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Effectiveness of a Structured Teaching Program on Knowledge and Practice Regarding Prevention of Type 2 Diabetes Mellitus among Adolescents in Selected Schools of Kerala, India

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Abstract:
*Background Type 2 diabetes mellitus (T2DM)has become a global epidemic with 451 million diabetics across the world and 69.2 million Indians. Kerala has 20% (1.24million) diabetics and 22.67% prediabetes from faulty lifestyle. Objectives: (i) assess and compare knowledge and lifestyle before and after intervention in control - experimental groups, (ii)find the relationship between knowledge and lifestyle practices in both groups, (iii) find if knowledge and lifestyle differ between rural and urban subjects (iv) find the association of knowledge and lifestyle with selected variables. Methodology: Quantitative, experimental, control - experimental groups and pretest- posttest design; 80 adolescents in 9th standards of 4 schools were selected randomly from urban and rural, Ernakulam. Twenty subjects from each school were assigned to control and experimental groups. Pretested, validated questionnaire and lifestyle inventory were tools used. Ethical clearance, school permission and assent obtained. Pretest was followed by STP to experimental group and posttest after 30days. Data was analyzed on SPSS. Results: T2DM was present in (56.2%)families,(43.8%) had no DM. Knowledge about risk factors(81.3%), complications (51.3%).Significant differences seen between pre - posttest knowledge (p=.003**) and lifestyle (p<0.001) in experimental group after STP. Significant correlation (p<0.05) seen between pre - posttest lifestyle among experimental group. Rural subjects showed significant difference in knowledge and activity between pretest and posttest(p<0.001).Mothers education had association with knowledge and lifestyle (p<0.01) and occupation with lifestyle (p=0.12).Conclusion: Education is effective to enhance knowledge and healthy lifestyle. Proactive campaigns against T2DM should include mothers for successful prevention of type 2 DM.*

Keywords: *Type 2 diabetes mellitus, knowledge, lifestyle, teaching program, adolescents*

1. Introduction

Type 2 Diabetes Mellitus (T2DM) has exacted an epidemic toll on developed and developing countries. Around **451** million people suffer from diabetes globally, projected to reach 642 million in 2040; the prevalence being 8.8%. Five million people died of diabetes in 2015, with a death every 6 seconds; every 11th person in the world is a diabetic. [i]

India has 69.2 million diabetics and 36.5 million with impaired Glucose Tolerance (IGT), accounts for 1 million deaths annually. South Indian states are more affected with Kerala reported to have 20% (1.24million) people with diabetes and 22.67% with prediabetes. Indians on average acquire diabetes 10 years earlier than their Western Counterparts. Recently, onset of diabetes has shifted to a younger age.[ii]Accurate number of adolescents with T2DM in India is unavailable. About 92,000 adolescents between 12 and 19 years of age are having pre-diabetes and at risk of progression to disease stage.[iii] *According to NCD clinic survey in 2015,* 1646newcases were detected from Idukki district including a 2-year-old child.[iv]The identified cases form only thetip of the iceberg.

1.1. Significance of the Problem

Diabetes goes undetected at early stages whereas 1/5 cases present with one or more complications at time of diagnosis. Diabetes is the leading cause of blindness, kidney failure, amputations, and heart attacks.[v]South Indian study of 368 children and adolescents with T2DM, reported micro vascular complications include retinopathy (26.7%), micro albuminuria (14.7%), neuropathy (14.2%), and nephropathy (8.4%).[vi]

The disease brings heavy economic burden on the family, demanding 2 to 5% of family income. Low income group spend up to one fifth of their income as direct and indirect cost of managing the disease.[vii] Intangible costs account for the pain, anxiety, inconvenience, lower quality of life and its impact on the patient and family.

Though no single cause has been identified, modifiable risk factors of T2DM are obesity[viii], lack of physical activity[ix, x]improper diet dense in calorie with fat, sugar, refined carbohydrate and salt can be prevented and controlled. Family history of diabetes, male gender[xi], females in puberty[xii], inadequately breast fed babies, thrifty genotype and Asian phenotype are non- modifiable risk factors.

Need for the study: India has 21% (243 Million) adolescent population. Increasing number of youth is getting obese in India, at risk of developing T2DM. Worldwide studies have reported inadequate knowledge regarding T2DM[xiii, xiv] among adolescents and recommend to create awareness through health education.[xv, xvi, xvii] Educational interventions among adults have shown positive outcomes.[xviii, xix, xx] However, few studies among adolescents are available on primordial prevention. Studies from India show relatively good knowledge, but risk factors are high[xxi] and preventive lifestyle least.[xxii]

The study aims at primordial prevention through imparting knowledge on T2DM, long term complications, its impact on life, susceptibility to develop T2DM at any age, and the possibility of prevention if a healthy lifestyle is followed. Investigator was interested to test if providing cost effective knowledge could bring a change in the lifestyle of children in their adolescent age.

Objectives of the study were (i)assess and compare the pretest and posttest knowledge and lifestyle practices namely food and activity pattern related to prevention of type 2 DM among adolescents in experimental and control groups,(ii) find the relationship between knowledge and lifestyle practices in experimental and control groups, (iii) find if knowledge and lifestyle related to prevention of type 2 DM differ between rural and urban adolescents and (iv) find the association between pretest knowledge and lifestyle practices with selected variables.

