COMMUNITY SCREENING FOR DIABETES MELLITUS (PREVALENCE, RISK FACTORS AND FOLLOW UP)

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IN COLLABORATION WITH
WORLD HEALTH ORGANISATION
2002.

CONTENTS

INTRODUCTION

Diabetes mellitus is a chronic condition characterised by hyperglycaemia due to absolute or relative deficiency of insulin. People who have a degree of hyperglycaemia which if detected and untreated is associated with significant risk of developing vascular disease. It is worldwide in distribution and the incidence of both types of primary diabetes (type 1 and type 2) is rising. WHO has estimated 120 to 140 million people suffer from diabetes mellitus worldwide, and that this number may well double by the year 2025 (Weerarathna 2000). Much of this increase will occur in developing countries and will be due to population ageing, unhealthy diets, obesity and a sedentary lifestyle. By 2025, while most people with affected diabetes in developed countries will be in the 45-64 year age range and a majority in their most productive years.

Type 2 diabetes commonly occurs in subjects who are obese and insulin resistant but these two factors alone are insufficient to cause diabetes unless accompanied by impaired beta cell function. Type 2 diabetes is associated with affluent lifestyle that is likely to arise in genetically predisposed individuals who eat too much and exercise too little.

The prevalence of diabetes mellitus in Sri Lanka is reported as 5.8% among 35-59 years of aged in 1993 and 4.8% among 30-64 years of aged in 1995 (Mendis S 1993 and Fernando et al 1995). Trends in hospitalisation due to Diabetes Mellitus is increasing in Sri Lanka from 1975 up to now, i.e. cases per 100,000 population from 95.5 to 164.2 (Ministry of Health 1998). The low birth weight rate in the country is also 16% (Ministry of Health 2000). It is a known factor to be associated with Type 2 Diabetes.

However, there are many ways of preventing it and/ or of controlling its progress. Early diagnosis and treatment are key factors. Between a third and a half of cases of diabetes are undiagnosed at any one time. Screening groups of patients at risk can identify new cases (Lawrence et al. 2001). The primary purpose of screening is to identify individuals without symptoms who either already have the disease or are clearly at high risk of developing it and where intervention could have the beneficial effect.

Screening programmes may also improve community awareness and pave the way for education about diabetes. Public and professional awareness of the risk factors for and symptoms of, diabetes are an important step towards its prevention and control (WHO 1994). After considering all these factors it was decided to carry out this study under following objectives:

OBJECTIVES

1. To test the feasibility of the screening for Diabetes Mellitus
2. To estimate the prevalence of Diabetes Mellitus in different populations: Working, Semi-urban and rural
3. To detect the risk factors for Diabetes Mellitus.
4. To evaluate the nutrition related advice as a management tool.

METHODOLOGY

This was a cross sectional community based study. Sample size was determined by considering the prevalence of diabetes was 10% in the population. Confidence interval was taken as 95% with 5% precision. Design effect was taken, as 1.5 and non-response rate was 12%. The calculated sample size was 280 from each sector. Three different populations were selected for the study, i.e. rural, semi urban and working.

Medical Officer of Health (MOH) divisions was selected as study areas. One MOH area from rural and other one was selected from the semi-urban populations. Maps of the particular areas were obtained with boundaries in 1:25,000 scale and the 20 starting points were randomly selected using the 1cm grid (Figure 1 & 2). Selected starting points were marked on the map and the location was identified with a landmark. Field investigators were made conversant with the procedure and they were provided with the marked maps and the details of the landmarks of the selected starting points. Field investigators were instructed to start from the house nearest to the starting point and then move on to the house facing the front door of the former house and so on till the 14 households be covered. From each selected household one person above 40 years irrespective to the sex were invited to participate in the study. Field investigator was advised to move to the next starting point from the other when the 14 people were met from that point.

When selecting the study subjects from the working population, 2 health offices were identified and all the staff was invited to participate in the study having obtained permission from the head of the institution.

Consent forms were distributed to the selected people after explaining the procedure (Annex 1) and the confidentiality of the information assured.

The selected people were asked to attend the pre arranged clinic centre on the given date after keeping the fasting for minimum of 10 hours. Fasting was defined as avoiding the consumption of any food or beverage other than water for at least 10 to 16 hours before testing. They were given written instructions on fasting (Annex 1). In each MOH area 4 centres were identified and each centre was allocated to a Pre-intern medical student, Medical Laboratory Technician and a Public Health Inspector or Public Health Midwife to collect information. Supervision of the centres was done by a Principal Investigator and another medical officer.

All the field investigators and technicians were given three days training on the testing of blood, measuring of height, weight, waist and hip circumference and they were standardised. After obtaining the written consent, all the subjects were interviewed to gather the following information: Birthday, if not age, family history, occupation and income, family history of diabetes, present history of diabetes and whether treatment is being taken or not, persons' weight, height, waist and hip circumference were measured and Body Mass Index (BMI) was calculated (Annex 2). Blood pressure was measured after the interview after allowing them to rest for sometime.

Finger pricked fasting capillary blood sample was taken to determine the fasting blood glucose level by using the Glucometer. The subjects were classified as indicated below (WHO 1995).

<4.4	-	Excludes diabetes
4.4 - 5.5	-	Low probability, not an indication for diagnostic testing
5.6 - 6.6	-	Indication for diagnostic testing

If the finger pricked (capillary) blood glucose value was above 5.5 mmol/l venous blood sample was taken to detect the fasting plasma glucose value (FPS) from the subjects who were not known to have diabetes. Subjects whose fasting plasma venous glucose value was >=6.1 mmol/l were sent letters asking them to come back for diagnostic testing. They had a standard 75g oral glucose tolerance test (OGT); blood was drawn after fasting and then two hours after a glucose load, in

keeping with Diabetes WHO's guidelines. Subjects from the rural community whose fasting plasma glucose concentration was >=6.1 mmol/l were subjected to only a second fasting glucose test and the OGT were not performed on them due to logistic reasons.

