VOLUME 12 NOMOR 2 DECEMBER 2025 ISSN 2548 – 611X

JURNAL
BIOTEKNOLOGI & BIOSAINS INDONESIA

Homepage Jurnal: http://ejournal.brin.go.id/JBBI/index



HEMATOLOGY AND URINAL ANALYSIS PROFILE IN DIABETES MELLITUS

Profil Hematologi dan Urinalisa pada Diabetes Mellitus

Rizka Ayu Wahyuni, Nurbidayah, Nurul Amalia, Aulia Syafa Al Fitri, Noor Zahwa Mubarakah

Bumi Berkat, Jl. Klp.Sawit Jl. Kemuning No.1, RT.2/RW.1, Kemuning, Kec. Banjarbaru Selatan, Kota Banjarbaru, Kalimantan Selatan.

*Email:rizkaayuwahyuni18@gmail.com

ABSTRACT

Type 2 Diabetes Mellitus (T2DM) constitutes a chronic metabolic disorder characterized by insulin resistance and consequential hyperglycemia. This state of elevated blood glucose can precipitate various complications, potentially influencing hematological parameters and urinary composition. This study aims to delineate the demographic characteristics, hematological profiles, and urinalysis results of individuals diagnosed with T2DM. Employing an observational descriptive design with a cross-sectional approach, the research examined T2DM patients who underwent laboratory testing at RSD Idaman Banjarbaru. The findings indicate that, from a total of 40 patients, the majority (n=18, 45%) belonged to the 46–55-year age cohort. Regarding gender distribution, female patients were more predominant, comprising 29 individuals (72.5%), compared to 11 male patients (27.5%). Most T2DM patients presented with hematological parameters within normal limits. However, specific hematological disturbances were still identified, notably reductions in Hemoglobin (Hb) and Mean Corpuscular Hemoglobin (MCH), alongside alterations in leukocyte differential counts. These anomalies may correlate with inflammatory complications or anemia prevalent in the T2DM population. Microscopic urinalysis revealed a high frequency of abnormalities across several parameters. Abnormal epithelial cells were observed in 26 patients (65%), aberrant erythrocytes in 28 patients (70%), and atypical leukocytes in 26 patients (65%). The most prevalent finding was abnormal urinary crystals, detected in 33 patients (82.5%). These results underscore the necessity for consistent renal health monitoring and proactive management in diabetic care. In conclusion, the hematological and urinalysis profiles of T2DM patients offer preliminary insights into their clinical status and the extent of associated complications, serving as valuable indicators for comprehensive patient management.

Keywords: *Diabetes Mellitus, Patient Characteristics, Hematology Profile, Urinalysis*

ABSTRAK

Diabetes melitus tipe 2 merupakan salah satu penyakit metabolik kronis akibat ganguan kerja insulin sehingga mengakibatkan hiperglikemia. Kondisi hiperglikemia dapat menimbulkan berbagai komplikasi yang dapat berpengaruh terhadap profil hematologi dan komposisi urin. Penelitian ini bertujuan untuk mengetahui karakteristik penderita, profil hematologi dan hasil urinalisa pada pasien DM Tipe 2. Penelitian ini menggunakan desain **deskriptif observasional** dengan pendekatan **cross sectional** terhadap penderita DM Tipe 2 yang melakukan pemeriksaan laboratorium RSD Idaman Banjarbaru. Hasil penelitian menunjukan dari total keseluruhan pasien, mayoritas berada pada kelompok usia 46–55 tahun sebanyak 18 pasien (45%) dan berdasarkan jenis kelamin pasien perempuan lebih dominan yaitu 29 pasien (72,5%) dibandingkan dengan laki-laki sebanyak 11 pasien (27,5%). Sebagian besar pasien diabetes melitus tipe 2 memiliki parameter hematologi dalam batas normal, namun masih