Research Hypotheses were stated as (i) H_1 There will be a significant difference between the mean pretest and posttest knowledge scores of adolescents after structured teaching program regarding prevention of T2DM (ii) H_2There will be a significant difference between the mean pretest and posttest lifestyle practice scores of adolescents after structured teaching program regarding prevention of T2DM. (iii) H_3 There will be a relationship between knowledge and lifestyle inventory scores of adolescents after teaching program regarding prevention of T2DM. (iv) H_4 There will be a significant difference between knowledge and lifestyle inventory scores of adolescents in urban and rural areas regarding prevention of T2DM. (v) H_5 There will be an association between pretest knowledge and lifestyle inventory scores with selected demographic variables of adolescents regarding prevention of T2 DM.

2. Methodology

The study was conducted using quantitative approach and experimental design with control-experimental groups and pretest-posttest design among 80 healthy adolescents studying in 9th standard of selected schools in Kothamangalam educational district, from urban and rural areas using random sampling. Twenty subjects were assigned to experimental and control from urban and rural areas, studying in CBSE and state syllabus. Tool consisted of (i) Lifestyle inventory to assess food habits and activity pattern, (ii) questionnaire to assess the knowledge on T2DM and socio-demographic profile. Structured Teaching program (STP) included information on Diabetes mellitus, its types, causes and risk factors, clinical manifestations and management, potential complications and preventive measures, including healthy lifestyle practices. Ethical clearance, formal permission and assent from subjects were obtained. Confidentiality was assured and data collected using investigator prepared, pretested, validated tools. Pretest was administered on day one, followed by administration of STP to experimental group. After 30 days, the posttest was administered to both experimental and control groups using the same tool. Sample was selected from different localities in order to avoid sample contamination. Knowledge questionnaire score range: 0-12, categorized as (0-4) poor, (5-8) average and (9-12) good. Lifestyle inventory with 12 healthy food items score range: 12-60 and unhealthy food habits with 15 items score range was 15-75. Activity pattern included 14 items with score: 0-14 and 8 items for sedentary activities with score 0-8. The collected data was analyzed using SPSS 18,as per objectives and hypotheses tested at $p<0.05$ for significance.

3. Results and Discussion

3.1. Socio- demographic Characteristics

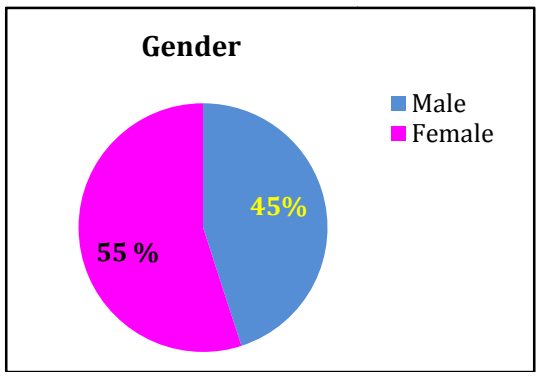

Figure 1: Distribution of subjects by gender

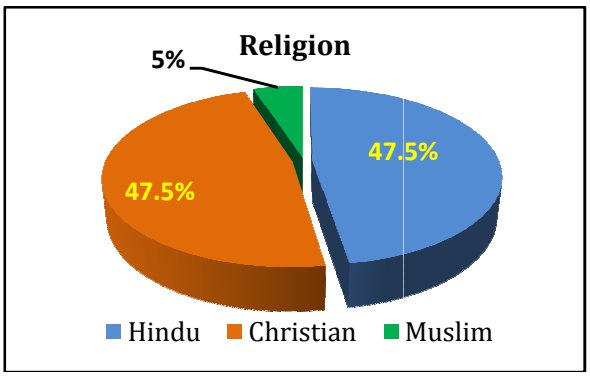

Figure 2: Distribution of subjects by religion

Majority subjects were 14 years old 61 (76.3%), females 44 (54%) (Figure 1), from rural 54 (67.5%), nuclear families 57(71.3%) and equally Hindus and Christians 38 (47.5%) (Figure 2) mostly first born 32(40%) (Figure 3)

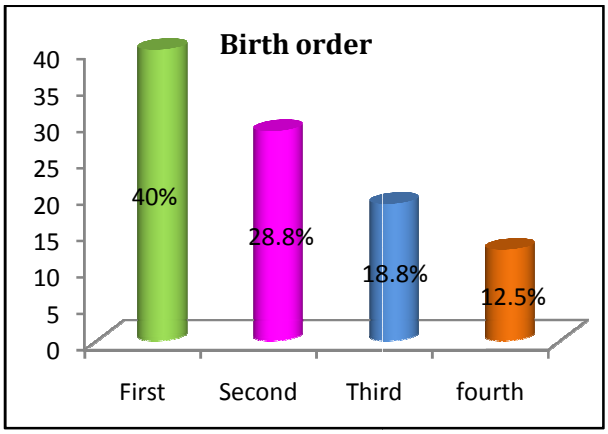

Figure 3: Distribution of subjects by order of birth

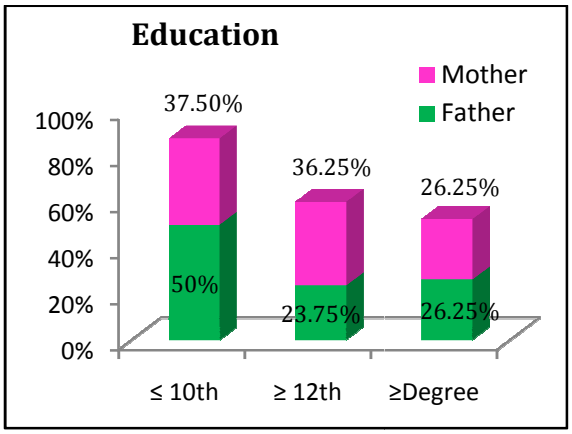

Figure 4: Distribution of subjects by parental education

Parents were educated up to 10th standard; fathers 36 (45%), mothers 28(35%), more mothers were up to 12th, 22(27.5%) than fathers 14(17.5%) while no one was illiterate (Figure 4).

