

## EVALUATION OF KIDNEY AND LIVER DISORDERS IN TYPE 2 DIABETIC PATIENTS USING USG

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### ABSTRACT

Total 450 Type2 Diabetic pts aged 35 yrs to >70 yrs attending the OPD at MLB Medical College were studied. Out of 450 pts 89 had abnormal USG. Out of 89 pts, 36 had kidney abnormalities, 32 had liver and 21 had both liver and kidney abnormalities. Most cases showed normal renal size and echogenicity (89%). Grade 1 nephropathy was more common than grade 2 or 3 nephropathy. The most common renal abnormality was simple renal cyst (30.55%) followed by renal stones (27.77%). Other less common complications are hydronephrosis, renal mass and mixed renal disease. NAFLD was most common liver abnormality present in 59.37% patients. Other USG abnormalities being cholecystitis & cholelithiasis (31.25%) and cirrhosis (9.3%).

Figures : 04

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KEY WORDS : Diabetes, NAFLD, USG, nephropathy.

### Introduction

Type 2 DM is one of the common epidemics worldwide. Renal affection by DM is in the form of nephropathy that may lead to renal failure and ESRD, which warrants chronic dialysis or renal transplantation. Amongst liver abnormalities NAFLD is considered to be the commonest liver problem and is a major cause of liver related morbidity and mortality.

Ultrasound has been routinely used for decades in the diagnosis of different renal and liver diseases owing to its great advantages *i.e.* being non-invasive, reliable, widely available, and affordable. Kidneys are mostly affected in the course of diabetes mellitus (DM). Patients often have wide spectrum of presentation *i.e.* from asymptomatic to renal failure.

A renal ultrasound is typically obtained to measure the renal size and echogenicity. Renal

enlargement may be seen early in diabetes due to hyper filtration<sup>3</sup>, while in late stages the kidneys diminish in size from glomerulosclerosis. In addition renal cortical hyperechogenicity is seen suggesting deteriorated renal function<sup>2</sup>. Ultrasound is used also to detect hydronephrosis, renal cyst, and renal mass and mixed renal disease.

Liver disease is an important cause of death in type 2 diabetes. The entire spectrum includes abnormal liver enzymes, non alcoholic fatty liver disease (NAFLD)<sup>1,4,6,8</sup>, acute liver failure, and hepatocellular carcinoma. Amongst liver abnormalities NAFLD<sup>5,7,9,10</sup> is considered to be the commonest liver problem and is increasingly being recognized as a major cause of liver-related morbidity and mortality.

### Materials and Methods

The present study was conducted on patients attending the Diabetes clinic in Dept of

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Out of 450 patients USG was abnormal in 89 pts (19.77%). Out of 89 pts majority had kidney abnormality 36 (40.45%) f/b liver abnormality 32 (35.96%) f/b both kidney and liver 21 (25.59%).

**TABLE -1: Case distribution Majority : of patients were in the group with Diabetes mellitus for duration <5yrs.**

| GROUP     | Duration of type 2 DM | Total no. of subjects | Age group |       |       |     | Sex distribution |        |
|-----------|-----------------------|-----------------------|-----------|-------|-------|-----|------------------|--------|
|           |                       |                       | 35-49     | 50-59 | 60-69 | 70+ | Male             | Female |
| Group 'A' | <5 yr                 | 253                   | 76        | 83    | 76    | 18  | 192              | 61     |
| Group 'B' | 5-10 yr               | 150                   | 54        | 56    | 25    | 15  | 106              | 44     |
| Group 'C' | >10 yr                | 47                    | 5         | 12    | 22    | 8   | 34               | 13     |
| Total     | 450                   | 135                   | 151       | 123   | 41    | 332 | 118              |        |

Medicine, MLB medical college Jhansi from March 2012 to August 2013. In this study, 450 patients were enrolled. Inclusion criteria were Type 2 diabetics and/or patients with symptoms of diabetes plus Random Blood Sugar >200 mg/dl or fasting blood glucose >126 mg/dl or 2 hr Post Prandial >200 mg/dl ,during oral glucose tolerance test. Exclusion criteria was diabetics with preexisting renal & liver disease. These 450 patients were, divided into three groups ( Group 'A', Group 'B', Group 'C') based on duration of diabetes( <5 yrs, 5-10years ,>10yrs.respectively). A detailed history was taken, thereafter routine investigations along with USG of kidney and liver was done.