Received: *8 December 2025* ***Accepted***: *28 December 2025* ***Published***: *13 January 2026*

ditemukan gangguan hematologi tertentu, terutama penurunan Hb, MCH, dan perubahan diferensial leukosit yang dapat berkaitan dengan komplikasi inflamasi atau anemia pada pasien DM tipe 2. Pada pemeriksaan mikroskopik urin, ditemukan tingginya abnormalitas pada beberapa parameter, di antaranya sel epitel abnormal pada 26 pasien (65%), eritrosit abnormal pada 28 pasien (70%), leukosit abnormal pada 26 pasien (65%), serta kristal urin abnormal yang merupakan temuan terbanyak yaitu 33 pasien (82,5%) yang mengindikasikan perlunya pemantauan dan manajemen kesehatan ginjal serta secara berkala pada pasien DM. Profil hematologi dan urinalisa pada penderita DM Tipe 2 dapat menjadi gambaran awal kondisi klinis dan tingkat komplikasi yang terjadi.

Kata Kunci: *Diabetes Melitus, Karakteristik Pasien, Profil Hematologi, Urinalisa*

INTRODUCTION

According to data published by the International Diabetes Federation (IDF), an estimated 463 million individuals aged 20–79 years worldwide were living with diabetes in 2019, constituting a global prevalence of 9.3% within that age demographic. National data from the Indonesian Ministry of Health's Data and Information Center for 2020 reflects this global trend, reporting a 2019 prevalence of 9.0% among females and 9.65% among males. Notably, prevalence demonstrates a significant correlation with advancing age, rising to 19.9% (or 11.2 million individuals) within the 65–79-year age group in the Indonesian context. Projections indicate a persistent upward trajectory in these figures, with global estimates anticipating a rise to 578 million cases by 2030 and 700 million by 2045. Diabetes mellitus is fundamentally characterized as a chronic disease group originating from pancreatic dysfunction, specifically an inadequate production of the hormone insulin. Insulin is essential for regulating blood glucose levels to meet the body's metabolic demands. Although classified as a non-communicable disease, its escalating incidence and prevalence over recent decades have rendered it a paramount public health priority requiring urgent and sustained intervention (Kemenkes, 2018).

Diabetes mellitus is a metabolic disorder fundamentally characterized by chronic hyperglycemia, resulting from defects in insulin secretion, impaired insulin action, or a combination of both. Prolonged hyperglycemia is intrinsically linked to long-term systemic damage, dysfunction, and eventual failure of various organs, including the eyes, kidneys, nerves, heart, and vascular system. Diabetes mellitus is classified into several categories, primarily Type 1, Type 2, other specific types, and gestational diabetes. This study focuses on Type 2 Diabetes Mellitus (T2DM), which is characterized by a progressive loss of adequate insulin secretion from pancreatic β-cells, frequently concomitant with underlying insulin resistance (Care, 2020). Laboratory investigation is indispensable for diagnosing and managing diabetes mellitus, primarily to identify and quantify aberrations in carbohydrate metabolism. Consequently, diagnosis is established based on elevated glucose concentrations in the blood (Kardika et al., Year). Diagnostic and monitoring procedures utilize various biological samples, such as blood and urine. Routine hematological analysis serves as a fundamental tool for monitoring the disease progression and overall health status of diabetic patients. Standard hematological parameters include assessments of hemoglobin, hematocrit, leukocyte count, and thrombocyte count. Regular hematological monitoring in individuals with T2DM is advocated as a strategic measure to mitigate and prevent the onset of diabetes-related complications. This approach is supported by a body of research indicating distinct alterations in hematological profiles among patients with diabetes mellitus, underscoring its clinical relevance.