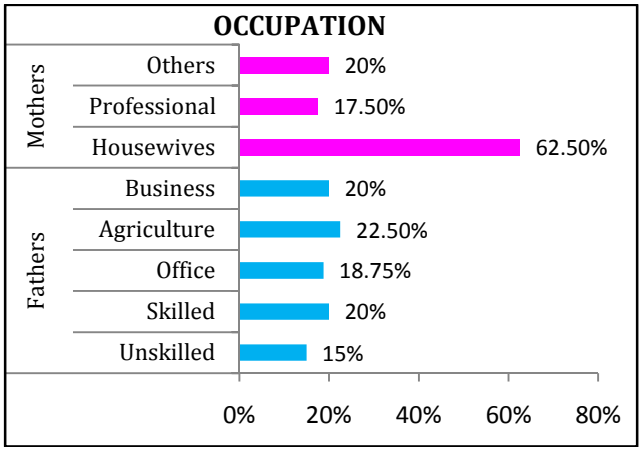

Figure 5: Distribution by parental occupation

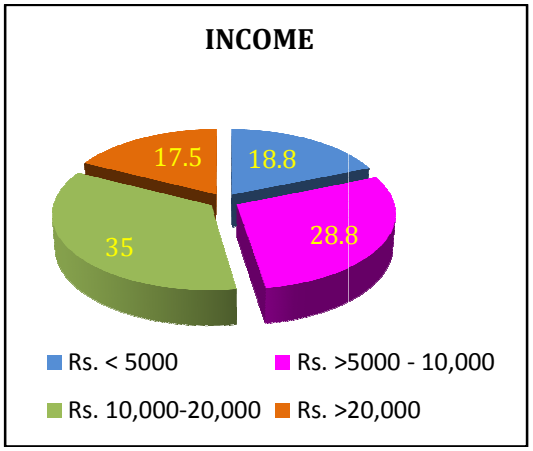

Figure 6: Distribution (%) by family income

Fathers occupation was agriculture 18 (22.5%), business 16(22%), skilled job 16(20%) or unskilled jobs 12(15%). Mothers were mostly housewives 50(62.5%) and professionals 11(13.8%) (Figure 5). Income varied between 10,000- 20,000 in 28(35%) and below 5000 in 15(18.8%) while 14 (17.5%) earned above Rs.20000/month (Figure 6). Subjects without family history of diabetes mellitus were only 35 (43.8%) while rest (56.2%) of them had parents, grandparents or both suffering from DM.

3.2. Knowledge and Lifestyle Related to Prevention of Type 2 Diabetes Mellitus

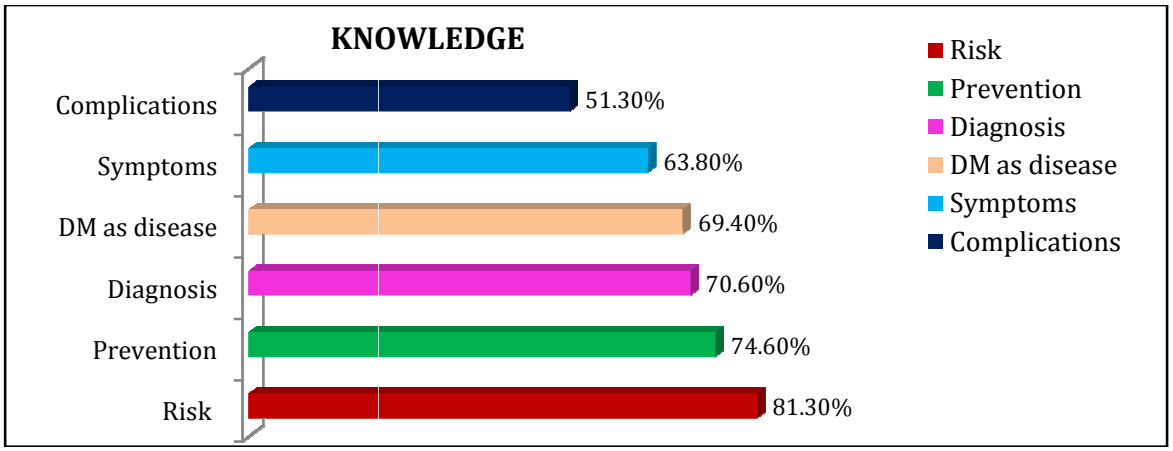

Figure 7: Distribution of subjects showing knowledge regarding type 2 diabetes mellitus

Majority subjects (81.3%) knew about risk factors and preventive measures (74.6%) whereas complications were least known (51.3%) (Figure 1)

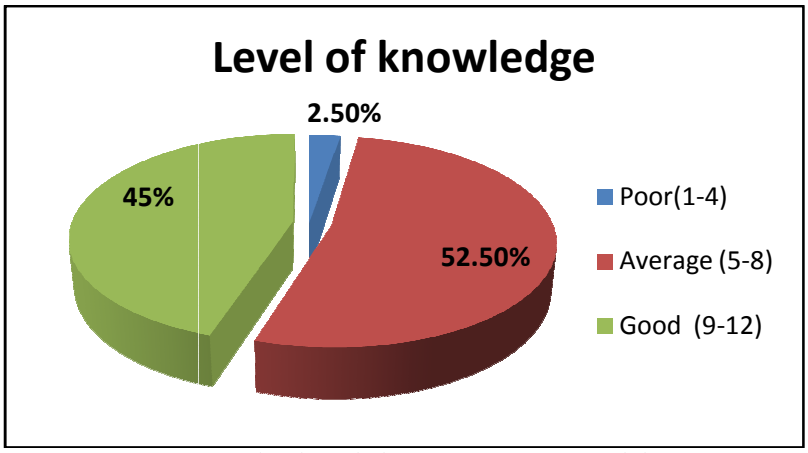

Figure 8: Level of knowledge onT2DM among adolescents

More than half (52.5%) of the sample had average knowledge and 45% had good awareness about T2DM, while a minority (2.5%) was poorly informed about T2DM (Figure 8).