#### USG OF KIDNEY:

Renal Axial and sagittal images were taken. **Length of each kidney** was measured in the sagittal plane. The **renal parenchymal echogenicity** was compared to the hepatic and splenic echogenicities, and was classified into-

**Grade 1 Nephropathy-** Where the renal parenchymal echogenicity is equal to that of the liver or spleen.

**Grade 2 Nephropathy-** Where the renal parenchymal echogenicity is more than that of the liver or spleen.

**Grade 3 Nephropathy-** Where the renal parenchymal echogenicity is equal to the renal sinus fat.

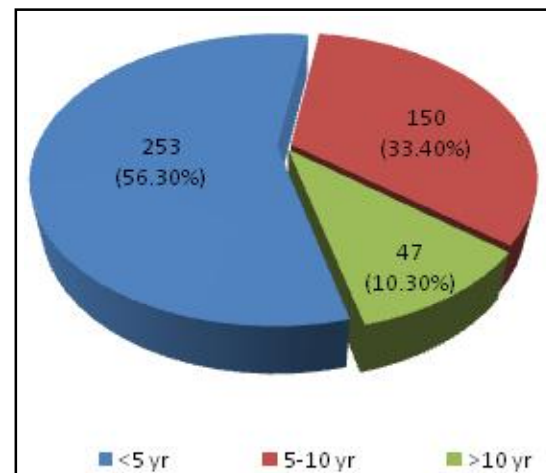
Associated renal diseases were fully evaluated. **Hydronephrosis** was classified into mild,

moderate or severe, and the level and cause of dilatation was studied. **Renal cysts** and **masses** were measured in 3 dimensions, and their echogenicity and vascularity were studied as well.

#### USG OF LIVER:

The liver ultrasound was done in deep inspiration. Liver **size**, **echotexture** and **echogenicity of parenchyma** were studied. Echogenicity was further classified as following-

**Grade 1:** Slight diffuse increase in the fine echoes. Liver appears bright as compared to the cortex of the kidney. Normal visualization of



**Fig. 1 : Case distribution according to the age, sex and duration of type - 2 Diabetes.**

Out of 36 patients who had abnormal renal ultrasound, renal cysts were present in 11 (30.55%), nephrolithiasis in 10 (27.77%), hydronephrosis in 7 (19.44%), mixed renal disease in 5 (13.88%) and renal mass in 3 (8.33%) pts.

**TABLE - 2 : Abnormal USG**

| Total abnormal USG | Kidney abnormality | Liver abnormality | Both (liver and kidney) |
|--------------------|--------------------|-------------------|-------------------------|
| N=89               | 36 (40.45%)        | 32 (35.96%)       | 21 (23.59%)             |

diaphragm and intrahepatic vessel borders.

