

IV RESULTS AND DISCUSSION

The results and discussion pertaining to the study **Efficacy of a software “Nutra Glyx” on Nutraceutical Recipes Incorporated with Selected Medicinal Plants for Diabetes Mellitus**, is discussed under the following headings.

Phase I : Survey on selected female type II diabetic subjects

Phase II : Selection of medicinal plants and testing of hypoglycemic effect

Phase III : Standardization and acceptability of nutraceutical recipes incorporated with selected medicinal plants

Phase IV : Development and evaluation of a software **“Nutra Glyx”** on nutraceutical recipes incorporated with selected medicinal plants`

PHASE I

4.1 Survey on Selected Female Type II Diabetic Subjects

A baseline survey was carried with 340 female type II diabetic subjects between the age group of 40 to 45 years from two diabetic clinics from the city of Coimbatore were selected through purposive sampling. Using appropriate tools, the background information, anthropometric measurement, biochemical parameter, physical activity, medical history and dietary pattern of the selected female type II diabetic subjects were collected.

The results and discussion of the baseline survey on the selected female type II diabetic subjects is presented under the following headings.

4.1.1. Background information

The background information for age, education, occupational status, family type and family income were elicited using an interview schedule and the results are presented and discussed below.

4.1.1.1. Age

The age wise distribution of the of selected female type II diabetic subjects is presented in Figure 7 and discussed below:



Figure 7 : Age wise Distribution of Selected Type II Female Diabetic Subjects (N=340)

From the above Figure (7) it is evident that 31 percent of the selected type II female diabetic subjects were at the age of 41 years followed by 22 percent of them at the age of 43 years. Yoon *et al.*, (2006), claims that change in diet and reduced physical activity have led to a fast growing increase in the incidence of obesity and diabetes at younger age. It can also be inferred from our study that sedentary life style and dietary habits of female type II diabetic subjects could have played an important role in the early onset of diabetes mellitus.

4.1.1.2. Occupational status and monthly income

The occupational status and monthly income of the selected female type II diabetic subjects is depicted in Fig. 8 and discussed below

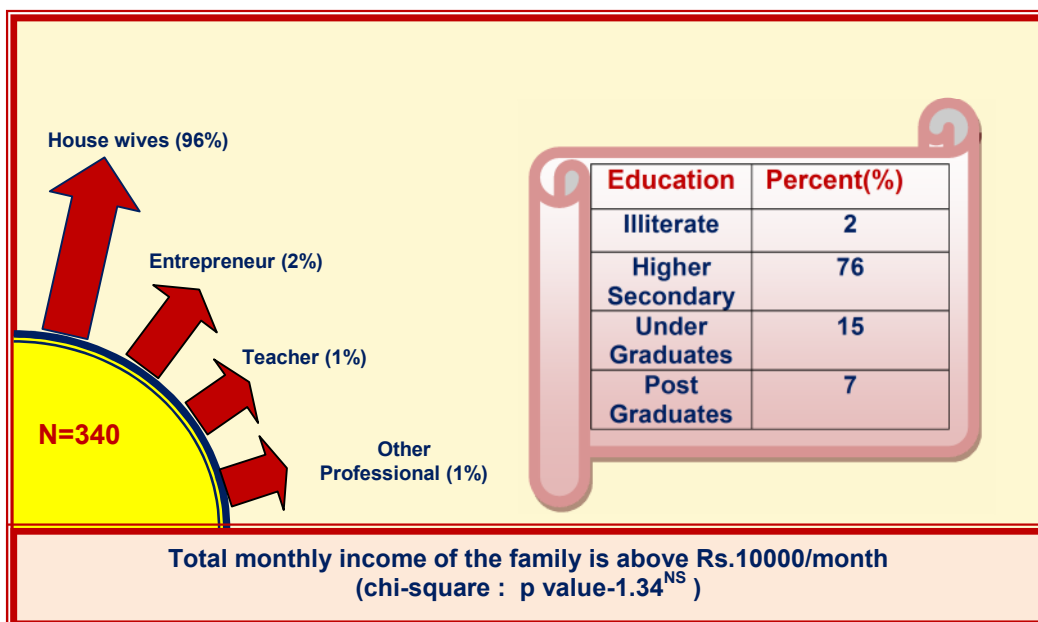


Figure 8: Education, Occupational and Income Status of the Selected Female Type II Diabetic Subjects (N=340)

From the depiction (Figure 8) on occupational status of selected female type II diabetic, it was observed that 96 percent of the female type II diabetic subjects were house wives and only four percent were found to be employed as entrepreneur (2%) teacher (1%) and in other profession. The above observation clearly indicate an increase in the onset of female type II diabetic subjects in house wives compared to the working women which can be attributed to their sedentary lifestyle and poor dietary habit.

Though 96 percent of the selected female type II diabetic subjects were found to be house wives, all the selected subjects belonged to a high income category with a monthly income of more than Rs.10,000 (HUDCO Classification, 2010). Further it was also observed that all the selected subjects were married and 73 percent lived in nuclear family. A similar study conducted by Ameesh and Murugan (2017), claims that aging, occupational changes,

truncal obesity, low physical activity and family history of diabetes as highly associated risk factors for Type II diabetes mellitus. However, in contrary to the above finding, the present investigation, did not show any significant relationship between occupational status and obesity (chi-square : p value-1.34).

4.1.2. Anthropometric measurement

The anthropometric measurement for height, weight, Body Mass Index (BMI) and Waist Hip Ratio was measured using standard procedure. The BMI was calculated and their relationship between BMI and Waist Hip Ratio was done. The results are tabulated and discussed below.

4. 1.2.1. Body Mass Index

The height and the weight of the selected female type II diabetic subjects were measured using a stadiometer and an electronic weighing balance respectively. The BMI was calculated and the subjects were categorised for their body weight composition using ICMR Classification for Indians (2016). The observations are tabulated in Figure 9 and discussed below.

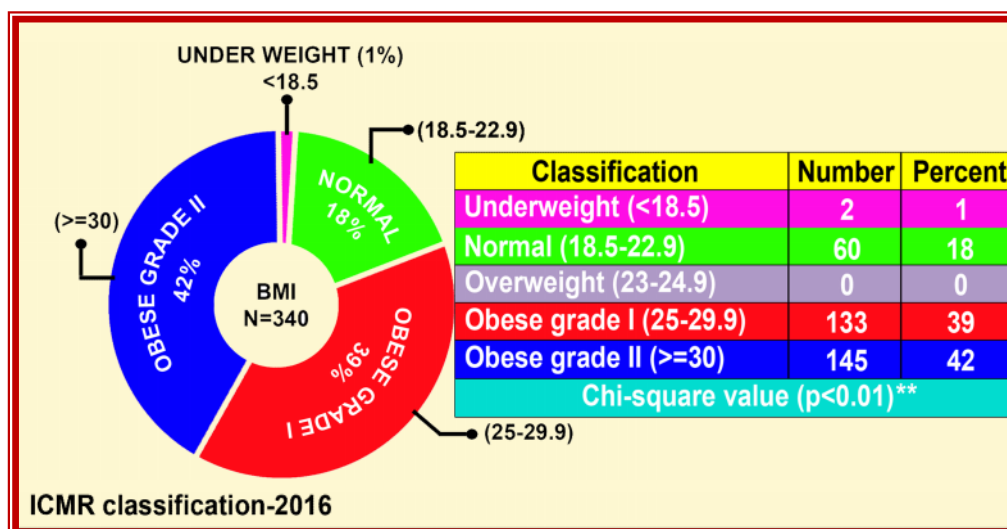


Figure 9: Body Mass Index of the Selected Female Type II Diabetic Subjects (N=340)

It is clear from the above Figure 9 that 42 and 39 percentage of the selected type II female diabetic subjects were found to be obese grade I and obese grade II respectively. Further it was also observed that none of the subjects were found to be overweight. However, a strong association between

age and BMI was observed (**chi-square value-($p < 0.01$)**) at one percent level of significance. Therefore from the present study it can be interpreted that as age increase the tendency to gain weight also increase, which can be attributed to sedentary life style and poor physical activity level of the selected subjects.

Gray *et al.* (2015) opined excess weight and obesity as major contributing factor to type II Diabetes Mellitus. Men and women in the overweight category ($25 \leq \text{BMI} \leq 29.99$) were at an increased risk of developing diabetes mellitus, with 30 percent and 10 percent greater risks respectively.

4.1.2.2. Waist Hip Ratio

As waist to Hip Ratio assess the prominent site of distribution of fat either on upper part or lower part of the body, the same was calculated for all the type II female diabetic to determine the nature of obesity.

Based on the WHO, classification of Waist to Hip Ratio (2011), the selected female type II diabetic subjects were classified as low risk (< 0.80 for women), moderate risk ($0.80 - 0.85$ for women), and high risk (> 0.85 for women) for obesity.

Waist Hip Ratio of the selected female type II subjects is shown in Table III and discussed below:

Table III
Waist Hip Ratio of the Selected Female Type II Subjects (N=340)

Waist Hip Ratio	Number	Percent (%)	Chi-square
Low risk (< 0.80)	145	43	BMI Vs WHR $P < 0.01^{**}$
moderate risk ($0.80 - 0.85$)	181	53	
High Risk (> 0.85)	14	4	Age Vs WHR $P < 0.01^{**}$

Source: WHO (2011); ** 1% level of significance

The Table III, indicates that 53 percent of female type II diabetic patients were at moderate risk ($0.80 - 0.85$) for life style disorders like obesity and diabetes and 43 percent were at low risk for life style disorders. Chi-square analysis revealed a significant relationship between BMI and WHR at one percent level of significance. Similarly a significant relationship between WHR and age was observed at 1 percent level of significance.



Plate1. Measurement of Weight



Plate 2. Measurement of Height



Plate 3. Blood Glucose Analysis



Plate 4. Data Collection

4.1.3. Biochemical Analysis

As part of biochemical analysis, the fasting and post prandial blood glucose levels of all the selected 340 female type II diabetic subjects were analysed using accu check glucose meter. Likewise using a digital sphygmomanometer, the blood pressure of all the 340 female type II diabetic subjects was measured and recorded. The findings are tabulated and discussed underneath.

4.1.3.1. Blood sugar

Blood sugar levels of selected female type II diabetic subjects is tabulated in Table IV and discussed below.

Table IV
Blood Sugar Levels of the Selected Female Type II Diabetic Subjects

Fasting blood glucose	No.	Percent (%)	Postprandial blood glucose (PP)	No.	Percent (%)	Chi-square
Insulin shock (<50 mg/dl)	0	0	N/A	0	0	P<0.01**
Hypoglycemic (<70 mg/dl)	0	0	N/A	0	0	
Normal (70-110 mg/dl)	0	0	Normal (140 mg/dl)	0	0	
Pre diabetic (110-126mg/dl)	32	10	Pre diabetic (140-200mg/dl)	32	10	
Diabetes (>126 mg/dl)	308	90	Diabetes (>200 mg/dl)	308	90	

Source: ICMR(2016); ** Significant at 1% level

The above Table IV clearly indicates that 90 percent of the selected female diabetics had a fasting blood glucose levels greater than 126mg/dL. Similarly the post prandial blood glucose level was greater than 200mg/dL for 90 percent of the selected female diabetics. A significant relationship between blood glucose level and fat intake was observed at one percent level of significance. Likewise a significant relationship between the intake of fibre and blood glucose level was observed at one percent level of significance (ICMR).

4.1.3.2. Blood pressure

Blood pressure levels of the selected type II female diabetic subjects is projected in Table V.

Table V
Blood Pressure Levels of Selected Female Type II Diabetic Subjects
(N=340)

Blood Pressure (mmHg)	No.	Percent (%)	Mean Systolic (mmHg)	Mean diastolic (mmHg)	Chi-Square
Normal (<120-<80)	234	69	119.2±23.4	78±11.4	BMI- (p<0.01)**
Pre hypertension (120-139/80-89)	63	18			
Moderate hypertension (140-159/90-99)	40	12	154.7±32.5	96.4±13.2	WHR- (p<0.01)**
Severe hypertension (≥160/≥100)	3	1	162.3±25.2	109.5±14.6	

Source: JNC7 (2016) **Significant at 1% level

Sixty nine percent of the selected female type II diabetic subjects were found to be non-hypertensive with a mean systolic and diastolic blood pressure of 119.2±23.4mmHg and 78±11.4mmHg respectively. Also 18 percent of the subjects were found to be mid hypertensive. Further a significant relationship between blood pressure and BMI was observed at one percent level of significance (chi-square value - p<0.01). Likewise a significant association between blood pressure and Waist Hip Ratio (p<0.01) was also observed at one percent level of significance. The results of the present investigation is in par with the comparative study conducted by Body *et al.* (2012), which showed a significant association between hypertension, BMI and WHR at one percent level of significance, he also claimed a higher prevalence of hypertension among females compared to male.

4.4.1. Exercise Pattern

Using a well-structured interview schedule, the type and duration of exercise performed by the selected female type II diabetic subject was elicited and the results are tabulated in the following Figure 10.

The Figure 10 depicts the exercise pattern of the selected subjects followed by discussion.

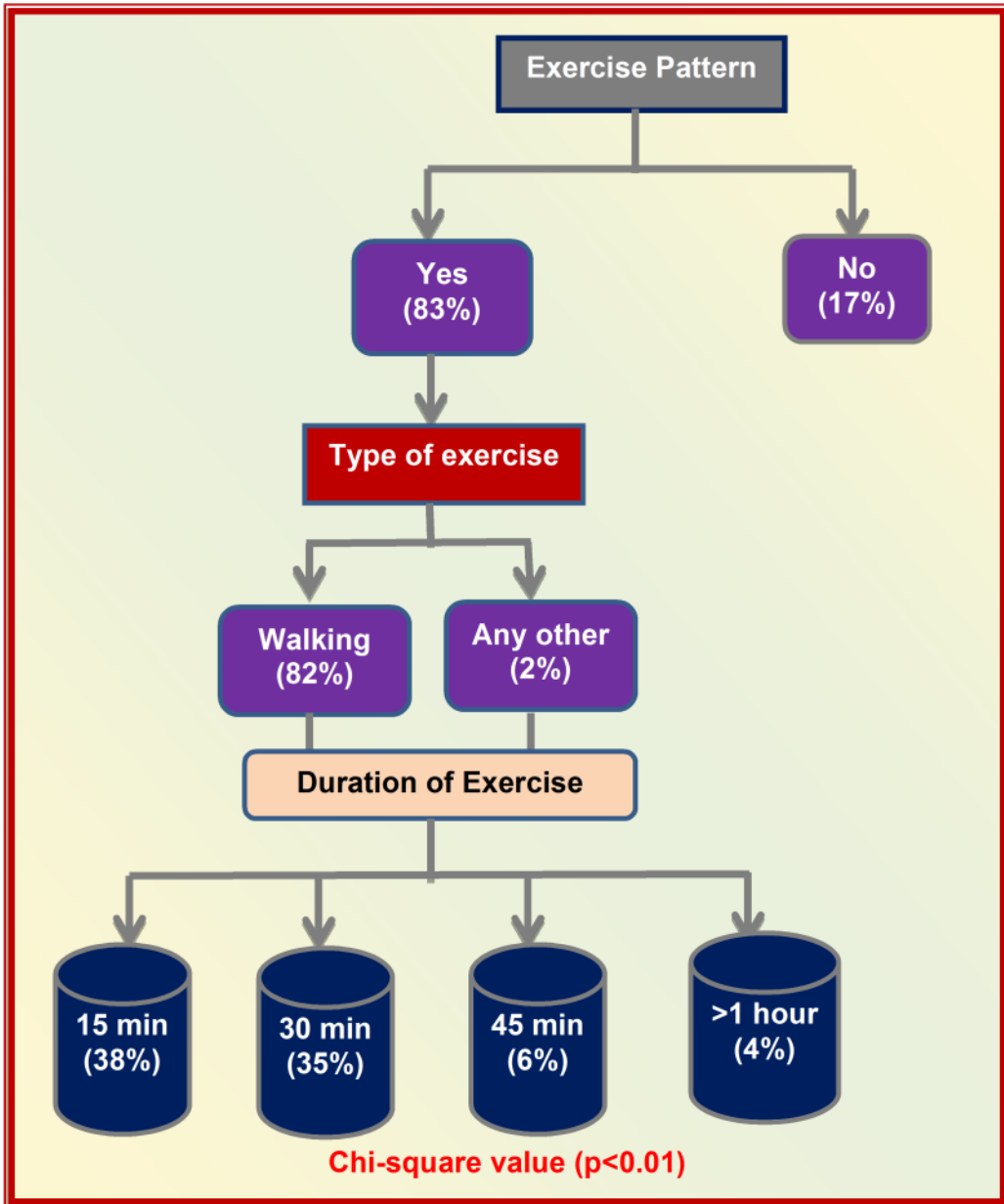


Figure 10 : Physical Activity Pattern of the Selected Female Type II Diabetics

From the Figure 10, it is evident that 83 percent had the habit of exercising regularly. Of the 83 percent of female who exercised, majority of them (81 percent) did walking and only two percent of them did other form of exercise like yoga and meditation. Further it was also observed that only 35 percent of the subjects walked for 30-40 minutes.

