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Studies of preventive nephrology: self-urinalysis as a feasible method for early detection of renal damage

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Summary

The ever expanding pool of ESRF patients is exerting considerable strain on the health care resources of all nations of the world. Rationing, in one form or the other has therefore become the norm for most countries. Because dialysis prolongs life and is more readily available, and because ethically acceptable donor kidneys remain in short supply, thus limiting the potential of renal transplantation, this rather exasperating situation is bound to continue unless the entry point into the pool can be actively tacked. As part of our initial effort in this direction, we have examined the feasibility of self urinalysis by the general population as an epidemiological tool for detecting evidence of early renal damage by a total population cross-sectional survey of Faizia East Primary Health District (FEPHD) of Buraidah, capital city of the Gassim region of Saudi Arabia. Out of a de facto population of 7,695, 75.37% (5,800) cooperated fully. Majority of those who could not cooperate (881 [11.44%]) were infants and children. A total of 969 subjects (12.59%), mostly males at work, were not available. Only 45 (0.58%) subjects refused to participate. Housewives were significantly more amenable to the organisation of family self-urinalysis than head of the family (92.2% vs 61.4%; chi square = 321.78; df: 3; $P < 0.0001$). The mean family size was 7.82 (± SD: 3.82). Above the age of 4 years, 66.5% of males (2108/3170) as against 81.7% of females (2,641/3232) were able to carry our self-urinalysis. 11.76% of boys and 8.5% of girls below the age of 5 years were able to carry out self-urinalysis. Only 0.05% of male subjects and 0.03% of females failed to interpret colour change for proteinuria correctly. Similar remarkable competence was demonstrated for glycosuria by the population. We conclude that self-urinalysis is quite feasible in the general population, even if illiterates, if young. It can form a sound foundation, if properly harnessed, for a renal registry.

Keywords: *Self-urinalysis, preventive nephrology, Saudi population renal registry*

Résumé

Le pool on ne peu plus etendu des patients ayant l'ESRF est entrain d'exercer une pressionc onsiderable sur les ressources de soin de sante de toute les nations du monde. La rationalisation sous une forme ou une autre est par consequent devenus la norme dans la majorite des pays. Parceque la dialyse prolonge la vie et est disposible et aussi parceque les singes donneurs de reins sont ethiquement acceptable et demaire une source limitee de ravitaillement et par consequent limitant le potentiel de transplantation renal. Cette solution nous permet seulement de sruvive pour une periode de 10 ans avant de revenir a la dyalyse. Dans plusieurs cas, cette situation plutot exasperante devrait continuer a moins que le print d'entrée a cee probleme ne soit resolut. Comme partie de notre effort, initial dans cette direction, nous avons examine la faisabilite de l'urinalyse personelle par la population generale comme outil epidemiologique pour detecter l'insufisance renale precauce en faisant une enquete periodique de la population totale du centre de sante primaire de Faizia Est (FEPHD), Buraidah, capital de la region de Gassim en Arabie Saoudite. Sur une population totale de 7695 personnes, 75,35% (5800) ont absulument coopere a l'equete. La majorite de ceux qui n'ont pas coopere, 881 (11,44%) etaient les bebes et enfants. 969 sujets (12.5%) pour la plupart des homme tous travailleus n'etaient pas disponsible. Seulement 45 (0.58%) des sujets avaient refuse de participer. Les femmes menageres ont ete significativement plus implique dans l'organisation de l'urinalyse personnelle que les chefs de familles (92.2%) contre 61.4%; chi-squeare = 321.78% df = 3; P 0,0001). La dimension moyenne de la famille etait de 7,82 (±SD: 3,82). Au dessus de l'age de 4 ans, 66.5% d'hommes (2108/3170) contre 81.7% des femmes (2641/3232) etaient capable de faire l'urianalyse personnelle. De notre vue, les personnes en dessous de l'age de 5 ans, 11.76% de garcons et 8.5% deffilles etainet capable de leur urianalyse personelle. Seulement 0.05% des sujets males et 0.03% des sujets femmelles n'ont pas put interprete correctement le changement de conleur due a la proteinurie. Une competence similaire avait demontre pour la glucossurie par lar population. Nous avons done conclut que l'urianalyse personelle est assez faisable dans la population generale meme si celle-ci est illletre ou jeune. Elle pourrait etre l'objet d'une solide fondation pour un registre de maladies renale.

