Impact of computer tailored nutrition application software on knowledge stage of diabetics

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■**ABSTRACT :** Diabetes is now-a-days occupying the central position around the globe. It is therefore essential to condense its likelihood and the best way to do so is education, only education can reduce the occurrence as well as can help in better management of the disease. With the help of present software user can understand different aspects of the diseases from theoretical as well as practical point of view. In practical side user can create his/ her profile and accordingly obtain results on BMI and health risk according to the waist hip ratio classification, similarly he can judge his/ her knowledge or risk in the disease so that he/ she can take preventive measures in future. Biochemical presentation shows disease status whether improving or declining with the help of diary maintenance. Tracking diet and activity is equally important so as to understand the concept of energy balance. The developed software was evaluated on different criteria by a panel of 18 experts on five point scale ranging from very good to very poor for most of the parameters. and in majority of section it secured the MWS above 4.61 *i.e.* which justifies the significance of the developed system.

■ **KEY WORDS:** Computer, Tailored nutrition, Software, Diabetes

Non communicable diseases (NCDs) are the major health burden in industrialized countries owing to demographic transition and changing life style among the people NCDs have their roots in detrimental life style or adverse physical and social environment. Risk factors like unhealthy nutrition over a prolonged period, smoking, stress, physical inactivity, excessive use of alcohol are among the major life style issues. In addition to above factors the shifts towards highly refined foods and towards meat and dairy products containing high level of saturated fat *i.e.* the nutrition transition together with industrialization, urbanization, reduced energy expenditure contributed to the alarming rise in the obesity and its related diseases.

Diabetes is a chronic metabolic disorder that prevents the body to utilize glucose completely or partially. It is characterized by raised glucose concentration in the blood and alterations in carbohydrates, protein and fat metabolism (Srilakshmi, 2003).

Globally diabetes affects 246 million people which are about 6 per cent of the total adult population. It is the fourth leading cause of death by disease and at every ten second a person dies from diabetes related cause in

the world. Over three million deaths worldwide are tied directly to diabetes (Neogi, 2007).

New technologies like computer software provide opportunities for nutrition educators to enhance communication efforts which can improve the health and wellbeing of people everywhere. Computer technologies are providing viable means of exchanging nutrition information among professionals and informing and influencing the public. Software for public presentations allows nutrition educators to enhance their talks by incorporating pictures, sounds, animations, text and videos (*www.icmr.nic.in*). Present software allow users to understand as well as in prevention and management of disease.

Few years back nutrition education was imparted using leaflets, posters, lectures, folk media but today computers are gaining more importance. Computers combine numerous communications methods, such as text, sound, still images and animation. This increases the possibilities of developing teaching tools that are challenging, enjoyable and attractive for everyone and thus computers are a valuable addition to nutrition education (Mathson, 2001).

Computer tailored health education; a promising tutoring technique is increasingly being delivered interactively for example over the internet. It has been suggested that there may be differences in use and appreciation between print and interactive delivery of computer tailored intervention which may influence information processing (Kroeze and Spranger, 2008).

■ RESEARCH METHODS
Step 1 : Locale of the study:
The planning for the present study was done within the Udaipur city looking into the availability of computer services in order to develop the software. For evaluation panel of 18 experts was selected including 3 doctors, 6 nutritionists, dieticians and 3 patients.

Step 2: The study was conducted in three phases:
Phase I: Formulation of knowledge assessment tool:
A tool for each disease was finally formulated by allotting 1 score to each correct answer and 0 to each wrong answer. The questionnaire comprised of closed ended questions on general facts, prevalence, etiology, clinical manifestations, role of diet and exercise in the management of disease.

The validity was knowledge assessment tool was tested by a panel of 18 experts (6 nutritionists, 6 dieticians, 3 doctors and 3 patients) for each disease on a five point scale (5- very good, 4 - good, 3- average, 2- poor, 1- very poor) ranging from very good to very poor for content, sequence and overall presentation in each disease. In case of language and relevance to topic the scale ranged from very simple to very difficult and totally relevant to totally irrelevant, respectively. For reliability split half technique was used. The knowledge assessment tools developed for the three disease were found highly reliable (r=0.83).