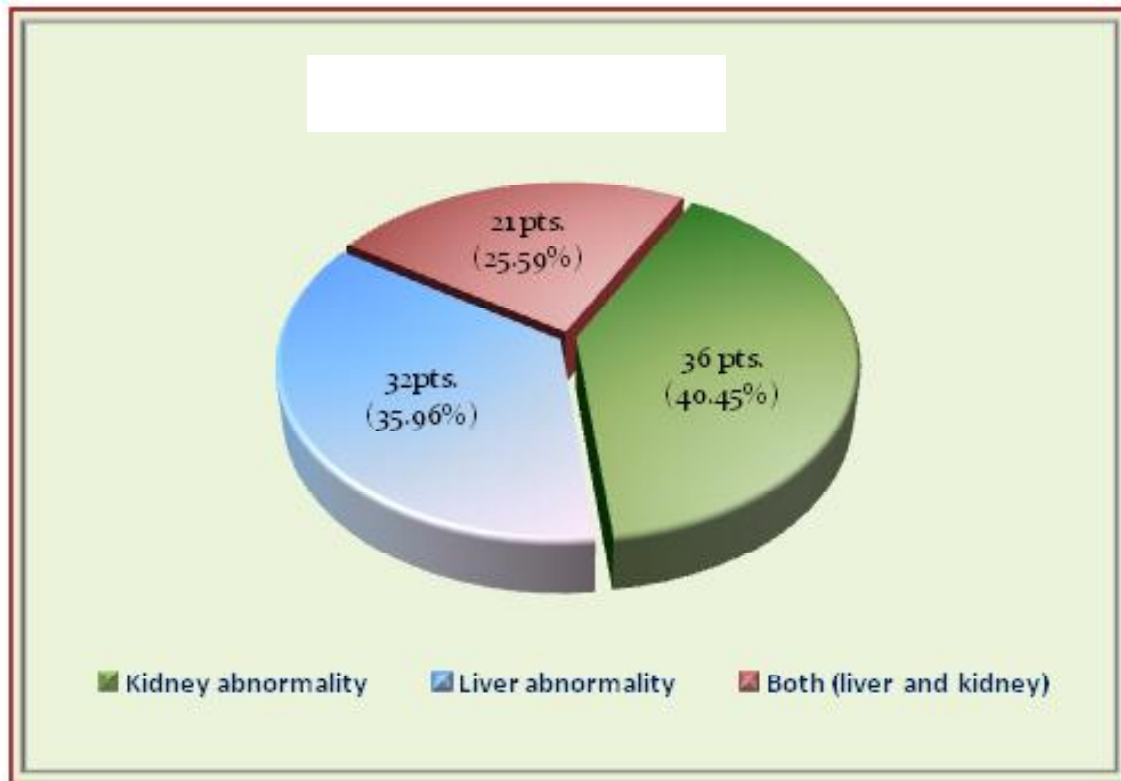
**Grade 2:** Moderate diffuse increase in the fine echoes. Slightly impaired visualization of the intrahepatic vessels and diaphragm.

**Grade 3:** Marked increase in the fine echoes. Poor or no visualization of intrahepatic vessel borders, diaphragm and the vessels.

In this study 450 patients were enrolled. These 450 patients were, divided into three groups ( Group 'A', Group 'B', Group 'C') based on duration

of diabetes (<5 yrs, 5-10years, >10yrs. respectively). A detailed history was taken, thereafter routine investigations along with USG of liver and kidney were done.

This study was conducted on patients attending the Diabetes clinic, at MLB medical college Jhansi from March 2012 to August 2013. In this study, 450 patients were enrolled. These 450 patients were, divided into three groups ( Group 'A', Group 'B', Group 'C') based on duration of diabetes (<5 yrs, 5-10years, >10yrs. respectively). A detailed



**Fig. 2 : Abnormal USG (n=89) q Kidney abnormality q Liver abnormality q Both (liver and kidney)**

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**TABLE -3 : Renal USG Abnormality**

| USG findings<br>(n=36) | Duration of diabetes      |                                |                               | Total       |
|------------------------|---------------------------|--------------------------------|-------------------------------|-------------|
|                        | < 5 yrs (n=7)<br>(19.44%) | 5-10 yrs<br>(n=14)<br>(38.88%) | >10 yrs<br>(n=15)<br>(41.66%) |             |
| Cysts                  | 3 (14.28%)                | 3 (21.42%)                     | 5 (41.66%)                    | 11 (30.55%) |
| Nephrolithiasis        | 1 (14.28%)                | 5 (35.71%)                     | 4 (26.66%)                    | 10 (27.77%) |
| Hydronephrosis         | 2 (28.57%)                | 3 (21.42%)                     | 2 (13.33%)                    | 7 (19.44%)  |
| Renal Mass             | 0 (0)                     | 1 (7.14%)                      | 2(13.33)                      | 3 (8.33%)   |
| Mixed                  | 1(14.28%)                 | 2(14.28%)                      | 2(13.33%)                     | 5(13.88%)   |

Amongst renal USG patients had renal cysts followed by nephrolithiasis, hydronephrosis, mixed renal disease and renal mass.

Majority of the patients had normal echogenicity of kidneys (89%). Patients who had RPD grade 1 were more in number accounting 7.5% and patients with RPD grade 3 accounting only 0.6%.