GROUPS	Knowledge scores			
	Urban		Rural	
	Pre	Post	Pre	Post
	Mean ± SD (Range)			
Experimental	7.75 ± 2.0 (3-11)	8.70 ± 2.4 (0-11)	7.65 ± 2.2 (1-12)	9.6 ± 1.5 (6-12)
Control	8.20 ± 1.4 (5-11)	8.50 ± 1.6 (5-11)	9.70 ± 1.4 (7-12)	10.79 ± 1.1 (9-12)

Table 1: Knowledge related to Diabetes Mellitus among adolescents showing pretest and posttest scores group wise and area wise.

The pretest knowledge about T2DM among control group subjects; however, posttest score was high among experimental group after intervention. The control group from rural area scored highest during pre and posttests which shows increased awareness about diabetes among rural population of Kerala (Table-1).

GROUPS	AREA	Lifestyle practices – food habit score			
		Healthy		Unhealthy	
		Pre	Post	Pre	Post
		Mean ± SD (Range)			
Experimental	**Urban (n=17)**	29.65 ± 4.27 (19 – 37)	29.12 ± 6.24 (17- 41)	48.32 ± 4.37 (41 – 58)	52.26 ± 5.92 (39 – 60)
	Rural (n=16)	30.20 ± 5.97 (18 – 41)	31.26± 7.79 (15 – 49)	53.47 ± 3.44 (46 – 59)	54.71 ± 6.96 (40 – 66)
Control	**Urban (n=17)**	25.89 ± 3.81 (19 – 34)	34.16 ± 12.19 (20 – 62)	41.5 ± 3.94 (35 – 47)	54.47 ± 14.39 (37 – 106)
	Rural (n=14)	34.70 ± 14.08 (25 – 91)	30.89 ± 2.70 (26 – 35)	57.00 ±17.16 (39 – 93)	53.56 ±11.48 (34 – 93)

Table 2: Lifestyle practices related to Diabetes Mellitus among adolescents showing pretest and posttest scores of food habits group wise and area wise. (N=80)

The food habits are described in terms of frequency of consumption. A lower score indicates good habits for healthy foods reflecting a healthy habit and a higher score indicates infrequent consumption of healthy foods. In case of unhealthy foods, a lower score shows frequent consumption depicting an unhealthy food habits and a higher score indicates infrequent consumption.
The mean score of healthy and unhealthy food habits remained relatively stable in area wise and group wise analysis (Table-2). The control rural had highest pretest score in healthy food habits. In experimental group, healthy food intake remained stable. Unhealthy food intake reduced among urban and rural subjects. Similar finding was observed in control urban with no teaching (Tab-2).

An increase in mean activity score was observed in experimental group during posttest. Similar change observed in rural control group. However, no such change was observed in urban control group (Table-3).

Comparison of knowledge and lifestyle between before and after intervention showed significant difference in the knowledge of experimental group (t= -3,212; p =.003*) and unhealthy food habits (t= -2.719; p = .010*). In the control group, significant difference (t=-2.661; p=.011*) seen in knowledge without any significant changes in unhealthy food habits (p > 0.05). The activity pattern differed significantly in both groups (p<0.001) (Tab-4)

GROUPS	AREA	Lifestyle practices – activity score			
		Active		Sedentary	
		Pre	Post	Pre	Post
		Mean ± SD (Range)			
Experimental	Urban (n=20)	4.85 ± 1.53 (2 – 9)	12.32 ±1.45 (10 – 15)	2.65 ± 1.35 (0 – 5)	6.79 ± .79 (6 – 8)
	Rural (n=20)	4.85 ± 1.53 (3 – 8)	12.89 ±1.69 (9 – 15)	1.44 ± 0.51 (1 – 2)	6.94 ± .66 (6 – 8)
Control	Urban (n=20)	3.65 ± 2.06 (0 -7)	0.0±0.0 (0)	.50 ± 0.60 (.0 – 2.00)	5.5 ± .86 (4 – 7)
	Rural (n=19)	6.63 ± 2.97 (4 -15)	14.53 ±2.22 (11 – 22)	3.08 ± 0.64 (2 – 4)	5.64 ± 1.12 (4 – 8)

Table 3: Lifestyle related to Diabetes Mellitus among adolescents showing pretest and posttest scores of activities pattern group wise and area wise

GROUP	Variables	PRE	POST	Paired t-value	p-value
		Mean ± SD			
Experimental	Knowledge score	7.70± 2.09	9.15 ± 2.00	-3.212	.003*
	Healthy food habits	29.53 ± 5.22	30.25 ± 7.09	-.597	.554
	Unhealthy food habits	50.86 ± 4.63	53.34 ± 6.54	-2.719	.010*
	Activity healthy pattern	5.00 ± 1.51	12.63 ± 1.65	-22.227	.000**
	Activity –sedentary	2.09 ± 1.19	6.85 ± 6.85	-18.794	.000**
	Lifestyle score (overall)	86.15 ± 7.10	103.41 ± 11.55	-8.513	.000**
Control	Knowledge score	9.00 ± 1.57	9.62 ± 1.86	-2.661	.011*
	Healthy food habits	30.59 ± 11.46	32.68 ±8.94	-.910	.369
	Unhealthy food habits	48.69 ± 14.57	54.03 ± 13.64	-1.741	.091
	Activity healthy pattern	6.61 ± 3.05	14.56 ± 2.28	-8.953	.000**
	Activity –sedentary	1.36 ± 1.37	5.57 ± .96	-13.589	.000**
	Lifestyle score (overall)	98.86 ± 21.82	100.71 ± 10.26	-.212	.839

Table 4: Comparison of pre, posttest knowledge and lifestyle scores of adolescents group wise.
Significant at p<0.05, ** Significant at p<0.01, *** Significant at p<0.001.

