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EPIDEMIOLOGICAL STUDIES ON TYPE-2 DIABETES MELLITUS IN KAANI TRIBES OF KANYAKUMARI DISTRICT, TAMIL NADU, INDIA.

ABSTRACT

Health is a vital aspect of life. It is determined by the controlled way of life activities. This includes hygienic and balanced nutrition, good habits and holistic environment. Any disturbance(s) in any one of these factors may cause ill-health. Transition in life-style, environment and hereditary (or) genetic traits independently (or) jointly lead to a life threatening metabolic syndrome / disorder known as diabetes.

Diabetes, a new challenge to the modern world, handicaps enormous number of people. It is considered as one of the front runners of death and disability in the entire globe. Diabetes prevalence among the modern men is quite acceptable because of their life-style changes. But its emergence among the nature's people (i.e) jungle tribes is a grave concern to the health status of this primitive group.

The present epidemiological studies on Type-2 Diabetes mellitus (T2DM) shows 1.2 percent disease prevalence in Kaani tribes. The sex and age specific prevalence, impact of body-mass index, waist-hip ratio, systolic pressure, socio-economic status, habituation, physical activities and blood groups on diabetes are well discussed.

KEY WORDS: Body mass index, kaani tribes, metabolic syndrome, Type-2 Diabetes mellitus, waist-hip ratio.

INTRODUCTION

After the dawn of civilization, man has started using adequate level of nutrients, especially sugar and sugar enriched stuffs. More over, uncontrolled way of life is the root cause of all sorts of miseries and many ill-fated diseases to mankind. Of course, diabetes is one such kind of its nature. Diabetes mellitus, a predictable and preventable metabolic disorder is becoming a global epidemic¹. It is predicted that the diabetes incidence will be doubled in most nations within 20 yrs and 19 percent world's diabetic cases are Indians.²

Diabetes mellitus is a group of chronic metabolic conditions with elevated blood glucose levels due to the body's inability to produce insulin (or) resistance to insulin action (or) both.³ The etiology of the disease is multi-factorial in nature. Some of the prime risk factors for the onset of diabetes and its associated complications include body mass index (BMI),^{4,5} age,^{6,7} ethnicity,⁸ family history,^{8,9} sedentary life style and lack of physical activity,^{10,11} sex,^{7,12} many set of genes,¹³ socio-economic status,¹⁴ waist-hip ratio,¹⁵ and systolic blood pressure.¹⁶

Studies on diabetes prevalence show that around 6-12% in urban and 2-3% in rural Indian populations are recorded.^{17,18} An accelerated increase of diabetes is noticed in tribal (or) aboriginal populations worldwide.¹⁹ Developing nations especially south east Asian countries show increasing level of Type-2 diabetes.²⁰ Metabolic syndrome is found as a common one even in traditional ethnic groups,^{6,21,22} but such studies in hill tribes in India is almost very little.

Almost all the studies in hill tribes are only focused on ethnobotany.²³⁻²⁶ In order to ascertain the existence of diabetes among the present Kaani tribes of Kanyakumari district an epidemiological study is conducted. The main objectives are: i) to assess the prevalence of T2DM ii) to identify the various known and unknown risk factors in the survey group iii) to find out the impact of habitat on the incidence of diabetes iv) to evaluate the role of individual, environment and heredity on the incidence of diabetes.

MATERIALS AND METHODS

Study area

The present epidemiological studies on T2DM has been carried out in Kanyakumari District, the southern land mark of the Indian sub-continent. This smallest district in Tamil Nadu with a land spread of 1684 Km², has a varied topography with sea on three sides and lush green mountains of the Western Ghats bordering the northern side. The district lies between 77°5' of the eastern longitudes and 8°03' and 8°35' of the northern latitudes. Of the total district area of 1684 Km², government forests occupy an area of 504.86Km², which comes to about 30 percent of the total geographical area of the district, which is about 75 million years old.²⁷ The study area includes 13 Kaani settlements (Viz) Manalodai, Kollenchimadam, Mukkaraikal, Valiyamalai, Koruvakuzhi, Paduparai, Killikonam, Pechipparai, Mothiramalai, Kadayalumoodu, Karayankuttikunnu, Valayanthooki and Alamparai.

