INTERNATIONAL CONFERENCE
ON LIFESTYLE DISEASES AND NATURAL MEDICINE (ICOLIFEMED)
Nomor ISSN: 3124-1115

Gc-Ms Instrument Analysis Test Of Nano Emulsion Preparation Of Turmeric Rhizom Extract (*Curcuma Domestica* Val.) On The Reduction Of Ureum And Creatinine Levels And Histopathological Picture Of The Kidney In Male Rats Induced By Alloxan

Eliza[1], Ermi Girsang[2], Sri Wahyuni[3]
[1,2,3]Faculties Medicine , Dentistry and Knowledge Health , Universitas Prima Indonesia, North Sumatra

*E-mail : elizakhairul.ek@gmail.com

ABSTRACT

Study This aim For To determine the potential of nano emulsion preparations of turmeric rhizome extract (Curcuma domestica val.) and test it on reducing urea and creatinine levels and histopathological features of the kidneys in male rats induced by alloxan. Methods used covering distribution mouse become a number of group treatment , where stock nanoemulsi extract turmeric given orally . Urea levels And creatinine measured before And after treatment , and analysis histopathology done For evaluate change structural on kidney . Results study show that giving nanoemulsi extract turmeric in a way significant lower level urea And creatinine compared to with group control . Turmeric rhizome extract nanoemulsion *(Curcuma Domestica val.)* was proven to be effective in reducing blood glucose, urea, and creatinine levels in male Wistar rats (Rattus norvegicus) induced by alloxan . The treatment group given turmeric rhizome extract nanoemulsion *(Curcuma Domestica val.)* at a dose of 180 mg/kgbw showed the most optimal results, with a significant decrease in blood sugar, urea, and creatinine levels, approaching the values shown by the control group. In kidney histopathology examination, the group given turmeric rhizome extract nanoemulsion *(Curcuma Domestica val.)* at a dose of 180 mg/kgbw also showed minimal tissue damage, characterized by only mild thickening of the glomerular basement membrane, compared to the other groups. Conclusion from study This is that stock nanoemulsi extract rhizome turmeric effective in lower level urea And creatinine , as well as repair condition histopathology kidneys , so that potential as therapy alternative For disturbance function kidney due to diabetes.

Keywords: *Nanoemulsi turmeric, urea, creatinine, alloxan*

INTRODUCTION

Diabetes Mellitus (DM) is a major threat to human health. This disease is not contagious, but the number of sufferers will continue to increase in the future . According to the American Diabetes Association (ADA) in 2010, DM is a group of metabolic diseases characterized by hyperglycemia that occurs due to abnormalities in insulin secretion, insulin action, or both. Chronic hyperglycemia in DM contributes to the emergence of various complications, long-term damage, dysfunction, and failure of various organs, including the kidneys. One cause of kidney damage (kidney failure) is diabetic nephropathy due to uncontrolled diabetes mellitus and is the leading cause of death in DM patients.

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There are several kidney diseases such as kidney stones which are hard deposits that form in the kidneys from minerals and salts. Diseases that cause a gradual decline in kidney function are known as chronic kidney failure where the kidneys remove fluid and waste from the blood, which are then excreted in *the urine* . And polycystic kidney disease is a disorder default in where group cyst develop in kidney. Cyst This can Lots or enlarge, causing damage to the kidneys (Rahayu, 2024).

Therefore, it is very important to make every effort to avoid kidney damage. caused by diabetes. Treat diabetes properly, maintain blood pressure and overall body health, do not take medication carelessly, maintain Maintaining an ideal body weight and reducing or stopping smoking are some ways you can prevent diabetic nephropathy. According to research (Sri Lestari Ramadhani Nasution, Ermi Girsang, 2022) with behavior compliance diet must accompanied by with intention, A consistent attitude will significantly reduce blood glucose levels, leading to a healthier life and avoiding diabetes mellitus. in blood is sign disease chronic Which known as Diabetes mellitus. If blood sugar levels are high or uncontrolled, the kidneys must work harder to filter the blood. This can eventually lead to kidney failure. To detect early signs of kidney damage, kidney function tests such as a microalbuminuria urine test, which measures the amount of albumin in the urine, are necessary. This test can also be performed with urea and creatinine tests (Basuki Rachmad, 2023). In addition consuming drugs and taking medical action to lower blood sugar levels, according to several studies on the properties of plants that can lower glucose levels (Elis, 2015).