A study by Jumar et al. reported a statistically significant elevation in leukocyte, lymphocyte, and neutrophil counts among diabetic patients compared to non-diabetic controls (Jumar et al., 2017). Urine samples serve as a critical medium for urinalysis profiling. Urine constitutes a filtrate of metabolic waste products following selective and

rigorous renal processing. Urinalysis is defined as the identification and examination of urine through macroscopic, microscopic, and chemical analysis (Firdaus et al., 2018). Macroscopic assessment typically encompasses parameters such as color, specific gravity, pH, and odor. Microscopic evaluation includes the identification of erythrocytes, casts, crystals, protozoa, bacteria, fungi, and the semiquantitative analysis of glucose, protein, ketones, bilirubin, urobilinogen, and nitrites (Mustopa, 2016). Based on the aforementioned background, this study was conducted to characterize the demographic profile, hematological parameters, and urinalysis findings in patients with Type 2 Diabetes Mellitus at RSD Idaman Banjarbaru.

MATERIAL AND METHODS

Place and time of Research

This study was conducted at the Clinical Pathology Laboratory of RSD Idaman Banjarbaru. Data collection took place over a two-month period, from June to July 2025. The study population encompassed all individuals with diabetes mellitus who underwent laboratory examinations at RSD Idaman Banjarbaru's laboratory during the aforementioned timeframe. The research sample was selected based on medical record data pertaining to the characteristics of diabetes mellitus patients. The sample consisted of patients who fulfilled the following inclusion criteria: (1) a diagnosis of Type 2 Diabetes Mellitus (T2DM) as confirmed by a physician, and (2) willingness to participate as a respondent. Patients were excluded from the sample if they presented with significant comorbid conditions.

Material

The principal instruments and materials utilized in this study included EDTA anticoagulant vacuum tubes (Vacutainers), a Hematology Analyzer, disposable syringes and tourniquets for venipuncture, and clinical-grade urine collection containers. Urinalysis was performed using a combination of reagent test strips (dipsticks) and a dedicated Urine Analyzer. All biological samples were procured from the Clinical Pathology Laboratory of RSD Idaman Banjarbaru.

Methods

This study employed a descriptive research design with a cross-sectional approach. The data analysis methodology utilized was quantitative descriptive analysis. This analytical approach entails the application of statistical techniques to systematically describe, summarize, and interpret quantitative data—that is, data expressed in measurable numerical terms. Consequently, the quantitative descriptive statistical analysis in this research encompassed a suite of techniques, including the calculation of measures of central tendency, measures of dispersion, and measures of skewness (Aziza et al., 2023).

RESULT AND DISCUSSION

Table 1. Characteristics of respondents with type 2 Diabetes mellitus in RSDI Banjarbaru

Variables	N	Percentage (%)
Ages		
17-25	1	2,5 %
26-35	4	10 %
36-45	4	10 %
46-55	18	45 %
56-65	7	17,5 %
>65	6	15%
Total	**40**	**100 %**
Sex		
Men	11	27,5 %
Women	29	72,5 %
Total	**40**	**100 %**

The demographic characteristics of the study are presented in Table 1. Analysis of age distribution revealed that the majority of patients belonged to the 46-55 year age bracket, comprising 18 individuals (45.0%). This was followed by the 56-65 year with 7 patients (17.5%), and those over 65 years with 6 patients (15.0%). Younger age groups were less represented, with 4 patients (10.0%) each in the 26-35 and 36-45 year brackets, and a single patient (2.5%) in the 17-25 year range.

Regarding gender distribution, female patients constituted a significant majority of the sample, with 29 individuals (72.5%), compared to 11 male patients (27.5%).

Table 2 The frequency distribution of respondents by the complication of diseases.

