

DIABETES MELLITUS AND ITS CONCOMITANT DISORDERS IN AFGHAN REFUGEES RESIDING IN PESHAWAR, PAKISTAN

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ABSTRACT

Objective: To determine the frequency of diabetes mellitus and its concomitant disorders in Afghan Refugees.

Material and Methods: This study was carried out to see the prevalence of a number of diseases in Afghan Refugees attending different dispensaries and hospitals under Red Cross control, located in Peshawar, Pakistan. The diseases that were looked for were diabetes mellitus, hepatitis, nephritis, hyperlipidemia, and diabetes mellitus with concomitant disorders like hepatitis, nephritis and hyperlipidemia. A total of 456 Afghan patients were seen with non-insulin-dependent diabetes mellitus, hepatitis, nephritis, hyperlipidemia, and diabetes mellitus with concomitant disorders like hepatitis, nephritis and hyperlipidemia, attending different dispensaries and hospitals under Red Cross control, located in Peshawar, Pakistan, during a two year study period. Blood glucose, total lipids, cholesterol, triglycerides, total and direct bilirubin, urea, creatinine, uric acid, aspartate aminotransferase (AST), alanine aminotransferase (ALT), and alkaline phosphatase (ALP) were determined by colorimetric method.

Results: Four hundred and fifty-six patients examined during the study period included 255 patients suffering from diabetes mellitus (NIDDM), 80 with hepatitis, 69 with nephritis, and 52 with hyperlipidemia. Out of 255 diabetic patients, 45 diabetics had hyperlipidemia, 37 had nephritis, and 22 had hepatitis, whereas the remaining 151 diabetic patients were not having any other concomitant disorder. The patients were divided into adult age group (18 – 50 years) and old age group (51 – 80 years). The level of total and direct bilirubin was found significantly higher ($P < 0.01$) in adult male when compared to the old age male patients with hepatitis, whereas the level of serum AST and ALT were found significantly increased ($P < 0.05$) in old age patients as compared to adult age group patients with hepatitis. Adult male patients had significantly increased levels

of cholesterol as compared to the old age male patients with hyperlipidemia. Blood urea levels in old age female group showed a significant difference ($P < 0.05$) when compared to adult age female patients with nephritis. The rest of the parameters were found statistically indifferent in both sexes in adult and old age patients with nephritis. In female diabetic patients with nephritis the blood uric acid levels were found to be significantly lower in old age patients as compared to the adult age group patients.

Conclusion: The frequency of non-insulin dependent diabetes mellitus was found to be very high in Afghan refugees in Peshawar then the rest of the diseases and the percentage of male patients in all groups of diseased subjects is higher than the female.

Key words: Type 2 Diabetes Mellitus, Nephritis, Hepatitis, Hyperlipidemia.

INTRODUCTION

Life style and behavioural changes over the last century have resulted in a dramatic increase in the incidence of diabetes worldwide.¹ Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. The chronic hyperglycemia in diabetes leads to long term complications of various organs especially the eyes, kidneys, nerves, heart, and blood vessels.²

Urinary tract infections in the hospitals are one of the most common infections. They are being the second most common infections seen in the general population.³ Urinary tract infection is a major disease burden for many patients with diabetes.⁴ Diabetic nephropathy occurs in 30-35% of insulin-dependent and 15-25% of non-insulin-dependent diabetic patients after duration of diabetes of at least 25 years. Diabetic Nephropathy has become the leading cause of chronic renal failure.⁵

Hepatitis is an inflammatory condition of liver, which results due to injury to the

hepatocytes, and is associated with an influx of acute or chronic inflammatory cells into the liver.⁶ Liver disease may induce and/or worsen the development of non-insulin-dependent diabetes mellitus and vice versa. Diabetes mellitus can also result in liver damage.⁷

This study was carried out to see the prevalence of diabetes mellitus (non-insulin-dependent), hepatitis, nephritis, hyperlipidemia, and diabetes mellitus (non-insulin-dependent) with concomitant disorders like hepatitis, nephritis and hyperlipidemia.

