lm}^2}} \quad (2)$$

Step 3: Determination of the Weighted Decision Matrix (WDM): We construct WDM by multiplying NDM to random weights.

$$V = V_{lm} = W_m \times L_{lm} \quad (3)$$

Step 4: Identification of the PIS and NIS: The PIS (I^+) and the NIS (I^-) are defined with respect to the WDM in below equations.

$$\begin{aligned} &\text{PIS} = I^+ = \{V_1^+, V_2^+, \ldots, V_q^+\}, \text{ where:} \\ &V_q^+ = \{(\text{maxi}(V_{lm}) \text{ if } m \in J); (\text{mini } V_{lm} \text{ if } m \in J')\} \end{aligned} \quad (4)$$

$$\begin{aligned} &\text{NIS} = I^- = \{V_1^-, V_2^-, \ldots, V_q^-\}, \text{ where:} \\ &V_m^- = \{(\text{mini}(V_{lm}) \text{ if } m \in J); (\text{maxi } V_{lm} \text{ if } m \in J')\} \end{aligned} \quad (5)$$

Where, *J'* is associated with the non-beneficial attributes and *J* is associated with the beneficial attributes.

Step 5: Separation Distance from PIS and NIS, of Each Alternative

$$S_l^+ = \sqrt{\sum_{m=1}^{p} (V_m^+ - V_{lm})^2} \; ; l = 1, 2, \ldots, q \quad (6)$$

$$S_l^- = \sqrt{\sum_{m=1}^{p} (V_m^- - V_{lm})^2} \; ; l = 1, 2, \ldots, q \quad (7)$$

where, l = Alternative index, m = Criteria index.

Step 6: RC to the Ideal Solution:

$$C_l = \frac{S_l^-}{(S_l^+ + S_l^-)} \, , 0 \le C_l \le 1 \quad (8)$$

Step 7: Ranking of Preference Order: Ranking is depending on the basis of C_l, alternative have better performance which have high RC value.

In this study we comprised of 110 T2DM patients having disease for more than 10 years. The data has been collected from Diabetes Management Centre of two local hospitals of Lahore.

A total of 40 healthy age and sex matched controls were recruited from general population. In T2DM patients group, 25 males and 85 females while in control group 7 males and 33 females were included. **Table 1** indicates the percentages of males and females in control group and patients. In control group, the frequency of females (82.5%) was greater than males (17.5%) and in patients frequency of females (77.27%) was also high than males (22.73%).

MATERIALS AND METHODS: There are two main types of the diabetes called type-1 and type-2. These are also known as insulin dependent and insulin independent diabetes.

In type-1 diabetes pancreas is attacked by the body's immune system. Person having type-1 diabetes cannot produce insulin naturally so they require life-long insulin injection.

In type-2 diabetes the insulin does not work properly or the body does not produce enough insulin. Patients having type-1 diabetes have to take medicine to control the sugar level in the blood. A person can have type-2 diabetes at any stage of life.

Table 1 shows elements of the DM with respect to different parameters

TABLE 1: ELEMENTS OF THE DM

Criteria	Alternatives				
	Females (n =118)		Males (n = 32)		
Baseline Characteristics	Controls (n = 33)	Patients (n = 85)	Controls (n = 7)	Patients (n = 25)	Weights
Age (Years)	50.93	51.84	50.86	52.2	0.2
Weight (Kg)	64.03	70.6	64.86	76.64	0.2
Height (cm)	155.94	151.5	159.71	163.36	0.01
BMI (Kg/m^2)	26.22	30.26	25.31	28.75	0.12
sBP (mmHg)	117.88	129.9	120	124	0.03
dBP (mmHg)	77.27	82.98	80	79.6	0.03
Urinary creatinine (mg/dl)	101.02	51.25	59.49	53.38	0.15
Albuminuria (mg/l)	3.56	112.29	4.53	109.89	0.13
ACR (µg/mg of creatinine)	6.51	173.87	3.9	110.1	0.13

In **Fig. 1** we see the controls and patients with respect to different parameters.