**TABLE -4 : Echogenicity of kidney on USG**

| Echogenicity  | Right Kidney | Left kidney  |
|---------------|--------------|--------------|
| Normal        | 404 (89.78%) | 403 (89.56%) |
| Grade I RPD   | 34 (7.5%)    | 37 (8.3%)    |
| Grade II RPD  | 8 (1.7%)     | 7 (1.5%)     |
| Grade III RPD | 4 (0.9%)     | 3 (0.6%)     |

Out of 32 pts with abnormal liver ultrasound NAFLD was present in 19 (59.37%), cholecystitis + cholelithiasis in 10 (31.25%) and cirrhosis of liver in 3 (9.3%). Out of 3 Patients who found cirrhotic 1 pt was HbsAg reactive and 2 were both HbsAg and HCV reactive.

history was taken, thereafter routine investigations along with USG of liver and kidney were done.

### Result and Discussion

In our study the number of patients who were diabetic more than 10 yrs duration were less because our diabetic clinic is comparatively young (established 14 yrs back).

The age group started from 35 yrs to >70 yrs with majority in group 40-60 yrs.

### Renal Sonographic Abnormalities

Out of 450 patients USG was abnormal in 89 pts (19.77%). and renal USG abnormality was present in 36 (8%) pts. Out of 36 patients who had abnormal renal ultrasound, renal cysts were present in 11 (30.55%) pts. As the duration of diabetes/ Age of pt increased no. of cysts increased. Other USG findings<sup>8</sup> were nephrolithiasis in 10(27.7%) pts, hydronephrosis in 7(19.44%) pts, mixed renal disease in 5(13.88%) pts and renal mass in 3(8.33%) pts. This was in

TABLE -5 : Liver USG abnormality

| USG findings<br>(n=32)         | Duration of diabetes      |                             |   | Total       |
|--------------------------------|---------------------------|-----------------------------|---|-------------|
|                                | < 5 yrs (n=5)<br>(15.62%) | 5-10 yrs<br>(n=11) (34.37%) | > 10 yrs (n=16)<br>(50.0%)                          |             |
| Non Alcoholic Fatty liver      | 2 (40.0%)                 | 8 (72.73%)                  | 9 (56.25%)  | 19 (59.37%) |
| Cholecystitis + choledithiasis | 3 (60.0%)                 | 2 (16.16%)                  | 5 (33.33%)  | 10 (31.25%) |
| Cirrhosis of liver             | 0 (0)                     | 1 (8.33%)<br>(HbsAg +ve)    | 2 (13.33%)<br>1pt=HbSAG+ve<br>1pt =HbSAG<br>HCV +ve | 3 (9.3)     |

$X^2= 3.795$ ,  $df= 4$ ,  $p$  value =0.04

**p value was 0.04 and is statistically significant.**

accordance with the Saddig D et al<sup>7</sup> study.

#### LIVER SONOGRAPHIC ABNORMALITIES

In our study, out of 32 pts with abnormal liver ultrasound, NAFLD<sup>1,4,6,8</sup> was present in 19 (59.37%), cholecystitis + choledithiasis<sup>9</sup> in 10 (31.25%) and cirrhosis of liver in 3 (9.3%).

Amongst pt. of fatty liver, 89.5% was in the

group with duration of >5 yrs of DM. Cholecystitis and choledithiasis was most common in >5 yr group i.e. 7 pts (70%). Cirrhosis<sup>4</sup> was not present in early diabetics. Patients with duration of diabetes >5 years cirrhosis was present in 3 pts (100%), two were found to be HBsAg reactive and one was HCV reactive. This is in concordance with Gavin N. Levinthal's study, who found fatty liver and steatohepatitis in 40-70% of patients with diabetes,

25% have associated fibrosis and 1-8% have cirrhosis. There were two to three fold increase in incidence of cholecystitis and choledithiasis in patients with diabetes. Study by ZEIN et al<sup>9</sup>, showed NAFLD in

19% patients, while 1.3% and 25% pts had cholecystitis & cirrhosis respectively.