Respondents with Compliations	N	Percentage (%)
Diabetic retinopathy	3	13,04 %
Diabetic neuropathy	6	26,09 %
Diabetic nephropathy	1	4,35 %
CAD	6	26,09 %
Hypertension	6	26,09 %
Dyslipiedmia	1	4,35 %
Total	**23**	**100 %**

As delineated in Table 2, the distribution of diabetes-related complications within the patient was as follows. Diabetic neuropathy and coronary artery disease were the most prevalent complications, each identified in 6 patients (26.09%). Hypertension was equally prevalent, also complicating the condition of 6 patients (26.09%). Diabetic retinopathy was present in 3 patients (13.04%), while diabetic nephropathy and dyslipidemia were each observed in 1 patient (4.35%). This profile underscores the significant burden of microvascular and macrovascular complications among the studied T2DM population.

Table 3 Frequency Distribution of Patients Based on Macroscopic Urinalysis Findings

Variables	N	Percentage (%)
Color		
Light yellow	19	47,5 %
Yellow	21	52,5 %
Total	**40**	**100 %**
Turbidity		
Clear	23	57,5 %
Slight Cloudy	15	37,5 %
Cluody	2	5 %
Total	**40**	**100 %**

The macroscopic examination of urine samples, as summarized in Table 3, indicates a relatively homogeneous profile among the study. Regarding color, the majority of patients (21 patients, 52.5%) presented with yellow urine, while the remainder (19 patients, 47.5%) exhibited a light yellow coloration. Assessment of turbidity revealed that most samples (23 patients, 57.5%) were clear. A significant proportion (15 patients, 37.5%) were classified as slightly cloudy, and a small subset (2 patients, 5.0%) presented with cloudy urine. These findings suggest that while most samples appeared normal upon gross visual inspection, a notable percentage showed alterations in clarity, which may warrant further microscopic or chemical investigation.

Table 4 Frequency distribution of patients based on chemical analysis results

Variables	N	Percentage (%)
pH		
Acid	37	92,5 %
Neutral	3	7,5 %
Base	0	0 %
Total	**40**	**100 %**
Specific gravity		
Normal	40	100 %
Abnormal	0	0 %
Total	**40**	**100 %**

The chemical analysis of urine samples, as presented in Table 4, demonstrates a pronounced trend in pH values among the patient cohort. The vast majority of patients (37 patients, 92.5 percent) presented with acidic urine. A small subset (3 patients, 7.5 percent) registered a neutral pH, while no patients (0 percent) were found to have alkaline urine.

Regarding urine concentration, all patients (40 patients, 100 percent) exhibited specific gravity values within the normal reference range, with no reported instances of abnormal concentration.

Table 5 Frequency distribution of patients based on urine microscopic examination results

Variables	N	Percentage (%)
Epitelial cells		
Normal	14	35 %
Abnormal	26	65 %
Total	**40**	**100 %**
Erytrhocyte		
Normal	12	30 %
Abnormal	28	70 %
Total	**40**	**100 %**
Leucocyte		
Normal	14	35 %
Abnormal	26	65 %
Total	**40**	**100 %**
Bacteria		
Normal	25	62,5 %
Abnormal	15	37,5 %
Total	**40**	**100 %**
Crystal		
Normal	7	17,5 %
Abnormal	33	82,5 %
Total	**40**	**100 %**

As detailed in Table 5, microscopic examination of urine sediment revealed a high prevalence of abnormalities within the study cohort. Analysis of cellular components showed that a majority of samples contained abnormal epithelial cells (26 patients, 65.0%) and abnormal erythrocytes (28 pa-

tients, 70.0%). Similarly, abnormal leukocyte levels were detected in 26 patients (65.0%). The presence of bacteria was noted in 15 samples (37.5%). The most notable finding was the presence of abnormal urinary crystals, which was observed in 33 patients (82.5%), representing the most frequent abnormality detected. Correspondingly, normal findings for these parameters were recorded in 14 (35.0%), 12 (30.0%), 14 (35.0%), 25 (62.5%), and 7 (17.5%) patients, respectively.