Introduction

All over the world, the national pool of end-stage renal failure (ESRF) continues to expand. This is no doubt due to the following:

1. The improved relatively available health care facilities, which have made case detection easier [1-8]. Coupled with more liberal legislation, a larger sector of the population has become entitled to free treatment for ESRP [9-11]. In Saudi Arabia, health care at all levels is totally free for all citizens.

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2. The continuing improvement in the technical delivery system of renal replacement therapy, which has resulted in substantial prolongation of life by as many as 30 productive years [12], with marked improvement in the quality [13-14].
3. The perennial shortage of ethically acceptable donor organs continue to severely limit the potential of renal transplantation [11; 12; 55-17].
4. Successful renal transplantation, in quite a number of cases, only allows us to buy about 10 years of productive existence before returning to the ESRF pool [12; 18].
5. Although seemingly remote and rare, we must not dismiss the fact that donor nephrectomy does contribute to the ESRF pool [19; 20]. We have had one case of ESRF, 14 years after donor nephrectomy. Interestingly, his brother, the recipient, had not required immunosuppressive therapy (self imposed) for six years at the time of writing. The recent USRDS (United States Renal Data System) 1993 annual report remains silent on this rather important subject [21].

Indeed, death seems to be the only certain exit form the pool (Fig)

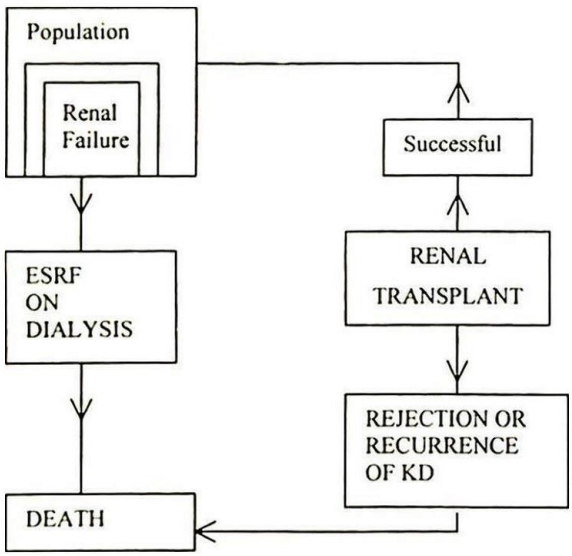

Fig. 1: ESRF – Recirculation with single pass

Further, the exact size of the pool is not known for any community, nor is it easily amenable to definition, although recent attempts have been made [22; 23]. It may be significant that these recent attempts utilise serum creatinine which measures a much later phase of renal damage. Clearly, therefore, these will give the estimate of relatively severe renal disease which is poorly amendable to prevention, and will also underestimate the size of the total and potentially preventable problem. It is thus difficult for most nations to predict the break-even point, i.e. when entry into the pool will be equal to exit [8; 9]. The net result is the increasing strain on the financial resources of virtually all nations [21]. Rationing has become the inevitable order of the day and in some countries, sub-optimal care of ESRF patients has been forced on practitioners [11]. As for the so-called developing countries, we agree that the currently acceptable modalities of renal replacement therapy (RRT) cannot be justified, especially when viewed against the compelling health care priorities that surround them [24; 25]. It seems to us questionable, even for the industrialised and developed nations, that the current modalities of RRT can be regarded as the most cost effective. We believe that all concerned must actively seek new ways of easing the burden of ESRF medicare.

One of such methods, as suggested earlier [13] must, of necessity, look at the entry point into the ESRF pool. The principal objective should be to prevent the development of nephron damage and thereby reduce, in the long run, the size of the pool. Under ideal situatibns, such a preventive strategy implies identification of all causes of such damage, removing them where possible or rendering them harmless (immunisation) if practicable. Utopian and simplistic as it may seem, such as objective is not impossible, if all the giant strides that the sciences have made in the last decade or two are actively brought to bear on this very important subject, which we have termed, "active preventive nephrology".

As part of a modest and realistic beginning, early detection of reliable indices of renal damage rather than easy detection of late lesions should, in some measure, not only enhance prevention, but may also help in estimating the size of the problem for any community. Mass screening for such indices (e.g. and for our purpose, proteinuria) is essential, but cost, even when cost effective, is quite often a limiting constraint [25; 26]. The other important limiting factor is the laboriousness of any population based exercise, a sector of medicine not as glamorous as most others.

