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Standard Levels of Uric Acid, Blood Glucose, Blood Pressure, and Body Mass Index as Steps to Control the Risk of Non-Communicable Diseases (NCDs) in the Community of Kumelembuai Dua Village, South Minahasa Regency, North Sulawesi Province

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KEYWORDS

Blood Pressure (BP), Body Mass Index (BMI), Blood Sugar (GD), Normal Standards, Risk of NCDs, Uric Acid (AU)

ABSTRACT

Non-communicable diseases (NCDs) are often considered trivial and can trap humans due to ignorance within normal limits: uric acid, blood sugar, blood pressure, and body mass index, which can lead to disease. Abnormal conditions can trigger NCDs gradually but surely. These conditions, if not anticipated through symptom observation and control of normal levels, can cause death. The causes are diverse, including genetic factors and environmental influences such as diet, sleep, activity, and social environment. Data from Kumelembuai Village, South Minahasa Regency, North Sulawesi, show that this research uses qualitative methods, following Basrowi & Suwandi (2014). Blood samples were taken in February–March 2025 to determine normal standards for uric acid, blood sugar, and BMI in adult men and women, mainly housewives, with a total of 72 respondents. The results show that women's average uric acid level is 9.12 mg/dL, men's is 9.4 mg/dL; blood sugar averages are 98.02 mg/dL for women and 115.94 mg/dL for men; blood pressure averages are 135.34/79.21 mmHg for women and 151.56/80.25 mmHg for men; BMI averages are 26.46 for women and 24.75 for men. Overall, some values exceed normal thresholds, indicating a risk of NCDs. The conclusion is that these levels surpass standard normal limits and could lead to health issues. Early steps are necessary to prevent NCDs by paying attention to factors such as genetics, environmental influences, and lifestyle patterns, including eating, sleeping, activity, and social gatherings that may trigger consumption of foods increasing disease risk.

Introduction

Non-communicable diseases (NCDs) are diseases whose causes are complex and difficult to observe and analyze. However, generally, the causes can be identified as uric acid, blood sugar, and blood pressure. *STIs* are local only (Igietseme et al., 2015; Ojo et al., 2025; Soh et al., 2016; Zhang et al., 2022). The significant increase in cases of *Non-Communicable Diseases* (NCDs) will increase the burden on society and the government because the treatment takes a long time and costs a lot of money (Jan et al., 2018). For this reason, it is necessary to conduct examinations of levels: uric acid, blood glucose, blood pressure, and *STIs* so that they can be detected early (Abebayehu, 2023). The characteristics of *non-communicable diseases* (NCDs) are that most of their symptoms cannot be detected in the early stages. NCDs are often ignored in the early stages because they are generally not realized by sufferers; often, the truly serious

symptoms experienced by sufferers are only recognized when the disease has already reached the chronic stage (Rahayu 2023).

In Indonesia itself, gout is the second most common disease after hypertension, estimated at around 840 out of 100,000 people suffering from the disease. The age groups under 34 years (32%) and over 34 years (68%) represent the most vulnerable groups in Indonesia affected by this condition. For men, normal blood uric acid levels range between 3.5 and 7 milligrams per deciliter; for women, normal blood uric acid levels range between 2.6 and 6 milligrams per deciliter (Hutagalung et al. 2024). The condition of gout, which is an influential factor related to NCDs, leads the community to avoid various types of food consumption that can affect it . Under normal conditions, uric acid can provide positive health effects. Uric acid in normal conditions in the body functions as a natural antioxidant, but if levels are excessive, it can be an indicator of various diseases (Sari, 2017).

Uric acid is formed as a byproduct or waste product of metabolism and the breakdown of purine compounds in the body. At normal concentrations, uric acid has a beneficial function as an antioxidant in the blood. However, if uric acid levels are too high, it can crystallize, forming a solid crystalline structure which causes gouty arthritis and acts as a prooxidant, damaging cells and tissues. To determine whether someone has normal uric acid levels, blood and urine samples can be tested (Martiningsih 2016). Purine nucleotide metabolism in the human body ends in uric acid (UA). Hyperuricemia refers to high levels of uric acid in the blood, while hypouricemia indicates low levels. If uric acid levels are below normal, they can have adverse effects. Both high and low uric acid levels are associated with an increased risk of serious illness and even death. This means there is a link between uric acid levels in the blood and the causes of cardiovascular disorders as well as other serious illnesses such as cancer. Uric acid is also closely linked to kidney stones, which can lead to hypertension, metabolic syndrome, and kidney disease.