After the second FPS or OGT results, study subjects were classified according to the WHO and Sri Lankan diagnostic criteria as indicated below (Fernando et al. 2000):

<7.0 FPS and 7.8-11.1 2h after glucose load	-	Impaired glucose tolerance
>=6.1-6.9 FPS	-	Impaired fasting glucose
>=7.0 FPS or >=11.1 2h after glucose load	-	Diabetes.

People were informed of the test results by letter (Annex 3); if the result was abnormal, patients were requested to meet the Principal Investigator. All the positives were given a prescribed diet and the exchange list (Annex 4). The total amount of calories per day in the diet was adjusted according to the level of BMI. All of them were educated regarding all the possible complications of Diabetes (Annex 5) and the importance of the follow up (Annex 6). People who were far away and found it difficult to travel were referred to the Physician of the closest hospital. They were posted all the educational leaflets on diabetes.

People who were followed by the Principal investigator were requested to visit after a month and the plasma fasting blood sugar and weight were measured during that visit. Further follow up visits were arranged with the patients' general practitioner or physician at the closest hospital or with the diabetes clinic in the hospital. Ethical approval was obtained from the Institutional Ethical Committee. Study period was May- July 2001.

RESULTS

A total of 840 subjects were invited for screening and 720 took up the invitation to have their fasting blood sugar measured by giving a response rate of 85.7%. The response rate in the working, rural and semi urban populations were 76.7%, 85% and 95.3% respectively giving the highest response rate among the semi urban community.

Table 1 shows the characteristics of the study population in different population groups. Almost all (99%) of them were Sinhalese. About 3.5% of the study population had never attended school and most of them (65.8%) had attended school upto O/L. Where the occupation was concerned the

majority of them were manual labourers, consisting of skilled, non-skilled and agriculture workers. 8.2% of the study population were pensioners. The male:female ratio was 0.69:1. In the rural population the study subjects were similarly distributed among 3 age groups and in the working population 40-49 year aged group were more present (65.6%) and semi-urban population 50-59 years subjects were more (41.4%). Majority of study subjects in the semi-urban population were females (70.3%).

Table 1

Characteristics of the study subjects in different sectors

Characteristics	Working	Rural	Semi-urban	Total	Significance
Age (years)					
40-49	141(65.6)	87(36.4)	106(39.8)	334(46.4)	X=80.11
50-59	66(30.7)	74(31.0)	110(41.4)	250(34.7)	df=4
>=60	8(3.7)	78(32.6)	50(18.8)	136(18.9)	P=0.000000
Sex					
Male	115 (53.5)	99 (41.4)	79 (29.7)	293 (40.7)	x=27.96
Female	100 (46.5)	140 (58.6)	187 (70.3)	427 (59.3)	df=2,
					P=0.00000
Ethnicity					
Sinhalese	214 (99.5)	233 (97.5)	266 (100.0)	713 (99.0)	
Others	1 (0.5)	6 (2.5)	0.0 (0.0)	7 (1.0)	
Education					
No schooling	0 (0.0)	23 (9.6)	2 (0.8)	25 (3.5)	X=239.29
Up to O/L	70 (32.6)	196 (82.0)	208 (78.2)	474 (65.8)	df=6
Up to A/L	107 (49.8)	18 (7.5)	49 (18.4)	174 (24.2)	P=0.00000
Higher	38 (17.7)	2 (0.8)	7 (2.6)	47 (6.5)	
Occupation					
Managerial	60 (27.9)	10 (4.2)	21 (7.9)	91 (12.6)	
Clerical	92 (42.8)	0 (0.0)	2 (0.7)	94 (13.1)	
Manual	63 (29.3)	199 (83.6)	214 (80.1)	476 (66.1)	
Pensioner	-	29 (12.1)	30 (11.2)	59 (8.2)	
Extra activities addition to the occupation					
Yes	45 (20.8)	27 (11.3)	30 (11.3)	102 (14.2)	
No	171 (79.2)	211 (88.7)	236 (88.7)	618 (85.8)	
Presence of family history of diabetes					

Yes	48 (22.3)	15 (6.3)	40 (15.0)	103 (14.3)	X=18.46,
No	167 (77.7)	223 (93.7)	226 (85.0)	616 (85.7)	P=0.000006
Presence of TV					
Yes	208 (96.3)	189 (79.4)	246 (92.5)	642 (89.3)	
No	8 (3.7)	49 (20.6)	20 (7.5)	77 (10.7)	
Mean systolic BP (SD)	124.5 (13.7)	125.1 (18.0)	126.3 (15.3)	125.4 (15.8)	
Mean diastolic BP (SD)	84.5 (49.9)	79.3 (10.4)	80.5 (9.2)	81.3 (28.6)	

The presence of family history of diabetes among working population was high (22.3%) and lowest among rural population (6.3%). It may be due to increase awareness about diabetes among working subjects because they are working in health institutions. About 85.8% of the study subjects did not do any extra activities in addition to their occupation. The mean systolic blood pressure among semi-urban population and the mean diastolic blood pressure of working population were the highest.