MATERIAL AND METHODS

A total of 456 Afghan patients were seen with non-insulin-dependent diabetes mellitus (NIDDM), hepatitis, nephritis, hyperlipidemia, and NIDDM with concomitant disorders like hepatitis, nephritis and hyperlipidemia, attending different dispensaries and hospitals under Red Cross control, located in Peshawar, Pakistan, during a two year study period. Detailed history was recorded from the patients on a Proforma designed for the study. Fasting blood (4 ml) was collected from the patients. Blood

glucose was determined immediately and the remaining sample was stored in the freezer till further analysis. Blood glucose, total lipids, cholesterol, triglycerides, total and direct bilirubin, urea, creatinine, uric acid, aspartate aminotransferase (AST), alanine aminotransferase (ALT), and alkaline phosphatase (ALP) were determined colorimetrically by kits obtained from Merck Diagnostica, Germany. The statistical analyses include percentages, mean \pm SD and Student's "t" test. P value less than 0.05 was considered as significant.

RESULTS

Four hundred and fifty-six patients examined during the study period included 255 patients suffering from diabetes mellitus, 80 with hepatitis, 69 with nephritis, and 52 with hyperlipidemia. The age of the patients (n = 456) ranged from 18 to 80 years. Male to female ratio was 262 (58%):194 (42%). Out of 255 diabetic patients, 45 diabetics had hyperlipidemia, 37 had nephritis, and 22 had hepatitis, whereas the remaining 151 diabetic patients were not having any other concomitant disorder. The patients with different diseases were divided on the basis of age as adult group (18-50 years) and old group (51-80 years). The age range and sex

distribution of patients with different diseases is given in Table-1. The percentage of male patients in all groups of diseased subjects is higher than the female, except for the diabetic patients with nephritis where there is female dominance.

Fasting blood glucose level of patients suffering from NIDDM with no other complication (n = 151) range from 150 to 435 mg/dl, having a mean value of 225.43 ± 23.53 mg/dl. NIDDM patients in adult group (n = 70) had mean blood glucose level of 224.16 ± 70.07 mg/dl, whereas old group (n = 81) had 229.95 ± 67.72 mg/dl. The level of blood glucose in male and female diabetic patients in both adult and old age group did not show any statistically significant difference, which can be seen in Table-2.

Patients having hepatitis had level of total and direct bilirubin ranging from 1.1 to 2.8 mg/dl (mean 1.69 ± 0.4 mg/dl) and 0.1 to 0.4 mg/dl (mean 1.39 ± 0.4 mg/dl) respectively.

The level of enzymes AST, ALT and ALP ranged from 23 to 34 U/l (mean 29.39 ± 5.2 U/l), 23 to 38 U/l (mean 27.12 ± 4.1 U/l) and 83 to 139 U/l (mean 105.86 ± 16.3 U/l) respectively. Table-3 shows level of total and direct bilirubin, AST, ALT and ALP in patients with hepatitis. The level of total and

AGE AND SEX DISTRIBUTION OF PATIENTS WITH DIFFERENT DISEASES

DISEASES	TOTAL (n)	AGE (Years)	MALE	FEMALE
DIABETES MELLITUS	151	28-75	83 (55%)	68 (45%)
HEPATITIS	80	18-62	47 (59%)	33 (33%)
HYPERLIPIDEMIA	52	30-80	30 (58%)	22 (42%)
NEPHRITIS	69	30-75	44 (64%)	25 (36%)
DIABETES WITH HEPATITIS	22	29-75	15 (68%)	7 (32%)
DIABETES WITH HYPERLIPIDEMIA	45	35-75	29 (64%)	16 (36%)
DIABETES WITH NEPHRITIS	37	28-75	14 (38%)	23 (62%)

n = number

TABLE-I

BLOOD GLUCOSE DISTRIBUTION ACCORDING TO SEX IN ADULT AND OLD GROUP OF DIABETIC PATIENTS

	MALE		FEMALE	
	TOTAL (n)	GLUCOSE (mg/dl)	TOTAL (n)	GLUCOSE (mg/dl)
ADULT (n = 70)	34	226.97 ± 77.92	36	224.57 ± 67.42
OLD (n = 81)	50	225.61 ± 65.60	31	238.55 ± 71.70