Study conducted by Shah and Afzal (2015) showed a strong relationship between physical activity and diabetes mellitus. Similar observation was observed in the present study, which showed a significant association between exercise and diabetes mellitus at one percent level of significance. Also a significant association between duration exercise and BMI was observed at one percent level of significance.

4.1.5. Dietary assessment

Dietary assessment is a comprehensive evaluation of a person's food intake. It is one of the key indicators of nutritional status of individuals. The life style and dietary habits of the selected female type II diabetic subjects was elicited using an interview schedule. A twenty four hour recall was conducted to ascertain their adequacy of dietary intake. Thus the subjects were asked to recall their food intake for the past 24 hours. The food intake obtained in house hold measure was converted into its raw equivalent. Using the nutritive value table of Indian foods (NIN, 2017), the mean nutrient intake for both macro and micro nutrients was calculated. Also the Knowledge, Attitude, Practice (KAP) and consumption of medicinal plants as dietary supplement was also obtained. The observations are tabulated and discussed below.

4.1.5.1. Dietary Pattern

Dietary pattern of the selected female type II diabetic subjects is given in Figure 11 and discussed below.

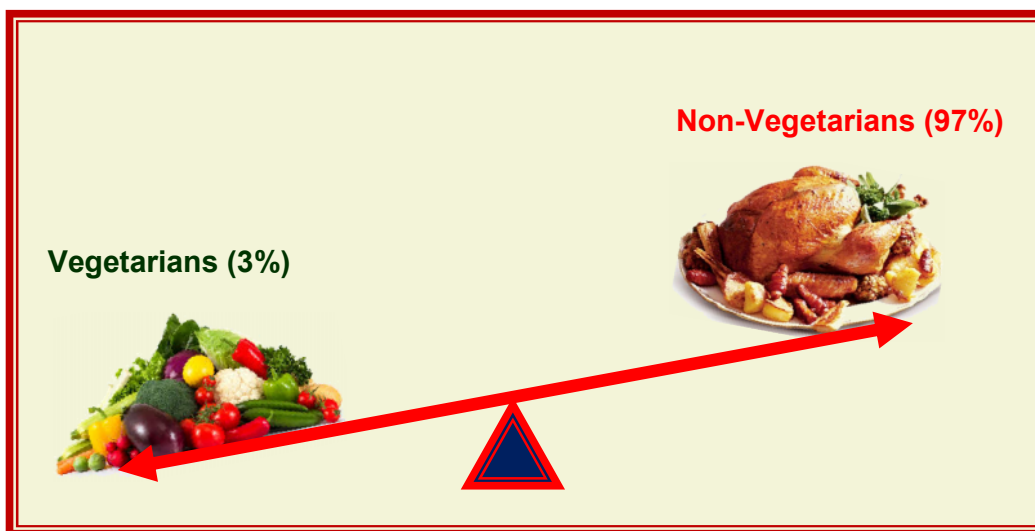


Figure 11: Dietary Pattern of the Selected Female Type II Diabetic Subjects (N=340)

The above Figure 11 shows that 97 percent of the female type II diabetic subjects were found to be non-vegetarians. Further none of the subjects reported a daily consumption of fleshy foods as it was restricted to once in a week. All subjected followed a three meals pattern.

According to Le and Sabaté (2014), vegetarian diet seems to provide some added protection against obesity, hypertension, type-2 diabetes and cardiovascular mortality. However, there are less evidence based study relating to intake of vegetarian diet and body weight.

4.1.5.2. Mean Nutrient

Mean nutrient intake of the selected female type II diabetic subjects is projected in Table VI and discussed below.

Table VI
Mean Nutrient Intake of the Selected Female
Type II Diabetic Subjects (N=340)

Nutrients	Mean nutrient intake		Excess / Deficit	Percent (%)	t- value
	RDA	Mean \pm S.D			
Energy kcal	1900	2231	203.58	-331	29.98**
Protein (g)	55	52	5.43	-3	10.20*
Fat (g)	20	23	4.36	3.3	13.95**
Calcium (mg)	600	298	75.45	-301.99	73.80**
Iron (mg)	21	29	8.10	8.42	19.17**
Carotene	4800	2668	453.04	-2132.3	86.79**
Thiamine	1	1	0.25	0.35	25.49**
Riboflavin	1.3	2	0.30	-0.37	22.65**
Nicotinic acid	12	18	4.59	-5.8	23.32**
Vitamin C	40	37	6.88	-3.38	9.06**
Free Folic acid	200	67	22.63	-133.34	108.66**

** Significant at 1% level

On the whole, the selected female type II diabetic subjects showed significant deficit in the intake for energy, protein, calcium, beta-caroten, nicotinic acid, Vitamin C and free folic acid when compared to the Recommended Dietary Allowances (2017) at one percent level of significance.

The study participants were found to have significant total energy deficit of 17 percent in comparison to the RDA. A significant deficit of macronutrient namely the protein was also observed among the diabetics' subjects dietary intake. In contrast to this macronutrient, the mean fat intake was found to be significantly increased to about 17 percent. The higher intake of energy dense macro nutrient fat is not advisable due to the associated health risk complication. The dietary micronutrients intake of iron, thiamine and free folic acid were found to be significantly decreased among the diabetics to about 40 percent, 30 percent and 67 percent respectively in comparison to RDA values. The dietary intake of other micronutrients namely: calcium, carotene, riboflavin, nicotinic

acid, vitamin C and Free folic acid followed a significant downward trend to about 50 percent, 44 percent, 35 percent, 48 percent and eight percent respectively. On consideration the ratio of total protein energy with the total dietary energy (208: 1900), the protein energy contributes to 11% of the total dietary energy. The proportion of protein intake of the diabetics was found to be within the recommended energy intake, and contributes to 11% between the recommended percentage of 10–15 percent total calories / day in sedentary to moderately active individuals as per the reports of Misra *et al.* (2011). Also the proportion of dietary energy from fat source intake among the diabetics was found to be 11% of total energy intake. This is found to be excess as far as the saturated fatty acid requirement is considered that must be lesser than seven percent of total energy / day as stated by WHO (2011) and Diekmann *et al.* (2009), otherwise as per the NIN limits the proportion of energy contributed by the measured fat intake is not more than 30 percent of the energy. Thus the significant difference in the mean nutrient intake can be attributed to the poor dietary habits and deficit intake of pulses, milk/milk products and vegetables.

4.1.6. Dietary Intake of Food Groups

The dietary intake of food group was elicited using an interview schedule from all the selected 340 female type II diabetic and compared with NIN's for recommended dietary guidelines for food groups.

Table VII
Dietary Intake of Food Groups of the Selected Female Type II Diabetic Subjects (N=340)

Food groups	Intake Mean	Recommended allowances	Excess / Deficit	t value	Sig.
Cereals and Millets	274±44.53	270gm	+4	0.4020 ^{NS}	0.689
Pulses	48±8.64	60gm	-12	6.2113 ^{**}	0.001
Milk & Milk Products	160±46.79	300ml	-160	13.3810 ^{**}	0.001
Roots and Tubers	124±30.85	200gm	-76	11.0173 ^{**}	0.001
Green leafy vegetable	140±35.54	100gm	+40	5.0334 ^{**}	0.001
Other vegetable	166±43.58	200gm	-34	3.4890 ^{**}	0.012
Fruits	86±32.95	100g	-14	1.9001 ^{NS}	0.065
Sugar	9±3.28	20g	-11	14.9980 ^{**}	0.001
Fat	30±8.75	20g	+10	5.1110 ^{**}	0.001

^{**} Significant at 1 % level, NS-No significance) Source: Indian Food Composition Table(2017)

Table VII shows the deficit intake for cereals, pulses, milk and milk products, roots and tubers, other vegetables, sugar and fat compared to the recommended intake of food groups suggested by NIN (2011).

The consumption of cereals and millets intake was found to be 270gm. This was found to be nearly 1.5% insignificant excess from the recommended dietary allowances of 270gm.

Similarly there was an excess intake of green leafy vegetables that contributes to 40 percent. This was found to be significantly varied with the number of portion suggested by NIN. Fat consumption was also found to be varying significantly to the event of 10 percent in comparison to number of portions.

All the other food groups consumption pattern namely, pulses, milk and milk products, roots and tubers, other vegetables and sugar intake among the female type II diabetics were found to be significantly decreased in the range of (20%), (53%), (38%), (17%) and (55%) respectively.

Fruits intake was found to be 14% deficit among the participant. This deficit was not found to be significantly differing with the number of portions recommended by NIN. Among the food group studied the consumption of fat is not advisable among diabetic subjects. Also a significant association between fat intake and blood glucose level was observed at one percent level of significant ($p < 0.01$).

4.1.7. Identification of commonly consumed recipes

The investigator collected the commonly consumed recipes using a preference sheet. The list of commonly consumed recipes are given in Figure 12 and discussed below.



Figure 12: Identification of Commonly Consumed Recipes of Selected Female Type II Diabetic Subjects (N=340)

A total of 67 South Indian commonly consumed vegetarian recipes were collected based on the preferences expressed by the 340 selected female type II diabetic subjects. Out of 67 recipes, 14 recipes were breakfast/dinner main dishes, five were chutney preparations used as accompaniment for breakfast/dinner. Similarly 17 main dishes for lunch were collected along with nine kuzhambu (A thick gravy prepared with or without pulses) and 13 poriyals (shallow fat or deep fried vegetable accompaniments cooked either using a single vegetable or combination of one or two). A total of ten commonly consumed snacks as listed in the figure were also collected.

4.1.8. The knowledge, Attitude and Practice(KAP) of medicinal plants

The knowledge, attitude and practice of medicinal plants by the selected subjects for the treatment of diabetes mellitus and their willingness to incorporate the medicinal plants in the commonly consumed recipes were elicited using a KAP sheet.

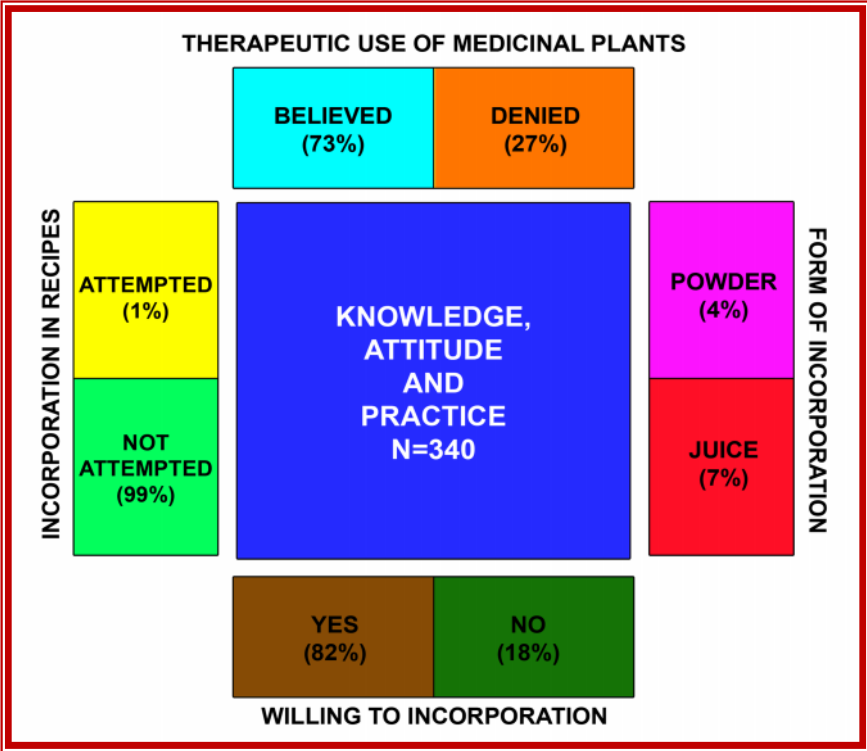


Figure 13: The Knowledge, Attitude and Practice (KAP) of Medicinal Plants of the Selected Female Type II Diabetic Subjects

It was observed from the study that 73 percent of the female type II diabetic subjects believed that, usage of medicinal plants can lower their blood glucose levels. Only 15 percent of subjects attempted consuming medicinal plants either in the forms of powder or juice. It was also observed that 99 percent of the subjects did not incorporate the medicinal plants in their recipes in any form (powder/extract/juice). Only one percent incorporated them in tea preparation. Out of 340 female type II diabetic subjects, 226 subjects showed willingness to incorporate medicinal plant extract in their daily recipes and to participate in the study.

PHASE II

4.2 Selection of Medicinal Plants and Testing of Hypoglycemic Effect

4.2.1. Nutraceutical components of selected medicinal plants

The state of Tamil Nadu houses a total of 131 medicinal plants of 115 genera belonging to 64 families. An extensive literature survey was carried out by the investigator to select the medicinal plants with nutraceutical compound. From the entire list of 402 medicinal plants listed in the herbal Tamil directory, *Guava leaf (Psidium guajava L.)*, Long Pepper (*Piper longum L.*), Sirukurinjan leaf (*Gymnema sylvestre (Retz.) R.Br.*), Naval Seed (*Syzygium cumini L.*), and Kandankathiri (*Solanum virginianum L.*), were selected for the study based on their availability, nutraceutical properties to lower blood glucose level and feasibility of incorporation in recipes.

The table VIII given below gives an bird eye view of nutraceutical component present in the selected medicinal plants.

Table VIII
Nutraceutical Components of Selected Medicinal Plants

Medicinal plants	Parts to be used	Bioactive components	Nutraceutical effect
<i>Psidium Guajava</i> Linn (guava leaves)	Leaves	Tannin, Phlobatannins, Saponin, Flavonoids, Steroids, Terpenoids, Triterpenoids, Carbohydrate, Polyphenol and Glycoside	Hypoglycemic and Hypolipidemic
<i>syzygium cumini</i> (Naval seed)	Seeds	Flavonoids, Phenolic acids, Glycosides and Tannins	Hypoglycemic and Hypolipidemic
<i>Gymnea sylvestre</i> (Sirukurinjan)	Leaves	Alkaloids, Tannins, Saponins, Phenols, Glycosides, Flavonoids	Hypoglycemic and Hypolipidemic
<i>Solanum virginianum</i> (Kandakathiri)	Fruits	Alkaloids, Phenolics, Flavanoids, Sterol, Saponins, Glycosides	Hypoglycemic and Hypolipidemic
<i>Piper longum</i> linn (Long Pepper)	Seeds	Alkaloids, Lignans and Volatile oil	Hypoglycemic and Hypolipidemic

Source: (Deguchi y et al., 2010), (Ramya, 2012), (Kumar .V and Ahamed.J, 2017), Singh, O. M., & Singh, T. P. (2010), (Rami, E *et al.*, 2013),

This table (VIII) shows the bioactive components/nutraceutical components present in the selected medicinal plants. The presence of nutraceutical components such tannins, flavonoids, glycosides, phenolic acids and terpenoids in Guava leaves, Naval seeds, Sirukurinjan, Kandakathiri and long peppers were believed to exhibit hypoglycemic effect in rats. However scientific evidence relating to human study is limited and therefore calls for more in-depth scientific studies in future.

4.2.1.2. Nutrient analysis of the selected medicinal plants

The nutrient analysis for macro nutrients (energy, carbohydrate, protein, fat, calcium, iron) and micro nutrients (Vitamin, thiamine, riboflavin, nicotinic acid, pyridoxine, ascorbic acid, vitamin B12, dietary fibre, sodium and potassium) of the selected five medicinal plants were analysed using AOAC procedure. The

analysed values are tabulated in Table IX and interpreted in the following discussion.