Experimental group had Significant gain in knowledge (p=.003**) and lifestyle (p<0.001)after learning about diabetes. Hence the research hypotheses **H_1** and **H_2**were accepted as education improved the knowledge and changed lifestyle among healthy adolescents.

Relationship between knowledge and lifestyle in experimental and control groups between pretest and posttest scores was tested using Pearson Correlation Coefficients. The results are presented in correlation matrix below.

In control group, a highly significant (p<0.001) correlation between pre and posttest knowledge and a significant (p=0.034) correlation between posttest knowledge and pretest lifestyle score was observed among adolescents (Table-5).

Among experimental group subjects, significant (p=0.020) correlation was observed between pre and posttest lifestyle scores. No significant relationship was observed between knowledge and lifestyle practices. Hence research hypothesis **H_2** was rejected (Table-6).

Pearson Correlation (P value)	Knowledge		Food Healthy		Food unhealthy		Activity Healthy		Activity Sedentary		Lifestyle (Overall)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Knowledge Pre	1											
Knowledge Post	.657**	1										
	.000											
Food Healthy Pre	.116	.167	1									
	.481	.316										
Food HealthyPost	.134	.193	.086	1								
	.424	.247	.612									
Food unhealthy Pre	.225	.349*	.069	-.091	1							
	.186	.040	.694	.610								
Food unhealthy Post	.211	.202	-.084	.483**	.223	1						
	.211	.231	.626	.003	.212							
Activity Healthy Pre	-.010	.357*	-.016	-.117	.227	-.102	1					
	.952	.028	.922	.491	.183	.552						
Activity Healthy Post	.126	.326	-.391	-.184	.086	.032	.024	1				
	.606	.174	.097	.450	.760	.901	.923					
Activity Sedentary Pre	.329	.505**	.480**	-.180	.380*	-.264	.564**	.272	1			
	.062	.003	.005	.334	.038	.159	.001	.392				
Activity Sedentary Post	.299	.162	-.292	.146	-.255	-.122	-.245	.218	.036	1		
	.115	.402	.131	.457	.208	.538	.208	.520	.854			
Lifestyle. Pre	.275	.402*	.909**	.072	.561**	.009	.332	-.396	.666**	-.377	1	
	.149	.034	.000	.722	.002	.966	.078	.291	.000	.070		
Lifestyle. Post	-.011	.485	-.152	.472	.708*	.896**	-.002	.443	-.135	-.330	.094	1
	.974	.130	.655	.143	.050	.000	.995	.172	.710	.321	.842	

*Table 5: Correlation matrix showing relationship between knowledge and lifestyle among adolescents in control group with (p-value) (n=40) * Correlation significant at p<0.05 * * Correlation significant at p<0.01*

Pearson Correlation (p-value)		Knowledge		Food Healthy		Food unhealthy		Activity Healthy		Activity Sedentary		Lifestyle (Overall)	
Group		Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Exp	Knowledge Pre	1	.029	-.246	-.261	-.006	-.116	-.081	.274	.075	-.212	-.182	-.239
			(.857)	(.126)	(.123)	(.971)	.500	.632	.096	.657	.215	.302	.204
	Knowledge post		1	-.096	-.331*	.174	-.083	.355*	.165	-.203	-.047	.097	-.253
				.556	.049	.295	.632	.031	.323	.221	.786	.585	.178
	Food Healthy pre			1	.335*	.193	.066	-.104	-.137	.104	-.002	.796**	.221
					.046	.245	.703	.540	.411	.535	.992	.000	.240
	Food unhealthy Post				1	.291	.589**	-.293	-.257	-.230	.047	.361*	.900**
						.090	.000	.097	.137	.190	.797	.046	.000
	Food unhealthy Pre					1	.577**	-.037	-.069	-.159	-.065	.708**	.471**
							.000	.832	.689	.346	.713	.000	.009
	Food unhealthy Post						1	-.113	-.280	-.229	-.100	.370*	.864**
								.530	.103	.186	.575	.041	.000
	Activity Healthy Pre							1	.177	-.025	.036	.113	-.232
									.309	.888	.839	.526	.235
	Activity Healthy Post								1	.039	.047	-.121	-.161
										.822	.786	.510	.396
	Activity Sedentary Pre									1	-.122	.072	-.275
											.493	.687	.149
	Activity Sedentary Post										1	-.101	.030
												.591	.873
	Lifestyle Pre											1	.444*
													.020
	Lifestyle Post												1

Table 6: Correlation matrix showing relationship between knowledge and lifestyle in experimental group (n=40)

3.3. Comparison of Knowledge and Lifestyle between Urban and Rural Adolescents Showing Differences in Pre- Post Test Scores