Therefore, most people around the world treat various ailments with traditional medicines. Many researchers consider plants to be an important resource for developing new therapies. Today, herbal products are widely used to control or prevent disease, and some plants continue to be tested for their pharmacological properties, such as antibiotic, anti-apoptotic, antioxidant, and anti-inflammatory properties (Nurhamidin S, 2022) .

The drugs given can be made from active chemical ingredients or herbal concoctions, one of which is the sambiloto plant. Turmeric rhizomes also have pharmacological activity as analgesics, antioxidants, antibacterials, antifungals, anti-inflammatory and digestive disorders (Anand *et al* , 2010; Hayakawa *et al* , 2011). The most active compound in turmeric is known to be curcumin, at 3-4%. Curcumin's low bioavailability is due to its rapid metabolism and low absorption, along with rapid elimination and excretion, which are factors that limit its bioavailability (Anand *et al* ., 2007). Nanoemulsion as a dosage form can increase the bioavailability and effectiveness of turmeric extract.

Research conducted by Madhan Vijayanan and Weseley for 21 days on albino rats with type 1 DM induced by streptozotocin *at* a dose of 60 mg/KgBW, given turmeric rhizome extract at a dose of 25 ml/KgBW and 50 ml/KgBW orally. At a dose of 25 ml/KgBW, there was a healing effect of kidney cell necrosis and at a dose of 50 ml/KgBW the shape and size of kidney cells had returned to the same as the control group (Vijayanand S, 2009). Previous research resulted in research that in female and male *Charles Foster rats* with type 2 DM induced *by nicotinamide* at a dose of 120 mg/KgBW 15 minutes later induced by *streptozotocin* at a dose of 65 mg/KgBW for 7 days intraperitoneally. Turmeric rhizome extract was given at a dose of 50 mg/KgBW, 100 mg/KgBW, and 200 mg/KgBW orally for 10 days. *Gas Chromatography Mass Spectrometry* (*GC-MS*) is a gas chromatography technique used in conjunction with mass spectrometry. Gas chromatography is used to detect compounds that evaporate easily under high vacuum and low pressure when heated.

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Due to the product's efficacy and safety assurance, as well as the limitations of existing quality control methods, *chromatographic fingerprint analysis* of curcuma extract is necessary. The currently limited number of markers available requires a better method to ensure product authenticity, namely *chromatographic fingerprinting* using GC-MS. Based on this description , the author is interested For research potential nanoemulsion preparation of turmeric rhizome extract (*curcuma domestica* val.) on reducing urea and creatinine levels in alloxan-induced male rats. *From the description above, the conceptual framework in this research is as follows:*