Table IX
Nutrient Analysis of the Selected Medicinal Plants

Nutrients	Guava Leaves	Naval seed	Sirukurinjan	Kandankathiri	Long Pepper
Energy (kcal)	399	417	429	437	400
Carbohydrate (gm)	69	55	65	65	64
Protein (gm)	18	34	22	21	18
Fat (gm)	2	0.01	4	5	4
Calcium (mg)	1042.0	1143.0	1540.0	1080.0	1008.0
Iron (mg)	8.80	18.30	23.0	16.0	10.0
Vitamin A (µgm)	1980.0	2260.0	3140.0	2845.0	2980.0
Thiamine (mg)	0.18	0.36	0.38	0.24	0.13
Riboflavin (mg)	0.11	0.27	0.48	0.33	0.38
Nicotinic acid (mg)	2.80	3.80	4.86	3.50	3.64
Pyridoxine (mg)	0.10	0.56	0.16	0.11	0.08
Ascorbic acid (mg)	334.0	580.0	592.0	468.0	308.0
Vitamin B12 (mg)	0.60	0.64	0.72	0.66	0.72
Dietary Fibre (gm)	9.0	6.0	13.0	11.0	6.60
Sodium (gm)	35.0	28.0	22.0	20.0	18.0
Potassium (mg)	1468.0	1613.0	1608.0	1613.0	1587.0

Values rounded off to the nearest decimal

It was observed from the Table IX that Kandankathiri (*Solanum virginianum* L.) was found to have the highest calorie content (437 kcal) followed by Sirukurinjan leaf (*Gymnema sylvestre* R.Br.) (429 kcal). *Guava leaf* (*Psidium guajava* L.) had the least calorie content(399) compared to the other medicinal plants. Naval Seed (*Syzygium cumini* L.) had highest protein (34gm) values

followed by Sirukurinjan leaf (*Gymnema sylvestre* R.Br.) (22gm) and Kandankathiri (*Solanum virginianum* L.) (21gm) and Long Pepper (*Piper longum* L.) had high Vitamin A (2980.0 µgm). Also the fat content was least in naval seed (0.01gm) followed by Guava leaves (2gm). Sirukurinjan was founded to be a rich source of iron with a calculated value of 23 mg/100gm followed by Naval seed (18.30 mg/100gm). However the iron content of Guava leaves was found to be least compared to other selected medicinal plants. Likewise the dietary fiber content of Sirukurinjan was also found to be higher (13.0gm/100gm) compared to other selected medicinal plants.

4.2.2. Testing of hypoglycemic effect

4.2.2.1. Mean organoleptic scores of chapathi's incorporated with medicinal plants

The investigator, choose chapathi, a standard recipe to test the hypoglycemic effect, since the chapathi's are commonly consumed by all age group particularly the diabetic for its low fat and high fiber content.

Seventy five grams of wheat flour (contributing 50gm of carbohydrate) was incorporated with calculated Human equivalent dosage of five selected medicinal plants separately, as five different test foods (2.5g of *Guava leaf* (*Psidium guajava* L.), 2g of Long Pepper (*Piper longum* L.), 1.5g of Sirukurinjan leaf (*Gymnema sylvestre* (Retz.) R.Br.), 2.5g of Naval Seed (*Syzygium cumini* L.) and 2g of Kandankathiri (*Solanum virginianum* L.)) and a portion of two chapathi's were prepared for each medicinal plant. The chapathi's were standardized and their acceptability was rated using a nine point hedonic scale by a panel of 20 semi trained members and was compared with standard chapathi for acceptability.

Mean organoleptic scores of chapathi's incorporated with *Guava leaf* (*Psidium guajava* L.), Long Pepper (*Piper longum* L.), Sirukurinjan leaf (*Gymnema sylvestre* R.Br.), Naval Seed (*Syzygium cumini* L.), Kandankathiri (*Solanum virginianum* L.), is presented in Table X and discussed below.

Table X**Mean organoleptic scores of chapathi's incorporated with medicinal plants**

Attributes	Incorporated Chappati Mean score					
	Standard chappati	Guava leaf (<i>Psidium guajava</i> L.)	Long Pepper (<i>Piper longum</i> L.)	Sirukurinjan leaf (<i>Gymnema sylvestre</i> R.Br.)	Naval Seed (<i>Syzygium cumini</i> L.)	Kandankathiri (<i>Solanum virginianum</i> L.)
Colour	8.3±0.82	8.5±0.52 ^{NS}	8.3±0.48 ^{NS}	8.6±0.51 ^{NS}	7.9±0.73 ^{NS}	8.6±0.51 ^{NS}
Flavor	8.5±0.52	8.6±0.51 ^{NS}	8.4±0.51 ^{NS}	8.5±0.52 ^{NS}	8.5±0.84 ^{NS}	8±0.66 ^{NS}
Consistency	8.1±0.87	8.5±0.52 ^{NS}	7.9±0.56 ^{NS}	8.4±0.84 ^{NS}	8.1±0.73 ^{NS}	7.8±0.63 ^{NS}
Taste	8.6±0.51	8±0.47*	8.1±0.56 ^{NS}	7.8±0.78*	7.9±0.56**	8.2±0.42 ^{NS}
Appearance	8.6±0.51	8.5±0.52 ^{NS}	8.2±0.63 ^{NS}	8.4±0.51 ^{NS}	8.5±0.52 ^{NS}	8.2±0.42 ^{NS}
Total	42.1±3.23	42.1±2.54	40.9±2.74	41.7±3.16	40.9±3.38	40.8±2.64

NS-Not significant; * - 5% level; **-1 % level

The mean organoleptic score of chapathi (Table X) incorporated with *Guava leaf (Psidium guajava L.)* extract showed no significant difference in colour, flavor, consistency and appearance in comparison to the standard chapathi, however a significant difference in taste was observed at five and one percent level of significance for chapathi's incorporated with guava leaves (*Psidium guajava L.*) and naval seeds respectively.

The difference in taste can be attributed to the mild bitterness of Sirukurinjan leaf (*Gymnema sylvestre* R.Br.) due to the presence of gymnemic acid and after taste effect of Naval seeds.

The chapathi incorporated with Kandankathiri (*Solanum virginianum L.*) showed no significant difference in mean organoleptic score for colour, flavor, consistency, taste and appearance compared to the standard chappathi. Since Kandankathiri (*Solanum virginianum L.*) has no distinct flavor or taste, not much of difference in the sensory characteristic was observed. Further since all the chapathis incorporated with medicinal plants were rated as highly acceptable as the mean total score was greater than 42.

4.2.3.2. Hypoglycemic effect of the selected medicinal plants

The hypoglycemic effect of the medicinal plant incorporated chapathi's were thus tested on a purposefully selected subsample of 210 female type II diabetic with BMI ranging between 23-27, blood glucose level (126-200mg/dl) with HbA_{1c} value of 5-7, taking oral hypoglycemic drugs (glycomet, Glucophage). Subsamples were grouped into seven groups (CC-Control group, E1CM: Chapati+Medication, E2CG: Chapati+*Guava leaf (Psidium guajava L.)*, E3CL: Chapati+Long Pepper (*Piper longum L.*), E4CS: Chapati+Sirukurinjan leaf (*Gymnema sylvestre (Retz.) R.Br.*), E5CN: Chapati+Naval Seed (*Syzygium cumini L.*) and E6CY: Chapati+Kandankathiri (*Solanum virginianum L.*) comprising 30 samples in each group. A portion of two chapathi's incorporated with selected medicinal plants along with 15gm of onion chutney was given to the experimental group and similarly two chapathi's without incorporation of medicinal plants with 15gm of onion chutney was administered to the control group for ten consecutive days. Their fasting and postprandial blood glucose levels (30 min, 60 min, 90 min, 120min) were analyzed using Accu check glucose monitor.

Thus, the Hypoglycemic effect of *Guava leaf (Psidium guajava L.)*, Long Pepper (*Piper longum L.*), Sirukurinjan leaf (*Gymnema sylvestre R.Br.*), Naval Seed (*Syzygium cumini L.*), kandankathiri (*Solanum virginianum L.*) is shown in Table XI and discussed below.

Table XI
Hypoglycemic Effect of the Selected Medicinal Plants

Groups	Fasting blood glucose level (0 min)	Post Prandial blood glucose level (120 min)
Control Meal (Chapathi) (Without medicinal plant)	116.2±1.4 ^b	157±1.5 ^b
Chapathi + Glucophage (75g wheat flour+ 250 mg of Glucophage)	103.7±1 ^a	144.3±1.8 ^a
Test Meal 1(TM1): Chapathi +Guava leaves (75g wheat flour+2g extract)	107.9±0.7 ^{ab}	145.6±1.8 ^{ab}
Test Meal 2 (TM2): Chapathi + Long Pepper (leaves (75g wheat flour+2g extract)	113.5±0.8 ^{abc}	155±1.5 ^{abc}
Test Meal 3 (TM3): Chapathi +Sirukurinjan leaves (75g wheat flour+1.5 g extract)	110.2±4.9 ^{abcd}	148±1.3 ^{abcd}
Test Meal 4 (TM4): Chapathi +Naval Seed leaves (75g wheat flour+2g extract)	106.6±0.9 ^{abcde}	153.7±2.2 ^{abcde}
Test Meal 5 (TM5): Chapathi +Kandankathiri leaves (75g wheat flour+2.2g extract)	108.7±0.8 ^{abcde}	152.2±2 ^{abcde}
F value	5.376 ^{**}	1.37 ^{**}
p value	<0.001	<0.001

a' denotes significant difference at 1% level between kandankthiri and control group, b denotes significant difference at one percent level between kandankathiri and naval seed, 'c' denotes significant difference at one percent level between guava leaves and sirukurinjan, 'd' denotes significant difference at one percent level between long pepper and kandankthiri, 'e' denotes significant difference at one percent level between sirukurinjan and naval seed.

Table XI depicts fasting and post prandial mean blood glucose levels of selected female type II diabetic subjects supplemented with control meal (chapathi) and test meal (chapathi made with traditional medicinal plant extracts but not in common food usage) viz., guava leaf, long pepper seeds, sirukurinjan leaf, naval seeds and kandankathiri fruits.

It is depicted from the table, that the glucophage medicated diabetic subjects supplemented with control meal were found to have significantly decreased pre and post-prandial mean blood sugar levels in comparison to the non-medicated diabetic patients with only control meal.

The control meal treated diabetic subjects had higher pre and post mean blood sugar levels in comparison to the test meals among both medicated and non-medicated diabetic subjects. The traditional medicinal plant extracts containing test meals (TM1, TM2, TM3, TM4 and TM5) were found to have hypoglycemic effect in par with the antidiabetic drug glucophage though their hypoglycemic effect were significantly reduced in comparison to glucophage drug. Among the test meals with medicinal plant extracts, it was found that hypoglycemic effect were in the order of guava leaves followed by sirukurinjan, kandankathri, navalseed and long pepper based on their post mean blood sugar levels in diabetic subjects. Thus herbs supplemented test meals were found to be more effective herbal food adjunct for diabetic patients in comparison to the control meal among diabetic non medicated subjects.

PHASE III

4.3 Standardization and Acceptability of Nutraceutical Recipes Incorporated with Selected Medicinal Plants

4.3.1. Standardization and acceptability of nutraceutical recipes

As nutraceutical recipes enhance the value of food that we consume by not only supplementing the diet with nutrient, but also by contributing phytochemical that aids in prevention / treatment of disease, the investigator was interested in developing nutraceutical recipes incorporated with the selected medicinal plants tested for hypoglycemic effects to benefit the society and the diabetic patients in particular.

Thus 67 commonly consumed recipes identified in **phase I** elicited using a preference sheet was considered for the incorporation of extract of selected medicinal plants.

A total of 335 (67X5 selected nutraceutical plants) nutraceutical recipes were developed by incorporating the fixed dosage of medicinal plant extracts namely [*Guava leaf (2.5gm)* (*Psidium guajava L.*), Long Pepper fruit (**2g**) (Piper

longum L.), Sirukurinjan leaf (**2gm**) (*Gymnema sylvestre* (Retz.) R.Br.), Naval Seed (**2.5gm**) (*Syzygium cumini* L.), and Kandankathiri (**2g**) (*Solanum virginianum* L.)]. The developed nutraceutical recipes were further classified, standardized and tested for their acceptability using a nine point hedonic scale by a panel of 25 semi trained member in comparison to the original recipe. The recipes that obtained a score between 35 and 45 were rated as highly acceptable, 25-34 as acceptable and score below 25 as not acceptable.

Thus, the standardization and acceptability of nutraceutical recipes incorporated with *Guava leaf* (*Psidium guajava* L.), Long Pepper (*Piper longum* L.), Sirukurinjan leaf (*Gymnema sylvestre* R.Br.), Naval Seed (*Syzygium cumini* L.), Kandankathiri (*Solanum virginianum* L.) is discussed in the following tables.

4.3.1.1. Acceptability analysis of nutraceutical recipes incorporated with medicinal plants (Breakfast/Dinner)

The acceptability analysis of nutraceutical recipes incorporated with selected medicinal plants (Breakfast/Dinner) is presented in Table XII.

Table XII
Acceptability Analysis of Nutraceutical Recipes Incorporated with Selected Medicinal Plants (Breakfast/Dinner)

Recipe names	Standard Recipe	Mean Acceptability Score				
		Guava Leaves	Long Pepper	Kandankathiri	Naval seed	Sirukurinjan
Kuzhipaniyaram	42.4±3.2	41±3.7	41.7±0.25	42.1±3.12	41.3±3.17	41±3.03
Appam	43.4±2.9	41.3±3.4	41.8±24	41.6±3.07	41.2±3.88	39.8±4.01*
Sevai	43.6±3	41.2±3.84	41.7±0.11	41.8±3.02	41.5±3.54	41.4±3.65
uthappam	42.7±3.78	41.4±3.32	42.1±0.32	41.2±3.66	41.7±3.6	40.9±3.39
Idli	43.3±3.35	41.1±3.51	41.7±0.15	41.2±3.6	40.1±3.43	41±3.49
Dosai	41.9±3.3	41.3±2.92	40.6±0.21	41.7±3.43	40.5±3.14	41.8±3.02
Pongal	42.5±0.32	41.8±3.18	42±3.2	40.6±3.5	40.6±3.16	41±3.55
Kichadi	42.2±3.3	41.2±3.79	40.6±3.76	41.2±3.21	41.7±3.26	41.7±3.69
Chappathi	43.5±3.7	41.9±2.95	41.2±3.3	41.6±3.42	42.1±2.88	49.3±3.35
Adai	42.5±3.12	41.9±3.3	41.6±3.09	41.3±3.81	41.6±3.25	41.1±3.39
Uppuma	42.7±3.07	40.8±3.07	41.1±3.23	42.4±3.29	40.4±3.47	41.4±3.57
Ragi dosai	41.9±3	41.8±2.43	41.5±3.08	41.2±3.13	40.9±3.53	41.7±3.03
Kambudosai	42.9±2.8	40.4±3.42	40.7±2.98	42.4±2.84	41.3±3.21	41.2±3.79
Fourflourdosa	42.5±3.08	41.2±3.64	40.8±3.88	41.8±2.81	40.4±3.32	41.5±3.43

*- Significant at 5% level

The mean organoleptic score of medicinal plant extracts incorporated nutraceutical recipes (breakfast/dinner) showed no significant difference in colour, flavor, consistency and appearance in comparison to the standard chapathi, however a significant difference in taste was observed at five percent level ($p < 0.01$) of significance for the Appam (South Indian breakfast dishes prepared using fermented batter of raw rice) incorporated with Sirukurinjan extract.

4.3.1.2. Acceptability analysis of nutraceutical chutneys incorporated with selected medicinal plants

The Acceptability analysis of selected nutraceutical chutneys incorporated with selected medicinal plants is tabulated in Table XIII and discussed below.

Table XIII
Acceptability Analysis of Nutraceutical Chutneys Incorporated with Selected Medicinal Plants

Recipe names	Standard recipe	Mean Acceptability Score				
		Guava Leaves	Long Pepper	Kandankathiri	Naval seed	Sirukurinjan
Thengai chutney	42.5±2.3	40.5±2.69	40.8±3.79	41.8±3.03	40.9±3.4	41.9±3.07
Pudina chutney	42.9±3	42.6±2.71	42.1±3.04	40.9±3.33	41.1±3.44	41.3±3.22
Onion chutney	42.5±3.5	41.1±3.59	41.4±3.53	41.9±3.28	41.8±2.91	41.8±3.27
Thakkali chutney	43.4±3.75	41.4±3.41	41.7±3.36	41.3±3.69	40.9±3.77	41.3±2.74
Kothamalli chutney	41.9±2.7	42.5±3.2	41.7±3.23	41±3.20	40.7±2.67	40.9±3.25

The mean organoleptic scores of nutraceutical chutneys incorporated with selected *medicinal plants* showed no significant difference for sensory attributes. All the chutneys were highly accepted by the panel members with the mean score greater than 40.