Phase II: Development of software:
Software on Diabetes was developed under the present study and it was named as "Conquer Diabetes". It was developed in c≠ language. For the development of software following steps were undertaken:

Preparation of manuscript for software development :
Collection of primary input:
In order to develop target oriented and user friendly software it is essential to develop a strong conceptual baseline. For the purpose a complete knowledge of the subject is must and therefore information pertaining to the different areas of the project or diseases was collected from different literature sources.

Content outline:
The information so collected was studied, analyzed critically, concised and accordingly categorized to prepare a content outline. The collected content was then segregated into different headings *i.e.* prevalence, types, symptoms, risk factors, complications, investigative values, role of diet and exercise in the management of the diabetes.

Organization, editing and finalization of the content:
The duly categorized matter was organized in a proper sequence, judged for its continuity, edited for errors and finally placed under respective disease section and suitable modules were prepared covering information in various aspects of diseases.

Development of "Conquer Diabetes":
Planning and development of Conquer Diabetes was

carried out at College of Home Science, Udaipur. The software was developed with the finally developed manuscript using Microsoft Visual Studio 2005 and database was developed using Microsoft Access. Knowledge and risk assessment tools developed by Paliwal (2010) were utilized in the software to assess the knowledge and risk of the users in diabetes.

The software was divided into 7 sections:

Section I: Create profile section:

In this section user can create his own profile by entering information in various fields *viz.,* name, age, sex, height, weight, waist circumference, hip circumference and accordingly the designed software provide the results on BMI, WHR and health risks associated with the user's indices.

Section 2 : Risk assessment section:

Here user (may or may not be the patient of the diabetes) can assess his /her risk to the diabetes with the help of developed risk assessment tools.

Section 3: Knowledge assessment section:

In this section user can assess the knowledge in various diseases with the help of knowledge assessment tools developed by the investigator covering every important dimension (general facts, prevalence, etiology, role of diet and exercise in the management of the diseases.

Section 4: Biochemical profile/ Biophysical profile section:

In this section, user can assess his disease status with that of normal standard levels with the help of graphical presentations. Graphical presentation helps to comprehend the disease progress made so far by the user. In this section user can also maintain diaries of his biochemical profile levels so as to monitor the progress in long run.

Section 5: Intake calculator section:

This section provides data on dietary intake of the subjects in terms of macro-micro nutrients *viz.,* energy, protein, fat, carbohydrate, thiamine, riboflavin, niacin, vitamin C, sodium and accordingly on the basis of present body weight or target body weight, software also provides information on daily nutrient requirement of the subject

so as to achieve the target body weight or maintain the present weight. To help the users sample menus were also provided ranging from 1100 kcal to 2500 kcal. In addition Diabetic exchange lists, Glycemic intake calculator are also made available to the users. A database of 600 recipes commonly consumed people was prepared by the investigator in Microsoft Access using information from different sources (Books, manuals, market survey of packed food items and dissertations and those prepared by the investigator).

Section 6: Activity calculator:

In this section user can estimate his/her whole day energy expenditure by selecting various activities conducted by him in the 24 hours period with duration, accordingly the software calculates the energy expenditure. In addition energy balancer facilitates the user to balance the input energy of the selected recipe with that of the selected activity (output energy). Here user can understand the concept of input-output energy balance.

Section 7: About disease section:

This section is the theoretical side of the software, here user get information about disease, types, etiology, role of diet and exercise in the management of the disease, myths and facts.

Evaluation of the IDMS :

Panel of 18 experts from various fields were invited to rate the content, continuity, sequence, graphical presentations, video sound, visual quality, pictorial presentations, language, relevance to topic, calculations, practical utility and overall presentation of each disease.

Panel members included- 6 Nutritionists, 6 Dieticians, 3 Patients and 3 Doctors. Patients were included in the team of experts so as to obtain suggestions form their practical point of view as they were the true sufferers.

Based on pertinent parameters a suitably structured evaluation sheet was developed. Scoring of the Conquer Diabetes was done separately for content, continuity, graphical presentation, video sound, visual quality, pictorial presentation and overall presentation of each disease on five point scale ranging from very good to very poor (5- very good, 4- good, 3- average, 2- poor, 1-very poor); for language and practical utility the five point scale

ranged from very simple to very difficult and totally adequate to totally inadequate respectively and lastly calculations were ranked on 2 point scale (2- clear and 1 unclear).

Improvisation and finalization :

The suggestions obtained from different members of the panel of experts were put together and penned down on a piece of paper. After assertion the CD was made for its permanency and easy handling.