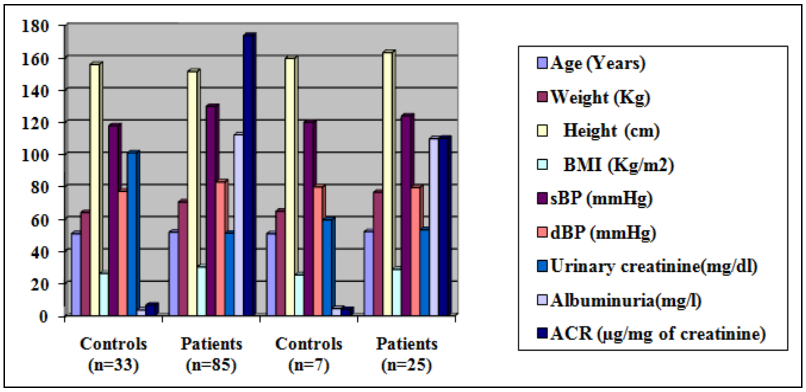

FIG. 1: COMPARISON OF PARAMETERS OF SUGAR PATIENTS

Calculation for Normalized values of DM:

$$R_{11} = \frac{50.93}{\sqrt{50.93^2 + 51.84^2 + 50.86^2 + 52.2^2}} = 0.494843$$

$$R_{12} = \frac{64.03}{\sqrt{64.03^2 + 70.6^2 + 64.86^2 + 76.64^2}} = 0.462522$$

$$R_{13} = \frac{155.94}{\sqrt{155.94^2 + 151.5^2 + 159.71^2 + 163.36^2}} = 0.494454$$

$$R_{14} = \frac{26.22}{\sqrt{26.22^2 + 30.26^2 + 25.31^2 + 28.75^2}} = 0.473196$$

$$R_{15} = \frac{117.88}{\sqrt{117.88^2 + 129.9^2 + 120^2 + 124^2}} = 0.479069$$

$$R_{16} = \frac{77.27}{\sqrt{77.27^2 + 82.98^2 + 80^2 + 79.6^2}} = 0.483008$$

$$R_{17} = \frac{101.02}{\sqrt{101.02^2 + 51.25^2 + 59.49^2 + 53.38^2}} = 0.728668$$

$$R_{18} = \frac{3.56}{\sqrt{3.56^2 + 112.29^2 + 4.53^2 + 109.89^2}} = 0.022643$$

$$R_{19} = \frac{6.51}{\sqrt{6.51^2 + 173.87^2 + 3.9^2 + 110.1^2}} = 0.031611$$

Table 2 shows the calculation of NDM.

TABLE 2: VALUES OF NDM

Criteria	Alternatives			
	Females (n = 118)		Males (n = 32)	
Baseline Characteristics	**Controls (n = 33)**	**Patients (n = 85)**	**Controls (n = 7)**	**Patients (n = 25)**
Age (Years)	0.494843	0.503685	0.494163	0.507183
Weight (Kg)	0.462522	0.509981	0.468518	0.553611
Height (cm)	0.494454	0.480376	0.506408	0.517982
BMI (Kg/m^2)	0.473196	0.546107	0.456773	0.518855
sBP (mmHg)	0.479069	0.527919	0.487685	0.503941
dBP (mmHg)	0.483008	0.518701	0.500073	0.497573
Urinary creatinine (mg/dl)	0.728668	0.369672	0.429108	0.385036
Albuminuria (mg/l)	0.022643	0.714223	0.028813	0.698958
ACR (µg/mg)	0.031611	0.844284	0.018938	0.534627

The **Fig. 2** shows the normalized values of DM with respect to their parameters.