4.3.1.3. Acceptability analysis of nutraceutical kuzhambu's incorporated with selected medicinal plants

The Acceptability analysis of nutraceutical kuzhambu's incorporated with selected medicinal plants is given in Table XIV and discussed below.

Table XIV
Acceptability Analysis of Nutraceutical Kuzhambus Incorporated with Selected Medicinal Plants

Recipe Names	Standard Recipe	Mean Acceptability Score				
		Guava Leaves	Long Pepper	Kandankathiri	Naval seed	Sirukurinjan
Sambar	42.4±2.95	41.8±2.75	41.4±2.93	40.8±3.41	41.7±3.78	40.9±3.44
Vendakkai Pulikulambu	41.9±3.7	40.7±3.48	41.4±3.2	41.5±3.53	41.9±3.19	41.9±3.28
Veg kuruma	42.5±2.45	41.5±3.21	41.5±2.47	40.4±2.7	41.1±3.04	40.4±3.52
Mor kuzhambu	43.7±3.26	41.8±3.11	41.7±3.62	41.6±3.34	41.4±2.86	40.8±3.69
Paruppu urundai kuzhambu	42.7±3.3	40.8±3.72	41±3.45	42±2.57	40.9±3.8	41.6±3.41
Paruppu Keerai kuzhambu	42.4±3.9	40.4±3.74	41.4±3.38	41.7±3.64	41.3±3.72	41.3±3.94
Pasipayaru kadaisal	42.7±3	41.9±2.99	42±2.4	41.1±3.05	41.8±3.54	42.4±3.07
Kai kuzhambu	41.4±3.47	41.3±4.03	41.4±3.47	42.2±3.29	40.6±3.57	41.3±3.43
Kathirikai sutta kuzhambu	40.6±3.91	41.3±3.45	40.6±3.91	42±3.09	41.3±3.52	41.2±3.73

The mean organoleptic score of nutraceutical kuzhambus incorporated with selected *medicinal plants* extract showed no significant difference in colour, flavor, taste, consistency, and appearance. All the nutraceutical kuzhambu obtained score ranging between 40 and 43 and hence were highly acceptable.

4.1.3.4. Acceptability analysis of nutraceutical poriyals and kootu's incorporated with selected medicinal plants

Table XV depicts the acceptability analysis of nutraceutical poriyals and kootus incorporated with selected medicinal plants.

Table XV
Acceptability Analysis of Nutraceutical Poriyals and Kootu's
Incorporated with Medicinal Plants

Recipe names	Standard chapati	Mean Acceptability Score				
		Guava Leaves	Long Pepper	Kandankathiri	Naval seed	Sirukurinjan
Beans poriyal	42.8±3.2	41.5±3.36	41.1±3.22	40.6±3.72	40.9±2.91	41.1±3.43
Carrot poriyal	41.9±2.35	40.9±3.22	41.3±3.18	40.5±2.88	41.5±2.88	40.8±3.7
kothavarangai poriyal	42.9±3.33	40.8±3.27	42±3.5	41.9±3.51	41.8±3.57	41±3.46
Avarakkai poriyal	42.5±3.7	41.9±2.98	42±2.96	41.5±3.35	41.3±3.17	41.9±3.09
Vazhithandu poriyal	42±2.7	40.5±3.22	40.7±3.71	41±3.59	41.9±3.49	42.2±3.28
Aria Keerai poriyal	43.5±3.5	41.7±3	41.9±2.88	42.6±2.57	41.5±3.16	40.6±4.11
Pasala Keerai kootu	41.9±3.23	40.9±3.52	41.5±3.56	40.7±3.55	41±3.45	41.4±3.67
Podalangai kootu	42.7± 3.9	40.9±4.12	41.3±3.68	41.8± 4.03	41.4±3.14	39.9±3.6
Cabbage poriyal	42.7±2.6	41.4±3.27	41.7±3.43	41.7±3.54	40.5±3.35	40.8±3.1
Cauliflower poriyal	43.2±3.12	40.5±3.79	39.8±3.3	42.2±3.36	41±3.66	40.4±3.67
Brinjal poriyal	42.1±3.6	40.9±3.65	41.7±3.54	41.1±3.32	40.7±3.69	41.8±3.31
Kovaikai poriyal	41.5±2.7	41.4±2.89	40.6±3.08	41.6±3.07	40.8±3.02	41.7±3.53
Sukiti keerai poriyal	42.7±3.43	42±3.67	42.1±3.29	41.2±3.31	42.1±3.16	41.6±3.49

Nutraceutical poriyals and kootu's incorporated with selected *medicinal plant* showed no significant difference in mean organoleptic score for colour, flavor, consistency, taste and appearance compared to the standard recipes. All the nutraceutical recipes were highly acceptable with score ranging between 40 and 43.

4.1.3.5. Acceptability analysis of nutraceutical recipes incorporated with selected medicinal plants(Lunch)

The Acceptability analysis of nutraceutical recipes for lunch dishes incorporated with selected medicinal plants is presented in Table XVI and discussed below.

Table XVI
Acceptability Analysis of Nutraceutical Lunch Recipes Incorporated with Selected Medicinal Plants

Recipe names	Standard recipe	Mean Acceptability Score				
		Guava Leaves	Long Pepper	Kandankathiri	Naval seed	Sirukurinjan
Thayir sadam	42.8±3.2	41.9±2.92	41±3.2	41.2±3.5	41.4±3.48	41.6±3.46
Thakkali sadam	42.9±2.45	41.4±3.23	41.4±3.19	41.2±3.23	40.1±3.41	41.7±3.46
Lemon sadam	43.5±3.2	41.4±3.44	41.2±3.72	41.3±3.82	41.2±3.4	42.2±2.74
Pudina sadam	42.7±3.5	41.3±3.52	42.3±3.4	42.5±2.68	40.9±2.92	41±3.58
Veg pulao	42.9±3.52	41.1±2.64	41.6±3.23	42.1±3.37	41.1±3.18	41.5±3.33
Besibelabath	42.9±4.3	41.3±3.38	40.9±3.61	42.2±3.55	41.1±3.58	40.8±3.01
Arisiparuppu sadam	41.9±3.21	42.3±3.2	41.6±3.19	40.21±3.73	41.7±3.11	41.9±3.21
Navarathna sadam	42.5±3.79	42.1±3.34	41.7±2.96	42.2±3.42	41.9±3.26	41.1±3.23
kothamalli sadam	42.9±3.35	41.1±3.57	40.6±3.42	42.3±2.55	40.9±3.51	41.1±3.38
Pulisadam	42.4±2.9	41.1±3.31	41.8±3.41	41.8±3.09	41.2±3.19	40.9±3.28
Ghee rice	42.5±3.7	41.9±3.47	41.2±3.34	41.8±3.41	40.1±3.63	41.8±3.09
Kushka	42.7±3.5	40.1±3.7	41±2.94	40.3±3.3	41±3.8	42±3.2
seeraga sadam	42.9±3.6	41±3.2	41.6±3.47	41.5±3.6	41.1±3.35	40.5±3.58
Fried rice	43.2±3.6	42.3±3.07	41.3±3.05	41.1±3.01	41.4±4.02	41±3.36
Thengai sadam	42.2±3.9	41.9±3.16	41.9±3.5	41.7±3.39	40.6±4.01	41.9±3.05
Manga sadam	43.1±3.3	41.5±3.57	42.3±3.41	42±2.92	41.8±2.79	40.9±3.38
Nellikai sadam	42±3.8	40.6±3.24	41.8±3.13	41.2±3.32	41.2±2.72	41.3±3.04

The mean organoleptic score of nutraceutical recipes (lunch) incorporated with selected *medicinal plant* extract showed no significant difference in colour, flavour, consistency and appearance in comparison to the standard recipes. All the nutraceutical recipes for lunch were rated as highly acceptable by the panellist in comparison to the standard recipes with overall score above 40.

4.1.3.6. Acceptability analysis of nutraceutical snacks items incorporated with selected medicinal plants

Table XVII projects the acceptability analysis of nutraceutical snacks items incorporated with selected medicinal plants.

Table XVII
Acceptability Analysis of Nutraceutical Snacks Incorporated with Selected Medicinal Plants

Recipe names	Standard recipes	Mean Acceptability Score				
		Guava Leaves	Long Pepper	Kandankathiri	Naval seed	Sirukurinjan
Sundal	41.9±3.12	41.5±2.93	41.5±3.14	41.8±2.51	40.9±3.32	41.3±3.49
Kolukattai	42.5±3	41.3±3.8	40.8±3.58	41.6±3.36	41.5±3.25	41.6±3.59
Masal pori	42.9±2.26	33.5±2.82	34.1±4.08	33.3±2.29	32.9±2.26	32.6±2.46**
Sprouted salad	42.5±2.6	41.6±3.29	41.3±2.95	41.8±3.17	41±3.5	42.1±2.86
Sandwich	42.5±2.7	41.2±3.49	41.2±3.01	41.3±3.33	41.2±2.99	40.3±3.72
Masala kadalai	42.3±3.5	41.1±3.58	41.6±3.78	41.6±3.17	41.3±2.95	41.8±3.16
Veg cutlet	42.5±2.3	40.6±3.5	41.3±3.13	41.6±3.61	41.2±2.72	41.4
Veg mixed salad	43.2±2.8	41.8±3.17	41.3±3.1	40.7±3.45	41.5±3.5	40.6±3.55
Veg roll	42.5±3.42	41.7±3.3	41.1±3.5	41.8±3.05	41.2±3.47	41.2±3.48

** - Significant at 5% level

The mean acceptability score of nutraceutical snacks incorporated with selected medicinal plant extract showed no significant difference in colour, flavor, consistency and appearance in comparison to the standard recipes, however a significant difference in texture was observed at one percent level of significance. Only in masala pori, the difference in texture was observed. Further it was also observed that irrespective of the medicinal plants, except for masala pori rest of the nutraceutical snacks items were rated as highly acceptable with a score more than 40.

PHASE IV

4.4 Development and Evaluation of a Software “*Nutra Glyx*” on Nutraceutical Recipes Incorporated with Selected Medicinal Plants

Information technology is recently proving to be an effective supplementary health care tool in the prevention and management of diseases as it can be used to educate and motivate patients particularly the diabetic to self-manage activities like monitoring of blood glucose, healthy eating practices, exercise, medication and diet planning. Software and database are currently used as one of the efficient aid in health management system.

As the whole globe moves towards digitalization, diet and health care services is also becoming challenging to meet out the health quest of individuals.

Integrating the information technology and dietary management of life style disorders at the door steps of every house hold will pave way for a healthy society. Thus the investigator developed a software “*Nutra Glyx*” on nutraceutical recipes incorporated with selected medicinal plants for diabetes mellitus using My SQL for backend programming and PHP (Hypertext Preprocessor) for front end programming. The software was developed with six modules. The discussion pertaining to the screenshots of the developed software “*Nutra Glyx*” is as follows.

The “*Log - In*” and “*Registration*” icon on the tool bar of the software “*Nutra Glyx*” enables the user to register and view the software. A click on the “*Registration*” button will take the user to the registration window. The user needs to fill his/her personal details such as the name, e-mail, mobile number and, user type(Home/Dietary department). Since the software was designed for both home maker/health care professional mainly dietician, the user can choose two option under “The user type”. Thus a click on the drop down button “user type” enlists two options namely home and dietary department. Thus selection of home connects the user to track all the information of the family member he/she wishes to maintain. Similarly selecting the option a “dietary department” enables the health care professional to track the record of their patient. The “*Log - In*” is also password protected and hence the users should set a password to secure their data. On completion of registration process, the user gets access to view the home page of the software “*Nutra Glyx*”.



Screenshot 1: Log-In Page for Registration

The home page of **Nutra Glyx** has six modules. A click on each module will take the user to the respective module namely **Module I: “Dia-Edu”**, **Module II: “Health Tracker”**, **Module III: “Herba Treat”**, **Module IV: “Diet Planner”**, **Module V: “Exercise Zone”** and **Module VI: “Glossary”**.

Module I: "Dia-Edu"


WELCOME TO DIA-EDU


NUTRA GLYX
DIA-EDU HEALTH TRACKER HFERRA TREAT DIET PLANNER EXERCISE ZONE GLOSSARY

NUTRA GLYX

GUAVA LEAVES

PSIDIUM GUAJAVA LINN (GUAVA LEAVES), FROM THE MYRTACEAL FAMILY, IS COMMON THROUGHOUT TROPICAL AND SUBTROPICAL AREAS






INTRODUCTION FOR DIABETES

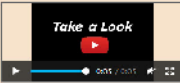
Diabetes, often referred to as diabetes mellitus, describes a group of metabolic diseases in which the person has high blood glucose (blood sugar), either because insulin production is inadequate, or because the body's cells do not respond properly to insulin, or both.


[CONTINUE READING](#)



TAKE A LOOK

Take a Look





SYMPTOMS

- Hunger and fatigue
- Peeing more often and being thirstier
- Dry mouth and itchy skin
- Blurred vision
- Yeast Infection
- Slow-healing sores or cuts

[CONTINUE READING](#)

TYPES OF DIABETES

Prediabetes is the precursor stage before diabetes, a condition in which not all of the symptoms required to diagnose diabetes are present, but blood sugar is abnormally high.

[PRE DIABETES](#)

Type 1 diabetes, once known as juvenile diabetes, or insulin-dependent diabetes, is a chronic condition in which the pancreas produces little or no insulin, insulin is a hormone needed to allow sugar (glucose) to enter cells to produce energy.

[TYPE I](#)

Diabetes mellitus type 2 (also known as type 2 diabetes) is a long-term metabolic disease that is characterized by high blood sugar, insulin resistance, and relative lack of insulin.

[TYPE II](#)

Gestational diabetes is a condition in which a woman without diabetes develops high blood sugar levels during pregnancy.


[GESTATIONAL DIABETES](#)

KNOW YOUR RISK !!!

Take up Your Risk Assessment Test

Factor	Click Appropriate Checkbox
Age:	<input type="checkbox"/> Below 30 <input type="checkbox"/> 31-50 Age: <input type="checkbox"/> Above 50 Age:
Activity Level:	<input type="checkbox"/> Sedentary <input type="checkbox"/> Moderate <input type="checkbox"/> Heavy
Exercise:	<input type="checkbox"/> Walk for 45mins <input type="checkbox"/> Walk for 30mins <input type="checkbox"/> Walk for < 15mins <input type="checkbox"/> Do Not Walk
Family Status (Diabetes):	<input type="checkbox"/> Mother <input type="checkbox"/> Father <input type="checkbox"/> Both <input type="checkbox"/> None
Dietary Habits:	<input type="checkbox"/> No Fibre Diet <input type="checkbox"/> Low Fibre Diet <input type="checkbox"/> Moderate Fibre Diet <input type="checkbox"/> High Fibre Diet
Stress:	<input type="checkbox"/> Low <input type="checkbox"/> Mild <input type="checkbox"/> Moderate <input type="checkbox"/> High

[REVIEW](#)



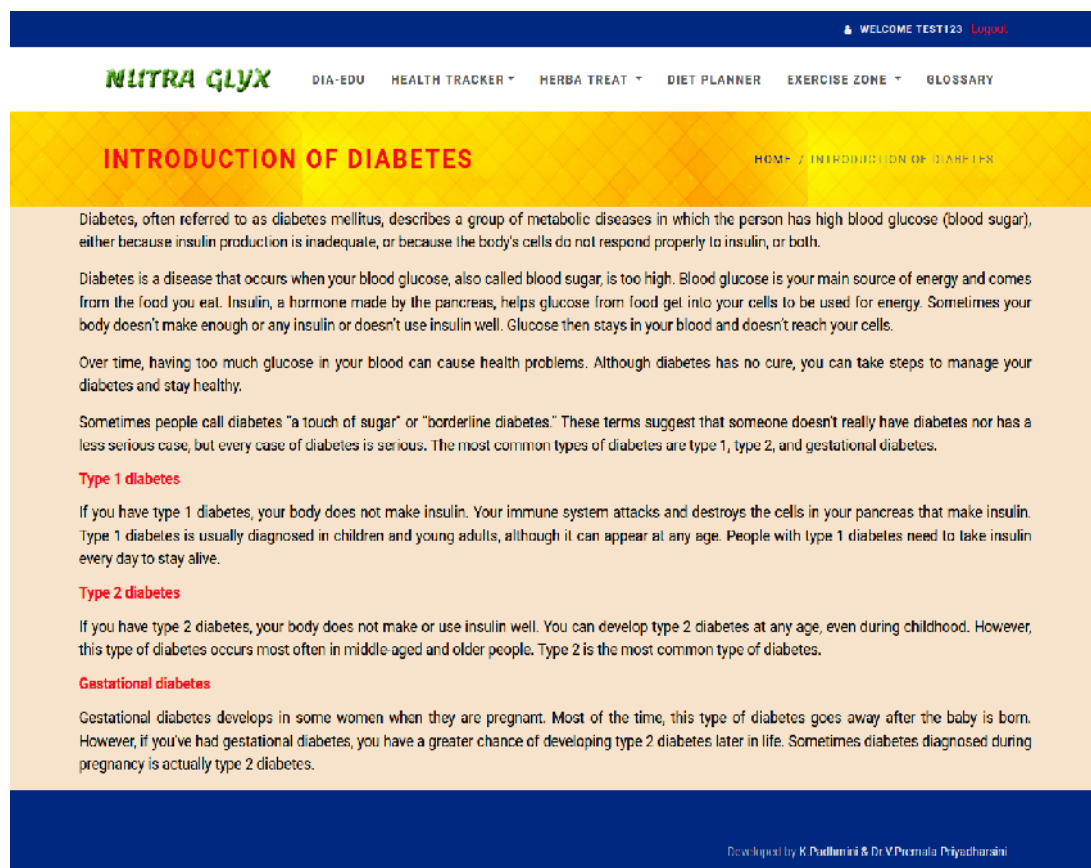
Developed by K.Padma & G.V.Pratima (Practitioners)

Screenshot 2: Full View of Screenshot of Module I "Dia-Edu"

The first module ***Dia-Edu*** was set as a home page. The module ***Dia-Edu*** was conceptualized by the investigator to educate the users on the meaning of diabetes, onset of the diseases condition, causes symptoms, types of diabetes and the risk factors for diabetes. Thus ***Dia-Edu*** screen was developed with five fragment section(FS), namely, the FS1 ***“Introduction on diabetes”***, FS2 ***“Take a Look”***, FS3 ***“Symptoms”***, FS4 ***“Types of Diabetes”*** and FS5 ***“Know Your Risk”***.