SCORES	AREAS	PRE	POST	Mean difference	t-value	p-value
		Mean ± SD				
Knowledge	Urban (n= 40)	7.98 ± 1.73	8.60 ± 2.06	-.63	-1.682	.101 (NS)
	Rural (n=39)	8.72 ± 2.11	10.18 ± 1.43	-1.46	-4.174	<0.001***
Healthy food	Urban (n=35)	27.57 ± 4.40	31.91 ± 10.15	-4.34	-2.601	0.014*
	Rural (n=38)	32.36 ±11.18	31.07 ± 5.76	1.29	.687	.496(NS)
Unhealthy food	Urban (n=37)	44.91 ± 5.48	53.29 ± 11.06	-8.38	-4.769	<0.001***
	Rural (n=31)	55.65 ±12.35	54.12 ± 10.01	1.52	.636	.530 (NS)
Healthy activities	Urban (n= 19)	4.95 ± 1.51	12.32 ± 1.45	-7.37	-18.472	<0.001***
	Rural (n=34)	5.88 ± 2.56	13.82 ± 2.19	-7.94	-14.780	<0.001***
Sedentary activities	Urban (n=37)	1.54 ± 1.48	6.16 ± 1.04	-4.62	-19.782	<0.001***
	Rural (n=25)	2.08 ± 0 .95	6.44 ± 1.08	-4.36	-12.270	<0.001***
Lifestyle(overall)	Urban(n=17)	85.12 ±6.52	100.53 ±9.98	-15.41	-7.195	<0.001***
	Rural(n=17)	92.41 ±15.68	105.18 ±12.15	-12.76	-2.688	0.016*

Table 7: Comparison of knowledge and lifestyle scores (pre, post) between adolescents of urban and rural areas. (Independent t)

Highly significant differences were observed between pre and post test scores in rural adolescents in their level of knowledge, and activity patterns both healthy as well as unhealthy (p<0.001). Where as in urban subjects, significant difference was observed in their healthy food pattern (p = 0.014) while no difference in their level of knowledge. Highly significant differences were observed in activity pattern of both urban and rural subjects (p<0.001).

Overall, significant difference was observed in rural subjects level of knowledge (p<0.001) and lifestyle practices (p=0.016) when compared to urban subjects. Hence it is inferred that rural subjects were more receptive to health needs and information than urban counterparts (Table-7).

3.4. Association of Knowledge and Lifestyle with Other Variables

Mothers education displayed significant association with knowledge (χ^2 = 86.680, p<0.003) and lifestyle (χ^2=259.859, p=0.005) while mothers' occupation indicated significant association with lifestyle (χ^2 =252.262, p=0.12). Age, gender, religion, habitat, type of family, birth order, father's education and occupation, family income or diabetes in the family did not show any significant association with knowledge or lifestyle of adolescents (Table-8).

Variable	Pretest score	χ^2 -value	p-value
Education of Mother	Knowledge	86.680	.003**
	Lifestyle	259.859	.005**
Occupation of Mother	Lifestyle	252.262	.012*

Table 8: Association of pretest knowledge and lifestyle scores with selected variables
*** Significance at p<0.01, * Significance at p<0.05*

3.5. Discussion

Present study found fairly good awareness about risk factors, prevention and diagnosis and low awareness about complications among adolescents.

Despite fairly better understanding about diabetes, studies have reported low awareness about risk factors, complications and management of DM among adolescents. Holla R et.al from Mangalore reported that 57.83% of 600 pre university students knew that DM could result in complications.[xxiii] A cross-sectional survey among 4333 adolescents from Kuwait regarding knowledge of diabetes, found 55.8% knew about complications.[xxiv]Present study had similar results, but only (51.3%) knew about complications.

Ansari S. et.al from Mangalore reported inadequate knowledge about risk factors among 600 university students; only 7.3% knew physical inactivity as risk factor, 5.5% and 5.3% subjects were aware of family history and obesity increases the risk of DM.[22] Present study found distinct results: knowledge about risk factor was 81.3%.

University students have higher rate of correct answers regarding what is diabetes (p =0.014), treatment regimens (P <0.001) and disease complications (P <0.001) compared to high-school students.[xxv] Poor knowledge levels about T2DM were found among school students.[xxvi]Awareness about preventive measures was reported poor among adolescents. [23], [25, 26] Opposing this, present study found 74.6% awareness regarding prevention of T2DM. Despite high awareness about T2DM, Mahajerin et al. found a high rate of self-reported risk factors among adolescents.[21] Present study had similar observation.

Lifestyle inventory found unhealthy food habits and sedentary activities were prevalent with a significant change in in both groups(p<0.001). Subjects from control rural were more active physically and less involve in sedentary behavior. Food habits

remained relatively stable in both groups with significant change in unhealthy food habits among experimental group after intervention. This reflects the impact of family food habits on lifestyle practices in Kerala.

Singh et al from Delhi reported fast food intake >3times weekly, extra salt intake and very low (39.4%) consumption of fruits daily and lack of physical activity for at least 60 min a day for three days a week among 510 children of 12- 18 years.[xxvii]Several studies have reported unhealthy food habits among adolescents[xxviii,xxix, xxx, xxxi]Present study had comparable findings: intake of chocolates, bakery items, fried foods, hotel foods and pickles and low intake of salads and fruits.

Activity pattern found sedentary activities high at school: sitting in class, homework, tuition and screen time.[xxxii] Age, media availability in bedroom, sleeping time, breakfast consumption and season were reported to be associated with physical inactivity and sedentary behavior among adolescents.[xxxiii]

Present study found subjects engaged in walking, cycling, swimming, playing games and doing yoga besides helping their parents at home or work. Sedentary activities included watching television or playing video games. More than half of the subjects commuted to school by walking or cycle.

The rural subjects were found to be more aware of diabetes and followed preventive measures in terms of food habits and activities than urban subjects.

