Gender-Age-Diabetes Mellitus Relation in Al-Qaseem Population#

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Objective: This study was conducted in the Al-Qaseem area to determine the prevalence of non-insulin dependent diabetes (NIDDM), insulin dependent diabetes (IDDM) and impaired glucose tolerance (IGT).

Methods: Blood samples were collected from 2694 individuals (1145 males; 1549 females) screened during a statistically designed household screening programme and grouped into adult males, adult females and children. The fasting blood sample was extracted and a glucose load was given to each individual. Two hour post-prandial glucose level was estimated and the diagnosis of diabetes and IGT was based on the World Health Organisation (WHO) criteria. Further grouping into IDDM and NIDDM was made on the basis of age of onset of diabetes and mode of treatment.

Results: The prevalence of iDDM, NIDDM and IGT in the overall population was 0.15 %, 5.23 % and 0.63 % respectively. Of the 2694 individuals screened 4 had IDDM giving an incidence of around 3 IDDM cases / 2000 individuals. In the adult male (> 14 years) the prevalence of NIDDM and IGT was 11.277 % and 0.829 % respectively while it was 7.50 % and 0.719 % in the adult females, respectively. When further grouping was done on the basis of age a significant increase was observed in those over the age of 30 years where 19.883 % and 1.462 % males and 14.839 % and 1.075 % females had NIDDM and IGT, respectively.

Conclusion: This study showed that diabetes is a significant health problem in the adult population of Al-Qaseem. Steps toward improved awareness, control and prevention are essential in order to reduce the prevalence of this metabolic disorder, which is associated with significant morbidity and complications.

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Diabetes mellitus occurs in most parts of the world, though its prevalence varies with population age structure and genetic and environmental factors. Of the two major forms of diabetes mellitus ie., insulin dependent diabetes mellitus (IDDM) and non-insulin dependent diabetes mellitus (NIDDM), the latter occurs at a higher incidence compared to the former[1-8]. The aetiological factors predisposing to each of these forms are different. Both genetic and environmental factors are believed to contribute to the development of diabetes mellitus, thus rendering it as a "multifactorial syndrome". Currently, environmental factors involved in the aetiology of NIDDM are better recognised and include factors such as dietary intake, age, ethnic group, body mass index and lack of physical activity. On the other hand, genetic contributions linked to IDDM development are better understood.

In Saudi Arabia, both NIDDM and IDDM are reported in various studies[9-13] with variable prevalence of diabetes in the different regions[14]. With the recent changes made in the socio-economic pattern and a shift towards more sedentary life style, the prevalence of diabetes is believed to be on the rise. Epidemiological studies are limited and with the exception of isolated population studies, the majority of investigations are hospital based. In order to better understand the aetiology, pathogenesis and natural history of diabetes mellitus in the different regions, we screened the population of Al-Qaseem to determine the prevalence of IDDM, NIDDM and impaired glucose tolerance (IGT). The results of our investigations are the first report on diabetes in Al-Qaseem, in the central province of Saudi Arabia.

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METHODS

The study population comprised Saudi family members with age ranging between 2 and 70 years. The screening programme incorporated a statistical plan including random household screening carried out in different sectors of Al-Qaseem region. Every 10th house of every 10th street was selected for screening in randomly selected sectors. The essential information on the families concerned was extracted from the files at the local health centre and the families were contacted. The purpose of the visit was explained to the family which was followed by an invitation to participate in the study. Over 95 % families contacted, volunteered to be involved in the study. They were asked to remain in a fasting state on the day of the visit which was mutually agreed upon. An early morning visit was made (between 8-10 am) usually on a Thursday, one of the two days of weekly holiday where all members were expected to be at home.

The basic data were obtained and recorded. Blood samples were extracted by venepuncture in EDTA tubes. Using Combur 8 urine samples were analysed from all members of the family except children less than 2 years. Glucose was immediately estimated using AnswerTM Blood Glucose Meter strips impregnated with glucose oxidase / peroxidase (Coulter-Wallace International Dist. USA). The glucose meter was regularly standardised against an autoanalyser "American Monitor". Each adult member was given an oral glucose load of 75 g in 200-250 ml water and the children were given 1.75 g glucose/kg body weight. Post-prandial samples were obtained 2 hours later and subsequently analysed using the AnswerTM machine.

The diagnosis of diabetes mellitus was based on the criteria recommended by WHO[15,16] as a fasting venous blood glucose $\geq$6.7 mmol/l ($\geq$120 mg/dl) and/or 2 hour post glucose load $\geq$10.0 mmol/l ($\geq$180 mg/dl). Normal fasting blood glucose level (< 6.7 mmol/l) and 2 hour post glucose load between 6.7-10.0 mmol/l (120-180 mg/dl) was diagnosed as impaired glucose tolerance (IGT)[15,16].