The scroll bars enable the user to view the entire screen of the ***Dia-Edu*** module.

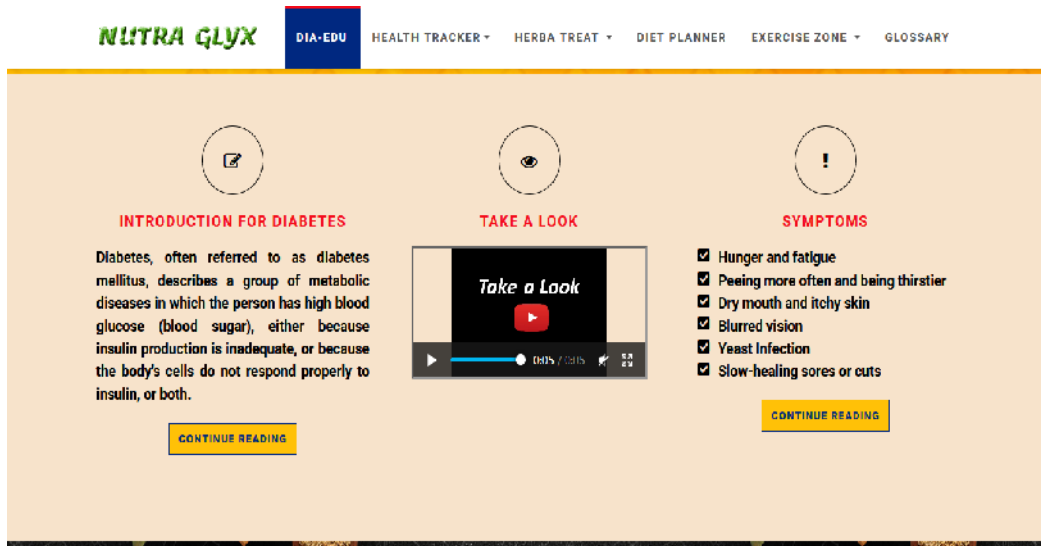
An introductory note on diabetes is given for the viewers in FS1 ***“Introduction on diabetes”*** to know what diabetes is. A click on the button ***“Continue Reading”*** navigates the user to view the entire introductory note for different types of diabetes.



Screenshot 3: “Introduction on Diabetes Mellitus”

FS2 Take a look

In the second fragment of *Dia-Edu* : FS2 **“Take a look”**- a short video was developed by the investigator to educate the viewers on the onset of diabetes. Thus a click on the play button connects the viewer to view the video developed.



The screenshot displays the NITRA GLYX website interface. The navigation bar includes 'DIA-EDU', 'HEALTH TRACKER', 'HERBA TREAT', 'DIET PLANNER', 'EXERCISE ZONE', and 'GLOSSARY'. The main content area is divided into three columns:

- INTRODUCTION FOR DIABETES**: A circular icon with a document symbol. Below it, text explains that diabetes mellitus is a group of metabolic diseases characterized by high blood glucose levels, caused by either inadequate insulin production or the body's cells not responding properly to insulin.
- TAKE A LOOK**: A circular icon with an eye symbol. Below it, a video player is shown with the title 'Take a Look' and a play button. The video player interface includes a progress bar and volume controls.
- SYMPTOMS**: A circular icon with an exclamation mark. Below it, a list of symptoms is provided, each with a checked checkbox:
 - Hunger and fatigue
 - Peeing more often and being thirstier
 - Dry mouth and itchy skin
 - Blurred vision
 - Yeast Infection
 - Slow-healing sores or cuts

Each column has a yellow 'CONTINUE READING' button at the bottom.

Screenshot 4: “FS2 Take a Look” - Display of video

FS3 Symptoms

WELCOME TEST123 [Logout](#)

NUTRA GLYX DIA-EDU HEALTH TRACKER HERBA TREAT DIET PLANNER EXERCISE ZONE GLOSSARY

SYMPTOMS OF DIABETES

[HOME](#) / [SYMPTOMS OF DIABETES](#)

Both types of diabetes have some of the same telltale warning signs.

Hunger and fatigue

Your body converts the food you eat into glucose that your cells use for energy. But your cells need insulin to bring the glucose in. If body doesn't make enough or any insulin, or if your cells resist the insulin your body makes, the glucose can't get into them and you have no energy. This can make you more hungry and tired than usual.

Hunger and fatigue

The average person usually has to pee between four and seven times in 24 hours, but people with diabetes may go a lot more. Normally your body reabsorbs glucose as it passes through your kidneys. But when diabetes pushes your blood sugar up, your kidneys may not be able to bring it all back in. This causes the body to make more urine, and that takes fluids.

HDry mouth and itchy skin

Because body is using fluids to make pee, there's less moisture for other things. If get dehydrated, and mouth may feel dry. Dry skin can make itchy.

Blurred vision

Changing fluid levels in the body could make the lenses in eyes swell up. They change shape and lose their ability to focus.

Yeast Infection

Type 2 diabetes

Both men and women with diabetes can get these. Yeast feeds on glucose, so having plenty around makes it thrive. Infections can grow in any warm, moist fold of skin, including:

- Between fingers and toes
- Under breasts
- In or around sex organs

Slow-healing sores or cuts

Over time, high blood sugar can affect the blood flow and cause nerve damage that makes it hard for your body to heal wounds.

Pain or numbness in your feet or legs

This is another result of nerve damage

Unplanned weight loss

If body can't get energy from food, it will start burning muscle and fat for energy instead. It may lose weight even though you haven't changed how you eat.

Nausea and vomiting

When body resorts to burning fat, it makes "ketones." These can build up in your blood to dangerous levels, a possibly life-threatening condition called diabetic ketoacidosis. Ketones can make you feel sick to your stomach.

Developed by K.Padimithi & Dr.V.Premala Priyadarshini

Screenshot 5: "FS3 Symptoms"- Display of Symptoms

The third fragment section "**FS3 Symptoms**" of the home page of **Dia-Edu** educates the users on the symptoms of diabetes. A click on the button "**Continue reading**" helps the user to continue their learning on the various symptoms of diabetes.

The types of diabetes

The fourth fragment section FS4 **“The types of diabetes”** of **“Dia-Edu”** project the definition for various type of diabetes. Two small buttons at the end of the fragment enable the user to slide the screen to view the content on other types of diabetes.



Screenshot 6: “FS4 Types of Diabetes”- Display of Different Types of Diabetes

The fifth fragment section FS5 **“Know your risk”** was designed by the investigator to assess the risk of the individual for diabetes.



KNOW YOUR RISK !!!

Take up Your Risk Assessment Test

Factor	Click Appropriate Checkbox			
Age:	<input checked="" type="checkbox"/> Below 30	<input type="checkbox"/> 31-50 Age:	<input type="checkbox"/> Above 50 Age:	
Activity Level:	<input checked="" type="checkbox"/> Sedentary	<input type="checkbox"/> Moderate	<input type="checkbox"/> Heavy	
Exercise:	<input type="checkbox"/> Walk for 45mins	<input type="checkbox"/> Walk for 30mins	<input checked="" type="checkbox"/> Walk for < 15mins	<input type="checkbox"/> Do Not Walk
Family Status (Diabetes):	<input type="checkbox"/> Mother	<input type="checkbox"/> Father	<input type="checkbox"/> Both	<input checked="" type="checkbox"/> None
Dietary Habits:	<input checked="" type="checkbox"/> No Fibre Diet	<input type="checkbox"/> Low Fibre Diet	<input type="checkbox"/> Moderate Fibre Diet	<input type="checkbox"/> High Fibre Diet
Stress:	<input checked="" type="checkbox"/> Low	<input type="checkbox"/> Mild	<input type="checkbox"/> Moderate	<input type="checkbox"/> High

Low Risk



REVIEW

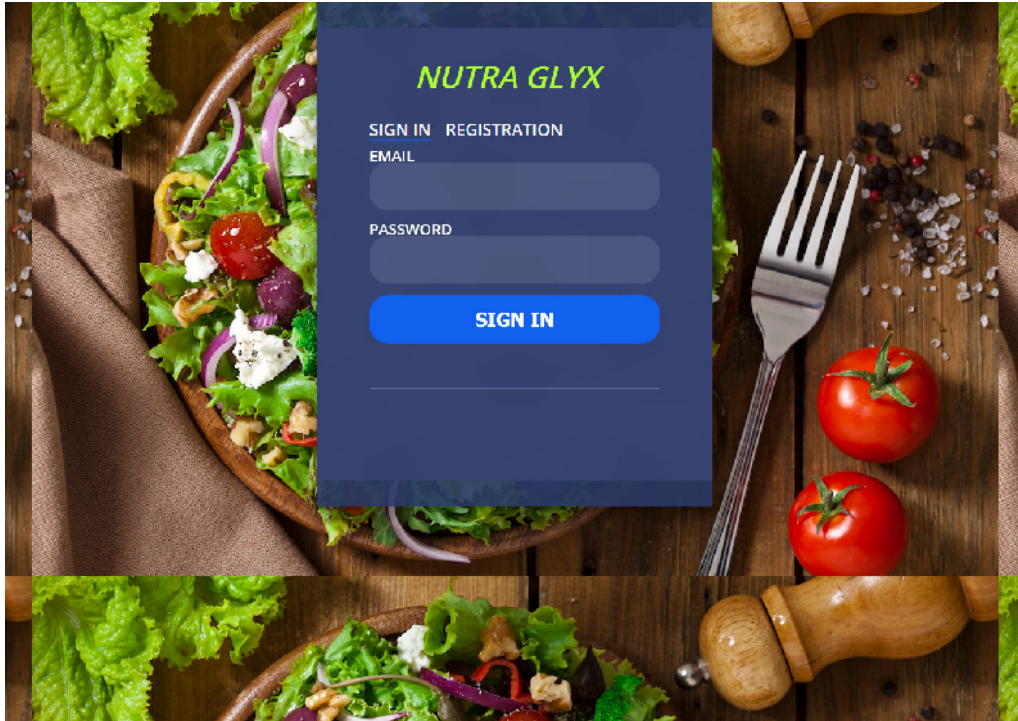
Screenshot 7: “FS5 Know Your Risk of Diabetes”- Display of Risk Assessment

Thus a click on each appropriate check box for risk factor listed on the page enable the user to take up the risk assessment. A final click on the “**Review**” button helps the viewers to assess their level of risk for diabetes. Based on the response, the user’s will be assessed as no risk, mild risk, moderate risk and high risk for diabetes.

Module II: “Health tracker”

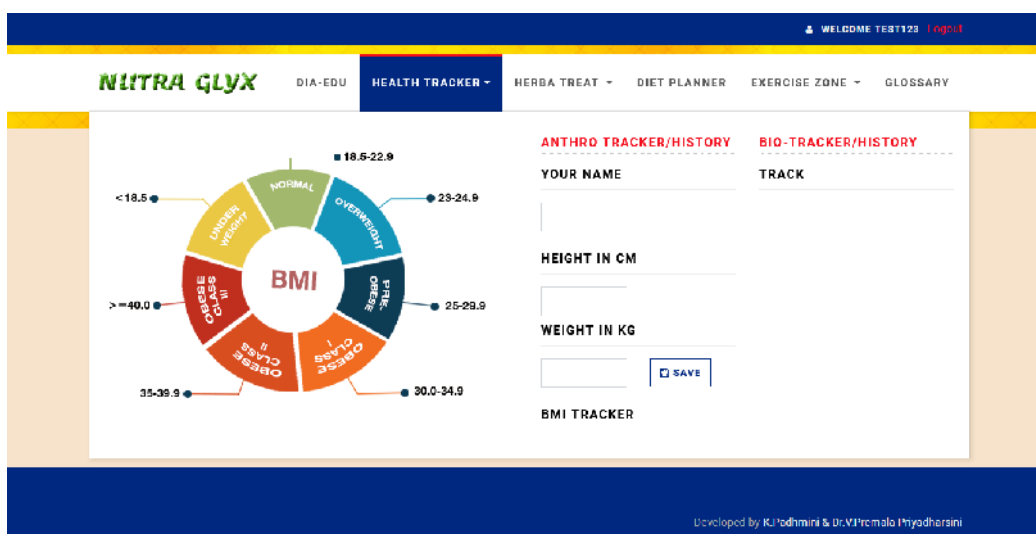
Module II *health tracker* was designed by the investigator to track the Anthropometric and Bio-chemical parameter of the user.

The *Sign - In button* at the top enables the user to get access to the tracking modules.



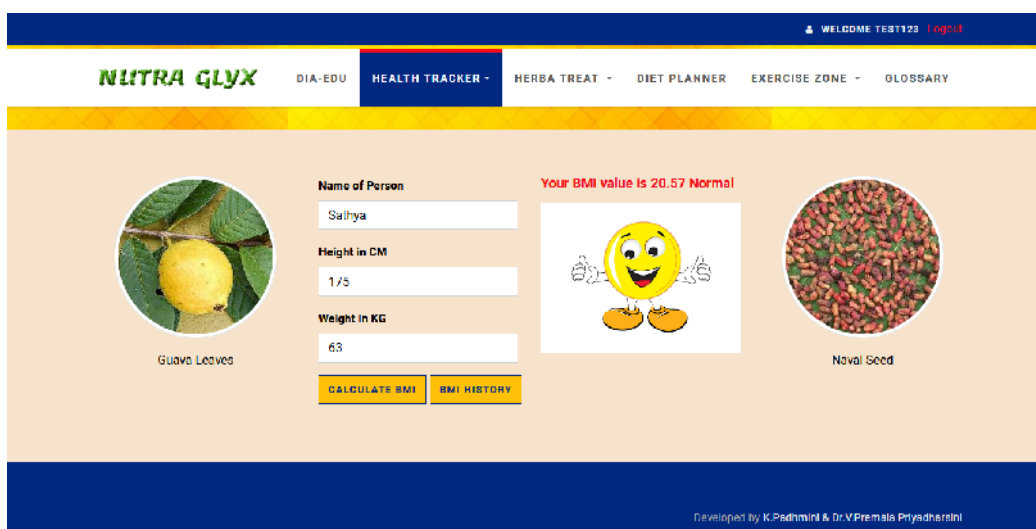
Screenshot 8: “Sign-In Page of Health Tracker”

A click on the *Sign - In button* takes the user to the log in window. The user should furnish the detail of email and password to gain access. Only the registered user can log in and gain access to all the modules of the software. This module was designed with two in-built sub modules namely *Anthro-tracker* and *Bio-Tracker*.