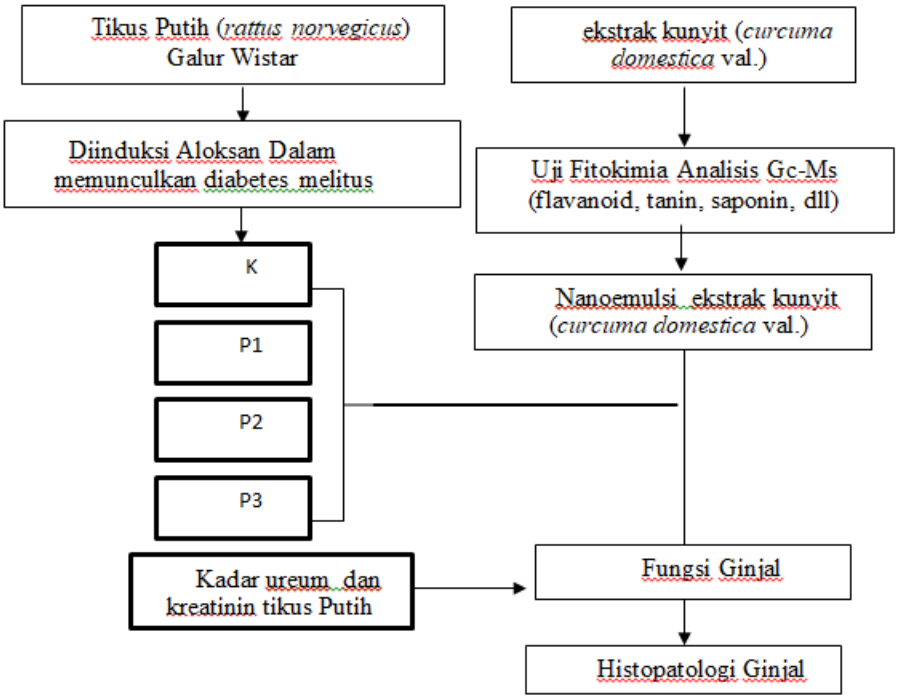

Figure 1. Conceptual Framework

METHODS

This research is a type of laboratory or *true experimental research. Experiment* . The research design used *a post-test with control group design* to analyze the nanoemulsion preparation of turmeric rhizome extract (*Curcuma domestica* val.) on reducing urea and creatinine levels in alloxan-induced male rats and kidney histopathology. This research was conducted at the Laboratory of the Department of Pharmaceutical Pharmacology, Faculty of Medicine, University of North Sumatra and the Laboratory of Anatomical Pathology, University of North Sumatra. This research was conducted from June to August 2025 .

Independent variable: administration of nanoemulsion e of turmeric rhizome extract (*curcuma domestica* val.) . Dependent variable: decrease in urea and creatinine levels and histopathological appearance of the kidneys and Pre-condition variables : Alloxan induction to induce diabetes mellitus .

The kidney function parameters in this study were urea and creatinine levels. Elevated blood urea levels are an indication of kidney damage. If the kidneys are unable to excrete enough urea, blood urea levels will rise above normal levels because glomerular filtration must decrease by 50% before blood urea levels can rise.

Serum creatinine levels are widely used to measure kidney function. Creatinine is a breakdown product of muscle creatine phosphate, produced by the body at a constant rate

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depending on muscle mass. Creatinine levels are related to muscle mass, reflecting changes in creatinine and kidney function. Serum creatinine is used to measure glomerular filtration rate and monitor the progression of kidney disease. Scoring data was then created from histopathological observation data through microscopic examination. The data obtained from the study were tabulated, then analyzed for the changes found, and finally presented descriptively. Next, the research data were analyzed using the Statistical Package for Social Sciences (SPSS) 25.0 for Windows. To assess data normality, the Kolmogorov-Smirnov test was used ($p > 0.05$). In addition, significance between test groups was tested using One-Way ANOVA or one-way analysis of variance at a 95% confidence level. Further analysis or testing was carried out using the Post Hoc Test and LSD techniques.

RESULTS AND DISCUSSION

Phytochemical Test Results

Phytochemical testing was conducted to identify the secondary metabolite compounds present in turmeric rhizome *(Curcuma Domestica val.) nanoemulsion extracts* , which are suspected to have potential as natural therapeutic agents. GC-MS analysis results for turmeric rhizome content typically present data as percentages of the various compounds detected. Here's a common way to present and understand these results:

Table 1 Analysis of Compound Content of Turmeric Rhizome Extract *(Curcuma Domestica val.)*

Compound	Percentage (%)
Curcumin	30.5
Demethoxycurcumin	15.3
Bisdemethoxycurcumin	8.2
Tumeron	5.7
Zingiberene	4.1
Beta-turmerone	2.8
Other Volatile Compounds	33.4

GC-MS (Gas Chromatography-Mass Spectrometry) analysis results for turmeric's compound content typically include a number of chemical compounds with various health benefits. Here are some of the main compounds commonly found in turmeric:

1. Curcumin : The main active compound that gives turmeric its yellow color and has anti-inflammatory and antioxidant properties.
2. Demethoxycurcumin : A variant of curcumin with anti-inflammatory properties.
3. Bisdemethoxycurcumin : Another compound that plays a role in the biological activity of turmeric.
4. Tumerones : Compounds that contribute to aroma and have potential therapeutic effects.
5. Volatile compounds : Such as zingiberene and beta-turmerone, which also have health benefits.

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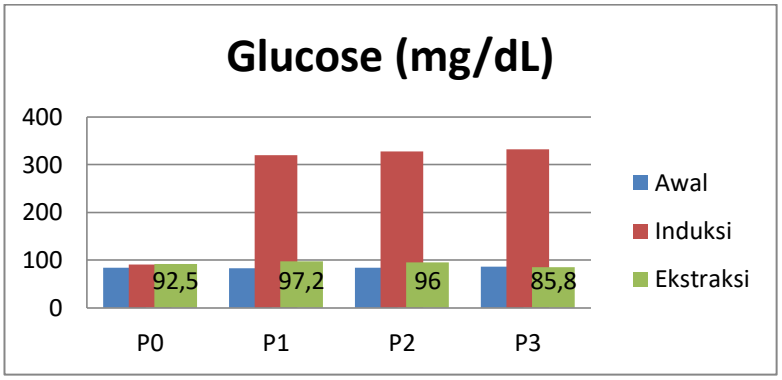
Measurement of Blood Glucose Levels