All previously diagnosed diabetic cases on insulin or oral hypoglycaemic agents were considered as diabetic. The classification of IDDM was based on age of onset < 25 years and a continuous requirement of insulin subsequent to diagnosis. Cases with a young age of onset that required dietary control or oral hypoglycaemic were classified as Maturity Onset Diabetes of the Young (MODY). All other cases were classified as NIDDM or IGT.

The prevalence of IDDM, NIDDM and IGT was calculated in the total population, total males and total females and in the children (< 14 years) and the adult males and females grouped on the basis of age.

The significance of the difference in the results of any two groups was determined by chi-square analysis using 2 x 2 contingency tables. $P < 0.05$ was considered statistically significant.

RESULTS

Table 1. **Number of Saudi males and females investigated in each group in Al-Qaseem**

Age Group (years)	*Male*	*Female*	*Total*
Total population (2-70)	1145	1549	2694
< 14	542	576	1118
14 - < 30	261	508	769
30 - < 45	145	265	410
45 - < 60	115	126	241
> 60	82	74	156
Total > 30	**342**	**465**	**807**

A total of 2694 blood samples were screened, including 1145 (42.05 %) males and 1549 (57.50 %) females in the age range of 2-70 years. This group comprised of 1118 (42.20 %) children below the age of 14 years and 1576 (58.5 %) adults (603 males and 973 females). Among the adults, 807 (male = 342, female = 465) were above the age of 30 years. Further grouping was done according to age. The total number of males and females in each age group are presented in Table 1. Initially the prevalence of NIDDM, IDDM and IGT was calculated in the total population and in the total males and females. The results are presented in Table 2. The children were separated and the prevalence of diabetes and impaired glucose tolerance was calculated in those over the 14 year age and the results are presented in Table 2. The results showed that the overall prevalence of IDDM, NIDDM and IGT in the Al-Qaseem population was 0.148 %, 5.230 % and 0.630 % respectively where 4 of the 2696 individuals screened had IDDM. Amongst the 1118 children only one (0.089 %) had IDDM and 5 (0.447 %) had IGT. In the adults, a significant increase was obvious in the prevalence of IDDM, NIDDM and IGT in total adults rose to 0.190 %, 8.947 % and 0.137 % respectively. The prevalence of NIDDM and IGT in the adult males was 11.277 % and 0.824 % and in the females was 7.50 % and 0.719 % respectively. The adult male had a higher prevalence of NIDDM than females with a statistically significant difference ($p < 0.05$). Within the adult group the prevalence of NIDDM was significantly higher in those above the age of 30 years (Table 2).

Table 2. **Prevalence of diabetes mellitus and IGT in the population of Qaseem**

Population group	No.inves-tigated	Prevalence of IDDM		NIDDM		Total DM		IGT	
		No	*%*	*No*	*%*	*No*	*%*	*No*	*%*
Total: (3-70 years)	2696	4	0.15	141	5.23	145	5.38	17	0.63
- Males	1145	0	0.00	68	5.94	68	5.94	10	0.87
- Females	1549	4	0.26	73	4.71	77	4.97	7	0.45
Total Adults:									
(> 14 years)	1576	3	0.19	141	8.95	144	9.14	12	0.76
- Males	603	0	0.00	68	11.28	68	11.28	5	0.82
- Females	973	3	0.31	73	7.5	76	7.81	7 0.	72
Total Adults:									
(> 30 years)	807	2	0.25	137	16.98	139	17.22	10	1.24
- Males	342	0	0.00	68 1	9.88	68	19.88	5	1.46
- Females	465	2	0.43	69 1	4.84	71	15.27	5	1.08

A further subgrouping was carried out and the adults were grouped into 14-<30, 30-<45, 45-<60 and≥ 60 years age groups (Table 1). The prevalence of NIDDM and IGT in each group are presented in Figures 1 and 2, respectively. As the age increased the prevalence of NIDDM increased significantly in both males and females. Prevalence of IGT increased significantly in the females even in the age group more than 60 years, but in the males the maximum prevalence of IGT was in 40-60 years age group and declined beyond this age.

Non-insulin dependent diabetes showed significant increase from 5.939 % and 4.713 % in males and females of 2-70 years age group, to 30.48 % and 27.02 % in males and females, respectively in those over the age of 60 years.

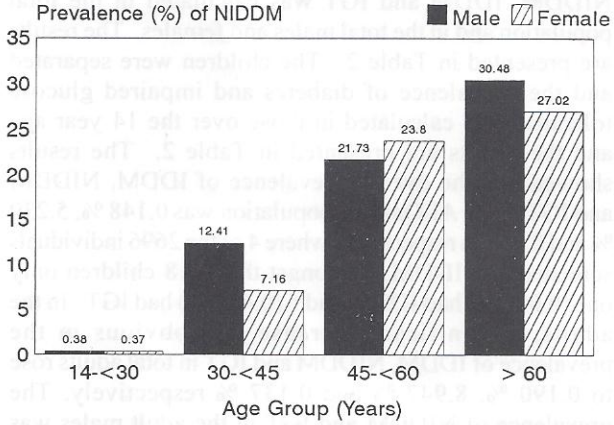

Figure 1. Prevalence of NIDDM in Males and females of different ages in Al-Qaseem.