Screenshot 9: “Anthro-Tracker”- Display of BMI Tracker”

The “**Anthro-tracker**” was designed to store and track the anthropometric measurement namely height, weight and BMI for single and multiple user. The “**Anthro-tracker**” has three text boxes. The user’s have to type their name, numerical value of height and weight in respective text box. A click on the **save** button will enable the user to save the entire anthropometric value into a database. Further a click on the “**BMI tracker**” button takes user to the next screenshot of “**BMI tracker**” which is structured with three text boxes. The user’s will have to enter their name, height and weight to track their BMI.



Screenshot 10: “BMI Tracker to Track BMI

A click on the calculate BMI button flashes the BMI value along with their BMI status normal (<18.5-22.9), underweight (<18.5), overweight (23-24.9) , obese grade I (25-29.9), grade II (>30).

The screenshot displays the NITRA GLYX BMI Tracker interface. At the top, there is a navigation menu with options like DIA-EDU, HEALTH TRACKER, HERBA TREAT, DIET PLANNER, EXERCISE ZONE, and GLOSSARY. The main content area features a yellow header with 'BMI TRACKER' and a breadcrumb 'HOME / BMI TRACKER'. Below this, there are input fields for 'Name of Person' (Sathya), 'Height in CM' (175), and 'Weight in KG' (63). A 'CALCULATE BMI' button is present, and the result shows 'Your BMI value is 20.57 Normal' with a thumbs-up emoji. There are also images of 'Guava Leaves' and 'Naval Seed'. Below the input fields, there are 'Excel' and 'PDF' buttons for data export, and a 'Search:' input field. A table titled 'Nutra Glyx' shows a history of BMI measurements for the user 'Sathya'.

Date	Idle Name	Height	Weight	BMI	BMI Status
26/02/2019	Sathya	160	80	31.25	Obese Grade II
26/02/2019	Sathya	180	70	21.6	Normal
27/02/2019	Sathya	170	65	22.49	Normal
27/02/2019	Sathya	180	70	21.6	Normal
27/02/2019	Sathya	160	70	27.34	Obese Grade I

Showing 1 to 5 of 11 entries

Navigation: First Previous 1 2 3 Next Last

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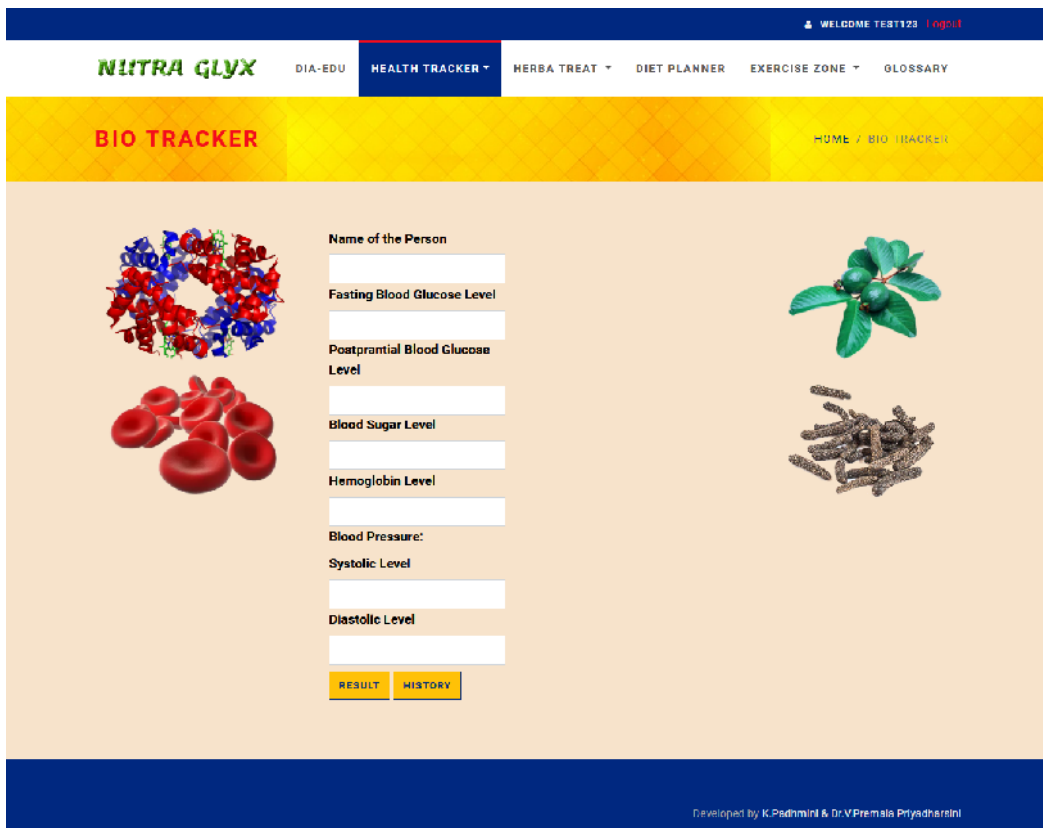
Screenshot 11: “BMI tracker to save BMI values”

“Search” options at the right side of the screen enable the user to track the anthropometric measurement of a particular patient. Also the entire history of the search for a particular user/patient will be automatically displayed.

The **EXCEL** and the **PDF** buttons at the left hand side of the screenshot helps the user to export the data in an excel format and store them as a PDF file.

Bio-tracker

The module **Bio-tracker** was conceptualized to track the bio chemical parametric of the individual. A click on the button **“Track”** on the screen shot of health tracker will navigate the user to the next screen shot of **Bio-tracker**. Seven text boxes will appear on the screen. The users will have to enter their Name, Fasting blood glucose level, Postprandial blood glucose level, Blood Sugar level, Hemoglobin level and Blood pressure values (Systolic and Diastolic levels).



The screenshot displays the 'Bio Tracker' web application interface. At the top, there is a dark blue navigation bar with the text 'WELCOME TEST123 | Logout'. Below this is a white header with the logo 'NITRA GLYX' and a menu containing 'DIA-EDU', 'HEALTH TRACKER', 'HERBA TREAT', 'DIET PLANNER', 'EXERCISE ZONE', and 'GLOSSARY'. The main content area has a yellow header with 'BIO TRACKER' and a breadcrumb trail 'HOME / BIO TRACKER'. The central form is on a light beige background and includes several input fields: 'Name of the Person', 'Fasting Blood Glucose Level', 'Postprandial Blood Glucose Level', 'Blood Sugar Level', 'Hemoglobin Level', 'Blood Pressure: Systolic Level', and 'Diastolic Level'. There are also two buttons, 'RESULT' and 'HISTORY', at the bottom of the form. The page is decorated with images of a molecular structure, red blood cells, green leaves, and brown sticks. A footer at the bottom right states 'Developed by K.Padmaulini & Dr.V.Premala Priyadharini'.

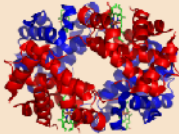

Screenshot 12: “Bio-tracker” to Track Blood Glucose Levels”

A click on the **Result** button assist the user to find out whether their blood parameter and blood pressure values are within the normal range or not.

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NITRA GLYX DIA-EDU **HEALTH TRACKER** HERBA TREAT DIET PLANNER EXERCISE ZONE GLOSSARY

BIO TRACKER HOME / BIO TRACKER

Name of the Person
Sathya

Fasting Blood Glucose Level
180

Postprandial Blood Glucose Level
130



Blood Sugar Level
120

Hemoglobin Level
8

Blood Pressure:
Systolic Level
130
Diastolic Level
70

[RESULT](#) [HISTORY](#)

Description	Status
Home/Professional Name:	Nutra Glyx
Person Name:	Sathya
Fasting Blood Glucose Status:	High Blood Sugar
Post Prandial Status:	Normal
Blood Sugar Level:	120
Blood Sugar Level Status:	Modrate
Hemoglobin Level Status:	Diabetes
BP Status:	Normal

Excel PDF
Search:

Nutra Glyx								
Date	Name	HBA1c level	HBA1c Status	Fasting Blood Glucose Status	Postprandial Status	Bloodglucose Level	Bloodglucose Level Status	Blood Pressure Status
26/02/2019	Sathya	7	Diabetes	High Blood Sugar	Normal	160	Modrate	High Normal
26/02/2019	abc	7	Diabetes	High Blood Sugar	Normal	130	Modrate	High Normal
26/02/2019	abc	7	Diabetes	High Blood Sugar	Normal	130	Modrate	High Normal
26/02/2019	Sathya	7	Diabetes	High Blood Sugar	Normal	130	Modrate	High Normal
26/02/2019	Sathya	7	Diabetes	High Blood Sugar	Normal	130	Modrate	High Normal

Showing 1 to 5 of 24 entries First Previous **1** 2 3 4 5 Next Last

Developed by K.Padmind & Dr.VPremia Priyadarshini

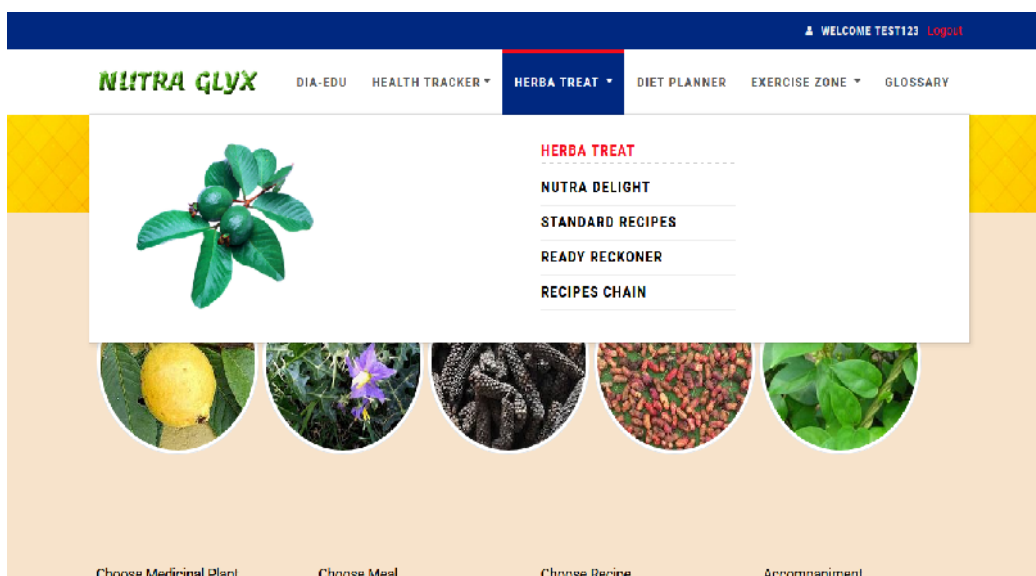
Screenshot 13: “Bio-tracker” to save blood glucose levels”

The Search option on the screen shot enables the user to track the biochemical values of particular user/patient. It also helps the user to view the entire history of search on the bio chemical parameters for a particular user/patient.

The EXCEL and the PDF button on the right side of the screen help the users to convert and export the stored data into EXCEL and PDF file.

Module III: “Herba -Treat”

The module III - “Herba-Treat” of the software *Nutra Glyx* was developed with four sub menu button namely SB1 “*Nutra delight*”, SB2 “*Standard recipes*”, SB3 “*Ready reckoner*” and SB4 “*Recipe chain*”.



Screenshot 14: “Herba Treat”

The sub menu SB1 “*Nutra Delight*” is a compilation of 335 nutraceutical recipes incorporated with five different medicinal plants namely *Guava leaf (Psidium guajava L.)*, *Long Pepper (Piper longum L.)*, *Sirukurinjan leaf (Gymnema sylvestre R.Br.)*, *Naval Seed (Syzygium cumini L.)*, *Kandankathiri (Solanum virginianum L.)*.

The investigator tested the hypoglycemic effect of these medicinal plants on a sub sample of 210 female's type II diabetic subjects.

NUTRA GLYX DIA-EDU HEALTH TRACKER HERBA TREAT DIET PLANNER EXERCISE ZONE GLOSSARY

WELCOME TEST123 | LOGOUT

NUTRA DELIGHT HOME / NUTRA DELIGHT

Choose Medicinal Plant: Guava Leaves
 Choose Meal: Breakfast
 Choose Recipe: Utthappam
 Accompaniment: Chutney, Sambur, Idli Podi

GET NUTRITIVE VALUE GET BIO ACTIVE COMPOUNDS COMPARE

Utthappam

Ingredients

- Idli Rice -30g
- black gram skinless-10g
- Fenugreek seeds -2g
- Onion – 15g
- Green chilli – 5g
- Ginger – 5g
- Salt- to taste
- Oil -5ml
- Water-150ml

Method of Preparation

1. Soak rice, Black gram dhal, fenugreek seeds with 100ml of water for five hours
2. Drain the water and grind in grinder.
3. Ensure that the batter is not too smooth.
4. Transfer the batter in a vessel and add salt, mix well and allow it to ferment overnight.
5. Chop onions, greenchillies and ginger finely
6. In a bowl add chopped onion, green chilli and ginger.
7. Sprinkle a little salt and mix it and Keep it aside
8. In a batter add 2g of guava leaves extract in a batter and mix it well
9. Keep batter ready before heating the dosa tawa.
10. Heat a tawa, add a drop of oil and rub it with half an onion.
11. This will help to take the dosa from the tawa easily.
12. Once the tawa is heated well, reduce the heat to medium.
13. pour a ladle of batter and spread it in a circular motion to form a thick dosa
14. Do not spread it thin, Utthappams should be thick.
15. After a minute, sprinkle the onion mixture all over the dosa.
16. Gently press utthappam with the ladle.
17. Drizzle a little of oil around the dosa.
18. Once the the base is golden brown and see lot of holes on the top, flip the dosa to the other side. Let it cook the other side.
19. Once it is cooked, remove the dosa from the tawa and serve hot

Herbs Used:	Preparation Time:	Cooking Time:	Soaking time:	Fermenting Time :	Yield/Portion size :	Servings :	Equipments Used:
guava leaves	10 minutes	Less than 5 mins per Utthappams	6 Hours	Overnight	2 No's	one	Grinder, Dosa tawa

Nutritive value

Energy(KJ)	CHO(g)	Protein(g)	Fat(g)	Calcium(mg)	Iron(mg)	Fibre(g)	Beta Carotene(µg)	Pyridoxine(mg)	Potassium(mg)	Thiamine(mg)	Riboflavin(mg)	Ascorbic Acid(mg)
1097	100	23.3	7.17	1097	9.85	12.9	1994.7	0.21	1090.97	0.23	0.15	335

Bio Active Compounds

contain tannin, phlobatannins, sapanoin, flavonoids, steroids, terpenoids, triterpenoids, polyphenol and glycosides.

Developed by K.Padmmini & Dr.V.Promala Prtyodharsini

Screenshot 15: Sub menu SB1 - “Nutra delight”

Since the selected medicinal plants showed significant reduction in the blood glucose level when incorporated in chapathi, the investigator identified 67 commonly consumed recipes using a preference sheet. Based on the preference sheet total of 335 nutraceutical recipes were developed by incorporating the selected herbs and the module facilitate the user to view and prepare nutraceutical recipes for the management of diabetes mellitus.

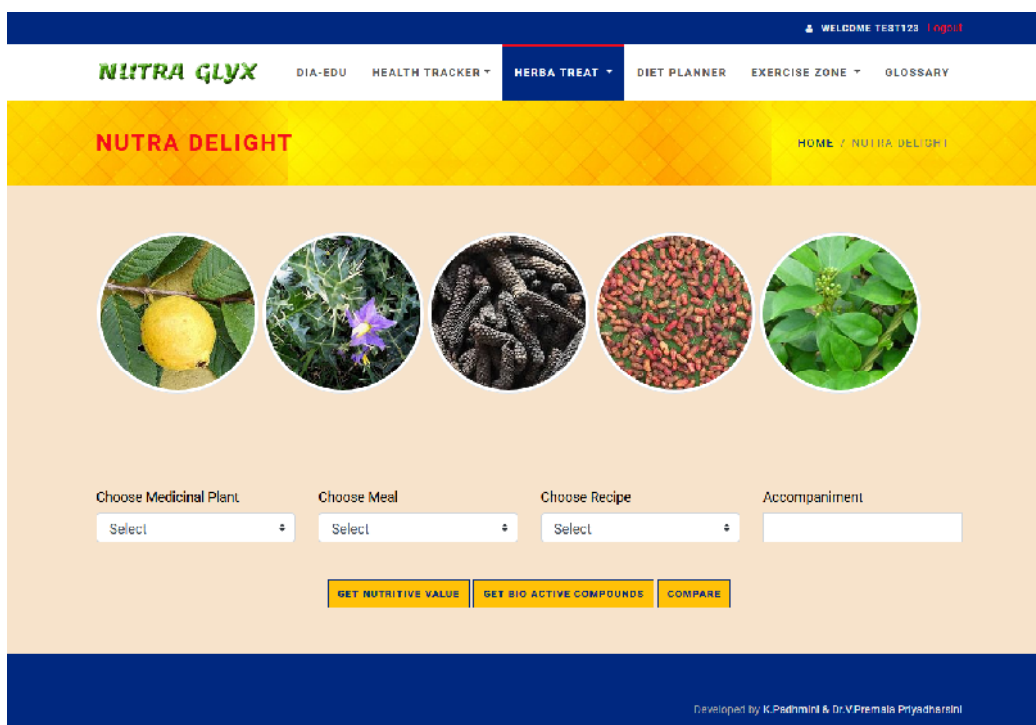
Thus, a click on the sub menu button takes the user to the next screen shot of Nutra delight. This screen shot of SB1 was constructed with four drop down menu options.