So the test results above show the success rate of the nanoemulsion of turmeric rhizome extract *(Curcuma Domestica val.)* on reducing blood glucose levels in mice with diabetes mellitus . The effectiveness was observed at doses of 150 mg/kg body weight and 100 mg/kg body weight. The comparison can be seen in the following graph:



In group P0, no diabetes induction treatment was given so that this group had stable glucose levels, whereas in groups P1, P2 and P3, this group was induced by alloxan so that in post-induction observations, it was seen that all groups had glucose levels >300 mg/dL, but after being given the extraction agent nanoemulsion of turmeric rhizome extract *(Curcuma Domestica val.)* It was seen that there was a decrease in the blood glucose levels of the mice until groups P1, P2 and P3 entered the normal blood glucose criteria for mice.

Urea Level Observation Results

Observations of changes in urea levels were carried out after alloxan induction, namely on day 1, day 14, and day 28. Normal urea levels : Around 20-40 mg/dL in healthy mice. Urea levels after alloxan induction : Can increase significantly, for example, to 60-100 mg/dL or more, depending on the level of kidney damage.

The following are the results of observations on the urea levels of test animals during the treatment process:

Table 2. Results of Observation of Urea Levels After Treatment

No	Group	Ureum Levels (mg/dL) Mean ± SD Day 1 Beginning	Day 14 After Induction	Day 28 After Extraction
1	Control	27.37 ± 4.79	29.37 ± 5.26	27.53 ± 5.13
2	Treatment 1	29.46 ± 3.78	65.10 ± 3.99	37.25 ± 1.13
3	Treatment 2	29.26 ± 3.42	69.55 ± 4.77	32.67 ± 1.86
4	Treatment 3	29.17 ± 3.39	67.82 ± 4.12	29.02 ± 1.58

Based on the results of urea level measurements on the 28th day, it can be concluded that treatment group 1 which was given nanoemulsion of turmeric rhizome extract *(Curcuma Domestica val.)* , with a dose of 100 mg/kgbb and treatment group 2 which was given nanoemulsion of turmeric rhizome extract *(Curcuma Domestica val.)* , with a dose of 140 mg/kgbb and turmeric rhizome extract *(Curcuma Domestica val.)* , with a dose of 180 mg/kgbb experienced a decrease. Treatment group 3 experienced the most significant

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decrease and was close to the control group compared to the other groups. Treatment group 1 which was given nanoemulsion of turmeric rhizome extract *(Curcuma Domestica val.)* , with a dose of 100 mg/kgbb was the group with the least decrease compared to the other groups.

Creatinine Level Observation Results

Observations of changes in creatinine levels were carried out after alloxan induction, namely on day 1, day 14, and day 28. Normal Creatinine Levels in Healthy Rats Normal creatinine levels in rats usually range from 0.5 to 1.5 mg/dL . This indicates good kidney function. After Alloxan Induction : Creatinine levels can increase significantly due to kidney damage induced by alloxan. Creatinine levels found can vary, but are often in the range of 1.5 to 3.0 mg/dL or higher, depending on the dose of alloxan and the degree of kidney damage. The following are the results of observations on creatinine levels in test animals during the treatment process:

Table 3. Results of Creatinine Level Observations

No	Group	Creatinine Levels (mg/dL) Mean ± SD		
		Day 1 Beginning	Day 14 After Induction	Day 28 After Extraction
1	Control	1.03 ± 0.37	1.14 ± 0.36	1.24 ± 0.32
2	Treatment 1	1.31 ± 0.08	2.50 ± 0.17	1.24 ± 0.04
3	Treatment 2	1.23 ± 0.12	2.62 ± 0.16	1.23 ± 0.11
4	Treatment 3	1.07 ± 0.09	2.77 ± 0.17	1.09 ± 0.07

Based on the results of urea level measurements on the 28th day, it can be concluded that treatment group 1 which was given nanoemulsion of turmeric rhizome extract *(Curcuma Domestica val.)* , with a dose of 100 mg/kgbb and treatment group 2 which was given nanoemulsion of turmeric rhizome extract *(Curcuma Domestica val.)* , with a dose of 140 mg/kgbb and turmeric rhizome extract *(Curcuma Domestica val.)* , with a dose of 180 mg/kgbb experienced a decrease. Treatment group 3 experienced the most significant decrease and was close to the control group compared to the other groups. Treatment group 1 which was given nanoemulsion of turmeric rhizome extract *(Curcuma Domestica val.)* , with a dose of 100 mg/kgbb was the group with the least decrease compared to the other groups.