Phase III: Gain in knowledge assessment :

A total of 20 subjects were contacted for the present study. Subjects were selected on the basis of pre determined criteria and information about general profile was collected using DCT.

Pre-test score collection:

Above developed knowledge assessment questionnaire was used for pre test score collection. It was distributed to the subjects to assess their present level of knowledge and they were asked to answer the questions and were then collected from them. The scores so obtained were totaled.

Exposure to the system:

The subjects were exposed to the system at their work spot/ homes/ offices/ parks as per their choice. Exposure was repeated twice or thrice as desired or requested by them.

Post-test score collection:

After exposure the same set of questionnaire with new blank answer sheets was again distributed to collect the post test score.

Statistical analysis:

Mean weight score (MWS):

For each aspects the frequency falling under each rating *i.e.* very good, good, average, poor and very poor were tabulated, then the frequency in each of the category were multiplied by the assigned scores *i.e.* 5, 4, 3, 2, 1, respectively and added. The resulting sum for each aspect was divided by the total no. of respondent.

Thus in this way, the MWS in each aspect were calculated.

Pre test -post test experimental design was used to assess gain in knowledge of the subjects. The data was statistically analyzed as per the objectives. General information among the subjects was expressed as percentage.

■ **RESEARCH FINDINGS AND DISCUSSION**

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Phase I: Development of knowledge assessment tool :

Knowledge assessment tools was developed for appraising the knowledge level of the patients in pertaining disease *viz.,* diabetes. The tool comprised of closed ended questions on general facts about the disease, prevalence, etiology, clinical manifestations, role of diet and physical activity in the management of diseases and complications were framed.

The validity was tested by a panel of 18 experts for each disease. Suitable modifications suggested by the panel of experts were finally incorporated and then the developed tools for each disease were added to the system. The validity of the tool was tested during the evaluation of IDMS. In order to find out the reliability of the tool, the reliability coefficient of the scale was calculated. The tool was found highly reliable (r=0.83).

Panel of experts included:
– Nutritionists - 6
– Dieticians - 6
– Doctors - 3
– Patients - 3

Knowledge assessment tool for diabetes -(See Appendix 1) :

Phase II: Development of software:

Software so developed on diabetes was evaluated in two parts on the basis of different criteria in Part I subject matter, continuity, graphical presentation, video

Table 1 : Distribution of scores on the basis of level of knowledge			
Disease	Good (Grade A)	Average (Grade B)	Poor (Grade C)
Diabetes	23-35	12-22	0-11

sound and visual quality were judged.

In Part II Pictorial presentations, language, relevance to topic, calculations and practical utility was judged.

Table 2 portrays the MWS obtained by different sections of software in view of different criteria *i.e.* subject matter, continuity, graphical presentation, video sound, visual quality. As can be seen in table MWS of 4.72 was obtained by majority of the sections in view of subject matter namely create profile, risk assessment, knowledge assessment, intake calculator and activity calculator. In view of continuity highest MWS of 4.77 was secured by BC/ BP section whereas least MWS of 4.61 was secured by about disease section. For graphical presentation MWS of 4.72 and 4.61 was achieved by BC/ BP and intake calculator section, respectively. Video sound and visual quality of the about disease section was rated with a MWS of 4.77 and 4.72. Videos were placed in this section so as to explain the disease process to the users.

A perusal of Table 3 shows the response of all the panel members regarding pictorial presentation, it reveals that majority of the evaluators gave very good in both the sections and thus the MWS of 4.77 and 4.83 was obtained. Data in table also point out the MWS of sections in view of language aspect. The MWS for language was achieved in decreasing order starting from activity calculator/ knowledge assessment/ BC sections (4.77),
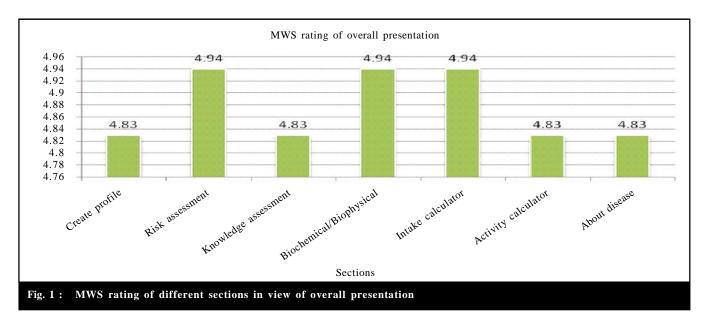
Risk assessment section/ Diet calculator (4.72), to about disease (4.61) sections. In case of relevance to topic criteria highest MWS of was obtained by risk assessment as well as knowledge assessment section followed by 4.88 of create profile section, 4.83 for intake calculator section, 4.77 for about disease section, 4.72 for two section namely biochemical/ biophysical section and activity calculator section. In calculation aspect MWS of 2 was obtained by all three sections namely create profile, intake calculator and activity calculator sections which clearly confirmed that the calculations were unambiguous to all the experts. Practical utility was give a MWS in a range of 4.72 to 4.94 by the experts.