Option 1 Choose Medicinal Plant

Option 2 Choose Meal

Option 3 Choose Recipe

Option 4 Choose Accompaniment



Screenshot 16: “Nutra Delight”- Display of Option I Choose Medicinal Plants”






A click on the **Option 1 “Choose Medicinal Plant”** enables the viewer to view a drop down menu with a list of five medicinal plants. A click on each medicinal plants connect the users to the next utility **Option 2 “Choose Meal”**.

A click on the said option enlist a drop down menu for different meal time namely breakfast, lunch, dinner, snacks and gravy/curry/poriyal. Selecting a particular meal connects the user to the **Option 3 “Choose Recipe”**. A click on the **“Choose Recipe”** list out the number of recipes under the selected category. Selecting a particular recipes facilitate the user to view the entire recipes with all information such as ingredients, method of preparation, medicinal plant used, preparation time, portion size, number of serving and equipment used. The screen also provides information on the nutritive value of the selected recipes for both micro and macro nutrients. To add scientific validation to the nutraceutical recipes, the bio-active / nutraceutical compounds present in selected medicinal plants is also list along with the recipe format.

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NITRA GLYX DIA+EDU HEALTH TRACKER **HERBA TREAT** DIET PLANNER EXERCISE ZONE GLOSSARY

NUTRA DELIGHT HOME / NUTRA DELIGHT



Choose Medicinal Plant:

Choose Meal:

Choose Recipe:

Accompaniment:

[GET NUTRITIVE VALUE](#) [GET BIO ACTIVE COMPOUNDS](#) [COMPARE](#)

Uththappam

Ingredients

- Idli Rice -30g
- black gram skinless-10g
- Fenugreek seeds -2g
- Onion - 15g
- Green chilli - 5g
- Ginger - 5g
- Salt- to taste
- Oil -5ml
- Water-150ml

Method of Preperation

1. Soak rice, Black gram dhal, fenugreek seeds with 100ml of water for five hours
2. Drain the water and grind in grinder.
3. Ensure that the batter is not too smooth.
4. Transfer the batter in a vessel and add salt, mix well and allow it to ferment overnight.
5. Chop onions, greenchillies and ginger finely
6. In a bowl add chopped onion, green chilli and ginger.
7. Sprinkle a little salt and mix it and Keep it aside
8. In a batter add 2g of guava leaves extract in a batter and mix it well
9. Keep batter ready before heating the dosa tawa.
10. Heat a tawa, add a drop of oil and rub it with half an onion.
11. This will help to take the dosa from the tawa easily.
12. Once the tawa is heated well, reduce the heat to medium.
13. pour a ladle of batter and spread it in a circular motion to form a thick dosa
14. Do not spread it thin, Uthappams should be thick.
15. After a minute, sprinkle the onion mixtura all over the dosa.
16. Gently press uththappam with the ladle.
17. Drizzle a little of oil around the dosa.
18. Once the the base is golden brown and see lot of holes on the top, flip the dosa to the other side. Let it cook the other side.
19. Once it is cooked, remove the dosa from the tawa and serve hot

Herbs Used:	Preparation Time:	Cooking Time:	Soaking time:	Fermenting Time :	Yield/Portion size :	Servings :	Equipments Used:
guava leaves	10 minutes	Less than 5 mins per Uththappams	6 Hours	Overnight	2 No's	one	Grinder, Dosa tawa

Nutritive value

Energy(KJ)	CHO(g)	Protein(g)	Fat(g)	Calcium(mg)	Iron(mg)	Fibre(g)	Beta Carotene(µg)	Pyridoxine(mg)	Pottacium(mg)	Thiamine(mg)	Riboflavin(mg)	Ascorbic Acid(mg)
1007	100	23.3	7.17	1007	9.85	12.9	1994.7	0.21	1696.97	0.23	0.15	335

Bio Active Compounds

contain tannin, phlobatannins, saponin, flavonoids, steroids, terpenoids, triterpenoids, polyphenol and glycosides.

Developed by K.Padhinai & Dr.V.Premala Priyadarshini

Screenshot 17: “Nutraceutical / Bio Active Compound of Recipe with Medicinal Plant”

95

Two tertiary button on the screen “**Get nutritive value**” and “ **Get bio active compound**” assist the user to view only the Nutritive value or Bio active compound of the recipe selected for specific medicinal plant.

NUTRA GLYX DIA-EDU HEALTH TRACKER HERBA TREAT DIET PLANNER EXERCISE ZONE GLOSSARY

NUTRA DELIGHT HOME / NUTRA DELIGHT

Choose Medicinal Plant: Guava Leaves
 Choose Meal: Breakfast
 Choose Recipe: Uthappam
 Accompaniment: Chutney, Sambhar, Idli P'odi

GET NUTRITIVE VALUE GET BIO ACTIVE COMPOUNDS COMPARE

Nutritive value

Energy(KJ)	CHM(g)	Protein(g)	Fat(g)	Calcium(mg)	Iron(mg)	Fiber(g)	Beta Carotene(µg)	Pyridoxine(mg)	Potassium(mg)	Thiamine(mg)	Riboflavin(mg)	Ascorbic Acid(mg)
1097	100	23.3	7.17	1097	9.85	12.9	1994.7	0.21	1096.97	0.23	0.13	335

Developed by K.Padhlmini & Dr.V.Premala Priyadarshini

Screenshot 18: “Nutraceutical Compound of Recipe with Medicinal Plant”

NUTRA GLYX DIA-EDU HEALTH TRACKER HERBA TREAT DIET PLANNER EXERCISE ZONE GLOSSARY

NUTRA DELIGHT HOME / NUTRA DELIGHT

Choose Medicinal Plant: Guava Leaves
 Choose Meal: Breakfast
 Choose Recipe: Uthappam
 Accompaniment: Chutney, Sambhar, Idli P'odi

GET NUTRITIVE VALUE GET BIO ACTIVE COMPOUNDS COMPARE

Bio Active Compounds

contain tannin, phlobatannins, sapanin, flavonoids, sterolids, terpenoids, triterpenoids, polyphenol and glycosides.






Developed by K.Padhlmini & Dr.V.Premala Priyadarshini

Screenshot 19: “Bio active compound of recipe with medicinal plant”

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NITRA GLYX DIA-EDU HEALTH TRACKER **HERBA TREAT** DIET PLANNER EXERCISE ZONE GLOSSARY

NUTRA DELIGHT HOME / NUTRA DELIGHT

Choose Medicinal Plant:

Choose Meal:

Choose Recipe:

Accompaniment:

[GET NUTRITIVE VALUE](#)
 [GET BIO ACTIVE COMPOUNDS](#)
 [COMPARE](#)

Choose other Medicinal Plant To Compare

Nutritions	Guavaleaves	Kandankathiri
Energy(KJ)	1097	1135
CHO(g)	100.3	96.2
Protein(g)	23.3	26.8
Fat(g)	7.17	10.9
Calcium(mg)	2080	2120
Iron(mg)	9.85	17.1
Fibre(g)	12.9	14.9
Beta Carotene(ug)	1994.7	2854.7
Pyridoxine(mg)	0.212	0.222
Pottassium(mg)	1699	1829
Thiamine(mg)	0.234	0.294
Riboflavin(mg)	0.146	0.366
Ascorbic Acid(mg)	335	469

Developed by K.Padhmilini & Dr.V.Premala Priyadarshini

Screenshot 20: “Compare Nutraceutical Compound of Recipe with Two Selected Medicinal Plants”

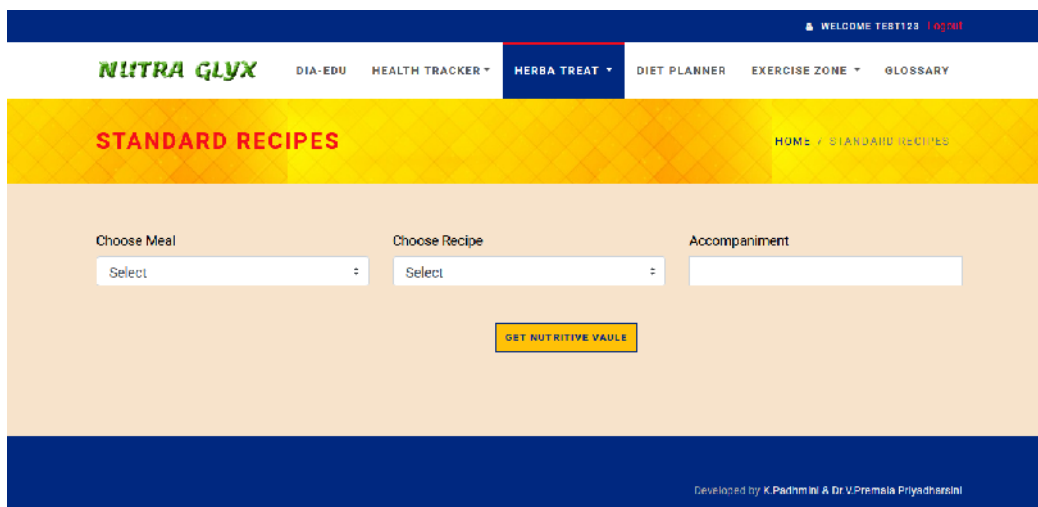
Standard recipes

The second sub menu SB2 “**Standard recipes**” is a recipe data base that navigates the user to view the compilation of 67 commonly consumed recipes collected and standardized by the investigator. This module enables the user to choose recipes without the incorporation of medicinal plants. Thus a click on the sub menu “**Standard recipes**” connect the users to the next screen shot of **Standard recipes** with built in three drop down menu option.

Option a “choose meal”

Option b “choose recipes”

Option c “accompaniment”



Screenshot 21: “Display of Standard Recipes”

A click on **Option a “Choose meal”** assist the user to view a drop down menu with the list of different meals namely breakfast, lunch, dinner, snacks and gravy/curry/poriyal. Further a click on each meal connects the users to the subsequent button **Option b “Choose recipes**. A click on “**Choose Recipes**” enlists a number of recipes selected under each category of meal. Further a click on the particular recipes take the viewer to the next screen shot that displays the entire information of the recipe such as ingredients, method of preparation, preparation time, cooking time, portion size, number of serving and equipment used, presented in a well-constructed recipe format. This screen shot also displays the nutritive value of the selected standard recipes for both micro and macro nutrient. A button “ **compare**” on the screen shot enables the users to

view and compare the nutritive value of nutraceutical recipe incorporated with medicinal plant and the corresponding standard recipe selected.

A default menu “**Accompaniment**” facilitates the users to view a set of accompaniments suggested for the main dishes chosen by the user “**Get nutritive value**” button assist the users to view only the nutritive value of the selected recipe.

STANDARD RECIPES HOME / STANDARD RECIPES

Choose Meal: Dinner | Choose Recipe: Select Dish | Accompaniment: Sambar

GET NUTRITIVE VALUE

Kuzhi Paniyaram

Ingredients	Method of Preparation
<ul style="list-style-type: none"> Idli Rice -30g black gram skinless-10g Fenugreek seeds -2g Oil -5ml Salt- to taste Water-150ml 	<ol style="list-style-type: none"> Soak rice, Black gram dhal, fenugreek seeds with 100ml of water for five hours Drain the water and grind in grinder. Ensure that the batter is not too smooth. Transfer the batter in a vessel and add salt, mix well and allow it to ferment overnight. Before cooking add 2g of guava leaves extract in a batter and mix it well Heat the paniyaram tawa over medium heat and grease each dent with a little oil. Pour a ladleful of batter in each dent, drizzle oil and cook for four to five minutes till the underside is done. Turn them over using a spoon and drizzle a little more oil and continue to cook for three to four minutes or until both the sides are evenly cooked. Transfer in a plate Serve as hot

Preparation Time:	Cooking Time:	Soaking time:	Fermenting Time :	Yield/Portion size :	Servings :	Equipments Used:
10 minutes	20minutes	6 Hours	Overnight	5 No's	one	Grinder, Kuzhipaniyaram pan

Nutritive value

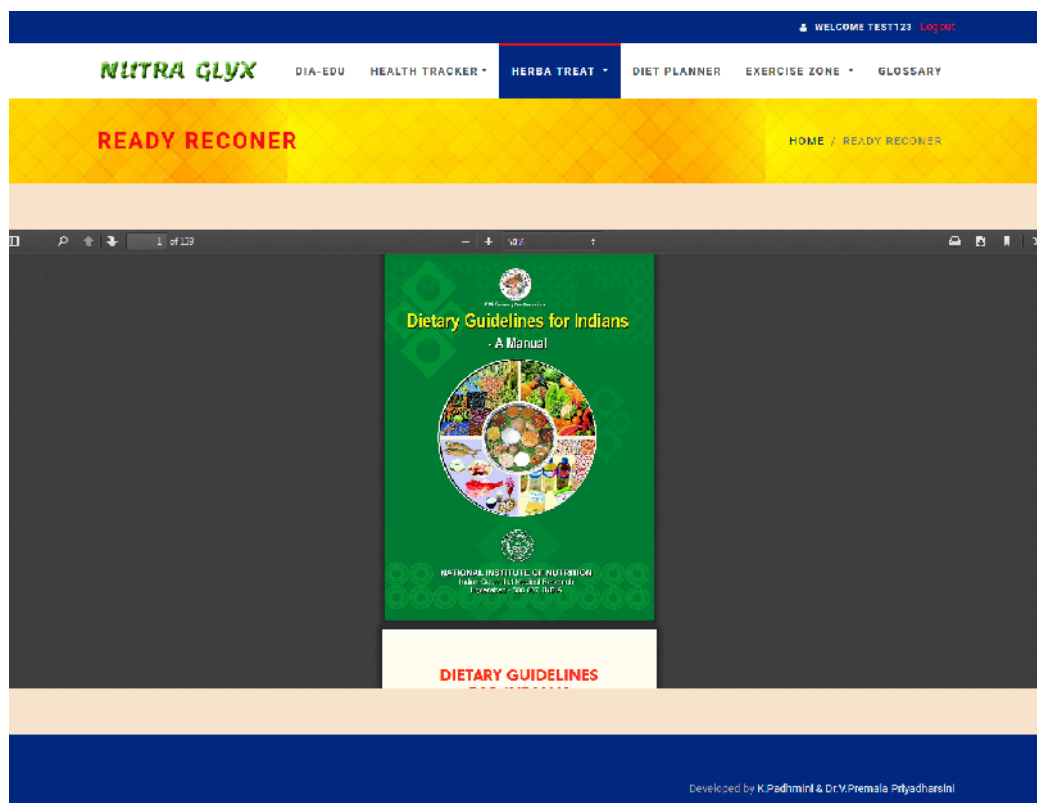
Energy(KJ)	CHO(g)	Protein(g)	Fat(g)	Calcium(mg)	Iron(mg)	Fibre(g)	Beta Carotene(µg)	Pyridoxine(mg)	Potassium(mg)	Thiamine(mg)	Riboflavin(mg)	Ascorbic Acid(mg)
647.56	28.8	5.20	5.44	10.5	0.83	2.99	3.85	0.073	166	0.0416	0.027	0.00

Developed by K.Jadhavini & Dr.VJremala Priyadarshini

Screenshot 22: “Display of Standard Recipe Format”

Ready reckoner

The third sub menu SB3 **“Ready reckoner”** of **“Herba treat”** was planned with the objectives to educate the user on various dietary guideline for different age groups of Indian population recommended by the Indian Council of Medical Research(2017).