Histopathological Observation Results

The control group, which was not induced by alloxan and was only given distilled water, had normal kidney histology because there were no changes in the glomeruli. In this group, there was no visible dilation of the glomerular cells. The glomerular diameter also appeared normal. The kidney histopathology in the control group was normal, so it was used as a reference to describe the other groups and as a comparison with the treatment group induced by alloxan and given turmeric rhizome extract *(Curcuma Domestica val.)* . The control group received a score of 0 because there was no histopathological damage.

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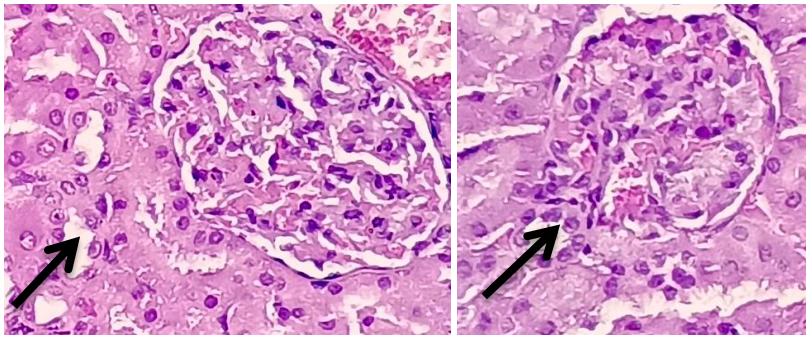

Figure 2. Histopathology of the Kidneys of the Control Group

Treatment group 1 was given alloxan induction and a nanoemulsion of turmeric rhizome extract *(Curcuma Domestica val.)* at a dose of 100 mg/kg body weight. Glomerular basement membrane thickening and multifocal (moderate) mesangial proliferation were observed. This condition is related to the induction and previous treatment. The kidney histology score in treatment group 1 was 2 due to moderate damage to the glomerular thickening.

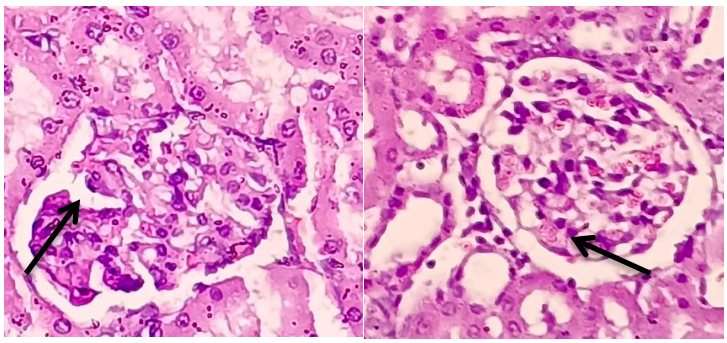

Figure 3. Kidney Histopathology of Treatment Group 1

Treatment group 2 was given alloxan induction and a nanoemulsion of turmeric rhizome extract *(Curcuma Domestica val.)* at a dose of 140 mg/kg body weight. Glomeruli showed thickening of the glomerular basement membrane and multifocal (moderate) mesangial proliferation. This condition is related to the induction and previous treatment. The score on the kidney histology condition in treatment group 1 received a score of 2 because there was moderate damage to the glomerular thickening showing hypertrophy and hypercellularity, which was characterized by an increase in the number of mesangial cells and endothelial cells. In addition, there was thickening of the glomerular basement membrane. The widening of glomerular cells resulted in adhesions between the glomerulus and Bowman's capsule. This condition is related to the effects of alloxan induction.

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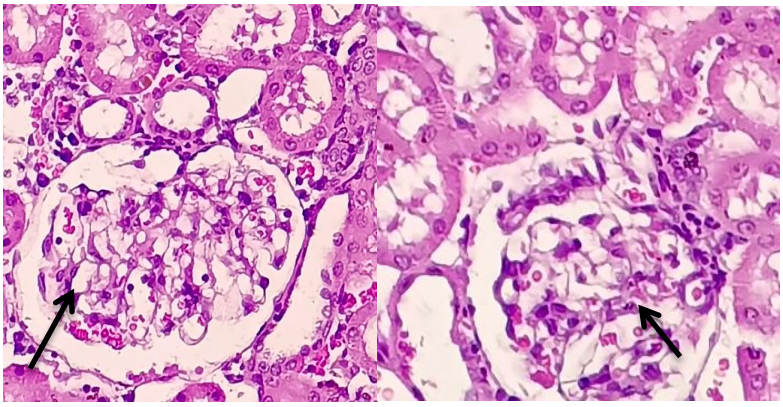