Study subjects

Kaanis (or) Kanikkars are tribals inhabiting the jungles in Kerala State, and in the south eastern slopes of the Western Ghats in Kanyakumari and Tirunelveli District in Tamil Nadu, India.²⁸ They are one of the oldest groups of ethnic people in South India and these traditional nomads, now lead a primarily settled life in the forests.²⁹

Kaanis are native, endogamous, non-vegetarian, Hindu, most primitive jungle tribes, called as Kanikkar by the "Puranic Sage" Agastya signifying the hereditary proprietors of the land. Kaanis are originally hunters and honey gatherers, they have taken to settled agriculture and to paid work as agricultural and plantation workers.²⁹

The study covered a sizable number of Kaanis of Kanyakumari District (i.e) 1000 subjects which includes 503 (50.3%) males and 497 (49.7%) females of age between 17-89 years. These subjects are residing in 13 settlements and the survey covered a distance of approximately 25 Km (on road). The present study is carried out during the period March 2011 to February 2012.

Standard methods are used for the various anthropometric measurements (BMI,³⁰ waist-hip ratio, ³⁰ BP,³¹), blood grouping,³² and screening of patients.³³ Door to door survey has been carried out to collect the data with a standard questionnaire. Priority has been given to human values during the data collection and Ethics Committees' guidelines have been strictly adhered during the survey. Statistical analysis of the data has been made with SPSS statistical package.³⁴

RESULTS

The present study reveals the incidence of diabetes in Kaani tribes and the result is given in table.1. The study covers 1000 subjects including 503 (50.3%) males and 497 (49.7%) females of primitive jungle tribes who are settled in 13 different settlements in Kanyakumari district. The over all disease prevalence is 1.2% which includes 0.8% in males and 1.6% in females of 51 – 88 yrs. It is evident from the table that diabetes is detected only in three places with low incidence rate. It is 2.84 % in Kollenchimadam settlement, 5.68% in Mukkaraikal area and 6.82% in Mothiramalai. Diabetes prevalence is noticed both in males and females of Kollenchimadam and Mothiramalai areas, where as it is detected only in females of Mukkaraikal and the disease prevalence ratio in males and females is 1:2.

Some of the prominent demographic characteristics of the Kaani tribes are denoted in table.2. It is very clear from the table that, around 86.9% subjects are middle aged people (i.e) < 52 yrs old and the rest 13.1% are more than 52 years old. The lowest age of the study subject is 17 yrs and the highest age is 89 yrs. Study also shows that, only one diabetic subject is 51 yrs and the rest 11 patients are above 52 yrs of age. The study further shows that, all the 12 patients are economically poor, newly detected cases, they are married to their closely related people and found as mixed diet users. It is also found that, 3.3% smokers, 1.1% tobacco users and 0.7 %people with alcohol and smoking habits are having diabetes. A moderate level of incidence of diabetes (i.e) 7.27% is observed in sedentary group and only a marginal level of diabetes prevalence is detected in labourers (0.45%).

The obesity characteristics is collected as BMI, which is a risk factor for T2DM and a significant health problem worldwide. It is well known from the table.3. that, there is no diabetic case in under weight category, 0.5% diabetics are normal weight group subjects, 4.3% patients are over weight cases and 66.7% diabetics are obese. It is also clear that, no diabetics in < 80 waist-hip ratio category, 2.84% are coming under 0.81 – 0.9 category, 0.61% are showing 0.91 – 1.0 waist-hip ratio and 50% cases are having 1.1 – 1.2 waist-hip ratio. Further, the study confirms that, 1.3% diabetics are with apple shaped body and 1.1% diabetics are having pear shaped body.

Blood pressure, one of the serious health concerns in man is also playing a key role in diabetic complications. The present study denotes that, all the diabetic cases are having the systolic pressure between 120-189. The study further confirms the blood group specific incidence of diabetes. There is 1.0% incidence in 'A' group, 0.8% in 'B' group, 1.5% in 'AB' group and 1.7% in 'O' group. It is also quite interesting to note that, 'Rh' positive persons seem to be highly susceptible to diabetes than the negative blood group people. In the present study, out of 12 diabetics, 10 (83.33%) are with 'Rh + ve' blood groups.

DISCUSSION

Diabetes is on the rise in Asian countries,²⁰ and an accelerated increase in tribal (or) aboriginal populations worldwide,^{6,19,21,22,35} but such studies in jungle tribes in India are scanty. The present epidemiological studies on T2DM is carried out in a primitive jungle tribe Kaanis in Kanyakumari District to analyse the extent of this disease.