Screenshot 23: Display of “Ready Reckoner”


Recipes chain

The fourth sub menu SB4 **“Recipes chain”** was created with the aim to facilitate the user to add new recipes he/she come across in future. Thus this module gives the scope of adding endless number of recipes into the software. A click on the **Recipes chain** drop down menu and text box. Each utility option helps the users to add the food type(Veg/Non-Veg) and choose meal (breakfast, lunch, dinner, snacks and gravy/curry/poriyal), choose variation(standard recipes, recipes incorporated with medicinal plants). The text box area given on the right hand side of the screen shot assist the user to type the ingredients and method of preparation.

WELCOME TEST123 [Logout](#)

NITRA GLYX DIA-EDU HEALTH TRACKER - **HERBA TREAT -** DIET PLANNER EXERCISE ZONE - GLOSSARY

RECIPES CHAIN [HOME](#) / [RECIPE](#) / [DIET PLAN](#)



Choose Meal	Choose Variation	Recipe Name	Sidedish Name
<input type="text" value="Select"/>	<input type="text" value="Select"/>	<input type="text"/>	<input type="text"/>
Prepreparation	Cooking Time	Servings	Portion Size
<input type="text" value="Making Batter"/>	<input type="text" value="20 mins"/>	<input type="text" value="one"/>	<input type="text" value="1 nos"/>
Fermenting Time	Soaking Time	Preparation Time	Equipments
<input type="text" value="10 mins"/>	<input type="text" value="10 mins"/>	<input type="text" value="10 mins"/>	<input type="text" value="Grinder"/>
Type Ingredients Name			
<input type="text" value="Select ingredients"/>			
Methods			
<input type="text"/>			

Developed by K.Padhmmini & Dr.V.Premale Priyadharshini

Screenshot 24: Display of “Add on Recipes” Option

The “**Save**” button on the screen shot adds the typed recipes to the database of the software.

WELCOME TEST123 | Logout

NUTRA GLYX DIA-EDU HEALTH TRACKER **HERBA TREAT** DIET PLANNER EXERCISE ZONE GLOSSARY

RECIPES CHAIN HOME / RECIPES CHAIN

New Recipe Added Successfully.

Choose Meal	Choose Variation	Recipe Name	Sidedish Name
Lunch	Naval Seed	Veg Dhiryan	Mixed vegetable ratta
Prepreparation	Cooking Time	Servings	Portion Size
Making Batter	20 mins	one	1 nos
Fermenting Time	Soaking Time	Preparation Time	Equipments
10 mins	10 mins	10 mins	Grinder

Type Ingredients Name

Amaranth seed, black (Amaranthus caryocarpus) x Amaranth seed, pale brown (Amaranthus) x Jowar (Sorghum vulgare) x
 Maize, tender, sweet (Zea mays) x Ragi (Eleusine coracana) x Rice, puffed (Oryza sativa) x
 Rice, parboiled, milled (Oryza sativa) x

Methods

1. Soak rice for 20 minutes. Drain the water completely and keep it aside.
2. Cut the vegetables lengthwise.
3. Blend tomato to a paste.
4. Take a pressure cooker, heat ghee + oil, add the cinnamon, cardamom, Bayleaf, cloves and stir. After it splutters, add onions and saute till they turn transparent.
5. Add ginger garlic paste and saute for a few more minutes.
6. Add tomato puree, green chilli, mixed vegetables, peas, turmeric powder, chilli powder, salt.

SAVE
CALCULATE NUTRITIVE VALUE

Nutritive value

Energy(KJ)	CHO(g)	Protein(g)	Fat(g)	Calcium(mg)	Iron(mg)	Fibre(g)	Beta Carotene(µg)	Pyridoxine(mg)	Potassium(mg)	Thiamine(mg)	Riboflavin(mg)	Ascorbic Acid(mg)
9527	482	98.5	18.5	9527	50.0	51.5	2316.8	25	3809	1.54	0.90	593

Bio Active Compounds

malic acid, oxalic acid, gallic acid, tannins, cynidin glycoside, oleonic acid, flavonoids, essential oils, betulinic acid, friedelin, alkaloids, flavonoids, glycosides, sterols, cardiac glycosides, saponins, resins, phenols, tannins and terpenoids.

Developed by K.Padmirini & Dr.V.Premala Priyadarsini

Screenshot 25: Display of Option “Save Recipe”

A click on the button **“Calculate nutritive value”** facilitate the users to view the nutrient content of the recipes added.

Module IV: “Diet Planner”

DIET PLANNER

WELCOME TEST123 | LOGOUT

NITRA GLYX | DIA-EDU | HEALTH TRACKER | HERBA TREAT | **DIET PLANNER** | EXERCISE ZONE | GLOSSARY

HOME / DIET PLANNER

Choose Age Groups
Men Adult

Activity Level
Sedentary Activity

GET DIET PLAN

You have to take 2320 kcal Food Per Day

BREAKFAST DIET PLAN

Main Dish	Side Dish
Kovakkai Poriyal	Rice and roti.
Kambu Dosa	dosa podi, chutney, sambar
Keerai Kootu	Serve it with hot steamed rice

LUNCH DIET PLAN

Main Dish	Side Dish
Vegetable Cutlet	Tomato ketchup or green chutney.
Mint chutney	Idli, Dosa, Vadai, Panyaram, Bajji,
Ladies finger Pulikulambu	Rice

DINNER/SNACKS DIET PLAN

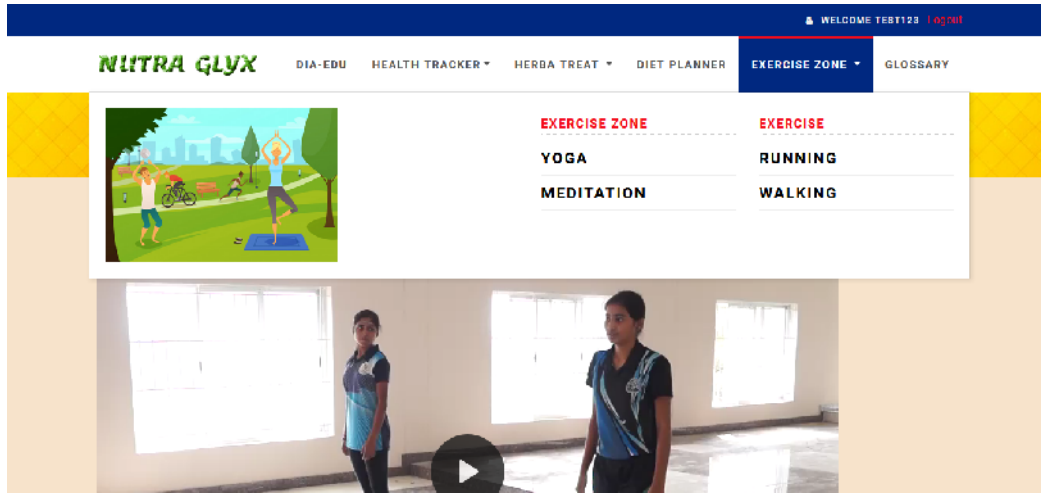
Main Dish	Side Dish
Tea, coffee, milk, juice	Masala Peanut
Tea, coffee	Sundal
Carrot Poriyal	a side dish for steamed rice (rasam s

Developed by K.Padhmhini & Dr.V.Premala Priyadarshini

Screenshot 26: Display of “Diet Planner Based on the Activity Pattern”

The module IV “*Diet planner*” was designed to assist the users in the self-management of diet planning (whole days menu) based on their activity level. Thus a click on diet planner on the menu bar takes the user to the next screen shot with a drop down menu that enlist the different age group of individual as given in the RDA (NIN, 2017). A click on a particular age group(eg: men adult, women adult, boy 10-12 years, girl 10-12 years, Boy 13-15 years, girl 13-15 years, boy 16-17 years and girl 16-17 years) connects the user to the next drop down menu that enlist the activity level (Sedentary, Moderate and Heavy activity). Selection of particular activity level showcases the caloric requirement of the individual with suggested possible combination of breakfast, lunch and dinner item along with their accompaniment for the whole day.

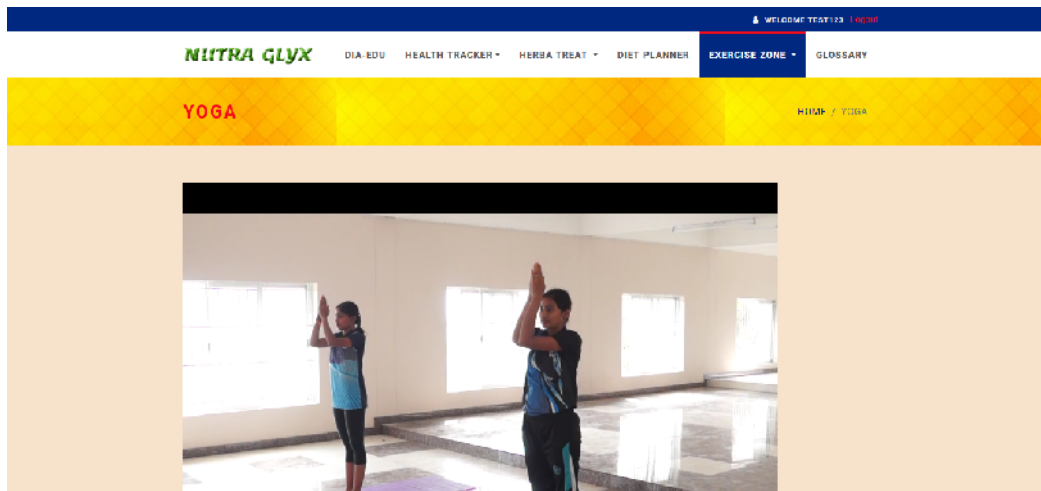
Module V: “Exercise zone”.



Screenshot 27: “Exercise Zone”

Since diet and exercise are the two major detrimental factors in the control and management of blood glucose level among diabetic, the investigator felt the need to create an awareness on the different types of exercise that benefit the diabetic subject. Thus the module V **“Exercise zone”** **“Exercise zone”** expedite the users on the right techniques of doing different types of exercise. A click on the **“Exercise zone”** displays three utility sub menus namely Yoga, Exercise and Meditation.

A click on the sub menu **“Yoga”** takes the user to a video clip on the different yoga postures for diabetic people.



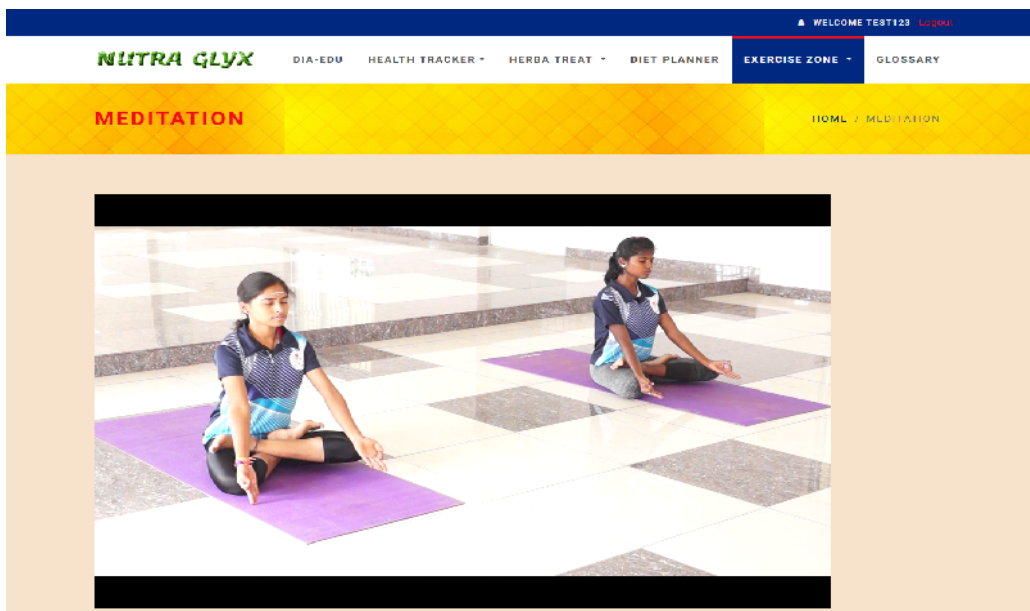
Screenshot 28: Display of Video on “Types of Yoga”

Further a click on the sub menu **“Exercise”** displays a sub menu options for **Walking and Running**. Selection of a particular exercise connects the user to their respective video clip on the right way of doing the selected exercise.



Screenshot 29: Display of Video on “Types of exercise”

A click on the sub menu **“Meditation”** educate the user on simple meditation techniques in the form of a video instruction.



Screenshot 30: Display of Video on “Meditation”

Evaluation of the software “*Nutra Glyx*”

The developed software *Nutra Glyx* was evaluated by 20 selected female type II diabetic subjects and 10 practicing dietitians for the usefulness and adaptability of the software at home / dietary departments using a three point rating scale. The observations of the results are tabulated and discussed below.

B. Evaluation of the software by “*Nutra Glyx*” by female type II diabetic subjects

The table (XVIII) projects the result of evaluation of the software “*Nutra Glyx*” by the selected female type II diabetic subjects.

Table XVIII
Evaluation of the Software by the Female Type II Diabetics (N=20)

Attributes	VE Score (40-60)	EFF Score (20-40)
Dia-Edu		
Ease of understanding the content	16	4
Effectiveness of video on “Take a look”		
Health tracker		
Adaptability of BMI-tracker	18	2
Authentication of BMI-tracker	19	1
Adaptability of bio-tracker	18	2
Authentication of bio-tracker	20	0
Herba treat		
Usefulness of nutraceutical recipes	17	3
Adaptability of nutraceutical recipes	19	1
Usefulness of nutrient content	16	4
Authentication of nutraceutical component given	19	1
Adaptability of new recipes	18	2
Ease of using and viewing the software	17	3
Usefulness of comparison of nutrient content between nutraceutical recipes and standard recipes	19	1

Attributes	VE Score (40-60)	EFF Score (20-40)
Diet planner		
Usefulness of diet planner	20	0
Adaptability of menu	18	2
Exercise zone		
Usefulness of exercise zone	20	0
Clarity of videos	20	0
Efficacy of the software		
Adaptability of the software in home/hospital dietaries	18	2
Duration of the software programmes		
Ease in using the software	19	1
Reliability of the software content	19	1
Presentation of the software content	20	0
Efficacy of a software in self-management of diabetes	20	0
	20	0

VE- Very Effective; EFF- Effective

From the above Table XVIII it is evident that on the whole the software was rated to be very effective and useful by selected female diabetic subjects. All the 20 female type II diabetic subjects rated the authentication of bio-tracker , reliability of the software content ,presentation of the software content, efficacy of a software in self-management of diabetes, usefulness of exercise zone and clarity of videos as very effective. Also 19 out of 20 female type II diabetic subjects rated Authentication of nutraceutical component given, usefulness of comparison of nutrient content between nutraceutical recipes and standard recipes and ease in using the software as very effective. Further it was also observed that none of the evaluator rated the software as not effective.

Evaluation of the software “Nutra Glyx” by the dieticians

Evaluation of the software “Nutra Glyx” by the selected ten practicing dietitians is projected in table XIX and discussed below.

Table XIX
Evaluation of the Software by the dieticians (N=20)

Attributes	VE (40-60)	EFF (20-40)
Dia-Edu		
Ease of understanding the content	7	
Effectiveness of video on “Take a look”		
Health tracker		
Adaptability of BMI-tracker	9	
Authentication of BMI-tracker	10	
Adaptability of bio-tracker		
Authentication of bio-tracker		
Herba treat		
Usefulness of nutraceutical recipes	10	0
Adaptability of nutraceutical recipes	9	1
Usefulness of nutrient content	9	0
Authentication of nutraceutical component given	10	0
Adaptability of new recipes	8	2
Ease of using and viewing the software	10	0
Usefulness of comparison of nutrient content between nutraceutical recipes and standard recipes	9	1
Diet planner		
Usefulness of diet planner	10	0
Adaptability of menu	8	2
Exercise zone		
Usefulness of exercise zone	10	0
Clarity of videos	10	0
Efficacy of the software		
Adaptability of the software in home/hospital dietaries	10	0
Duration of the software programmes	10	0
Ease in using the software	9	1
Reliability of the software content	10	0
Presentation of the software content	9	1
Efficacy of a software in self-management of diabetes	9	1

VE- Very Effective EFF- Effective

From the above Table XIX, it is evident that on the whole the software was rated to be very effective and useful by selected practicing dietitians. All the selected practicing dietitians rated the authentication of BMI-tracker, usefulness of nutraceutical recipes, authentication of nutraceutical component given, usefulness of diet planner , adaptability of the software in home/hospital dietaries ,duration of the software programmes, reliability of the software content as very effective. Further it was also observed that none of the evaluator rated the software as not effective.