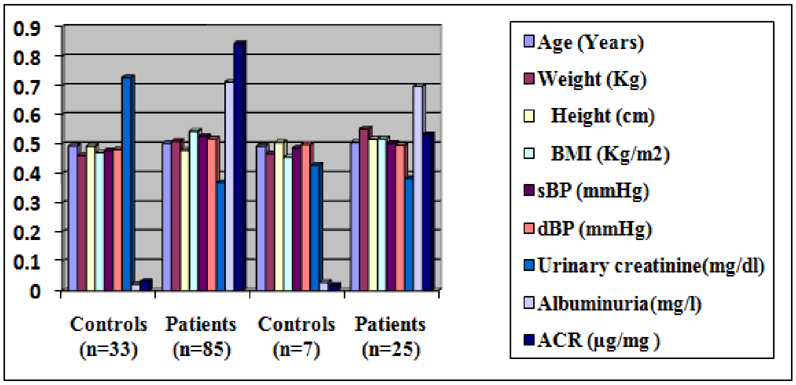

FIG. 2: THE NORMALIZED VALUES OF DM WITH RESPECT TO THEIR PARAMETERS

Calculation for the Weighted Decision Table:

$$V_{11} = 0.2 \times 0.49484 = 0.098968$$
$$V_{12} = 0.2 \times 0.462522 = 0.092504396$$
$$V_{13} = 0.01 \times 0.494454 = 0.004944542$$
$$V_{14} = 0.12 \times 0.473196 = 0.056783544$$
$$V_{15} = 0.03 \times 0.479069 = 0.014372083$$
$$V_{16} = 0.03 \times 0.483008 = 0.01449025$$
$$V_{17} = 0.15 \times 0.728668 = 0.109300197$$
$$V_{18} = 0.13 \times 0.022643 = 0.00294365$$
$$V_{19} = 0.13 \times 0.031611 = 0.004109493$$

Table 3 shows the Calculation of WDM.

TABLE 3: WDM

Criteria	Alternatives			
	Females (n = 118)		Males (n = 32)	
Baseline Characteristics	**Controls (n = 33)**	**Patients (n = 85)**	**Controls (n = 7)**	**Patients (n = 25)**
Age (Years)	0.098968655	0.100737	0.098833	0.101437
Weight (Kg)	0.092504396	0.101996	0.093704	0.110722
Height (cm)	0.004944542	0.004804	0.005064	0.00518
BMI (Kg/m^2)	0.056783544	0.065533	0.054813	0.062263
sBP (mmHg)	0.014372083	0.015838	0.014631	0.015118
dBP (mmHg)	0.01449025	0.015561	0.015002	0.014927
Urinary creatinine(mg/dl)	0.109300197	0.055451	0.064366	0.057755
Albuminuria (mg/l)	0.00294365	0.092849	0.003746	0.090865
ACR (µg/mg of creatinine)	0.004109493	0.109757	0.002462	0.069502

The **Fig. 3** shows the WDM of controls and patients with respect to their parameters.

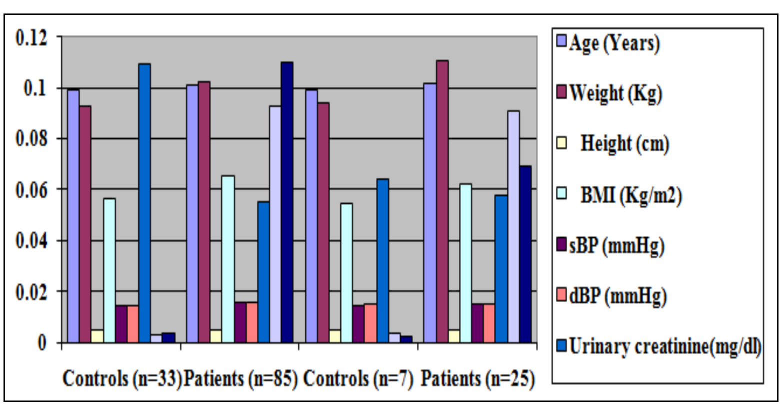

FIG. 3: THE WDM OF CONTROLS AND PATIENTS WITH RESPECT TO THEIR PARAMETERS

Calculation of PIS and NIS: The PIS (I^+) and NIS (I^-) defined according to the WDM and calculate separation distance by using ideal and non ideal solution of each alternative.

$$I^+ = \begin{Bmatrix} 0.101437, 0.110722, 0.00518, \\ 0.065533, 0.015838, 0.015561, \\ 0.109300197, 0.092849, 0.109757 \end{Bmatrix}$$

$$I^- = \begin{Bmatrix} 0.098833, 0.092504396, 0.004804, \\ 0.054813, 0.014372083, 0.01449025, \\ 0.055451, 0.00294365, 0.002462 \end{Bmatrix}$$

Calculation for the separation distance from PIS of each alternative is given in **Table 4**.