Figure 4. Kidney Histopathology of Treatment Group 2

Treatment group 3 was given alloxan induction and a nanoemulsion of turmeric rhizome extract *(Curcuma Domestica val.)* at a dose of 180 mg/kg body weight. Glomerular basement membrane thickening and focal (mild) mesangial proliferation were observed. This condition is related to the induction and previous treatment. The kidney histology score in treatment group 3 was 1 because the glomeruli experienced slight thickening of the basement membrane. Glomerular cell dilation resulted in adhesions between the glomeruli and Bowman's capsule. This condition is related to the effects of alloxan induction during preconditioning. However, this dilation was smaller than in treatment groups 1 and 2.

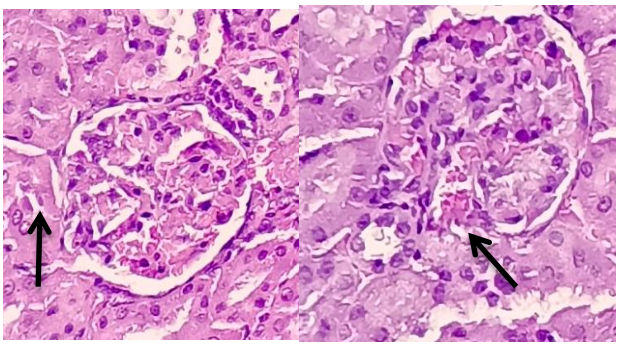

Figure 5. Kidney Histopathology of Treatment Group 3

The results of histopathological observations of the kidneys in the negative control group, positive control, treatment 1, and treatment 2 were then scored. The scoring system used was based on glomerular cell damage, namely: score 0 = no histopathological damage, score 1 = focal (mild) damage, score 2 = multifocal (moderate) damage, and score 3 = diffuse (severe) damage.

Table 4. Renal Histopathology Score

Group	Mean Score ± SD	Interpretation
Control	0.2 ± 0.6	No damage
Treatment 1	2.1 ± 0.7	Moderate damage
Treatment 2	2.0 ± 0.6	Moderate damage
Treatment 3	1.2 ± 0.9	Minor damage (structural repairs)

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CONCLUSION

1. GC-MS (Gas Chromatography-Mass Spectrometry) analysis results for turmeric's compound content typically include a number of chemical compounds with various health benefits. Here are some of the main compounds commonly found in turmeric: Curcumin (30%) : The main active compound that gives turmeric its yellow color and has anti-inflammatory and antioxidant properties , d emethoxycurcumin (15.3%) : A variant of curcumin with anti-inflammatory properties , b isdemethoxycurcumin (8.2%) : Another compound that plays a role in the biological activity of turmeric , t umeron (5.7%) : A compound that contributes to the aroma and has potential therapeutic effects , z ingiberene (41%), b eta-turmerone (2.8%) And s volatile compounds (33.4) : Such as zingiberene and beta-turmerone, which also have health benefits.
2. Nanoemulsion of turmeric rhizome extract *(Curcuma Domestica val.)* has been proven to be effective in reducing blood glucose, urea, and creatinine levels in male white rats (Rattus norvegicus) of the Wistar strain induced by alloxan.
1. The treatment group given a nanoemulsion of turmeric rhizome extract *(Curcuma Domestica val.)* at a dose of 180 mg/kgbb showed the most optimal results, with a significant decrease in blood sugar, urea, and creatinine levels, approaching the values shown by the control group.
2. In histopathological examination of the kidneys, the group given nanoemulsion of turmeric rhizome extract *(Curcuma Domestica val.)* at a dose of 180 mg/kgbb also showed minimal tissue damage, characterized by only mild thickening of the glomerular basement membrane, compared to the other groups.

ACKNOWLEDGEMENT

The Faculty of Medicine, Dentistry, and Health Sciences, as well as the directors of study programs, are acknowledged by the authors for their support of this research at Universitas Prima Indonesia. Additionally, we appreciate the supervisors' insightful comments. The University of North Sumatra, the Faculty of Pharmacy, the Pharmacology Laboratory, and the Nanomedicine Laboratory are all acknowledged by the authors for their invaluable support of this study.

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