TABLE-2

direct bilirubin was found significantly higher ($P < 0.01$) in adult male when compared to the old age male patients with hepatitis, whereas the level of serum AST and ALT were found significantly increased ($P < 0.05$) in old age patients as compared to adult age group patients.

Hyperlipidemia was seen in 52 patients attending the clinics. They were having no other illness, except for high lipid levels detected during routine blood analysis. The cholesterol, triglycerides and total lipid levels in patients ranged from 243 to 480 mg/dl (mean 324.1 ± 56.8 mg/dl), 209 to 464 mg/dl (mean 314.9 ± 77.2 mg/dl), and 1030 to 1678 mg/dl (mean 1341.7 ± 171.1 mg/dl) respectively. The level of cholesterol was seen

significantly raised ($P < 0.05$) in old age male patients with hyperlipidemia as compared to adult age patients, whereas the level of total lipid was found high ($P < 0.05$) in old age females as compared to adult female patients with hyperlipidemia. No statistically significant difference was seen in level of triglycerides, on comparison among different age groups in either sex (Table-4).

Sixty-nine patients were diagnosed with nephritis a renal disorder. Blood urea, creatinine and uric acid were determined in these patients and the parameters were found to be in a range of 43 to 147 mg/dl (mean 78.4 ± 23.5 mg/dl), 1.4 to 4 mg/dl (mean 2.2 ± 0.7 mg/dl), and 7.2 to 10.7 mg/dl (mean 8.4 ± 0.9 mg/dl) respectively. Comparison of

LEVEL OF TOTAL AND DIRECT BILIRUBIN, AND ENZYMES IN MALE AND FEMALE ADULT AND OLD GROUPS OF PATIENTS WITH HEPATITIS.

GROUPS	SEX	TB (mg/dl)	DB (mg/dl)	AST (U/l)	ALT (U/l)	ALP (U/l)
ADULT (n = 49)	Male (n = 26)	1.86 ± 0.43	1.56 ± 0.41	28.4 ± 4.97	26.1 ± 3.65	104 ± 19.11
	Female (n = 23)	1.91 ± 0.46	1.67 ± 0.45	29.6 ± 4.74	27.7 ± 4.11	104.8 ± 13.53
OLD (n = 31)	Male (n = 21)	**1.51 ± 0.44	**1.23 ± 0.44	*30.9 ± 3.81	*28.1 ± 3.93	107 ± 17.3
	Female (n = 10)	1.82 ± 0.30	1.51 ± 0.31	29 ± 3.65	27.2 ± 3.58	104.2 ± 18.10

Note: TB = Total Bilirubin, DB = Direct Bilirubin, AST = Aspartate aminotransferase,

ALT = Alanine aminotransferase, ALP = Alkaline phosphatase.

* $P < 0.05$ as compared to adult male group.

** $P < 0.01$ as compared to adult male group.

TABLE-3

CHOLESTEROL, TRIGLYCERIDES, AND TOTAL LIPID LEVELS IN ADULT AND OLD AGE GROUP OF HYPERLIPIDEMIC PATIENTS.

GROUPS	SEX	CHOLESTEROL (mg/dl)	TRIGLYCERIDES (mg/dl)	TOTAL LIPIDS (mg/dl)
ADULT (n = 25)	Male (n = 14)	295.5 ± 33.6	287.6 ± 74.9	1424.7 ± 206.7
	Female (n = 11)	323.6 ± 60.8	312.5 ± 63.3	1229.4 ± 148.9
OLD (n = 27)	Male (n = 16)	331.3 ± 60.5 *	318 ± 64.7	1361.8 ± 133.1
	Female (n = 11)	330.5 ± 62.3	336.1 ± 89	1374.2 ± 167.8 **

* P < 0.05 as compared to adult male group.