DISCUSSION

Al-Qaseem region is situated in the northern part to the central region, the Najd. It is approximately 335 Km north of Riyadh, the capital of Saudi Arabia. This is the first report presenting the prevalence of diabetes mellitus and impaired glucose tolerance in the population of Al-Qaseem diagnosed on the basis laid out by the WHO.

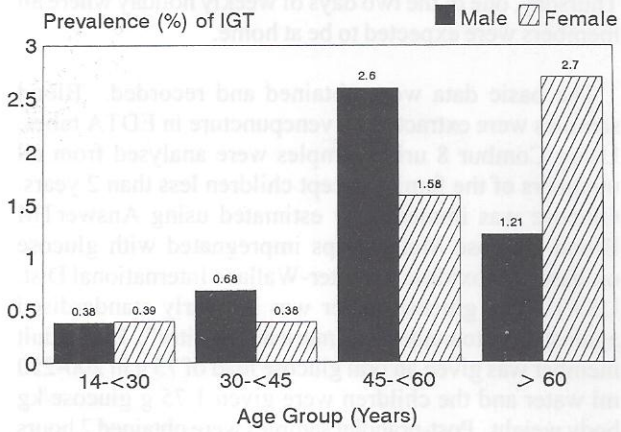

Figure 2. Prevalence of IGT in males and females of different ages in Al-Qaseem.

The overall prevalence of diabetes mellitus in Al-Qaseem region is 5.939 % in males and 4.971 % in females and the prevalence of IGT is 0.873 and 0.452, in the males and females, respectively. The prevalence of NIDDM is higher than that reported for the population of Riyadh[14]. The prevalence of IGT, on the other hand, is lower in the female population in Al-Qaseem compared to Riyadh females. While the reverse is true among the males. When grouped on the basis of age, a significant increase was found in the prevalence of NIDDM, and in those over the age of 30 years, 19.883 % male and 14.839 % of females are suffering from diabetes mellitus in the Al-Qaseem area. The prevalence of IGT also increases with age particularly in the females. In the males the highest prevalence of IGT was in the 40-<60 years age group.

Interestingly, males have a significantly higher prevalence of NIDDM compared to females. This trend is also observed in the Riyadh population[14], in urban Saudi communities in the western province[10], and in a semi-urban population in the southern province[12]. This seems to be the pattern generally found in the populations of

developing countries[17]. In the developed countries, on the other hand, the trend is generally the reverse[18]. The differences in the prevalence of diabetes between the different sexes could be related to differences in the life-style including eating habits, stress, obesity and other factors. An indepth exploration of the underlying causes may unveil interesting aetiological differences among populations of developed and developing countries.

Of relevance is the higher prevalence of glucose intolerance among the females aged >60 years compared to the males. This finding was more evident in the population of Riyadh[14] and in Abha, a semi rural population in the southern Saudi Arabia where in each age group, females had a higher prevalence of IGT compared to males[12]. As multi-parity is the norm in Saudi population and gestational diabetes occurs frequently (Al-Mishari-personal observation), this glucose intolerance could be one of the causes behind gestational diabetes in this population. However it is more difficult to contemplate why the glucose intolerant states did not proceed to overt diabetes and this may be due to a better tolerance in some of these females. Additionally, the absence of genetic predisposing factors, in presence of predisposing environmental factors may play a role in reduction in the prevalence of diabetes mellitus in the females compared to the males in this community.

It is alarming to see that beyond 45 years of age almost one in four males and females develop diabetes and age appears to be a major factor in the development of the diabetic state. Other factors ie. dietary habits, life style, extent of exercise and obesity possibly contribute significantly in conjunction with age. It is of utmost urgency that awareness programmes are initiated in Saudi Arabia in an attempt to spread knowledge about the causes of diabetes, its symptoms, its complications and ways and means of achieving control. Being multifactorial in nature avoidance of the harmful environmental factors may actually delay or even prevent diabetes development and the development of its complications.

CONCLUSION

In conclusion we emphasise that such a high prevalence of diabetes mellitus in Al-Qaseem and other Saudi areas will create a significant burden on the health services and on the diabetic patients due to associated long term complications and by adopting proper prevention and control measures, it may be possible to avoid the development of diabetes. The search for preclinical markers of diabetes is actively being pursued and it is hoped that in the near future one or more such markers probably at the DNA level, may be highlighted which will enable an individual to be classified as a "prospective diabetic" prior to disease development. Avoidance of the precipitating environmental factors may play an essential role in preventing the development of diabetes mellitus. Such studies are an active area of research and it is hoped that the next decade or two may reveal the mysteries behind this complex metabolic syndrome-diabetes mellitus.

Despite years of extensive research that has been conducted to unveil the mysteries behind diabetes development, there is still tremendous amount that needs to be clarified, particularly in developing countries, such as Saudi Arabia.

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