If, however, the individuals can be convinced to generate self-interest in the welfare of their kidneys, we reckon that it should be easy for them to bear, most, if not all, the cost of screening. Cost effectiveness will thus be enhanced. Fortunately, a dipstix test is inexpensive less than SRO. 30 ($0.08) for preoteinuria. Perhaps even more auspicious, is the fact that the method is not only sensitive, but also very simple [27], lending itself to any exercise in mass education.

In other words, all the prerequisites for mass screening for renal damage, as may be indicated by proteinuria, seem to have been met: the problem must be important; the test must be accurate; early detection must improve prognosis [28]; in addition, the test for proteinuria is accurate, cheap, simple to use and easy to interprete [27]. We thus feel that all these advantages should be applied to the problem of prevention of renal damage.

Our principal aim in this study is to explore the feasibility of self-urinalysis in a largely illiterate population as an epidemiological tool for early detection of renal damage. We also hope to define the prevalence and pattern of related indices, namely, proteinuria, glycosuria, blood pressure and systemic hypertension as well as body mass index. As far as we know, this is the first exercise of its kind in the Kingdom of Saudi Arabia.

Population, materials and methods

The Faizia East Primary Health District (FEPHD), one of the 14 serving at the time of our study, Buraidah, capital of Gassim region of Saudi Arabia, was selected for this exercise. It is divided into two sections: Block B and Labdia. The former is well planned with a good network of well-surfaced roads, pipe-borne water supply and all

modern amenities. The houses bear numbers which correspond to that of the family file in the primary health centre, thus making subject identification easy. It is largely a middle class residential zone with shopping facilities generously distributed within the area. Labdia, on the other hand, is inhabited largely by bedouins who live in close proximity to and sometimes within the same enclosure as their livestock. Although it has an existing master plan, its execution is still pending. Buildings are randomly constructed, without proper streets. The roads and alleys remain unsurfaced, making the area very dusty. The houses are not numbered, making geographical location of individual subjects very difficult. Water is supplied to most households from a concrete underground reservoir which is fed by a bore-hole meant for irrigation purposes. Other households receive treated water by tankers from the Ministry of Water Resources. Virtually every household has a motorised means of transportation as distinct from the traditional camels and donkeys. This area is served by a few grocery shops and mini-markets. The general setting of Labdia is thus distinct from Block B, the latter well urbanised with all modern amenities and the former semi-rural, dusty, impatiently waiting to be developed. It is presumed that the socio-economic status of Labdia is probably lower than that of Block B. For the purpose of this presentation, "urban" refers to Block B while "rural" describes Labdia.

Team preparation

The entire field survey team was carefully appraised of the objectives of the exercise. The emphasis was particularly on paying attention to details, especially in such simple routine items as height and measurement; in particular all were to be extra sensitive to the traditions and local culture. Details of blood pressure recording based on the recommendations of the Working Party of the British Hypertension Society [29] was amply explained. The videocassette by the Society on the subject was viewed repeatedly and discussed exhaustively by the team.

Community preparation

Labdia: Because of the state of its development, the houses were numbered following which a crude map was prepared so that identification of families and individuals could be feasible. Family file numbers were then matched with the map. Block B did not require such an exercise.

A careful preparation of the whole district community consisted the following:

1. Detailed explanation (in Arabic) of our project to heads and members of each household, detailing the advantages of prevention and the solicited responsibilities of individual members;
2. Distribution of written copies (in Arabic) of our proposal as per (1) above.
3. Securing the assistance of the Chief Imams of the major mosques in further explanation of the project at few successive Jummat services to the congregation and
4. Revising each household the prior of the survey to remind them of our coming and supplying necessary items (urine specimen containers), if requested.

Random sampling of opinions as well as unsolicited reports indicated that the community was ready for the exercise.