** P < 0.01 as compared to adult female group.

TABLE-4

these parameters can be seen in old age and adult age patient groups in both sexes in Table-5. Blood urea levels in old age female group showed a significant difference (P < 0.05) when compared to adult age female patients with nephritis. The rest of the parameters were found statistically indifferent in both sexes in adult and old age patients with nephritis.

Diabetic patients with hepatitis seen during the study period were 22 in number. The mean level of blood glucose, total and direct bilirubin, AST, ALT, and ALP in these patients was 231.64 ± 63.79 mg/dl, 1051 ± 0.27 mg/dl, 1.2 ± 0.32 mg/dl, 28.45 ± 4.19 U/l, 26.09 ± 3.36 U/l, and 105.5 ± 17.56 U/l respectively. In diabetics having hepatitis no significant difference was observed in any parameter, when adult and old age group patients were compared on basis of sex amongst each other (Table-6).

Blood glucose, cholesterol and triglyceride levels in diabetic patients with hyperlipidemia are given in Table-7. They (n = 45) had mean level of blood glucose as 245.71 ± 98.81 mg/dl, cholesterol as 367.51 ± 53.6 mg/dl and triglyceride level as 334.58 ± 72.7 mg/dl. No significant difference was seen in case of male and female adult and old age group patients suffering from diabetes with hyperlipidemia when compared with each other.

Diabetic patients with nephritis (n = 37) had mean fasting blood glucose, urea, creatinine and uric acid as 239.60 ± 77.40 mg/dl, 79.90 ± 33 mg/dl, 2.20 ± 0.6 mg/dl and 8.30 ± 0.9 mg/dl respectively. Blood uric acid level was found significantly high (P < 0.05) in adult female patients having diabetes with nephritis as compared to old age female group (Table-8).

BLOOD UREA, CREATININE, AND URIC ACID LEVELS IN ADULT AND OLD AGE GROUP OF NEPHRITIC PATIENTS.

GROUPS	SEX	UREA (mg/dl)	CREATININE (mg/dl)	URIC ACID (mg/dl)
ADULT (n = 34)	Male (n = 22)	71.8 ± 15.4	2.3 ± 0.6	8.5 ± 0.8
	Female (n = 12)	74.9 ± 18.6	2.1 ± 0.7	8.6 ± 0.9
OLD (n = 35)	Male (n = 22)	78 ± 26	2.4 ± 0.9	8.2 ± 0.8
	Female (n = 13)	95.7 ± 28.2 *	2 ± 0.6	8.5 ± 1

* P < 0.05 as compared to adult female group.

TABLE-5

BLOOD GLUCOSE, TOTAL AND DIRECT BILIRUBIN, ASPARTATE AMINOTRANSFERASE, ALANINE AMINOTRANSFERASE, AND ALKALINE PHOSPHATASE LEVELS IN ADULT AND OLD AGE GROUP OF DIABETIC PATIENTS HAVING HEPATITIS.

GROUPS	SEX	GLUCOSE (mg/dl)	TB (mg/dl)	DB (mg/dl)	AST (U/l)	ALT (U/l)	ALP (U/l)
ADULT (n=12)	Male (n=8)	221.87 ± 51.54	1.61 ± 0.25	1.27 ± 0.3	27.75 ± 4.62	25.75 ± 3.01	108.25 ± 19.62
	Female (n=4)	248.25 ± 83.28	1.4 ± 0.36	1.12 ± 0.46	29.75 ± 5.56	27 ± 4.83	108 ± 22.85
OLD (n=10)	Male (n=7)	235 ± 80.33	1.5 ± 0.2	1.2 ± 0.18	27.7 ± 3.35	25.3 ± 3.15	106 ± 16.58
	Female (n=3)	227 ± 51.64	1.4 ± 0.42	1 ± 0.51	30.3 ± 4.16	27.7 ± 3.79	93.7 ± 5.51

Note: TB = Total Bilirubin, DB = Direct Bilirubin, AST = Aspartate aminotransferase, ALT = Alanine aminotransferase, ALP = Alkaline phosphatase.