Table 2

Nutritional status of the study subjects in different populations

Mean weight (SD)					
Male	61.1 (11.1)	53.4 (10.7)	62.2 (10.3)	58.8 (11.4)	F=18.9, P=0.000
Female	56.6 (8.9)	47.7 (9.9)	56.6 (10.6)	53.5 (10.8)	F=33.4, P=0.000
Mean height (SD)					
Male	163.5 (6.5)	160.3 (7.0)	163.3 (7.7)	162.4 (7.1)	F=6.8, P=0.0000
Female	152.5 (5.5)	148.7 (6.7)	151.0 (6.5)	150.6 (6.5)	F=12.1, P=0.0000
Mean BMI (SD)					
Male	22.8 (3.6)	20.8 (4.1)	23.3 (3.5)	22.2 (3.8)	F=11.6,P=0.0000
Female	24.3 (3.5)	21.6 (4.1)	24.6 (4.5)	23.6 (4.4)	F=22.7, P=0.0000
BMI group					
<18.5	24 (11.2)	68 (28.6)	25 (9.4)	117 (16.3)	X=79.1
18.5-24.9	115 (53.7)	128 (53.8)	124 (46.6)	367 (51.1)	P=0.00000
25.0-29.9	72 (33.7)	38 (16.0)	93 (35.0)	201 (28.0)	
>=30.0	3 (1.4)	4 (1.7)	24 (9.0)	31 (4.3)	
Mean waist circumf. (SD)					
Male	83.0 (10.2)	78.1 (10.1)	84.9 (9.0)	81.9 (10.2)	F=11.5, P=0.000
Female	83.5 (9.3)	75.1 (10.3)	82.0 (11.1)	80.1 (11.0)	F=23.2, P=0.000
Mean waist/hip (SD)					
Male	0.90 (0.07)	0.89 (0.07)	0.93 (0.14)	0.91 (0.09)	KW=9.4, P=0.000
Female	0.87 (0.07)	0.84 (0.07)	0.86 (0.11)	0.86 (0.09)	
Total	**215 (29.9)**	**238 (33.1)**	**267 (37.1)**	**720 (100.0)**	

Table 2 shows the nutritional status of the study subjects. It was assessed by calculating the Body Mass Index (BMI). The mean BMI of females (23.6kg/m2) are higher than males (22.2 kg/m2). About 16.3% of the study subjects were undernourished and the majority from the rural population. The overweight prevalence was 32.3%. It was interesting to note that 4.3% of the study subjects were obese and most were from semi-urban population.

A total of 720 (293 males and 427 females) of different age groups were screened. 170 (23.0%) were found to have a capillary fasting blood glucose (FBG) greater than 5.5 mmol/L. Fasting venous blood sample was taken from all those to detect the fasting plasma glucose value (FPG). About 75 (44.1%) had FPG >=6.1 mmol/L as shown in Table 3. All the subjects who were not previously diagnosed as diabetes were invited to reattend for diagnostic testing (FPG or OGT test). But only 16 people attended for OGTT. Other 41 subjects were tested with FPGT by having an another prearranged centre in the area.

Table 3

Distribution of blood glucose levels in the screened population

Blood sugar value (mmol/L)	**Glucometer tested (FBG) No (%)**	**FPG tested No (%)**	**Known diabetes found No (%)**	**OGTT or FPGT tested No (%)**	**OGTT after 2 hrs No (%)**
3.0-4.9	369(51.3)	3 (1.8)	13 (27.7)	-	1 (6.3)
5.0-5.5	185(25.7)	6 (3.5)	1 (2.1)	-	1 (6.3)
5.6-6.0	86(11.9)	86 (50.6)	12 (25.5)	3 (1.8)	-
6.1-6.9	39(5.4)	30 (17.6)	3 (6.4)	26 (45.6)	-
>=7.0	41(5.7)	45 (26.5)	18 (38.3)	28 (49.1)	14 (87.5)
Total	**720(100.0)**	**170**	**47 (6.5)**	**57**	**16**

It is interesting to note that 38.3% of known diabetes had FBG value higher than 7.0mmol/L indicating the poor control of diabetes. 14 people were diagnosed as diabetes by OGTT and others were diagnosed by the FPGT.

Table 4

Prevalence of diabetes in different sectors

Sector	No. Screened	Previous cases No (%)	New cases No (%)	Total cases No (%)
Working	215	27 (12.6)	6 (3.2)	33 (15.3)
Rural	238	9 (3.8)	13 (5.7)	22 (9.2)
Semi-urban	267	11 (4.1)	11 (4.3)	22 (8.3)
Total	**720**	**47 (6.5)**	**30 (4.5)**	**77 (10.7)**

Table 4 shows a total of 77 diabetic cases (47 previous and 30 new) were found among the screened. The diabetic cases (prevalence rate) in working, rural and semi-urban populations were 33 (15.3%), 22(9.2%) and 22(8.3%) respectively. This shows that it was highly prevalent among the working community and there was no difference in the prevalence rate between semi-urban and rural populations. The total prevalence rate was 10.7% (6.5% previous and 4.2% new) in this study is higher than those found in many countries (WHO study group 1994;Vannasaeng et al 1986; Chou et al 1994;Karki et al 2000)

Table 5

Prevalence of diabetes by age and sex

Sex	Age (years)			Total
	40-49	50-59	>=60	
Diabetes in Male				
Screened	125	106	62	**293**
Previous cases	11	13	3	**27**
New cases	7	4	2	**13**
Total	18	17	5	**40**
Prevalence (%)	14.4	16.0	8.1	**13.7**
Diabetes in Female				
Screened	209	144	74	**427**
Previous cases	5	13	2	**20**
New cases	4	9	4	**17**
Total	9	22	6	**37**
Prevalence (%)	4.3	15.3	8.1	**8.7**

Total diabetes				
Screened	334	250	136	**720**
Previous cases	16	26	5	**47**
New cases	11	13	6	**30**
Total	27	39	11	**77**
Prevalence (%)	8.1	15.6	8.1	**10.7**

Table 5 shows the prevalence of diabetes according age and sex. The prevalence of diabetes increased with age but not after 60 years. The prevalence of diabetes in males is higher than females. The prevalence is high among 40-49 years in males than females. The highest prevalence is noted in the 50-59 years aged subjects.