Fig. 1 illustrates the MWS secured by all the sections of diabetes in view of Overall presentation. Highest MWS of 4.94 was achieved by activity calculator section and least of 4.77 by risk assessment section. However both the scores confirmed the perfection in presentation of all the sections from highest to lowest. Fig. 1 illustrates the MWS of different sections in view of overall presentation and it was found that highest MWS of 4.94 was obtained by three sections namely intake calculator, activity calculator and risk assessment sections. The MWS scores so obtained by all the sections were close to the point of perfection.

Looking to the range of scores attained *i.e.* in between 4.2 to 5 (good to very good) in most of the sections, it can be concluded that software so developed

Table 2 : MWS rating of Part I of the software						
Sr. No.	Sections	A	B	C	D	E
1.	Create profile	4.72	4.72	-	-	-
2.	Risk assessment	4.72	4.72	-	-	-
3.	Knowledge assessment	4.72	4.72	-	-	-
4.	Biochemical/ Biophysical	4.77	4.77	4.76	-	-
5.	Intake calculator	4.72	4.72	4.61	-	-
6.	Activity calculator	4.72	4.72	-	-	-
7.	About disease	4.61	4.61	-	4.77	4.72

Table 3 : MWS rating of Part II of the software						
Sr. No.	Sections	F	G	H	I	J
1.	Create profile	-	4.66	4.88	2	4.94
2.	Risk assessment	-	4.72	5	-	-
3.	Knowledge assessment	-	4.77	5	-	-
4.	Biochemical/ Biophysical	-	4.77	4.72	-	4.83
5.	Intake calculator	4.77	4.72	4.83	2	4.83
6.	Activity calculator	-	4.77	4.72	2	4.72
7.	About disease	4.83	4.61	4.77	-	-

MWS rating of overall presentation

Fig. 1 :   MWS rating of different sections in view of overall presentation

on diabetes was found close to the point of perfection and hence, it is optimum for its wider application and use.

Phase III : Gain in knowledge assessment:

To determine the efficacy of the Software developed for subjects, a pre test - post test experimental design was used and gain in knowledge denotative of the usefulness of the system was assessed. The system covered all the important aspects of the diseases for disseminating knowledge on different components of the three selected diseases from theoretical as well practical point of view. Knowledge assessment tool developed for the purpose was used here so as to collect the pre and post test scores of the subjects. Pre -post data so obtained were analyzed using paired 't' test and results have been presented here under:

Information about subjects:

A total of 20 patients were selected purposively for the present study. Information pertaining to the general profile of the subjects was gathered about the subjects. The information gathered from individual respondents on their sex, age, religion, occupation, educational level, total family income, dietary habit, anthropometric measurements have been suitably classified below to depict a clear picture of the population under study.

Table 4 depicts the distribution of patients on the basis of gender. It shows that majority of the diabetic

(75 %) were males. whereas in case of osteoporosis majority of the patients were females (70 %).

Table 4 : Distribution of subjects on the basis of gender

Gender	Diabetic patients
Male	15(75.00)
Female	5 (25.00)
Total	20

Note: Values in parentheses denote percentage

Table 5 throws a light on the age range of the selected patients. Non communicable diseases usually occur in 4th and 5th decade of life due to many controllable or uncontrollable risk factors. Likewise majority of the present study subjects were in the age range of 40-60 years. These findings are in line of 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

Table 5 : Distribution of subjects on the basis of age group

Age (Years)	Diabetic patients		
	Male	Female	Total
21-30	0 (0.00)	0 (0.00)	0 (0.00)
31-40	0 (0.00)	0 (0.00)	0 (0.00)
41-50	6 (40.00)	1 (20.00)	7 (35.00)
51-60	6 (40.00)	4 (80.00)	10 (50.00)
61-70	3 (20.00)	0 (0.00)	3 (15.00)
71-80	0 (0.00)	0 (0.00)	0 (0.00)
Total	15	5	20

Note: Values in parentheses denote percentage

35 years and the maximum incidence was seen between the age of 40-60 years.