Table 6 Complete blood count results of type 2 diabetes patients at RSDI Banjarbaru

Complete blood analysis	N	Percentage (%)
Hemoglobin (Hb)		
Men		
< 13 g/dl (low)	5	12,5%
13-18 g/dl (normal)	2	5%
>18 g/dl (elevated)	4	10%
Women		
< 12 g/dl (low)	8	20%
12-16 g/dl (normal)	21	52,5%
>16 g/dl (elevated)	0	0%
Haematocryte		
Men		
< 35% (low)	5	12,5%
35-47% (normal)	2	5%
>47% (elevated)	4	10%
Women		
< 35% (low)	8	20%
35-47% (normal)	21	52,5%
>47% (elevated)	0	0%
Leukocyte		
< 4.000 sel/mm^3 (low)	0	0%
4.000-11.000 sel/mm^3 (normal)	37	92,5%
>11.000 sel/mm^3 (elevated)	3	7,5%
Basophyl		
<0 sel/mm^3 (low)	0	0%
0-1 sel/mm^3 (normal)	33	82,5%
>1 sel/mm^3 (elevated)	7	17,5%
Eosinophyl		
< 2 sel/mm^3 (low)	10	25%
2-4 sel/mm^3 (normal)	17	42,5%
>4 sel/mm^3 (elevated)	13	32,5%
Neuthrophyl		
< 50 sel/mm^3 (low)	6	15%
50-70 el/mm^3 (normal)	29	72,5%
>70 sel/mm^3 (elevated)	5	12,5%
Limphocyte		
< 25 sel/mm^3 (low)	14	35%
25-40 sel/mm^3 (normal)	23	57,5%
>40 sel/mm^3 (elevated)	3	7,5%

Complete blood analysis	N	Percentage (%)
Monocyte		
< 2 sel/mm^3 (low)	2	5%
2-8 sel/mm^3 (normal)	33	82,5%
>8 sel/mm^3 (elevated)	5	12,5%
Erithrocyte		
< 4.000 sel/mm^3 (low)	6	15%
4.000-11.000 sel/mm^3 (normal)	25	62,5%
>11.000 sel/mm^3 (elevated)	9	22,5%
MCV		
< 80 fL (low)	8	20%
80-96 fL(normal)	31	77,5%
> 96 fL(elevated)	1	2,5%
MCH		
< 28 pgsel (low)	22	55%
28-33 pg/sel (normal)	17	42,5%
> 33 pg/sel (meningkat)	1	2,5%
MCHC		
< 32 g/dL (low)	2	5%
32-36 g/dL (normal)	38	95%
>36 g/dL (elevated)	0	0%
Platelets		
< 150.000 sel/mm^3 (low)	0	0%
150.000-400.000 sel/mm^3 (normal)	40	100%
>400.000 sel/mm^3 (elevated)	0	0%
PDW		
<9,0 fL (low)	13	32,5%
9,0-17,0 fL (normal)	27	67,5%
>17,0fL(elevated)	0	0%
MPV		
<7,0 fL (low)	1	2,5%
7,0-11,8 fL (normal)	39	97,5%
>11,8 fL(elevated)	0	0%
Total	**40**	**100 %**

The hematological profile of the study, as presented in Table 6, reveals a predominance of normal values alongside specific deviations. Regarding erythrocyte parameters, diminished hemoglobin (Hb) was observed in 10 patients (25.0%), with the majority (24 patients, 60.0%) within the normal range and 4 patients (10.0%) exhibiting elevated Hb. Hematocrit (Ht) was reduced in 13 patients (32.5%), normal in 23 (57.5%), and elevated in 4 (10.0%). The erythrocyte count was decreased in 6 patients (15.0%), normal in 25 (62.5%), and increased in 9 (22.5%). Analysis of erythrocyte indices showed Mean Corpuscular Volume (MCV) was decreased in 8 patients (20.0%) and Mean Corpuscular Hemoglobin (MCH) was notably diminished in 22 patients (55.0%), while Mean Corpuscular Hemoglobin Concentration (MCHC) was largely normal (95.0%). For leukocyte parameters, the total count was normal in 37 patients (92.5%) with only 3 instances (7.5%) of leukocytosis. The differential count exhibited variations:

basophils were elevated in 7 patients (17.5%); eosinophils were decreased in 10 (25.0%), normal in 17 (42.5%), and increased in 13 (32.5%); lymphocytes were decreased in 14 patients (35.0%); and monocytes were elevated in 5 patients (12.5%). The thrombocyte series was characterized by uniformly normal platelet counts across all patients (100.0%), while Platelet Distribution Width (PDW) was decreased in 13 patients (32.5%) and Mean Platelet Volume (MPV) was normal in the vast majority (97.5%).

DISCUSSION

This study involved patients diagnosed with Type 2 Diabetes Mellitus (T2DM) who underwent hematological and urinalysis examinations at RSD Idaman Banjarbaru. The findings indicate variations in respondent characteristics regarding age, gender, and accompanying complications. The majority of T2DM patients in this study were within the age group above 40 years. This result aligns with research conducted by Masruroh (2018), which states that glucose intolerance tends to increase with advancing age. Experts further note that the risk of developing T2DM begins to rise after the age of 45. This progression is attributed to a progressive decline in pancreatic β-cell mass associated with aging, leading to diminished hormone production and consequent elevation of blood glucose levels. Regarding gender distribution, of the 40 patients, 11 were male and 29 were female. Gender is a recognized factor associated with T2DM, with a higher prevalence observed in females compared to males. This disparity is influenced by generally higher levels of LDL (low-density lipoprotein) cholesterol and triglycerides in women, alongside differences in daily activity patterns and lifestyle. Furthermore, blood lipid concentrations also tend to be higher in females, thereby increasing their risk for elevated blood glucose levels (Masruroh, 2018). The higher incidence of Diabetes Mellitus in women, particularly post-menopause, is also linked to declining levels of estrogen and progesterone, hormones that play a role in enhancing insulin sensitivity. Additionally, a frequently non-ideal Body Mass Index (BMI) in women can reduce the body's responsiveness to insulin, making blood glucose levels more difficult to control and elevating the risk for complications such as diabetic nephropathy (Tarawifa et al., 2020). These findings are consistent with epidemiological theory, confirming that T2DM is more frequently encountered in females.

The most prevalent complications among the T2DM patients in this study were diabetic neuropathy, coronary artery disease (CAD), and hypertension, each constituting 26.09% of reported complications. Diabetes Mellitus, characterized by insulin deficiency or resistance and hyperglycemia, leads to various microvascular and macrovascular complications. Diabetic neuropathy, one such complication of T2DM, involves nerve damage resulting from the weakening and deterioration of capillary walls responsible for supplying nutrients to nerves (Prasetyani & Martiningsih, 2019). Advancing age in patients contributes to vascular changes, such as intimal layer thickening, which renders blood vessels rigid. This vascular stiffness impedes the flow of oxygen and nutrients to tissues, potentially causing ischemia and, over time, neuropathy (Prasetyani & Martiningsih, 2019). Furthermore, T2DM warrants serious attention due to its complications, particularly macrovascular ones like Coronary Artery Disease (CAD), a leading cause of mortality in this population. Optimal glycemic control, commonly measured via HbA1c levels, is a critical management factor. Suboptimal glycemic control significantly increases the risk of such complications (Ratulangi & Sutanto, 2024). The significant association between poor glycemic control and the incidence of CAD in this study reinforces previous findings that chronic hyperglycemia can induce endothelial dysfunction, atherosclerotic plaque formation, and systemic inflammation, collectively elevating cardiovascular risk. It is established that each 1% increase in HbA1c can raise the risk of CAD by up to 2%, underscoring the imperative for improved glycemic management (Ratulangi & Sutanto, 2024).