The prevalence of diabetes among different sexes is a controversial one. Earlier studies reveal the male sex specific,^{7,12,36} female sex specific,^{37,38} and sex non-specific¹⁸ prevalence of diabetes. Female sex specific (1.6% in females and 0.8% in males) prevalence of diabetes has been noticed in the present study, which is contrary to our previous study in an agrarian community in Kanyakumari District.³⁶

Many studies are in support of age – specific onset of T2DM.^{6,7,39,40} All of our diabetics are newly detected ones, hence the age of onset of the disease is unknown. The minimum and the maximum age of the diabetic subjects are 51 and 88 yrs respectively. Further more, metabolic syndrome is on the run in this jungle group which may be under the control of gene. Lack of literature on hill tribes is a handicap to justify the impact of heredity (inheriting), individual life-style (inviting) and / or environment (imposing) on diabetes. One tribal study in diabetes on hill tribes explains the possible role of heredity and the existence of this disease.⁴¹

Obesity (or) weight gain is a major risk factor for T2DM.⁴² The relationship between BMI and diabetes mellitus is reported by many researchers.^{4,43,44} It is true in our study too. 67% diabetics are found as either over weight (or) obese subjects. WHR has been used as an indicator (or) measure of the health of a person, and the risk of developing serious health conditions. The importance of WHR and diabetes is observed by some authors.^{45,46} The present study also supports the previous findings with a positive correlation of $r = 0.69$ is noticed between the non-diabetic and diabetic subjects.

The clinical association between hypertension and diabetes has been well discussed by previous studies.^{16,47} A two fold prevalence of hypertension in diabetics than the non-diabetics is explained by one study,¹⁶ and its co-existence in T2DM may be a part of insulin resistance (or) metabolic syndrome.⁴⁸

It has been found that an elevated systolic pressure is noticed in our diabetic subjects ($r = 0.38$ non-diabetics Vs diabetics) and it correlates with the previous studies also.

Sedentary lifestyle denotes a type of lifestyle with no (or) irregular physical activity,⁴⁹ and it increases the likelihood of development of insulin resistance.⁵⁰ The importance of physical activities on diabetes is well known from the present study, where 67% diabetics are with no physical activities. Reports show that incidence of diabetes is lower in vegan,^{51,52} and it may be effective in managing T2DM.⁵³ It is true in our study also. The impacts of alcohol,⁵³ and smoking⁵⁴ on diabetes have been discussed by previous studies. A positive correlation ($r=0.69$) between non-diabetics and diabetics with different habits has been observed in the present study also.

More diabetic prevalence among low income population has been traced out in previous studies.^{14,54} Our study too coincides with the previous ones, and all of our diabetics are poor people. The present study paves a way to understand the relationship between blood groups and genetic susceptibility to T2DM. Previous studies show that blood groups have no absolute connection with diabetes.⁵⁵⁻⁵⁷ Our study also corroborates with the previous findings.

CONCLUSION

Diabetes pandemic is a new challenge to the modern world. The incidence may vary from nation to nation, area to area, people to people and even in the same group people. The heterogeneous (or) differential prevalence among people is decided by their socio-economic, cultural and topographical conditions. Metabolic syndrome is found as an inseparable problem even in traditional ethnic groups. Metabolic diseases are decided partly or jointly by lifestyle factors, genetic constitution of the people and the environment. A low level of incidence of T2DM in the present primitive jungle tribe may be due to their life style changes and genetic constitution. The incidence of diabetes in 50 plus aged people reveals that it is an age-related illness. It also envisages that it is not confined to any group of people, but it is a cosmopolitan disease to the entire global community. Since, it is a multifactorial disorder, the authorities should take stringent measures to keep control of this dreaded killer among this helpless jungle people.

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**Table.1. denotes the sex-wise distribution and the prevalence of diabetes in Kaani tribals.
(n = 1000 subjects; 503 males + 497 females)**

Sl. No	Name of the areas	Males		Females		Total	
		Non-diabetics	Diabetics	Non-diabetics	Diabetics	Non-diabetics	Diabetics
1.	Manalodai	160	-	119	-	279	-
2.	Kollenchimadam	76 (97.43)	2 (2.56)	61 (96.83)	2 (3.17)	137 (97.16)	4 (2.84)
3.	Mukkaraikal	35	-	48 (90.57)	5 (9.43)	83 (94.32)	5 (5.68)
4.	Valiyamalai	35	-	41	-	76	-
5.	Koruvakuzhi	33	-	39	-	72	-
6.	Paduparai	24	-	45	-	69	-
7.	Killikonam	31	-	34	-	65	-
8.	Pechipparai	25	-	28	-	53	-
9.	Mothiramalai	20 (90.91)	2 (9.09)	21 (95.45)	1 (4.55)	41 (93.18)	3 (6.82)
10.	Kadayalamoodu	20	-	18	-	38	-
11.	Karayankuttikunnu	18	-	16	-	34	-
12.	Valayanthooki	18	-	15	-	33	-
13.	Alamparai	04	-	04	-	08	-
14.	Total	499 (99.2)	4 (0.8)	489 (98.4)	8 (1.6)	988 (98.8)	12 (1.2)