#### Conclusion

n Out of 450 patients renal USG abnormality was present in 36 (8%) pts. Renal cysts were present in 11 (30.55%) pts. Other USG findings were nephrolithiasis, hydronephrosis, mixed renal disease and renal mass.

n Majority of the patients had normal echogenicity<sup>7</sup> of kidneys (89%). Patients who had increased

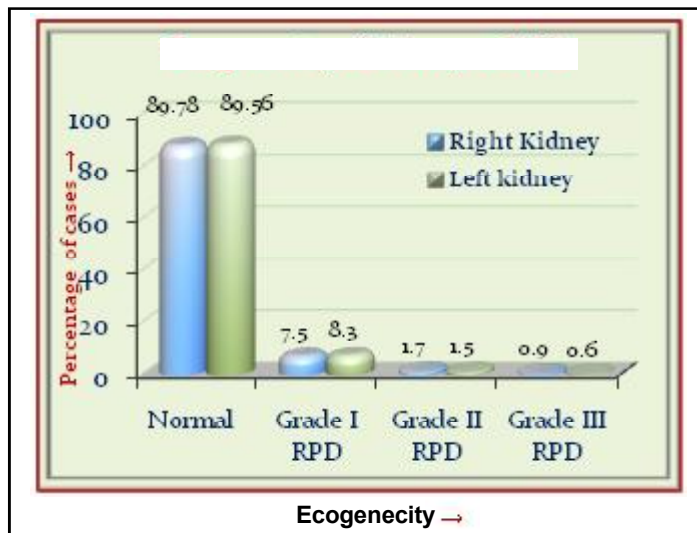


Fig. 3 : Ecogenicity of kidney on USG

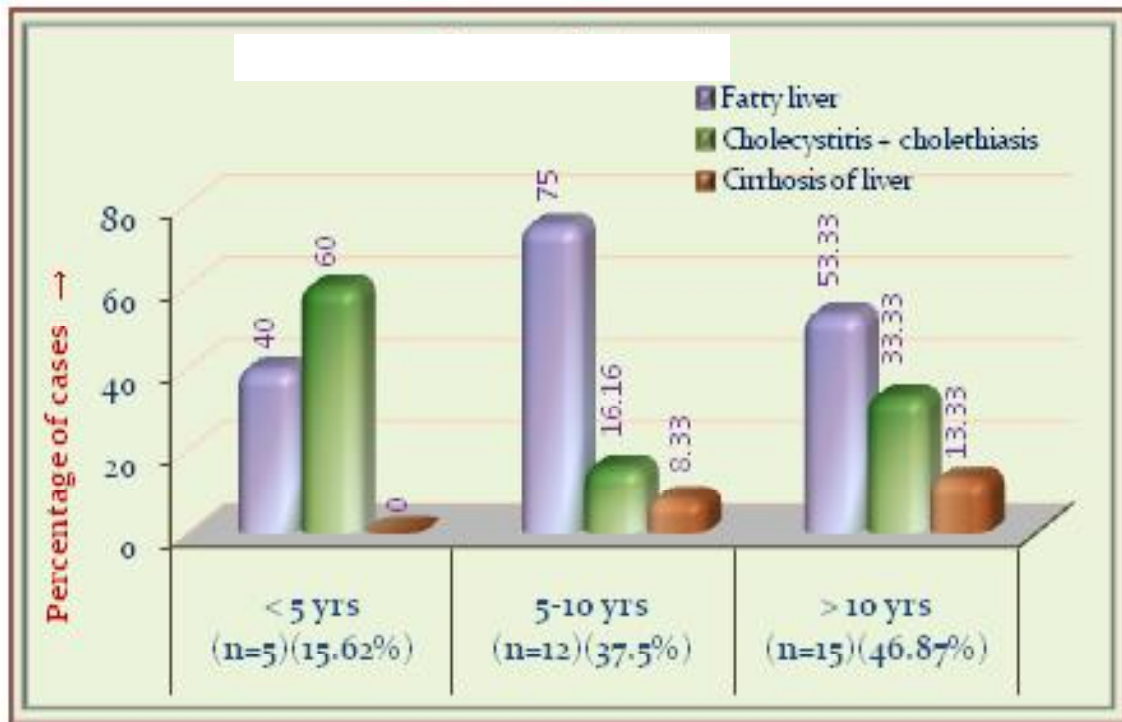
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**TABLE - 6 : Comparison of Renal USG Finding  $\bar{C}$  other studies.**

| Renal USG abnormality | Our study (%) | Saddig D et al (%) |
|-----------------------|---------------|--------------------|
| CYSTS                 | 11 (30.55%)   | 12.3               |
| NEPHROLITHIASIS       | 10 (27.77%)   | 11.3               |
| HYDRONEPHROSIS        | 7 (19.44%)    | 9.9                |
| MASS                  | 3 (8.33%)     | 1.9                |
| MIXED                 | 5 (13.88%)    | 3.4                |

RPD grade I was found in 7.55% in right kidney and 7.7% in left kidney. RPD grade II was found in 1.7% & 1.5% respectively. 0.8% had RPD grade III in right kidney and 0.6% in left kidney. These results are with accordance to the Saddig D et al study.