Table 6

Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) for diagnosing diabetes at different 'cut-off points' of fasting blood sugar (FBS) concentration

Cut-off FBS value	Sensitivity (%, CI)	Specificity (%, CI)	PPV (%, CI)	NPV (%, CI)
> 5.5	100.0 (85.9, 100.0)	84.3 (81.2, 87.0)	22.9 (16.2, 31.2)	100.0 (99.1, 100.0)
> 6.0	90.0 (72.3, 97.4)	95.5 (93.5, 96.9)	48.2 (34.8, 61.8)	99.5 (98.5, 99.9)
> 6.5	58.4 (46.6, 69.4)	98.8 (97.5, 99.4)	84.9 (71.9, 92.8)	95.2 (93.2, 96.6)
> 7.0	49.4 (37.9, 60.9)	99.8 (99.0, 100.0)	97.4 (84.9, 99.9)	94.3 (92.2, 95.8)

The sensitivity, specificity, positive and negative predictive value for detection of diabetes using the glucometer method was carried out from different levels of FBS "cut off" points as assessed by using the glucometer (Table 6). The ability to detect diabetes, i.e. sensitivity and negative predictive values were reduced with the increase level of FBS levels.

The risk of developing diabetes in the subjects due to the presence of risk factors was examined in subjects diagnosed as diabetes in relation to the non-diabetes as shown in Table 7. Being a male, presence of family history of diabetes, age >= 50 years, employed people and diastolic blood pressure higher than 90mmHg had statistically significant odds ratios. The subjects with family history of diabetes have 4 times of high risk to develop diabetes than the subjects without family history.

Twenty of newly diagnosed diabetes subjects were followed up for one month with the prescribed diet (and counselling to promote to a healthy lifestyle. At the end of the 4 weeks, it showed that the weight decreased by 1.51 (5.6) kg and plasma glucose fell by 3 (2.8) mmol/L.

Table 7

Assessment of risk factors in the subjects diagnosed as diabetes

Risk factor	Diabetes(%)	Non-diabetes (%)	Significance test
Presence of family history	33.8	12.0	OR=3.74(2.12-6.59) X^2=24.81, P=0.0000
Sex = Male	51.9	39.3	OR=1.67(1.01-2.76) X^2=4.02, P=0.05
BMI >=25	9.5	90.5	OR=0.84(0.48-1.46) X^2=0.28, P=0.59
Age >=50	64.9	52.3	OR=1.69(1.00-2.87) X^2=3.95, P=0.05
Diastolic blood pressure>=90	33.3	21.1	OR=1.87(1.07-3.24) X^2=5.11, P=0.02
Employed = Yes	66.2	52.7	OR=1.76(1.04-3.00) X^2=4.53, P=0.03
Waist circumference			OR=1.61(0.58-4.29)
Male >=94 cm	18.9	81.1	X^2=0.62, P=0.4
Female >=88cm	8.2	91.8	OR=0.92 (0.4-2.07) X^2=0.05, P=0.82

CONCLUSIONS AND RECOMMENDATIONS

This study showed a relatively high prevalence of diabetes. One new patient with diabetes was identified for every 22 normal people screened. The prevalence of diabetes was higher even in rural areas. A fasting capillary glucose test proved to be a simple and sensitive method of helping to identify previously undiagnosed disease. The high response rate among screened population showed the willingness to undergo screening. This could be effectively used by health staff, targeting all adults with age>50 years. A positive family history of diabetes mellitus can also be used as an

effective screening tool. Therefore a screening system should be developed to identify diabetes people through public health system. The most of cases can be controlled by the diet alone. Therefore the programs targeted towards to improve education and awareness of risk factors are also very important to reduce the prevalence of diabetes.

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ACKNOWLEDGEMENTS

I wish to place on record, my appreciation of those who assisted me in numerous ways to make this study, a success. I thank World Health Organisation for providing the funds to conduct the study. Special mention must be made of Dr. Amal Harsha de Silva, Acting Director Non communicable diseases, for his assistance. I wish to thank Prof. Dulitha Fernando, Professor of Community Medicine, Faculty of Medicine, Colombo, assisted in the preparation of the report. I am grateful to Dr. Gaya Colambage, Director, Medical Research Institute who was a source of strength. She gave her best to make the study a success. Last but not least, I wish to say I am deeply indebted to the, Provincial Directors of Health, Medical Officers of Health, and all the participants for having been partners in this study.

ANNEX 1

STUDY TEAM

Dr. Renuka Jayatissa	- Consultant Nutritionist (Principal Investigator)
Dr. Ariyarathna	- Medical officer
Mr. A.G. Ranasingha	- Pre-intern Medical Student
Mr. C.U.K. Senarath	- Pre-intern Medical Student
Mr. V.P. Ranaweera	- Pre-intern Medical Student
Mr. M.V. Rasika	- Pre-intern Medical Student
Mr. A.H. Chittaka	- Pre-intern Medical Student
Mr. K.K.A.G. Wijesekara	- Public Health Inspector (Field Assistance)
Mr. J.S.Dean	- Secretary

Laboratory team:

Dr. M. M. Gunathilake	- Consultant Chemical Pathologist
Mrs. K.S.N. Jayaratne	- Medical Laboratory Technologists
Mrs. B.Y. Gamage	- Medical Laboratory Technologists
Miss. H. Kulathunga	- Medical Laboratory Technologists
Mrs. S. Nanayakkara	- Medical Laboratory Technologists
Mr. P. Gamage	- Laboratory Orderly
Mrs. W. Polpitiya	- Laboratory Orderly
Mrs. A.G. Sriyani	- Labourer
Mrs. W.P. Perera	- Laboratory Orderly

ANNEX 2

INSTRUCTION FORM

STUDY ON DIABETES MELLITUS

What is it?

Diabetes Mellitus is a condition that arises when the pancreas does not produce enough insulin or when the body cannot use the insulin produced effectively.

Why is it important?

It leads to life threatening complications, like kidney failure, blindness, heart attacks and non-healing wounds lead to amputation.