TABLE 4: SEPARATION DISTANCE OF PIS

$V_m^+ - V_{lm}$				$(V_m^+ - V_{lm})^2$			
0.002468	0.0007	0.002604	0	6.09053E-06	4.89388E-07	6.78044E-06	0
0.018218	0.008726	0.017019	0	0.000331885	7.61433E-05	0.000289633	0
0.000235	0.000376	0.000116	0	5.53535E-08	1.41419E-07	1.33944E-08	0
0.008749	0	0.01072	0.00327	7.65495E-05	0	0.000114919	1.07E-05
0.001465	0	0.001207	0.000719	2.14767E-06	0	1.4569E-06	5.17E-07
0.001071	0	0.000559	0.000634	1.14657E-06	0	3.12293E-07	4.02E-07
0	0.053849	0.044934	0.051545	0	0.002899763	0.002019068	0.002657
0.089905	0	0.089103	0.001984	0.008082975	0	0.007939399	3.94E-06
0.105647	0	0.107295	0.040255	0.01116138	0	0.011512221	0.00162
0.002468	0.0007	0.002604	0	6.09053E-06	4.89388E-07	6.78044E-06	0
0.018218	0.008726	0.017019	0	0.000331885	7.61433E-05	0.000289633	0
$\sum (V_m^+ - V_{lm})^2$				0.019662231	0.002976537	0.021883804	0.004293
$\sqrt{\sum (V_m^- - V_{lm})^2}$				0.140222076	0.054557645	0.147931753	0.06552

Calculate for the separation distance from NIS of each alternative is shown in **Table 5**.

TABLE 5: SEPARATION DISTANCE OF NIS

$V_m^- - V_{lm}$				$(V_m^- - V_{lm})^2$			
-0.00014	-0.0019	0	0.002604	1.85031E-08	3.6266E-06	0	6.78044E-06
0	-0.00949	-0.0012	-0.01822	0	9.0092E-05	1.44E-06	0.000331885
-0.00014	0	-0.00026	-0.00038	1.982E-08	0	6.78E-08	1.41419E-07
-0.00197	-0.01072	0	0.00745	3.88385E-06	0.00011492	0	5.55004E-05
0	-0.00147	-0.00026	-0.00075	0	2.1477E-06	6.68E-08	5.56752E-07
0	-0.00107	-0.00051	-0.00044	0	1.1466E-06	2.62E-07	1.90916E-07
-0.05385	0	-0.00892	-0.0023	0.002899763	0	7.95E-05	5.31112E-06
0	-0.08991	-0.0008	-0.08792	0	0.00808298	6.43E-07	0.007730082
-0.00165	-0.1073	0	0.06704	2.71454E-06	0.01151222	0	0.004494316
-0.00014	-0.0019	0	0.002604	1.85031E-08	3.6266E-06	0	6.78044E-06
0	-0.00949	-0.0012	-0.01822	0	9.0092E-05	1.44E-06	0.000331885
$\sum (V_m^- - V_{lm})^2$				0.002906399	0.01980713	8.2E-05	0.012624765
$\sqrt{\sum (V_m^- - V_{lm})^2}$				0.053911031	0.1407378	0.009053	0.112359977