- echogenicity were 11%.
- n Fatty liver<sup>1,4</sup> was found in 57.14% patients, cholecystitis and cholelithiasis was found in 35.71% patients. cirrhosis was found in 7.14% patients.
- n Our study showed that the prevalence of liver and kidney disease is increased as the the duration of diabetes increased.



**Fig. 4 : Liver USG abnormality (n=32)**

TABLE - 7 : Comparison of Renal Echogenicity of Kidney  $\bar{C}$  other studies

| Echogenecity  | Right kidney  |                          | Left kidney   |                          |
|---------------|---------------|--------------------------|---------------|--------------------------|
|               | Our study (%) | Saddig D et al study (%) | Our study (%) | Saddig D et al study (%) |
| Normal        | 88.66         | 87.6                     | 89.11         | 88.10                    |
| Grade I RPD   | 7.5           | 7.9                      | 7.7           | 7.9                      |
| Grade II RPD  | 1.7           | 1.5                      | 1.5           | 1.5                      |
| GRADE III RPD | 0.9           | 0.7                      | 0.6           | 0.4                      |

TABLE - 8 : Liver abnormalities on USG in various studies

|                            | CIRRHOSIS | FATTY LIVER DISEASE | CHOLELITHIASIS |
|----------------------------|-----------|---------------------|----------------|
| Present study              | 9.3%      | 59.37%              | 37.25%         |
| Gavin n. levinthal's et al | 1-8%      | 40-70%              | 25%            |
| Zein et al                 | 25.0%     | 19.0%               | 1.3%           |

### References

1. ANGULO, P. (2002) Nonalcoholic fatty liver disease. *NEJM*, **346**:1221- 31.
2. AL-KHADER (2001) "Impact of diabetes in renal diseases in saudi arabia," *Nephrology Dialysis Transplantation*, **16**(11): 2132-2135.
3. AL-ZAID, S., SOBKI AND DE SILVA, V. (1994) "Prevalence of microalbuminuria in saudi arabians with non-insulin-dependent diabetes mellitus—a clinic based study." *Diabetes research and clinical practice*, **26** (2):115-120.
4. GAVIN N. LEVINHAL ET AL (2007) study : Prevalence of liver cirrhosis in Diabetics. *Open Journal of Medical sciences* **3** : 102-105.
5. FARRELL, G.C. AND LARTER, C.Z. (2006) Nonalcoholic fatty liver disease: From steatosis to cirrhosis. *Hepatology*, **43**:s00-s112.
6. HALL, P. M. (2006) "Prevention of progression in diabetic nephropathy." *Diabetes Spectrum*, **19** (1):18-24.
7. NEUSCHWANDER-TETRI, B.A. AND CALDWELL, S.H. (2003) Nonalcoholic steatohepatitis. Summary of an AASLD single topic conference. *Hepatology* **37**:1202-19.
8. SADDIG, D., JASTANIAH, NAGLAAM., ALSAYED, IBRAHIM, A., AWAD, HASHIM R., FIDA, HAMMAD H. AND ELNIEL. (2013) Evaluation of Renal Disorders in Type 2 Diabetic Patients Using Ultrasonography. *Open Journal of Medical Imaging*, **3**: 165-170.
9. SANYAL, A.J. (2002) Technical review on nonalcoholic fatty liver disease. *Gastroenterology*, **123** :1705-25.
10. ZUKOWSKA-SZCZECHOWSKA AND TOMASZEWSKI, M. (2004) "Renal affection in patients with diabetes mellitus is not always caused by diabetic nephropathy." *Roczniki aka- demii Medycznej w Białymstoku*, **49** : 185- 189.