Uric acid levels in men and women can vary. For men, normal levels are 3.4-7 mg/dL, while for women, normal levels are 2.4-6 mg/dL. The *body mass index* (BMI) is the result of measuring body weight (kg) divided by the square of height (m^2), with malnutrition defined as less than 18.5, normal as 18.5-25, and more than 25 categorized as overweight or obese. The BMI clearly reflects the physical body condition, whereas uric acid, blood sugar, and blood pressure cannot be seen physically and require blood sampling and measurement to determine health conditions in detail (Wu et al., 2024; Zykova et al., 2015).

The prevalence of *diabetes mellitus* in various regions of Indonesia varies and can be influenced by cultural factors as well as factors of adequate or even excessive nutritional adequacy according to per capita income levels. The prevalence of *diabetes mellitus* has experienced a significant increase. The prevalence of diabetes mellitus based on doctor diagnosis for the population aged ≥ 15 years increased significantly from 1.5% in 2013 to 2% in 2018. In North Sumatra Province, the prevalence also increased significantly from 1.8% in 2013 to 2% in 2018 (Kemenkes RI, 2013; Kemenkes RI, 2018) (Megawati 2022).

Diabetes Mellitus (DM) is a non-communicable disease and ranks among the top 10 causes of death worldwide, responsible for 6.7 million deaths. The prevalence of DM in North Sulawesi Province ranks fourth nationally, with a prevalence of 2.3%, exceeding the national average. Comprehensive treatment that goes beyond managing the patient's disease is urgently needed to address the increasing number of DM cases. The Indonesian government, through the Social Security Administration (BPJS), implements a primary care system that empowers family doctors as the frontline in serving the community. However, several studies have shown a low frequency of physician knowledge, attitudes, and family actions regarding DM management (Raranta 2023).

Uric acid normal levels differ between women and men: men (3.5-7 mg/dL), women (2.6-6 mg/dL), while normal blood sugar levels during fasting (minimum 9 hours) are less than

100 mg/dL; if not fasting, less than 126 mg/dL; pre-diabetic blood sugar levels range from 100-125 mg/dL; and diabetes is diagnosed at levels of 126 mg/dL or higher. These standard figures are generally known because various tests are available and information is spread via social media. However, other factors sometimes less realized include weather conditions, social status in society, and cultural factors such as for the Minahasa tribe, where every social activity typically ends with various delicious food dishes that can affect these standard values. Blood pressure can affect physical conditions and lead to symptoms impacting a person's overall well-being. When health weakens, negative thought patterns may emerge, such as feelings of despair, social withdrawal, inferiority, shame, self-blame, and even blaming others, possibly leading to further illnesses such as heart disease, kidney disease, and others caused by metabolic process disturbances in the body. Hypertension is influenced by a person's lifestyle, especially their diet, making lifestyle management crucial for controlling hypertension (Badjo et al., 2020).

Previous research has established important foundations for understanding NCD risk factors. A study by Johnson et al. (2020) demonstrated that elevated uric acid levels above 7 mg/dL significantly increased cardiovascular disease risk by 35% in middle-aged adults. Similarly, Zhang et al. (2021) found that hyperuricemia was independently associated with metabolic syndrome components, including hypertension and dyslipidemia, in Asian populations. Research by Kumar et al. (2022) revealed that the combined elevation of uric acid and blood glucose produced synergistic effects on cardiovascular outcomes, with hazard ratios exceeding those of individual risk factors. Furthermore, Lee et al. (2023) documented that body mass index above 25 kg/m² strongly correlated with hyperuricemia prevalence, suggesting obesity as a key mediator in metabolic dysregulation. These studies collectively highlight the interconnected nature of metabolic biomarkers in NCD development.

The novelty of this research lies in its comprehensive assessment of four key metabolic parameters simultaneously within a specific Indonesian cultural context. Unlike previous studies that examined individual biomarkers in isolation, this research investigates the combined profile of uric acid, blood sugar, blood pressure, and BMI in the Kumelembuai community, where unique dietary patterns and cultural practices—particularly the Minahasa tradition of communal eating—may influence metabolic health. This integrated approach provides a more holistic understanding of NCD risk in rural Indonesian populations, addressing a significant gap in the literature regarding metabolic health in culturally distinct communities.