RC to Ideal Solution:

$$S^+ = \{0.140222076, 0.054557645, 0.147931753, 0.06552\}$$

$$S^- = \{0.053911031, 0.1407378, 0.009053, 0.112359977\}$$

$$S^+ + S^- = \{0.194133, 0.195295, 0.156985, 0.17788\}$$

$$C_l = \{0.277701, 0.72064, 0.05767, 0.63166\}$$

The **Fig. 4** shows the ranking of control and patients

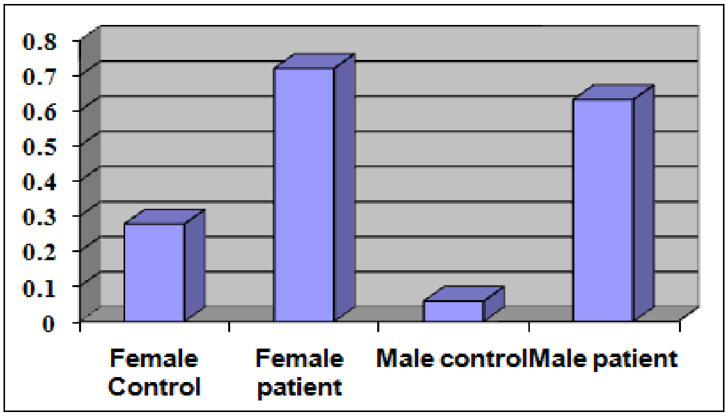

FIG. 4: RANKING OF CONTROLS AND PATIENTS

CONCLUSION: The proposed new procedure gives the result that female patients have maximum chances of diabetes because of the RC with the ideal solution and the values are 0.2777, 0.7206, 0.05767 and 0.63166 respectively. It is observed that female patients have more chances of having diabetes than male patients. Consequently, they need more care about their health to minimize the chances of having diabetes and led a healthy lifestyle.

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REFERENCES:

1. Zadeh LA: Fuzzy Sets, Journal of Information and Control 1995; 8(3): 338-353.
2. Molodtsov DA: Soft Set Theory-first result, Computers and Mathematics with Applications 1999; 37: 19-31.
3. Maji PK, Roy AR and Biswas R: Fuzzy soft sets, Journal of Fuzzy Mathematics 2001; 9(3): 589-602.
4. Maji PK, Roy AR and Biswas R: An application of soft sets in a decision making problem, Computers and Mathematics with Applications 2002; 44: 1077-1083.
5. Maji PK and Roy AR: Soft set theory, Computers and Mathematics with Applications 2003; 45: 555-562.
6. Chen D, Tsang ECC, Yeung DS and Wang X: The parameterization reduction of soft sets and its applications, Computers and Mathematics with Applications 2005; 49: 757-763.
7. Ali MI, Feng F, Liu XY, Min WK and Shabir M: On some new operations in soft set theory, Computers and Mathematics with Applications 2009; 57: 1547-1553.
8. Zulqarnain M and Saeed M: An application of Interval valued fuzzy soft matrix (IVFSM) in decision making, Sci. Int. (Lahore) 2016; 28(3): 2261-2264.
9. Zulqarnain M and Saeed M: Comparison between fuzzy soft matrix (FSM) and interval valued fuzzy soft matrix (IVFSM) in decision making, Sci. Int. (Lahore) 2016; 28(5): 4277-4283.
10. Zulqarnain M and Saeed M: A New Decision Making Method on Interval Valued Fuzzy Soft Matrix (IVFSM), British Journal of Mathematics and Computer Science 2017; 20(5): 1-17.
11. Yayla AY, Yildiz A and Özbek A: Fuzzy TOPSIS Method in Supplier Selection and Application in the Garment Industry, Fibres and Textiles in Eastern Europe 2012; 20(4): 20-23.
12. Jahanshahloo GR, Lotfi FH and Izadikhah M: Extension of the TOPSIS method for decision-making problems with fuzzy data, Applied Mathematics and Computation 2006; 18(1): 1544-1551.
13. Srikrishna S, Reddy AS and Vani S: A New Car Selection in the Market using TOPSIS Technique, International Journal of Engineering Research and General Science 2014; 2(4): 177-181.
14. Eraslan S: A Decision Making Method via TOPSIS on Soft Sets, Journal of new results in science 2015; 8: 57-71.
15. Bhutia PW and Phipon R: Appication of ahp and topsis method for supplier selection problem, IOSR Journal of Engineering (IOSRJEN) 2012; 2(10): 43-50.
16. Hwang CL and Yoon K: Multiple Attribute Decision Making, Methods and Applications, Berlin Heidelberg New York, Springer -Verlag 1981.

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