What is the situation in the World and Sri Lanka?

- It affects 100 million people round the World and over 01 million in Sri Lanka.
- Diabetes is an endemic and these numbers are expected to double in 15 years, and treble in 30 years according to the WHO.
- You can be the next victim of this dreaded disease, whether you are young or old, strong or weak, male or female.

Join us and get you screened!

This is a rare opportunity that you get. Ministry of Health conducts a clinic at……. On…….

Please come and join us! We will help you to get out from the dreadful disease.

Instructions to be followed:

1. We will do the blood test for you to detect diabetes
2. Therefore, you should follow these instructions before you visit the blood drawing centre.
   - Keep fasting from 10PM onward till the sample of blood is drawn from you in the morning (not even a drink of water).
   - Come to the blood drawing centre at 8.30AM

ANNEX 3

STUDY QUESTIONNAIRE

ANNEX 4

FORMAT FOR TEST RESULTS

ANNEX 5

PRESCRIBED DIET
(1500 Kcal)

Morning	– Tea – milk powder (NON FAT)	- 2 tablespoon
	Bread – slices.	- 2
	Dhal curry	- 2TBS
	Banana/ Orange	- 1 small
10 AM	- Plain Tea + without sugar	- 1 cup
Lunch	- Cooked rice	- 1 and 1/2 teacup
	Leafy vegetables (malluma with coconut)	- 3 tablespoon
	Other vegetables cooked with coconut milk	- 3 tablespoon
	Root vegetables cooked with coconut milk	- 2 tablespoon
	Fish	- 1 piece
	Fruit	- 1
Afternoon	– Tea –milk powder (non fat)	- 2 tablespoon
Dinner	– Cooked rice or	- 1 and 1/2 teacup
	Pittu or	- 1 pieces
	String hoppers	- 5
	Leafy or other vegetables cooked	- 3 tablespoon
	Soya /Pulses	-3Tbs
	Fruit	

Whole day- Minimum of 10 glasses of water

1. MILK EXCHANGE

Calories – 100; Protein – 5g; Carbo-15g

Food	**Quantity**	**Approx. amount**	**Fat (g)**
Cheese	30g	(1"x1"x1")	7.5
Curd	200g	Two cup	8.0
Milk (cow)	180ml	One glass	7.0
Milk (skimmed)	260ml	One &quarter glass	-
Full cream Milk powder	30g	2 TBS	5.3
Condensed Milk	30g	2 TBS	2.5
Ice cream	75g	3/4 cup	3.0
Yoghurt	100g	One cup	0.8

2. LEGUME AND PULSE EXCHANGE

30g provides cal–100; Carbo –15g, protein-6g

Food	**Quantity**	**Approx. amount**
Gram Green gram Gram (roasted) Lentils Gram flour Peas (dried) Cow pea Lima Bean Soya bean Dambala	30g	3 TBS

3. FLESH FOOD EXCHANGE

Calories – 70; Protein – 10g;

Food	Quantity	Approx. amount	Fat (g)
Fish	60g	1/2 thin slice	1.7
Chicken	50g	Two cup	2.8
Beef	20g	3 pieces	6.3
Pork	30g	One &quarter glass	4.6
Dry fish	26g	2 pieces	0.2
Prawn	80g		1.0
Egg	50g	1	7.0
Crab	70g	1	0.5

4. VEGETABLE EXCHANGE

Calories: negligible-50 (most of the vegetables are cooked with coconut milk)

These add vitamins and minerals to the diet.

Food	Quantity	Approx. amount	Food
Katuramurunga			Ash Gourd
THAMPALA			Bitter Gourd
Gotukola			Bottlt Gourd
Drumstick leave	30g	3 TBS	Drumstick
Kankun			Bean
Leek			Pumpkin
Lettuce			Tomato
Mukunuwanna			Ladies fingers
Cauliflower			Knokhol
Brinjal			Cabbage

5. ROOTS AND TUBERS EXCHANGE

Calories: 50-100, (most of the vegetables are cooked with coconut milk), Carbohydrate - 10g

Food	Quantity	Approx. amount
Beetroot	75g	1/2
Carrot	105g	1
Manioc	15g	1TBS
Potato	50g	1(medium)
Yam	63g	1 piece
Sweet Potato	42g	1
Jack fruit seeds	105g	10
Jack tender	30g	6
Plantain (green)	75g	1

6. FRUIT EXCHANGE

Calories: 50, CARBOHYDRATE - 10g

Food	Quantity	Approx. amount
Apple		1 small
Avacado		1/4
Banana - Abul		1
- Kolikuttu		3/4
- Anamalu		1/2
Dates dried		2
Durian	50g	1 piece
Grapes blue		10
Guava		4 (medium)
Manderin		1
Mango		3/4

Mangoosteen (small)		2
Water Melon		1/2
Ceylon Olive		14
Orange		1 small
Passion fruit		3
Papaya		1/4
Pine apple		1 slice
Wood apple		1 small
Rambutan (medium)		6

7. CEREALS EXCHANGE

30g provides cal–100; Carbo –30g, protein-4g

Food	**Quantity**	**Approx. amount**
Rice		1 cup
Bread, brown or white		2 slice
Bun (10cm diameter)		1
Biscuit	30g	6
Pittu		1
Rotti		small 1
Hopper		1
String Hoppers large		4

7. FAT EXCHANGE

calories–100; Fat - 11g

Food	**Quantity**	**Approx. amount**
Butter	15g	1 TBS
Cashewnuts	20g	6
Coconut	30g	3TBS
Oil	11g	2TEAS