TABLE-6

BLOOD GLUCOSE, CHOLESTEROL AND TRIGLYCERIDE IN MALE AND FEMALE, ADULT AND OLD AGE DIABETICS WITH HYPERLIPIDEMIA.

GROUPS	SEX	GLUCOSE (mg/dl)	CHOLESTEROL (mg/dl)	TRIGLYCERIDES (mg/dl)
ADULT (n = 27)	Male (n = 17)	239.90 ± 92.80	367.60 ± 56.50	339.40 ± 75.70
	Female (n = 10)	247.10 ± 96.80	344.60 ± 45.60	304.80 ± 87.10
OLD (n = 18)	Male (n = 12)	259.80 ± 109.60	390.20 ± 49.40	325.80 ± 58.30
	Female (n = 6)	259.30 ± 115.90	360.00 ± 55.90	354.00 ± 53.30

TABLE-7

BLOOD GLUCOSE, UREA, CREATININE AND URIC ACID LEVELS IN ADULT AND OLD AGE GROUP OF DIABETIC PATIENTS HAVING NEPHRITIS.

GROUPS	SEX	GLUCOSE (mg/dl)	UREA (mg/dl)	CREATININE (mg/dl)	URIC ACID (mg/dl)
ADULT (n = 21)	Male (n = 7)	233.40 ± 51.00	80.60 ± 34.80	2.10 ± 0.70	8.00 ± 0.40
	Female (n = 14)	231.00 ± 81.00	74.00 ± 30.60	2.30 ± 0.60	8.70 ± 1.10
OLD (n = 16)	Male (n = 7)	252.60 ± 87.50	83.40 ± 37.00	2.10 ± 0.60	8.10 ± 0.60
	Female (n = 9)	248.20 ± 90.20	87.90 ± 36.00	2.10 ± 0.70	8.00 ± 0.70 *

* P < 0.05 as compared to adult female group.

TABLE-8

DISCUSSION

Diabetes mellitus is divided into two broad classes, insulin dependent diabetes mellitus (IDDM, type 1) and insulin-dependent diabetes mellitus (NIDDM, type 2). In

IDDM there is absolute insulin deficiency whereas in NIDDM there is relative insulin deficiency and insulin resistance.⁸ NIDDM is one of the most common carbohydrate metabolism disorders affecting at least 5% of the population in the industrialized world.⁹

Diabetes mellitus is frequently associated with lipid metabolism abnormalities.¹⁰ The development of dyslipidemia and hypertension in diabetic individuals is due to the insulin resistance.¹¹ The levels of blood glucose in female diabetics were observed to be high in old age patients on comparison with adult age patients. Whereas the levels were found to be statistically indifferent in adult and old age patient groups in both male and female diabetic patients. The severity of the disease increased with age and was maximum in the old females and consistent with the study that prevalence of diabetes mellitus is age specific.^{12,13} There are numerous reports that modernization has major effects on life style, socioeconomic, moral, and agricultural and health, still dramatic increase in prevalence rates of diabetes mellitus in certain native populations have been documented.¹⁴ It seems quite possible to explain the prevalence of diabetes mellitus on the basis of sex, physical activity, diet and stress. Yet obesity in females could be considered as another factor to explain this phenomenon.¹⁵