Population survey and self-urinalysis

A cross-sectional total population survey of the district was then carried out by the field team, starting from Labdia and moving from house to house. In the household,

1. all members were assembled and our purpose re-explained in Arabic;
2. *de facto* population census was taken against family file records, taking care to account for deaths, permanent departures e.g., by reason of marriage or change of occupation, location, new additions by births, etc.
3. chronological age was computed from birth certificates or records and corroborating, especially in the elderly with historical landmarks, where birth certificates were not available.
4. body weight was recorded with portable bath-room scales with house-hold clothing on, but without shoes, taking care to ensure that the scalestood on a rigid flat surface. In cases of occasional gross obesity when readings were beyond our instrument, the subject was requested to report to the primary health center for accurate recording with a bigger scale;
5. height was recorded, without shoes, but with head covered with only head scarf, using a thick plywood scale, especially constructed for the project by the maintenance engineering department of King Fahd Specialist Hospital;
6. blood pressure was recorded according to details given elsewhere [MAOS et al. 1995].
7. using laboratory prepared position and negative (for proteinuria and glycosuria) standard urine specimens, the procedure for urinalysis with dipstix (Boehringer-Mannheim) technique was carefully demonstrated to the assembled household and the colour change explained in Arabic to all;
8. each member was then positioned behind his/her respective urine specimen; small children stood next to parents or elder siblings and specimens whose owners were not available or blind were placed next to the family head or his deputy;
9. test sticks, one at a time for protein and glucose, were distributed and all individuals performed their urinalysis and announced their interpretation of colour change to the hearing of all;
10. results were recorded in Arabic; into personal record form provided, by any competent literate member of the household; only when none was literate did a team member do the recording;
11. in all subjects, results were verified; correctness or otherwise and degree of positivity was recorded by the team;
12. urine specimens were collected as fresh as possible, soon after carrying out the *de facto* population census, except in those who would not be available and who left their labelled specimens behind; the original plan to use early morning specimen did not suit the convenience of the citizens and was accordingly abandoned;
13. history of current anti-hypertensive therapy, anti-diabetic therapy, current pregnancy and the degree of consanguinity in marriage for all married females, taking care to include the widowed and divorced, was carefully recorded as appropriate.

Data Processing

Data entry was done with Dbase4 programme EPI5 (Epidemiological Information: WHO) and SPSS (Statistical Package for Social Sciences) for DOS programme were used as appropriate for data listing and statistical analysis.

Harvard graphic and Microsoft Word programmes were used for producing tables, graphs and figures.

Results

Tables 1a, 1b, Figs 2 and 3 show the de facto population and gender. A total of 7695 subjects inhabit the district. Gender distribution was roughly equal in both sections of the community. A total of 5342 live in Block B, the urban zone while 2353 inhabit Labdia the rural section. It can be seen from Table 1a and the population pyramid that the population is largely young, 4000 (51.98%) being under 15 years of age.

Table 1a: Faizia East PHD, Buraidah, Gassim, KSA De Facto Population, 1992: Urban Vs Rural (Block B Vs Labdia)

Age Group	Block B	%	Labdia	%	Total	%
0-4	894	16 7	398	6 9	1292	16 8
5-9	960	18.0	48.0	20.4	1440	18 7
10-14	852	15 9	415	17 6	1267	16 5
15-19	551	10 3	246	10 5	797	10 4
20-24	420	7 9	135	5.7	555	7 2
25-29	370	6 9	97	4 1	467	6 1
30-34	367	6 9	102	4.3	469	6 1
35-39	288	5 4	123	5.2	411	5 3
40-44	169	3.2	69	2.9	238	3 1
45-49	105	2 0	57	2 4	162	2 1
50-54	121	2 3	67	2 8	188	2 4
55-59	77	1 4	37	1 6	114	1 5
60-64	74	1 4	46	2 0	120	1 6
65-69	37	0 7	31	1 3	68	0 9
70+	57	1 1	50	2 1	107	1 4
Total	5342	100	2353	100	7695	100

Table 1b: Faizia East Phd, Buraidah, Gassim, KSA Population: Urban Vs Rural

	Urban (Block B)		Rural	
Gender	Number	%	Number	%
Male	2683	50.2	1159	49.26
Female	2659	49.8	1194	50.74
Total	5342	100	2353	100

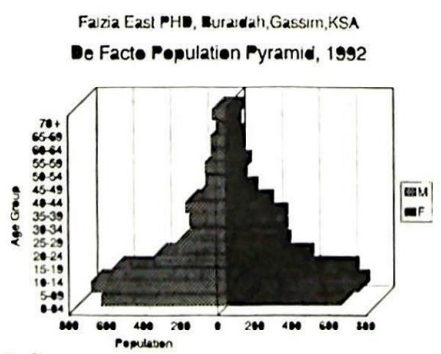

Fig. 2

The vast majority of our study population are Saudi nationals, being 72600 (93.16%). Non-Saudi Arabs make up 3.35% and other nationals 3.49%. (Fig. 3). Mean family size (Fig. 4) for both urban and rural sectors of the study population was 7.82 (±S.D. 3.82).