ANNEX 6

EDUCATIONAL LEAFLETS

osshjevshd frda.h ms<sno jsia;r m;Aq+sldj

oshjevshdj hkq l=ulao@

oshjevshdj ksoka.; frda. ;;ajhls' fuu ;;ajh Wodjkafka bkaishq,ska kuz fydafudakh YrSrh ;=, ksis mqudKfhka fkdbmojSu fyda tu bkaishq,ska fydafudakh YrSrh ;=, ksis f,i ls%hd fkdlsrSu ksidh' tu ksid reOsrfhys we;s iSks ugzgu ksis f,i md,kh lr.; fkdyels fjz'

bkaishq,ska hkq fudkjdo@

bkaishq,ska jkdyS fydafudakhls' fuu fydafudakh YrSrfha we;s w.akHdYh kuz .qka:sfhka ksmojhs' fuu fydafudakh u.ska wdydrj, we;s iSks ^.a,Qfldaia& YrSrfha ffi, ;=,g Wrd.ekSug WmldrSfjz' bkaishq,ska fkdue;s jqjfyd;a fuu iSks ^.a,Qfldaia& ffi, j,g Wrd.ekSug fkdyels jk ksid tajd reOsrfha tl;=fjz' tjsg reOsrfha iSks ugzgu by, k.S'

oshjevshd j._ fudkjdo@

oshjevshd j._ 2 la we;' tkuz mqfNao 1 iy mqfNao 2 h'

oshjevshd mqfNao 1 je<oS we;s mqoa.,hska YrSrhg wjYH bkaishq,ska ksis mqudKfhka idokafka ke;' tuksid tu mqoa.,hskag cSjs;h f.khdu ioyd oskm;d bkaishq,ska ,ndosh hq;=h' fuu ;;ajh nyq,j olakg ,efnkafka <uqka iy fh!jkhka w;rh' uq:Z oshjevshd frda.Skaf.ka 10-15] la w;r m%udKhla fuu ;;ajfhka fmf,a'

oshjevshd m%fNao 2 ;;ajfhaoS YrSrfha ksmofjk bkaishq,ska ksis m%udKj,ska ksmojQj;a ksishdldrj YrSrh ;=, ls%hd fkdlrhs' fuu mqoa.,.hska fuh md,kh lsrSug fm;s j._ mdjspzps lsrSug isoqjk w;r iuyrjsg wjidkfhaoS bkaishq,ska bkafclaIKho mdjspzps lsrSug isoqfjz'

fuu oshjevshd jrsA. folu ioZyd jeo.;a jk uQ,sl m%;slrAu jkqfha ksisf,i md,kh l, wdydr, YdrSrsl jHdhdu iy fi!LH ;;ajh kssssis f,i md,kh lr.ekSuh'

fuu jrA. folg wu;rj we;s wksla oshjevshd ;;ajh kuz .raNKS iufha we;sjk oshjevshdjhs' uq:Z .raNKS ujqjrekaf.ka 2-5] la w;r m%udKhla fuu ;;ajhg f.doqrefjhs. orejd nsysl, miq fuu ;;ajh ke;sfjz' fuys we;s jeo.;alu jkqfha fuu ujqjrrekag miqld,fhaoS oshjevshd m%fNao 2 ;;ajh we;sjSug we;s yelshdj b;du;aau jevs jSuhs'

osshjevsshd frda.fha we;s ixl=+,;d fudkjdo@

1 wefia wdndO - fuu ;;ajfhka wkaONdjh we;sfjz'

2 jl=.vq wdndO - jl=.vq ksIal%sh jSu'

3 iakdhq wdndO - fuysoS mrAhka; iakdhqj,g m%Odk jYfhka n,mdhs' frda. ,laIK f,i w;a iy md j, fjzokdj iy ysrs;a we;sfjz

4 reOsr ixirK moaO;sfha wdndO - oshjevshd ;;ajfhka reOsrjdyskSj,g ;=jd,jSu isoqfjz m%Odk jYfhkau yDo jia;=jg iy fud<hg reOsrh imhk jdyskSj,g fuh n,mdhs fuhska yDo frdaa. wxYNd. ;;ajh we;sfjz

5 ll=,aj, ;=jd, ll=,aj, ixfjzoSNdjh ke;sjSu ksid iy reOsr .ufkys **wvqlu ksid ll=,aj, ;=jd, yg.kS** fuh jevsjSfuka ll=,a lmd oeuSug isoqfjz

osshjesvshd frda.sfhl=g fuu ish:Zu ixl+,;d j,g f.doqrejSfuka je,ls isgsh yel' ta ioZyd oshjevshd frda.hg ksis m%;ssldr ,ndosh hq;=h' ish:Zu mqoa.,hka oshjevshd frda.fhys frda. ,laIKo thg f.doqrejSug we;s idOlo oek.; hq;=h' thska fuu Nhdkl frda. ;;ajfhka je,lS isgsh yel'

osshjevshd frda.h we;sjsh yels idOl fudkjdo@

1 mjq,a b;sydih

Tn mjqf,ys lsishuz idudcslfhl=g oshjevshd frda.h je<oZS ;sfnzkuz th Tngo we;sjSsug we;s yelshdj b;ddu;au jevsh

2 ;rndrej

oshjevshd m%fNao 2 ;;ajh je,oZS we;s mqoa.,hskaf.ka 80] lau ;rndre mqoa.,hskah

3 wl%sh osjs fmfj;

jHhdu iy YdrSrsl l%shdj,shka wvqlu ksid oshjevshd frda.h je<foZa

4 jhi

oshjevshd m%fNao 2 b;du;a m%p,s; jkafka wjqreoq 40 g jevs mqoa.,hskagh

5 ;SrA;h

oshjesvshdj iy ;SrA;h w;r we;s iuznkaO;djh t;ruz meyeos,s ke; tysoS isoqjkafka ;SrA;h ;;ajh we;sjsg bkaishq,ska YrSrfha ksisf,I mdjspzps fkdjsuh

Tnf.a fi!LHh Tnu; roZd mj;S tuksid wou oshjesvshdj ms<snoZ oekqj;ajS tu frda. ;;ajfhka usoSug ls%hdlrkak

fi!LH iuzmkak osjsfmfj;la Tn ieugu m,odhlhs

oshjesvshdj TzkEu mqoa.,fhl=g je<oZsh yel kuq;a ish:Z fokdgu tu frda.hg ldrl jk idOl wvqlrf.k fuu frda.fhka usoSugo wjia:djla we;

fi!LH iuzmkak osjshla ioZyd wjYH **Wmfoia ms,smoskak**

fi!LH iuzmkak osjs fmfj;la hkq l=ulao@

1 **iun, wdydr**

2 **Ydrsrsl jHdhdu**

3 ksis ffjoH Wmfoia iy l%uj;a cSjk rgdj.