Liver disorders and inflammatory processes lead to the death of liver cells, affecting almost all areas of the liver. Major causes are hepatitis A and B viruses. Drugs and alcohol can produce liver damage. The hepatic enzymes show variable elevation, depending upon severity of the disease. Alkaline phosphatase may rise moderately or remain within normal limits. Both alanine and aspartate aminotransferase manifest elevations often up to 10 times and more the upper limit of reference range.¹⁶ In clinical diagnosis of hepatitis prevalence of incidence has been reported with varying degrees of abnormalities in liver function tests mostly in the males between 21 – 30 years.¹⁷ Again a more frequent occurrence of acute viral hepatitis has been documented in the younger individuals.¹⁸ A number of studies reported liver function profile of

female patients having hepatitis between 14 – 45 years of age with abnormalities in alkaline phosphatase, transaminase, bilirubin, and albumin and thymol turbidity reported.^{19,20,21} Our results also indicate abnormalities in the level of total and direct bilirubin, transaminases, and alkaline phosphatase in male and female patients with hepatitis of both adult and old age groups. Contaminated water supply with sewage has been responsible for out breaks of hepatitis E virus.²² The largest outbreak was in New Delhi, India in 1956.²³ In many other parts of the world, South East Asia, Central Asia, North and West Africa and Mexico,²⁴ North America, Western Europe infection has been reported.²⁵ Epidemics of acute viral hepatitis have also been documented from Quetta in 1985, Mardan in 1984 and in Rawalpindi.²⁶

Cholesterol and other plasma lipids, such as triglycerides, do not circulate in the blood as free lipids, but in the form of lipoprotein complexes. There is no particular level of plasma cholesterol which identifies those at risk, the highest the level the greater the risk.^{27,28} In the age group 15 to 45 years, the serum cholesterol values were higher in the females as compared to age matched males and in the age group 45 to 74 years, the cholesterol values were found to be lower in females as compared to the age matched males. A progressive rise in the level of cholesterol was noticed in the females of age 15 to 64 years followed by a decline. A similar observation was found in the males between the ages 15 to 64 years after which cholesterol was found to be lowered. In females, the level of triglycerides increased between the age 15 to 74 years however, in the males the value of triglycerides were fairly constant between 15 to 44 years of age and then a fall was observed.²⁹ Our results indicate a significant increase in blood cholesterol in old age group as compared to the adult age group in male patients, whereas total lipid concentration

was found to be higher in the old age females as compared to the adult age female patients with hyperlipidemia.

Renal disease usually accompanied by a variety of alterations in renal functions. Some of these complications have a little and other have considerable clinical importance. Hyperuricemia is associated with disturbed renal functions and in severe renal impairment values up to 35 mg/dl have been observed. Renal failure without apparent cause may develop and renal function may deteriorate rapidly in these patients but the rate and pattern varies considerably. Measuring serum creatinine concentration in addition to urea sometimes permit early diagnosis of renal failure.³⁰ The levels of blood urea showed a significant rise in old age females as compared to adult age female patients with nephritis. Increase in urea was also seen in old age male when compared to adult age male subjects with nephritis but this did not reach the statistical level of significance. Creatinine and uric acid also have alterations in both adult and old age group patients in both sexes but without statistical significance.