Table 6 presents data on anthropometric measurements of the patients of the three diseases. BMI was found to be of above normal range. Asian Indians are considered more prone to the occurrence of NCDs. In this regard, WHO, 2000 gave a new classification of BMI for them. It is the most important screening tool for predicting the risk of NCDs in later life. The risk is directly proportional to the body mass index (*www.americanheart.gov*). Table 7 depicts that 60-85 per cent of the patients were crossing the border of normal BMI. In the same mileu Malini *et al.* (2007) also found that 75 per cent of diabetes in the study group were having BMI more than 25 kg/m^2 and the prevalence of diabetes or impaired glucose tolerance increase with the increase in BMI.

Table 6 : Anthropometric measurements of the subjects

Anthropometric measurements	Diabetic patients (Mean±S.D)
Weight (kg)	68.8±14.017
Height (cm)	163.625±5.28
BMI (kg/m^2)	25.65±5.019
Waist circumference (cm)	93.3±8.053
Hip circumference(cm)	108.55±12.210
Waist- hip ratio	.086±.058

Note: Values in parentheses denote percentage

Table 7 : Distribution of subjects on the basis of BMI

BMI (kg/m^2)	Diabetic patients		
	Male	Female	Total
<18.5	1 (6.66)	0 (0.00)	1 (5.00)
18.6-19.9	1 (6.66)	1 (20.00)	2 (10.00)
20-22.9	2 (13.33)	2 (40.00)	4 (20.00)
23-24.9	1 (6.66)	0 (0.00)	1 (5.00)
>25	10 (66.66)	2 (40.00)	12 (60.00)
Total	15 (75)	5 (25)	20 (100)

Note: Values in parentheses denote percentage

Pre test score collection:

Knowledge assessment tool developed by the investigator along with the blank answer sheet was administered to the patients so as to assess the existing knowledge of the user in the diseases they were suffering from.

Exposure to the system :

After pre test score collection the patients were exposed to the Conquer Diabetes twice. About disease section of the system was provided in printed form to the users so that they can read the matter carefully and to ensure maximum gain in knowledge by the user.

Post test score collection:

Same set of questionnaire with new answer sheet was distributed to the patients for the purpose of post test score collection.

Perusal of Table 8 reveals that before exposure to the system the pre test scores were 13±4.76, the subjects with these scores were either in poor or average category of knowledge but after exposure they all were shifted to good category of knowledge. Here, it is worthwhile mentioning that percent improvement in knowledge was of greater magnitude in case of males as compared to female counterparts. The only probable reason is males had relatively lower knowledge scores in almost all the diseases except osteoporosis. The highly significant 't' values obtained for knowledge gain justifies the viability of Software in effectively delivering messages on all the components of the disease.

The scores obtained by the patients proved the efficacy or utility of the system. These findings reflect that majority of the subjects were able to understand the content. The reason might be the new learning experience through computers. In addition content on diseases was supplemented with videos and pictures so as to enrich it, as well as ease in understanding.

Findings of the few earlier studies assessing the gain in knowledge of the users, reveals variable pattern of observations. Few of these relatively more pertinent to the present study have been discussed below. The beneficial effect of nutrition education as observed in the present study is in conformity with the findings of

Table 8 : Effect of software on the knowledge gain

Patients		Pre test (Mean±S.D)	Post test (Mean±S.D)	t value	Per cent improvement
Diabetic	M	11.46±4.03	26.93±5.29	7.83*	134.99
	F	17.6±3.97	26±4.35	2.44**	47.72
	T	13±4.768	26.7±4.985	7.502*	105.38

* indicates significance of value at P=0.01   **NS=Non-significant

the study undertaken by Srivastava *et al.* (2005), on the effectiveness of video film produced to impart micronutrients related knowledge to rural women. It was found that the aid was effective in imparting nutrition education to women regarding prevention and control of anemia and vitamin A deficiency. It was observed that mean scores increased greatly at post exposure stage when compared to pre exposure stage.