4. Conclusion

The study findings support feasibility of prevention of type 2 diabetes mellitus in adolescents through structured teaching program before they develop modifiable risk factors. Mothers play an important role in knowledge and lifestyle of adolescents as there was a significant association observed with mother's education and occupation. Hence the proactive campaign should target and include mothers for successful prevention of type 2 DM. **Educate a girl child to save the nation!**

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6. References

i. IDF Diabetes Atlas 7th Edition (2015) Accessed on 31/8/2016 from: IDF_Atlas 2015_UK
ii. Mohan V, Sandeep S, Deepa R, Shah B, Varghese C. (2007). Epidemiology of type 2 diabetes: Indian scenario. Indian J Med Res 125, p 217-230. Accessed on 11/28/2015 from: http://www.icmr.nic.in/ijmr/2007/march/0302.pdf
iii. Sunni M, Mays R, Kaup T, Nathan B , and members of the Minnesota Department of Health Diabetes Steering Committee (2011) CLINICAL AND HEALTH AFFAIRS Recognizing and Managing Type 2 Diabetes Mellitus in Children an Algorithm for Primary Care Providers. Accessed on 9/11/2015 from: http://www.minnesotamedicine.com/Past-Issues/Past-Issues-2011/August-2011/Recognizing- Managing-Type-2-Diabetes-Mellitus
iv. News in Malayala Manorama, dated 11/14/2015 Accessed on 11/16/2015 from: http://epaper.manoramaonline.com/edaily/flashclient/Client_Panel.aspx#currPage4
v. Van Dieren S, Beulens JWJ, Van Der Schouw YT, Grobbee DE, Neal B. (2010) The global burden of diabetes and its complications: an emerging pandemic. Eur J Cardiovasc Prev Rehabil. Vol.17 Suppl 1:S3–8.
vi. Amutha A, Datta M, Unnikrishnan R, Anjana RM and Mohan V (2012) Clinical profile and complications of childhood- and adolescent-onset type 2 diabetes seen at a diabetes center in south India. Diabetes Technol Ther. Vol. 14; 497-504.| Article | PubMed
vii. Chandra P, Gogate B, Gogate P, Thite N1, Mutha A et.al.(2014) Economic Burden of Diabetes in Urban Indians. THE OPEN OPHTHALMOLOGY JOURNAL. Accessed on 12/13/2015 from: http://www.researchgate.net/publication/272188640
viii. Wood JR, Kaufman and FR (2012) Childhood diabetes In: Atlas of Diabetes, eth Ed. Edited by Skyler, JS. New York, Springer, 115-148.
ix. Leech RM, McNaughton SA, Timperio A.(2014) The clustering of diet, physical activity and sedentary behavior in children and adolescents: a review. Int J Behav Nutr Phys Act. 11:4.
x. Jordan DN, Jordan JL. Pediatric type 2 diabetes mellitus complications: a systematic review of the literature | Journal of Diabetes Research and Clinical Metabolism. Accessed on 11/12/2015 from: http://www.hoajonline.com/jdrcm/2050-0866/1/24
xi. Wei J N, Li H Y, Wang Y C, Chuang L M, Lin M S, et.al.(2010) Detailed family history of diabetes identified children at risk of type 2 diabetes: a population-based case-control study. Pediatr Diabetes, 11:258-64.| Article | PubMed
xii. Awa W L, Fach E, Krakow D, Welp R, Kunder J, et.al. (2012) Type 2 diabetesfrom pediatric to geriatric age: analysis of gender and obesity among 120,183 patients from the German/Austrian DPV database. EurJ Endocrinol, 167: 245- 54. | Article | PubMed
xiii. Cullen KW, Buzek BB.(2009) Knowledge about type 2 diabetes risk and prevention of African-American and Hispanic adults and adolescents with family history of type 2 diabetes. Diabetes Educ. 35(5):836-42.
xiv. LeClair C-A, Marquis M, Villalon L, Strychar I.(2009) Healthy Adolescents' Social Representations of Diabetes. Canadian Journal of Diabetes.33 (3):170-9. Accessed on 9/25/2015from:http://www.canadianjournalofdiabetes.com/article/S1499267109330087/abstract
xv. B A N Okoh, T Jaja (2014) Knowledge and awareness of diabetes among adolescents in Port Harcourt Nigeria. African Journal of Diabetes Medicine (2): 18-20 Accessed on9/25/2015 from: http://africanjournalofdiabetesmedicine.com/articles/november_2014/AJDM-490%20(Okoh).pdf

xvi. Al-Mutairi RL, Bawazir AA, Ahmed AE, Jradi H.(2015) Health Beliefs Related to Diabetes Mellitus Prevention among Adolescents in Saudi Arabia. Sultan Qaboos Univ Med J. (3):e398–404. Accessed on 9/14/2015 from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4554276/

xvii. Khan N, Gomathi KG, Shehnaz SI, Muttappallymyalil J.(2012) Diabetes Mellitus- Related Knowledge among University Students in Ajman, United Arab Emirates. Sultan Qaboos University Med J, (3): p 306-314, Epub 15thJul12.Accessedon12/6/2015from:http://www.researchgate.net/publication/230716546_Diabetes_Mellitus-Related_Knowledge_among_University_Students_in_Ajman_United_Arab_Emirates

xviii. Omisore AG, Alebiosu CO, Abe OS, Kolawole BA, Familoni OB,Adeleye JO et.al. Awareness and knowledge about diabetes mellitus and hypertension amongst adolescents in secondary schools, Oyo State, Nigeria – an + interventional Study by the SIDCAIN Research Group 1 1 2 3 4 5 3 5. Accessed on 9/25/2015 from: http://www.academia.edu/8005207/Awareness_and_knowledge_about_diabetes_mellitus_and_hypertension_amongst_adolescents_in_secondary_schools_Oyo_State_Niger ia_an_interventional_Study_by_the_SIDCAIN_Research_Group_1_1_2_3_4_5_3_5