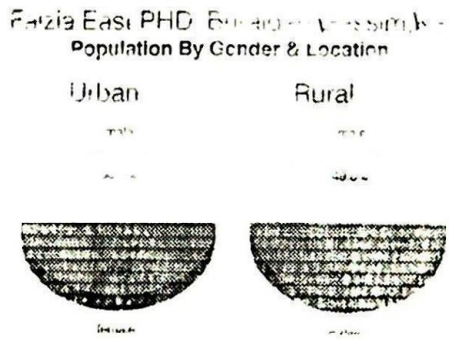

Fig. 3

Cooperation with the survey team

Tables 2a, 2b, and Fig. 4 show that 5800 subjects out of our study population of 7695 cooperated fully with the survey team, giving an overall return of 75.37%. This only means that they submitted to all items, but does not necessarily imply that all such items were feasible. In all 881 (11.44%) largely infants but some mentally retarded and physically handicapped adults were unable to cooperate. A total of 969 subjects (12.59%) were not available for the survey. Most were males who were at work, but some were visiting. Only 45 (0.58%) subjects refused to participate and 160 permanent departures were excluded from the register. Contrary to expectation, the team was welcomed and entertained in all households except in two adjacent houses in Block B where some young enthusiasts prevented the survey on religious grounds.

Table 2a: Faizia East PHD, Buraidah, Gassim, KSA Cooperation with survey team and return

	No.	%
Fully Cooperation	5800	75.37
Unable to Cooperate	881	11.4
Not Available	969	12.59
Refused	45	0.58
Total	7695	100
Dead	38	
Permanently Away	160	
No Information	9	
Grand Total	7902	

Table 2b: Faizia East PHD, Buraidah, Gassim, KSA
Cooperation: Heads of Family Vs Wives

	Heads	%	Wives	%
Fully Cooperation	592	61.4	1006	92.2
Unable to Cooperate	7	0.7	19	1.7
Not Available	361	37.4	60	5.5
Refused	4	0.4	6	0.5
Total	964	100	1091	100

Chi Square = 321.78
d.f = 3
P < 0.0001

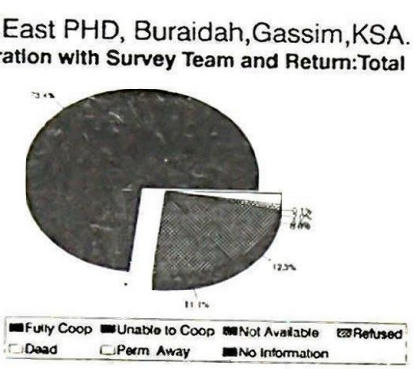

Fig. 4

Table 3 and Fig. 5 show that housewives were more cooperative and therefore more amenable to self-urinalysis organisation in the family setting than the head family (92.2% Vs 61.4%; chi square = 321.78; df = 3; $P < 0.0001$). It is noted that whereas 361 (37.4%) of the family heads were not available, only 60 (5.5%) of the housewives fell into this category.

Table 3: Faizia East PHD, Buraidah, Gassim, KSA
Self-urinalysis: by gender

	Male		Female	
	Below 5	5+ (%)	Below 5 (%)	5+ %
By Self	79 (11 76)	2108(66 5)	53 (8 5)	2641 (81 7)
By Others	268 (39 88)	434 (13 69)	206 (33 17)	375 (11 61)
No Information	325 (48 36)	628 (19 81)	362 (58 29)	216 (6 68
Total	672	3170	621	3232

	5 & Above	Below 5
Chi Square (Excluding No Information) =	23.87	0 46
d f =	1	1
P <	0.0001	N S