Mageshwari and Sunitha (1995) developed a software namely 'Diet Advisor' on obesity for its management. Computer aided counseling was imparted to the subjects using the developed software. The results of pre test and post test computer counseling with the help of KAP questionnaires on male and female subjects indicated significant gain in knowledge in both males as well as females. The body weight of the sample before and after counseling showed significant reduction.

Findings of another study undertaken by Kavadia, 2001 to assess the effectiveness of audio visual educational package on hypertensive patients shows that there was significant gain in knowledge among all the patients after exposure to the educational package. The video cassette was found to be conducive learning tool fro all the study subjects.

Nutrition Pathfinder a CD-ROM programme was developed by Robertson and Zalles, 2005. The goal of the self directed CD-ROM simulation was to encourage students to understand the role of food and activity in their personal growth and development. The evaluation demonstrated that the programme achieved its desired outcome to positively impact student's knowledge, attitude and behavior about nutrition and physical activity. Almost half (49 %) reported eating less extra foods, more grains (44 %) and more milk and dairy products (40 %).

Menaria (2006) developed multimedia CD on environmental sanitation covering different components *viz.,* drainage system, use of dust bins, sanitary toilets, cattle sheds, compost pit, cleanliness around wells and hand pumps. The package was got evaluated by 10 experts on different criteria *i.e.* overall purpose served, content, visuals, interest orientation, audio recording. It was rated on 3 point scale (good-3, average-2 and poor-1). It achieved the MWS ranged between 2.75 to 2.85 for all components. Overall comprehension of the developed multimedia CD by the respondents was found to be very good.

Arora (2008) developed an educational package on

NIDDM consisted of power point presentation, charts, posters, leaflets and folders. The package on evaluation obtained the MWS in a range of 4.6 to 4.8 on 5 point scale indicating that the package was excellent hence fit for serving the purpose for which it was prepared.

Nutrition software namely Diet Master 2100, Nutrinote, Diet Power, Kathleen's Diet Planner, Diet Organizer, Fit Day, Be Nutrifit, Diet Pro, Meal Information and Do-It are the top ten nutrition software developed by different researchers. These all software were together rated on different features *viz.*, ease of use, diet management, general nutrition features and help criteria. They were rated on 0-4 point scale from poor to excellent. Majority of the software were rated in between 2-4, Do-It obtained the least score of 2, whereas Diet Master 2100 obtained a highest score of 4 which portray it in excellent category. These software were able to evaluate the food intake, track progress of individual in regard to weight, diet, exercise and body fat goal (*www.nutritionsoftware reviews.toptenreviews. com, 2010*).

Goswami (2009) developed an audio visual aid on obesity to impart nutritional education to the overweight/ obese children. Prior to the exposure of the aid, observations on nutritional knowledge of the respondents revealed that knowledge of the subject was fair (25.72 males and 38.92 females). The mean post test scores of all the subjects were significantly higher (37.96 males and 38.92 females). The total per cent gain was 24.48 males and 24.44 females.

Appendix 1 :
Diabetes knowledge assessment questionnaire:
1. Diabetes is a ....disease
   a. Communicable
   b. Non communicable
   c. a and b
   d. None of the above
2. Diabetes word has been derived from .... Greek word
   a. Diabenieni
   b. Diaben
   c. Diabety
   d. None of the above
3. .... acts like a key for the entry of glucose into the cells
   a. Insulin

b. Water
c. Food
d. None of the above

4. Insulin is a ....
   a. Hormone
   b. Enzyme
   c. Vitamin
   d. Mineral

5. Insulin is secreted by .... gland
   a. Pancreas
   b. Adrenal
   c. Pituitary
   d. None of the above

6. In diabetes body cells are not able to utilize glucose properly due to ....
   a. Failure in the formation of insulin
   b. Failure in the liberation of insulin
   c. Failure in the action of insulin
   d. Any one of the above

7. ....Country is known as the Diabetic Capital of World
   a. India
   b. Japan
   c. China
   d. Pakistan

8. 19.4 million Indians in 1995 were suffering from diabetes in 1995 and this number is projected to increase to .... Million in 2025
   a. 57.2
   b. 59.2
   c. 60
   d. 70