xix. Unadike BC, Chineye S.(2009) Knowledge, awareness, and impact of diabetes among adolescents in Uyo, Nigeria.Accessedon12/6/2015from:http://www.africanjournalofdiabetesmedicine.com/articles/may_2009/Knowledge,%20awarenes s,%20and%20impact%20of%20diabetes%20among%20adolescents%20in%20Uyo,%20Nigeria.pdf

xx. Azinge N.(2013) Healthy adolescents' knowledge of diabetes mellitus in a semi-urban community in South-South Nigeria. Orient Journal of Medicine.;25(3-4):126–30. Accessed on 9/25/2015 from: http://www.ajol.info/index.php/ojm/article/view/94510

xxi. Mahajerin A, Fras A, Vanhecke TE, Ledesma J.(2008) Assessment of Knowledge, Awareness, and Self-Reported Risk Factors for Type II Diabetes Among Adolescents Keywords: Diabetes, Adolescence, Intervention, Self-report, Risk factors. Journal of Adolescent Health (2):188–90.Accessed on 9/14/2015 from: http://linkinghub.elsevier.com/retrieve/pii/S1054139X08000840

xxii. Ansari S, Samaga S, Rao S, Gowda S, Mohammed T, et.al (2014), Awareness of risk factors of diabetes and practices regarding its prevention among the adolescents. Nitte University Journal of Health Sciences 4(1):79-81 Accessed on 12/6/2015 from:http://www.nitte.edu.in/journal/March%202014/79-82.pdf

xxiii. Holla R, Prabhu S, Shetty S, Deshpande S, Balla K S, et.al.(2014) Awareness about diabetes among adolescents of Mangalore, South India. NUJHS. 4(2): p-118-20. Accessed on 9/25/2015 from: http://nitte.edu.in/journal/June2014/118-120.pdf

xxiv. Al-Hussaini M, Mustafa S. (2016) Adolescents' knowledge and awareness of diabetes mellitus in Kuwait. Alexandria Journal of Medicine. Accessed on 9/25/2016 from: http://www.sciencedirect.com/science/article/pii/S2090506815000251

xxv. Blaslov K , Brcina N. (2014) Diabetes knowledge among Croatian non-medical high school and university students. Int J Diabetes Dev Ctries) 34(1): 101007/s13410-013-0171-x. Accessed on 12/6/2015 from http://download.springer.com/static/pdf/956/art%253A10.1007%252Fs13410-013017x.pdf?originUrl=http%3A%2F%2Flink.springer.com%2Farticle%2F10.1007%2Fs134100171x&token2=exp=1449415216~acl=%2Fstatic%2Fpdf%2F956%2Fart%25253A10.1007%25252Fs13410x.pdf%3ForiginUrl%3Dhttp%253A%252F%252Flink.springer.com%252Farticle%252F10.1007%252Fs13410x*~hmac=d7a2b3e6669d14c6847d97704397a790585d014f660d8050f827b9bd5002a207

xxvi. Al-Mahrooqi B, Al-Hadhrami R, Al-Amri A, Al-Tamimi S, Al-Shidhani A, et.al.(2013) Self-Reported Knowledge of Diabetes among High School Students in Al Amerat and Quriyat, Muscat Governate, Oman. Accessed on 12/6/2015 from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3749023/

xxvii. Singh A K, Maheshwari A, Sharma N, Anand K.(2006) Indian Journal of Pediatrics. 73(10) : 901-906. Lifestyle Associated Risk Factors in Adolescents. Accessed on 12/6/2015 from: http://www.nipccd.nic.in/reports/eag.pdf

xxviii. Moreno LA, Gottrand F, Huybrechts I, Ruiz JR, González-Gross M, et al.(2014) Nutrition and lifestyle in european adolescents: the HELENA (Healthy Lifestyle in Europe by Nutrition in Adolescence) study. Adv Nutr. (5):615S – 623S. Accessed on 9/24/2015 from: http://www.ncbi.nlm.nih.gov/pubmed/25469407

xxix. Al-Hazzaa HM, Abahussain NA, Al-Sobayel HI, Qahwaji DM, Musaiger AO(2011) Physical activity, sedentary behaviors and dietary habits among Saudi adolescents relative to age, gender and region Int J Behav Nutr Phys Act. 8:140.

xxx. Kilani H, Al-Hazzaa H, Waly MI, Musaiger A (2013) . Lifestyle Habits Diet, physical activity and sleep duration among Omani adolescents. Sultan Qaboos University Med J, 13(4): p 510-19 Accessedfrom:http://www.researchgate.net/publication/249225053_Lifestyle_Habits_Diet_Physical_Activity_and_Sleep_Duration_among_Omani_Adolescents

xxxi. Kotecha PV, Patel SV, Baxi RK, Mazumdar VS, Shobha M, et al.(2013) Dietary Pattern of School going Adolescents in Urban Baroda, India. J Health Popul Nutr (4):490–6. Accessed on 9/20/2015 from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3905643/

xxxii. Jama AO (2013) Levels of Sedentary Activity among Adolescent Boys and Girls in Bijapur, India [MPH] Emory University Accessed on 10/5/2015 from: http://pid.emory.edu/ark:/25593/dwqjk

xxxiii. L.S. Yun et al.(2007)Patient Education and Counseling 69: 47–54 www.elsevier.com/locate/pateducou