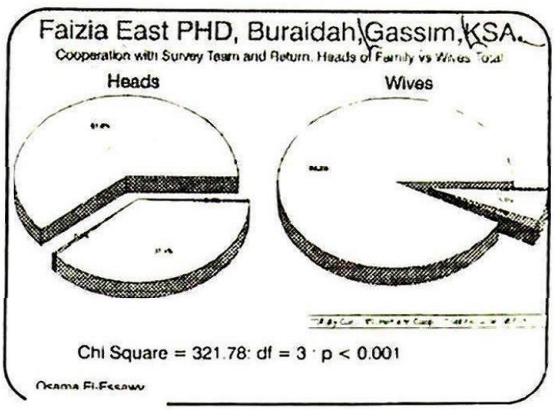

Fig. 5

Self-Urinalysis

Table 3 and Fig. 6 show that among male subjects aged 5 years and above, 2108 (66.59%) of 3170 were able to carry out self urinalysis. The corresponding figure for females was 2641 (81.7%) out of 3232. Clearly women are more amenable to this exercise than their male counterpart (chi-square = 23.87 – excluding no information; df = 1; $P < 0.0001$. It can also be seen that a greater percentage of males in this age group had others to perform their tests or did not provide information. The "no information" category is particularly striking – 628 (19.81%) Vs 216 (6.68%), respectively for males and females. Below the age of 5 years, we are impressed by the fact that 79(11.76%) boys and 53 (8.5%) girls were able to carry out self-urinalysis.

Table 4, 5 and Fig. 6 show that the vast majority of those who performed the test for proteinuria (albuminiuria, more correctly) were able to interprete the colour change correctly. Only 0.34% of males and 0.23% of females failed to interprete a positive change correctly. Corresponding figures for incorrect interpretation of negative result were 0.05% for males and 0.03% for females. The gender difference was not statistically significant.

Table 4: Faizia East PHD, Buraidah, Gassim, KSA
Self-urinalysis proteinuria: interpretation: total by gender

	Male		Female	
	n	(%)	n	(%)
Pros. & Correct	146	(3.8)	199	(5.16)
Pos. & Incorrect	13	(0.34)	9	(0.23)
Neg. & Correct	2726	(70.97)	3064	(79.52)
Neg. & Incorrect	2	(0.05)	0	(0.03)
No Information	954	(24.84)	580	(1505)
Total	3841		3853	

Chi Square = 4.76 (Excluding no Information)
d.f = 3 p = NS

Table 5: Faizia East PHD, Buraidah, Gassim, KSA
Self-urinalysis proteinuria: interpretation: total by gender

	Male				Female			
	Below 5 %)		5 & Above (%)		Below 5 %)		5 & Above (%)	
Pos & Correct	3	(0 45)	143	(4 51)	4	(0 64)	195	(6 03)
Pos & Incorrect	1	(0 15)	12	(0 38)	0	(0 16)	8	(0 25)
Neg & Correct	342	(50 89)	2384	(75 32)	253	(40 74)	2811	(86 97)
Neg & Incorrect	0	(-)	1	(0 06)	0	(-)	1	(0 03)
No Information	326	(48 51)	628	(19 82)	363	(58 45)	217	(6 71)
Total	672		3169		621		3232	

Chi Square (5 & above) = 3.82 (Excluding No Information)
d.f = 3 p = 0.28

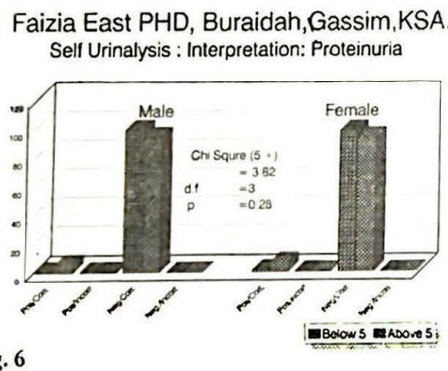

Fig. 6

Table 6, 7 and Fig. 7 show similar trends for glycosura. However, females above the age of 4 years were significantly more competent in interpreting colour change for glycosuria – chi square = 12.26 (excluding no information) df = 3; $P = 0.0065$.