Hypertension was another dominant complication in this study cohort. Evidence indicates that hypertension is more frequently observed in patients with Diabetes

Mellitus compared to the general population. Both DM and hypertension are independent risk factors for cardiovascular disease, and their co-occurrence synergistically increases the likelihood of various complications (Damayanti et al., 2023). In patients with T2DM, hypertension demonstrates a reciprocal relationship with impaired renal function. While hypertension is a primary risk factor for chronic kidney disease in T2DM, diabetic nephropathy can also contribute to the onset of hypertension. This bidirectional relationship, involving mechanisms such as increased volume due to sodium reabsorption, peripheral vasoconstriction from endothelial dysfunction, dysregulated renin-angiotensin-aldosterone system (RAAS) activation, elevated endothelin-1 activity, and decreased nitric oxide production, is most evident in type 1 DM patients without prior hypertension history (Damayanti et al., 2023).

Analysis of macroscopic urinalysis parameters (Table 4.3) showed that 21 patients (52.5%) had yellow urine and 19 patients (47.5%) had light yellow urine. Regarding turbidity, 23 samples (57.5%) were clear, 15 (37.5%) were slightly cloudy, and 2 (5.0%) were cloudy. These findings are consistent with research by Ardaningtyas et al. (2023), which also reported patients with yellow and cloudy urine. Normal urine typically appears clear and yellow due to pigments urochrome and urobilin. In diabetes mellitus patients, urine is often light yellow. Cloudy urine in nephropathy patients can be caused by the presence of erythrocytes, leukocytes, epithelial cells, bacteria, protein, and glucose (Adliana & Wahid, 2023). The microscopic urinalysis results (Table 4.5) align with the findings of Ardaningtyas et al. (2023), who stated that renal tubular epithelial cells can absorb lipids from the glomerular filtrate, forming structures known as oval fat bodies. This lipiduria is often associated with glomerular damage due to nephrotic syndrome or diabetes mellitus. However, the presence of patients with normal epithelial cells indicates that not all DM patients experience renal damage. Concerning erythrocytes in urine, the results concur with Ardaningtyas et al. (2023), who note that erythrocyturia is related to damage of the glomerular membrane or injury to blood vessels in the genitourinary tract. Erythrocyturia is a common finding in patients with diabetic nephropathy, though its absence in some patients explains the observed normal erythrocyte counts.

The leukocyturia parameter findings in this study correspond with research conducted by Ritonga (2022) at Estomihi Hospital, Medan, which reported that 60% of 30 Diabetes Mellitus patients experienced leukocyturia. This condition occurs because leukocytes can enter the urinary tract due to increased excretion rates resulting from altered glomerular permeability or motility disorders. Leukocyturia itself is an indicator of infection or inflammation in the genitourinary system (Ardaningtyas et al., 2023). The bacteriuria findings are also consistent with research by Widiatmoko et al. (2019) at Sultan Syarif Mohammad Alkadrie Hospital, Pontianak, which showed that 95.5% of 89 Diabetes Mellitus patients had bacteriuria. This occurs because DM can weaken the immune system by reducing levels of interleukin-8, interleukin-6, and leukocyte counts, coupled with a diminished ability to control metabolism. Furthermore, impaired bladder emptying due to autonomic neuropathy increases the risk of urinary tract infections. Poor glycemic control, particularly in patients with HbA1c levels above 8, carries a higher risk for such infections (Widiatmoko et al., 2019).