REFERENCES

1. Zimmet P, Alberti KG, Shaw J. Global and societal implications of the diabetes epidemic. *Nature* 2001;414:782-7.
2. Schuster DP, Duvuuri V. Diabetes mellitus. *Clin Podiatr Med Surg*. 2002;19:79-107.
3. Valiquette L. Urinary tract infections in women. *Can J Urol* 2001;8:6-12.
4. Ronald A, Ludwig E. Urinary tract infections in adults with diabetes. *Int J Antimicrob Agents* 2001;17:287-92.
5. Romero R. Diabetic nephropathy: strategies for prevention]. *Nefrologia*. 2002;22:46-50.
6. Crawford JM. The liver and the biliary tract. In; Kumar V, Cotran RS, Robbins SL, eds. *Basic Pathology*. Philadelphia. W.B. Saunders Company, 1997:516-55.
7. Chlup R, Ehrmann J. Special aspects of diagnosis and therapy of diabetes in liver diseases. *Vnitr Lek* 2001;47:320-3.
8. Levy J, Gavin III JR, Sowers JR. Diabetes mellitus: A disease of abnormal cellular calcium metabolism? *Am J Med*. 1994;96:260-71.
9. Hauner H, Scherbaum WA. Diabetes mellitus type 2. *Dtsch Med Wochenschr*. 2002;127:1003-5.
10. Barbagallo CM, Aversa MR, Amato S, Marino G, Labisi M, Rao AG, Barbagallo M, Cupidi GF, Notarbartolo A. Apolipoprotein profile in type II diabetic patients with and without coronary heart disease. *Acta Diabetol Lat* 1990;27:371-7.
11. Odawara M. [Evidence based treatment of dyslipidemia associated with diabetes mellitus]. *Nippon Rinsho*. 2002;60:1010-6.
12. Zimmet P Taft P. The high prevalence of diabetes mellitus on a Central Pacific Island. In; *Advance in metabolic disorders*. New York. Academic Press, 1978;9.
13. Bennet PH, Burch TA, Miller M. Diabetes mellitus in American (Pima) Indians. *Lancet* 1977;2:125.
14. West KM. Diabetes in American Indians and other native populations of the new World. *Diabetes*. 1974;23:841.
15. West KM, Kalbfleisch JM. Diabetes in Central America. *Diabetes*. 1970;19:656.
16. Calboech D, Ciulla A. *Clinical Chemistry; A Fundamental Textbook*. WB Saunders Company, 1992;45.
17. Rahman S, Hameedi AA, Ibrahim M. Infectious hepatitis. A ClinicoPathological study. *J P M A*. 1970;20:320.
18. Zuberi SJ, Lodi TZ. Sub specificities of hepatitis B surface antigen. *J P M A*. 1978;28:8.
19. Haider Z, Fayyaz ud Din, Fayyaz A, Begum M. Liver function tests in women

- of child bearing age attending hospital out-patients in Lahore. *Pak J Med Res.* 1975;14:57.
20. Rehman A, Khan T. Prevalence of liver function impairment of women of child bearing age. *J P M A.* 1972;22:94.
21. Zuberi SJ, Lodi TZ, Samad F. Prevalence of hepatitis B surface antigen and antibody in healthy subjects and patients with liver disease. *J P M A.* 1978;28:2.
22. Melnick JK. Awater borne urban epidemic hepatitis. In; Lo Grippo GA, Hartman FW, Matee JG, Barron J, eds. *Hepatitis Frontiers.* Boston. Little Brown, 1957: 211-25.
23. Wiswanathan R. Infectious hepatitis in Delhi 1955-56. A critical study. *Indian J Med Res.* 1957;45:1-30.
24. Bradley DW. Hepatitis E, epidemiology, aetiology and molecular biology. *Med Virol.* 1992;2:19-29.
25. Mikhail SB. Hepatitis E virus infection in Europe, Regional situation regarding laboratory diagnosis and epidemiology. *Clin Diag Virol* 1993;1:1-8.
26. Malik IA, Qureshi MS, Luqmann M. Epidemics of non-A, non-B hepatitis in Pakistan. *Trop Doctor.* 1988;18:88-101.
27. Rosenmay RH et al. Multivariate prediction of coronary heart disease during 8.5 years follow-up in the Western Collaborative Group Study. *Am J Cardiol.* 1976;37:903.
28. Kannel WB. Some lesions in cardiovascular epidemiology from Framingham. *Am J Cardiol* 1976;37:269.
29. Malik R, Pirzado ZA, Arshad M, Sajjid M, Ahmad S. Study of lipid profile, blood pressure and blood glucose in rural population. *Pak J Med Res.* 1995;34(3):154-155.
30. Shahid A, Qureshi H, Zuberi SJ. Disorders of renal function in liver disease. *Pak J Med Res* 1983;22(4):103.

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