Table 6: Faizia East PHD, Buraidah, Gassim KSA.
Self-urinalysis: glycosuria interpretation by gender

	Male	%	Female	%	Total	%
Pros & Correct	87	(3 01)	61	(1 86)	148	(2.40)
Pos & Incorrect	2	(0 07)	2	(0.06)	4	(0.065)
Neg & Correct	2796	(96 88)	3210	(98 08)	6006	(97 52)
Neg & Incorrect	1	(0 035)	0	(-)	1	(0.016)
No Information	955	(-)	590		1536	
Total	3842		3853		7695	
Effective Total	2886		327		6159	

Table 7: Faizia East PHD, Buraidah, Gassim KSA.
Self-urinalysis: glycosuria interpretation by gender

	Male				Female			
	Below 5		5 & Above		Below 5		5 & Above	
	n	(%)	n	(%)	n	(%)	n	(%)
Pos & Correct	0	(-)	87	(3 43)	1	(0 39)	60	(1 99)
Pos & Incorrect	0	(-)	2	(0 08)	0	(-)	2	(0 07)
Neg & Correct	346	(100)	2450	(96 46)	257	(99 61)	2953	(97 94)
Neg & Incorrect	0	(-)	1	(0 04)	0	(-)	0	
No Information	326	-	630	-	363	-	217	
Total	672		3170		621		3232	
Effective Total	(100)		2540	(100)	258	(100)	3015	

Chi Square = 12.26 (5 and Above: Excluding No Information)
d.f = 3 p = 0.28

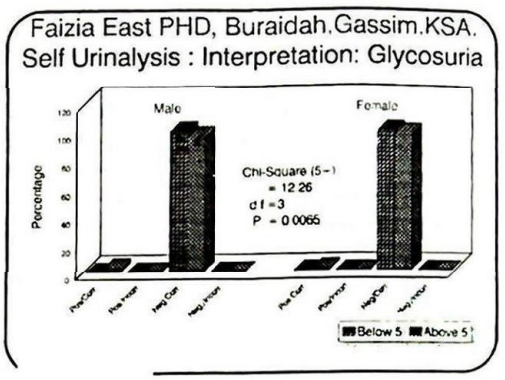

Fig. 7

Discussion

Self-urinalysis for glycosuria has been successfully organised for 45-70-year-old British diabetic patients by telephone and letter writing [30], but such methods can hardly be suitable for a developing environment with high level of illiteracy. The idea of organising such an exercise for the population at large is, to our knowledge, being attempted for the first time. Clearly, from our results, it is feasible to teach the Saudi population, even if young and illiterate, to perform self-urinalysis and correctly interpret the colour change using the dipstix technique. This should not be suprising considering that the test is simple and easy to perform. Non-the-less it is remarkable that some children below 5 years (11% of males of that age group and 8.5% of females) could perform self-urinalysis and correctly interpret the colour change. We are therefore confident that appropriate mass campaign should be effective in teaching the general population to utilise this technique for mass screening to detect early renal damage. We have found that the housewives are significantly more amenable to the exercise than heads of the family, indicating that subsequent exercises are better entrusted to them.

We believe that self-urinalysis has three implicit advantages. First, if properly harnessed, it will make mass screening for renal damage more extensive than any members of the primary care system could physically achieve; secondly, because the test for albuminuria and glycosuria is inexpensive (< SR 0.20 per test and SR3.00 for the family per annum), individual families can easily bear the cost and thus enhance the cost effectiveness of the exercise; it should be noted that, the cost of laboratory and technical staffing will be largely eliminated; thirdly and perhaps most importantly, it will generate self-interest of individual subjects in the care and protection of his kidneys and thus enhance the effectiveness of health education on the subject.

In the context of preventing nephrology, our objective is self-urinalysis for microalbuminuria. Unfortunately, the test is still relatively expensive (approximately SR6-8.00 per test). In our view, with successful media campaign, tremendous increase in demand should enable manufacturers to reduce the cost to levels similar to the macro test. We believe that this is a worthwhile objective because it has been estimated that by detecting and tackling

microalbuminuria (in IDDM), the need for dialysis and renal transplantation is reduced by 21 to 63% and life expectancy increased by 4 of 14 years [31]. Further, microalbuminuria detected for causes other than diabetes mellitus has been found to be amenable to pharmacological treatment [32], thus underscoring the importance of early detection by self-urinalysis for microalbuminuria.

The question may be asked, "will a successful community campaign for self-urinalysis generate a "renal neurosis" and thus impose an inordinate amount of work load on health care staff?" No answer can be given at present. But an intensive campaign for at least a short period of five years will be worthwhile. Such an exercise will give an idea of the size of the problem as well as provide further insight into the pathogenesis of renal disease.

In conclusion, we believe that self-urinalysis by the population is feasible and can form a sound broad based foundation for a renal registry if successfully manipulated.

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