CONCLUSION

The findings of this study indicate that patients with Type 2 Diabetes Mellitus (T2DM) at RSD Idaman Banjarbaru predominantly belong to late adulthood and elderly age groups, with a higher prevalence among females compared to males. This demographic profile is concomitant with the emergence of various complications, including neuropathy, hypertension, and coronary artery disease. Urinalysis revealed that a majority of patients exhibited acidic urinary pH, urine color ranging from yellow to light yellow, and alterations in microscopic components such as elevated erythrocytes, leukocytes, epithelial cells, bacteria, and crystals. These findings suggest a tendency toward renal function abnormalities and an increased risk of urinary tract infection in a

subset of patients. Hematological examination also revealed result variations reflective of the metabolic and inflammatory state in T2DM patients. While most hemoglobin and hematocrit levels fell within normal ranges, a number of patients presented with either diminished or elevated values. Overall leukocyte parameters remained within standard limits; however, specific fractions, including eosinophils, neutrophils, and basophils, demonstrated fluctuations. Erythrocyte indices and platelet counts were largely within normal parameters for the majority of patients. Collectively, these results demonstrate that T2DM exerts a significant impact on both urinary and hematological profiles, thereby underscoring the critical importance of routine laboratory monitoring to oversee patient health and mitigate the progression of further complications.

ACKNOWLEDGMENTS

The authors wish to extend their sincere gratitude to the Borneo Lestari Foundation for funding this study through an Internal Research Grant. Our appreciation is also extended to the LPPM, as well as to the research team comprising faculty members and students of the Universitas Borneo Lestari, whose invaluable support and collaboration were instrumental in the successful execution of this research project.

REFERENCES

Adliana, R., & Wahid, R. S. A. (2023). Complete Urine Examination with Dirui Fus-2000 Instrument in The Clinical Pathology Laboratory of The Hospital Abdoel Wahab Sjahranie Samarinda. *JSN: Jurnal Sains Natural*, *1*(3), 56–83.

Ardaningtyas, D. P., Retnaningrum, Y. R., & Hoopmen. (2023). Gambaran Hasil Pemeriksaan Urinalisis Pada Pasien Nefropati Diabetik Di RSUD Abdul Wahab Sjahranie Samarinda. *Jurnal Ilmu Kedokteran Dan Kesehatan*, *10*(5), 896–904.

Damayanti, V. W., Yonata, A., & Kurniawaty, E. (2023). Hypertension in Diabetes Melitus: Pathophysiology and Risk Factor Abstract. *Medula*, *14*(1), 1253–1257.

Masruroh, E.-. (2018). Hubungan Umur Dan Status Gizi Dengan Kadar Gula Darah Penderita Diabetes Melitus Tipe Ii. *Jurnal Ilmu Kesehatan*, *6*(2), 153. https://doi.org/10.32831/jik.v6i2.172

Prasetyani, D., & Martiningsih, D. (2019). Analisis Faktor Yang Mempengaruhi Kejadian Neuropati Diabetik Pada Pasien Diabetes Melitus Tipe 2. *Jurnal Kesehatan, Kebidanan, Dan Keperawatan*, *12*(1), 40–49.

Ratulangi, S. E., & Sutanto, H. (2024). Pengaruh kendali glikemik pasien diabetes tipe 2 terhadap komplikasi penyakit jantung koroner International Diabetes Federation (IDF) menyebutkan hubungan kendali Studi ini menggunakan desain analitik dengan pendekatan potong lintang untuk mengevaluasi . *6*(2), 341–346.

Ritonga, T. P. (2022). *Analisis Jumlah Leukosit Urine Penderita Diabetes Mellitus Di Rumah Sakit Estomihi Kota Medan*.

Tarawifa, S., Bonar, B. samuel, & Sitepu, I. (2020). Hubungan Kadar HbA1c Dengan Resiko Nefropati Diabetikum Pada Pasien DM Tipe 2. *Jurnal Ilmu Kedokteran Dan Kesehatan*, *7*(April), 471–476.

Widiatmoko, M. T., Uwan, W. B., & Mahyarudin, M. (2019). Prevalensi Infeksi Saluran Kemih pada Penderita Diabetes Mellitus Tipe 2 di RSUD Sultan Syarif Mohammad Alkadrie Pontianak. *Jurnal Cerebellum*, *5*(4B), 1559. https://doi.org/10.26418/jc.v5i4b.44822