4 iudc osjsh.

Tn oshjevshd frda.fhka fmf,kakl= jQj;a fkdjQj;a fi!LH iuzmkak wdydr ,nd .ekSu ioyd YdrSrsl jHhduj, fhoSu jeo.;ah. fuu.ska oshjevshd m%fNao 2 frda. ;;ajh we;sjSu j,lajd.; yels w;r oekg oshjevshdfjka fmf,kakkag tu.ska we;sjsh yels ixl+,;d j,lajd .;yelsh. oekgu;a oshjevshd frda. ;;aj j,ska fmf,kakka ;u reOsr .a,Qfldaia ugzgu md,kh l, hq;= w;r wjYH kuz bkaishq,ska tkaihsuh iy fT!IO o ,nd.; hq;=h.

iun, wdydr

TzzkEu oshjevshd m%fNao ;;ajhla md,kh lr.ekSu ioZyd oskm;d fmdaIHodhS iun, wdydr fjz,a ,nd.ekSu b;d jeo.;ah. fuu.ska reOsrfha iSks ugzgu md,kh fjz. Tn oekgu;a oshjevshd frda.h ksid bkaishq,ska iy T!IO ,nd.kakl= jQj;a ksjeros l%uhg wdydr .ekSu w;HjYHfj.z

oshjevshd wdydr fjz,la hkq yqfola wdydr fjz,lau fkdfjS. th uqZ:Z mjq,gu irs,k jsOsu;a wdydr .ekSfuz l%uhla f,i yeoZskajsh yelsh. fuz l%u wkq.ukh lsrSfuka reOsrfha iSks ;;ajh md,kh lsrSug muKlau fkdj isrefra nr ksishdldrj mj;ajd.ekSug iy yDo frda. uevmj;ajd.ekSugo WmldrSfjz. Tnf.a reOsrfha iSks ugzgu Tn .kakd iEu wdydrhla u;u roZd mj;S nqoaOsu;a f,i wdydr f;dard.ekSu kSfrda.S osjshlg we;s m%Odku udrA.hhs.

fmdalHodhS wdydr fjz,la idod .ekSug my; Wmfoia ms,smoskak.

- ieujsgu ffjoHjrfhl= fyda fi!LH ldrAh uKav,fha Wmfoia ms,smeoSuo fuysoS b;d jeo.;ah.
- wdydrhg jsjsO wdydr j._ tlalr.kak.
- f;,a iys; wdydr j._ jevsmqr .ekSfuka yels;ruz j,lskak.
- wdydr msiSfuzoSo f;,a yels;rsuz wvqfjka Ndjs;d lrkak.
- rilejs,s flala nsialgz jeks wdydr jsfYaI wjia:dj,g muKlA iSud lrkak.
- ,qKq wdydrhg .ekSu wvq lrkak. ,qKq nyq,j fhoQ wdydr ks;r wdydrhg .ekSfuka j<lskak. wdydr ri .ekajSu ioZyd ,qKq Ndjs;h fjkqjg fjk;a l+:Znvq foys hqI jeksfoa fhdod.kak.
- u;ameka Ndjs;h md,kh lrkak.

m%dfhda.sl Wmfoia.

- osklg jsYd, m%udKfha wdydr fjz,a folla fjkqjg l+vd m%udKfha wdydr fjz,a ;+kla .kak.
- wdydr fjz,a u.yerSfuka j<lskak.
- oskm;d tlu fjz,djlg wdydr .kak.
- ksis m%udKhg muKla wdydr .kak.

YdrSrsl jHdhdu

f,dl+ l+vd ieugu YdrSrsl jHhdu w;HdjYHh. isrer ksisf,i mj;ajd .ekSug;a YrSrfha we;s jevsmqr le,rs oykh lsrSug;a isrefrA nr wvqlr .ekSug;a YdrSrsl jHhduj, fhoSsu WmldrSfjz.
oshjevshdfjka fmf,k mqoa.,hkag YdrSrsl jHdhdu u.ska reOsr .a,Qfldaia ugzgu wvqlr .ekSug yelsfjss. bkaishq,ska fukau YdrSrsl jHhduo reOsrfha .a,Qfldaia jeh lsrSug WmldrS fjz.jHhdu u.ska bkaishq,ska j, ls%hdldrs;ajho jevs lrhs. oshjevshdfjka fmf,kafkl+go kSfrda.S mqoa.,fhl+g iudkju jHdhdu u.ska isrefrA nr md,kh lr .ekSu yd udkisl ieye,a,q nj we;slr.; yel.

idudkH Wmfoia

- Tn leu;s iy iEu jsgu Tng fhosh yels jHdhduhla f;dard.kak. fufia lsrSfuka oskm;d jHdhdu lsrSug Tn osrsu;a fjkjd we;.
- ieu jsgu Tn lrk jHdhdu fndfyda ld,h jeh l<hq;+ tajd jsh hq;+ ke; .
- jHdhdu Tfnz oskprAhdfjz fldgila lr.kak
- l+vd jqj;a Tn fhfok iEu jHdhduhlau jeo.;a nj i,lkak.

ffoksl YdrSrsl jHdhduj, fhoSug m%dfhda.sl Wmfoiaa.