(Figures in parentheses are percentage values)

Table.2. reveals some prominent demographic characteristics in Kaani tribes.
(n = 1000 subjects; 503 males + 497 females)

Characteristics	Non – diabetics	Diabetics	Total
Study subjects	988 (98.8)	12 (1.2)	1000
Males	499 (99.2)	4 (0.8)	503 (50.3)
Females	489 (98.4)	8 (1.6)	497 (49.7)
Age of detection (Yrs) : < 52	868 (99.9)	1 (0.1)	869 (86.9)
> 52	120 (91.6)	11 (8.4)	131 (13.1)
Marriage : closely related	206 (94.5)	12 (5.5)	218 (21.8)
distantly related	747 (100)	-	747 (74.7)
Economic status : poor class	988 (98.8)	12 (1.2)	1000
Food habits : Vegan	2 (100)	-	2 (0.2)
Mixed diet	986 (98.6)	12 (1.2)	998 (99.8)
Habituation : tobacco (chewing)	442 (98.9)	5 (1.1)	447 (44.7)
smokers	119 (96.7)	4 (3.3)	123 (12.3)
alcohol + smoking	400 (99.3)	3 (0.7)	403 (40.3)
teetotallers	27 (100)	-	27 (2.7)
Physical activities :sedentary	102 (92.73)	8 (7.27)	110 (11.0)
skilled labourers	886 (99.55)	4 (0.45)	890 (89)

(Figures in parentheses are percentage values)

t and r values : non –diabetics vs diabetics

habituation, $r = 0.69$; physical activities, $r = -1$

**Table.3. illustrates some of the anthropometric measures in Kaani tribes.
(n = 1000 subjects; 503 males + 497 females)**

Parameters		Non-diabetics	Diabetes	Total
BMI :	< 18.5	82 (100)	-	82 (8.2)
	18.51 – 24.99	770 (99.5)	4 (0.5)	774 (77.4)
	25 – 29.99	135 (95.7)	6 (4.3)	141 (14.1)
	30 and above	1 (33.3)	2 (66.7)	3 (0.3)
WHR :	< 80	5 (100)	-	5 (0.5)
	0.81 – 0.9	171 (97.15)	5 (2.84)	176 (17.6)
	0.91 – 1.0	810 (99.39)	5 (0.61)	815 (81.5)
	1.1 – 1.2	2 (50)	2 (50)	4 (0.4)
Body shape :	Apple	518 (98.7)	7 (1.3)	525 (52.5)
	Pear	470 (98.9)	5 (1.1)	475 (47.5)
Systolic BP :	< 120	478 (100)	-	478 (47.8)
	120 – 129	350 (99.72)	1 (0.28)	351 (35.1)
	130 – 139	121 (99.18)	1 (0.82)	122 (12.2)
	140 – 149	22 (95.65)	1 (4.35)	23 (2.3)
	150 – 159	4 (80)	1 (20)	5 (0.5)
	160 – 169	3 (75)	1 (25)	4 (0.4)
	170 – 179	2 (66.7)	1 (33.3)	3 (0.3)
	180 – 189	8 (57.14)	6 (42.86)	14 (1.4)
Blood group:*	A ⁺	145 (98.6)	2 (0.4)	147 (14.7)
	A ⁻	56 (100)	-	56 (5.6)
	B ⁺	284 (99.3)	2 (0.7)	286 (28.6)
	B ⁻	79 (98.7)	1 (1.3)	80 (8.0)
	AB ⁺	166 (98.2)	3 (1.8)	169 (16.9)
	AB ⁻	25 (100)	-	25 (2.5)
	O ⁺	170 (98.3)	3 (1.7)	173 (17.3)
	O ⁻	63 (98.4)	1 (1.6)	64 (6.4)

(Figures in parentheses are percentage values)

t and r values : non –diabetics vs diabetics

BMI, r = 0.34 ; WHR, r = 0.69 ; systolic pressure, r = 0.38

Blood group, r = 0.16 ; body shape, r = 1; * p = < 0.01 highly significant

*t = 0.008