9. .... City is the Diabetic Capital of India
   a. Hyderabad
   b. Udaipur
   c. Bangalore
   d. Ahmadabad

10. There are .... main types of diabetes
    a. 2
    b. 3
    c. 4
    d. 5

11. .... diabetes is also known as juvenile onset diabetes.
    a. Type 1 diabetes
    b. Type 2 diabetes
    c. Gestational diabetes

d. None of the above

12. .... type of diabetes is due to complete inability of pancreas to produce insulin.
    a. Type 1
    b. Type 2
    c. Gestational diabetes
    d. Latent diabetes

13. Adult onset diabetes is also known as ....
    a. Type 1
    b. Type 2
    c. Gestational diabetes
    d. Latent diabetes

14. ....are common symptoms of diabetes.
    a. Polyuria and polyphagia
    b. Polydipsia, blurred vision
    c. Weakness, delayed wound healing
    d. All the above

15. Polyphagia refers to..................
    a. Increased hunger
    b. Increased thirst
    c. Increased urination
    d. All the above

16. Fasting blood glucose for non diabetic should be in .... range
    e. 80-120 mg/dl
    f. 100-120 mg/dl
    g. 140 mg/dl
    h. 200-220 mg/dl

17. Post prandial blood glucose for non diabetic should be .... range
    a. 80-120 mg/dl
    b. 100-120 mg/dl
    c. < 140 mg/dl
    d. 200-220 mg/dl

18. HbA1C value for a non diabetic ....
    a. 1- 2 per cent
    b. 2-4 per cent
    c. 3.5-5.5 per cent
    d. 5-6 per cent

19. .... are common risk factor for diabetes
    a. Obesity, heredity, physical activity
    b. Smoking, obesity, stress
    c. Smoking, heredity, advancing age
    d. All the above

20. Diabesity is a term comprised of ....
    a. Diabetes + Obesity
    b. Diabetes + Genetics

c. Diabetes + Activity

d. Diabetes + Personality

21. People with diabetes have .... times the risk of heart attack as compared to non diabetic.
    a. 2
    b. 3
    c. 4
    d. 5

22. Principal diet recommended for NIDDM is ....
    a. High carbohydrate, High fat, low protein
    b. Low fat, low carbohydrate, High protein
    c. Normal fat, low carbohydrate, High protein
    d. None of the above

23. Diabetics should consume ....
    a. Complex carbohydrate
    b. Simple carbohydrates
    c. None of the above
    d. a and b

24. .... to .... per cent of energy should be derived from carbohydrates in diabetes
    a. 60-65
    b. 70-75
    c. 70-85
    d. 50-60

25. Vegetable food sources are better than animal food sources in human health as they are high in ....
    a. Fat
    b. Fibre
    c. Cholesterol
    d. Protein

26. Intake of .... gm dietary fibre per 1000 kcal of energy is recommended for diabetics.
    a. 10
    b. 15
    c. 20
    d. 25

27. Benefits of fibre includes.............
    a. Controls blood sugar levels
    b. Lowers blood cholesterol levels
    c. Delays gastric emptying
    d. All the above

28. .... mineral is / are involved in carbohydrate metabolism

a. Copper and vanadium

b. Zinc and magnesium

c. Chromium and copper

d. All the above

29. Glycemic index is blood glucose response to 50 gm carbohydrate present in given food as compared to that of 50 gm carbohydrate present in ....
    a. White bread
    b. Jam
    c. Guava
    d. All the above

30. Range used in glycemic index is
    a. 10-1000
    b. 10-100
    c. 0-100
    d. 0-50

31. .... should be taken in moderation in diabetes.
    a. Roots and tubers
    b. Fruits like banana, grapes, sapota
    c. Sweet Dishes
    d. All the above

32. .... join with glucose in blood to form HbA1C
    a. Haemoglobin
    b. Iron
    c. Fat
    d. Protein

33. .... are commonly seen complications in diabetes
    a. Heart disease
    b. Eye disease and kidney disease
    c. Infections
    d. All the above

34. Non calorie sweeteners contains .... calories hence are recommended in diabetes.
    a. Zero
    b. Less
    c. More
    d. None of the above

35. .... are certain examples of Non calorie sweeteners.
    a. Equal
    b. Sweet n low
    c. Sugar free
    d. All the above

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