- ieujsgu jsoq,s fidamdkh fjkqjg ;rmamq fm, Ndjs;d lrkak. th b;d fydoZ jHdhduhls.
- oskm;d oj,a fyda ? lEfuka miq t,suyfka wejsoSuo fydoZ jHdhduhls.
- Tn nia r:hl .uka lrkafkl+ kuzz Tn hdhq;+ ia:dkhg tla nia kej;+ulg l,ska nifhka nei b;srs oqr wejsoskak.
- Tn jdykh mojdf.k hkafka kuz hdhq;+ ;ekg uo oqrla wE;ska jdykh kj;d t;eka isg wejsoSu lrkak.
- rEmjdyskS jSvsfhda leigz frfldavrA ioZyd oqria: md,lh Ndjs;fhka j,lskak.
- nhsisl,a meoSu msyskSu jeks ls%hdldrluzj, fhfokak.
- Tnf.a us;+rka fyda oQorejka iu.Z mdmkaoq fjd,sfnda,a jeks YrSrh fjfyi lrjk lS%vdj, fhfokak.

ksis ffjoH Wmfoia yd l%uj;a cSjk rgdj

oshjevshd m%fNao 1 oS YrSrfha bkaishq,ska ksYamdokh fkdjk nejska reOsr .a,Qfldaia ugzgu wvq lr .ekSug bkaishq,ska ,nd.ekSu l<hq;+ fj.z oshjevshd m%fNao 1 ka fmf,k mqoa.,hka osklg lSmjrla bkaishq,ska bkafclaIkh ,nd.ekSu l< hq;+h. kuq;a oskm;d ;u reOsrfha iSks ugzgu mrSCId lrf.k ta wkqj wjYH bkaishq,ska ud;%dj ,nd.ekSu l<hq;+h.

oshjevshd m%fNao 2 oS YrSrh u.Zska huz m%udKhlg bkaishq,ska ksmojk kuq;a th YrSrfha iuzmQrAK wjYH;d ioZyd m%udKj;a fkdfjz. fuu frda.S ;;ajfhka fmf<kakka ioZyd we;euzjsg fm;s jrA. ,ndosh yels w;r huz huz wjia:dj,oS iuyrekayg bkaishq,ska bkafclaIkh ,ndoSu l<hq;+ fj.z ^oshjevshd m%fNao 2 frda.S ;;aj j,ska fmf<k mqoa.,hska 30] lg bkaishq,ska bkafclaIkh ,ndoSu lrkq ,efnz&.

fuysoS jeo.;a jkafka ksjeros Wmfoia ,nd.ekSu yd tu.Zska ;u cSjk rgdj ilid .ekSfuka frda.S ;;ajh Tnu md,kh lr .ekSuhs.

iudc osjsh

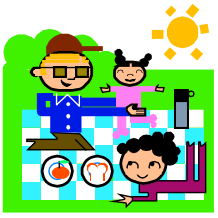
iudcfha wka wh iu.Z fydoZ iuznkaO;d f.dvk.Zd .ekSuo kSfrda.S osjsfmfj;lg WmldrS fjz. Tnf.a mjqf,a wh yd us;+rka iu.Z jsfkdaojSu u.ska udkisl wd;;sh wvqlr .;yels fjz. udkisl wd;;sh oshjevshd frda.h

je,oSug tla fya;+jla jk nejska udkisl wd;;sh wvqlr .ekSu u.Zska oshjevshd frda.h we;sjSu md,kh lr.; yelh.

Tnf.a fi!LH ms<snoZ jsfYaIfhka ie,ls,su;a jSug isoqjSu yd fT!IO ,nd .ekSug isoq jSu hym;a iudc osjshla .; fkdlsrSug fya;+jla fkdfjz. md,khla we;sj wdydr .kakd w;ru W;aij wjia:djloS fyda fjk;a jsfYaI wjia:djloS jsfkdao jSug Tng yelshdj we;. fmdaIHodhS wdydr ,nd.ekSu ioZyd we;s Wmfoia ms<smeoSu yeu fokdgu fi!LH iuzmkak cSjs;hla .;lsrSug Wmldr jk nejska tfia slsrug isoq jSu lrorhla fia Tn fkdis;sh hq;+h.

jHdhduj, fhoSuo Tfnz iudc cSjs;fha fldgila lr .; yelsh . Tfnz us;+rka yd mjqf,a wh iu.Z wejsoSug hdu fyda us;+frl+ iu.Z lS%vd iudchlg iuznkaOj lghq;+ lsrSu jHdhduh Tng jsfkdao ckl w;aoelSula lrjhs . Tng YdrSrsl yd udkisl i;+gla f.k oSug th Wmldrjkjd we; .

fmdaIK wxYh
ffjoH mrafhaIK wdh;kh
fi!LH fomdra;fuka;+j
(f,dal fi!LH ixjsOdkfha wkq.%yfhks)



ANNEX 7

FORMAT FOR FOLLOW UP

Diabetes mellitus - Follow up visits

Name:---------- Age:---------- Sex:-------- Occupation:----------

Date of first examined:----------Wt (kg):--------- Ht (cm):---------- BMI:--------FBS (plasma mmol/L):…… GTT:Date:----------FBS:---------- 2hrs:----------Urine(2hrs):----------

Date					
Body weight					
BMI					
Urine for fasting specimens: Glucose					
Albumin (micro & macro)					
Glycaemic control: HbA_{1c}					
Blood glucose monitoring record at home					
Hypoglycaemic episodes: No. of serious episodes					
Mild episodes					
Time when "hypo" experience					
BP (Supine)					
BP (Erect)					
Visual acuity Opthalmoscopy (with pupils dilated)					
Lower limbs: Peripheral pulses					
Tendon reflexes					
Perception of vibration senses					
Feet: ulcer, callous, nails					