The objective of this research is to assess the current metabolic health status of the Kumelembuai Dua village community by measuring and analyzing four key biomarkers—uric acid, blood sugar, blood pressure, and body mass index—and comparing these measurements against established normal standards to identify NCD risk levels. This research aims to provide baseline data that can inform targeted health interventions and preventive strategies tailored to the specific needs of this rural Indonesian community. The benefits of this study extend beyond immediate health assessment, as it will contribute to building a comprehensive health profile database for the region, facilitate early detection and intervention programs, support evidence-based policymaking for local health authorities, and ultimately reduce the long-term economic and social burden of NCDs on families and the healthcare system. Furthermore, the implications of this research include establishing a replicable model for community-based NCD screening in similar rural settings, identifying culturally specific risk factors that require targeted interventions, and providing educational foundations for community health awareness programs that address local dietary and lifestyle patterns contributing to NCD development.

Method

This research employed a quantitative approach to measure the levels of uric acid, blood sugar, blood pressure, and body mass index, which are key metabolic markers present in the

body through systematic physiological assessment. The study incorporates qualitative elements in understanding behavior within a culture within a community group. The qualitative method is a method with a research process based on perceptions of a phenomenon with an approach where the data produces descriptive analysis in the form of oral sentences from the research object (Sahir, S. 2021).

The implementation of this research was carried out in Kumelembuai Village, South Minahasa Regency, North Sulawesi Province. The implementation time was February to March 2025. The research activities included carrying out blood sampling and examination of uric acid levels, blood sugar, blood pressure, and measurement of body mass index through assessment of height and weight in the general community group of adult men and women.

The population is the entire community living in Kumelembuai village with a sample of 72 respondents with 56 women and 16 men with the criteria of mothers and fathers who are ready to be examined and are generally active in Kumelembuai village activities. Sampling is incidental purposive sampling, namely sampling based on chance, where if the sample is deemed to have met the criteria being studied, this method is carried out on the basis of certain considerations (Sahir, S. 2021). Sampling in this study involved measuring physical height and weight and taking blood samples which were then examined simultaneously at the research location using portable measuring instruments that had been calibrated. Physical measurements and blood sampling in the community who are generally housewives and heads of families yielded 72 respondents who were dominated by housewives because men generally work as breadwinners, namely farmers, and these respondents were willing to participate in physical measurement samples and blood sampling.

The qualitative data analysis process involves measuring the results of blood sugar, uric acid, body mass index, weight and height and then comparing them with normal standards to predict the risk of non-communicable diseases whether they are at a high or standard position, with the risk of NCDs that can occur. The results of measurements on respondents who were studied are presented in the form of a table of measurements representing all 72 respondents with separate tables presenting the measurement of levels for women with 56 respondents and for men with 16 respondents in table form to facilitate comparison of the figures for achieving levels of uric acid, blood sugar, blood pressure, and body mass index in each research target.

Results and Discussion

Overview of Research Location

Kumelembuai Village is a village resulting from the expansion of Motoling District and now stands alone as Kumelembuai District, this village is in a mountainous area with an altitude of 454 meters above sea level with an area of 9600 M^2. Fertile soil conditions with agricultural products in the form of clove coconut, patchouli, corn, secondary crops and various other plants that can contribute to supporting the community's economy so that in general seen from the economic and housing conditions that exist in the categorized as quite prosperous when compared to other villages in the South Minahasa area of North Sulawesi Province.

Measurement data table: Body weight, height, body mass index, blood pressure, blood sugar, uric acid.

Table 1. Measurement Results of Adult Female Respondents

Women Statistics (F)	BB (kg)	TB (cm)	BMI	BP (mmHg)		N	GD	AU
				Systole	Diastole			
Average (Mean)	57.39	147.84	26.46	135.54	79.21	82.21	98.02	9.12
Median	57.5	148.5	27.0	135.0	80.0	83.0	88.0	8.3
Mode	52	150	28	134	80	87	91	6.7
Minimum	43	136	17	83	57	58	63	5.4
Maximum	89	160	36	187	105	125	238	63.0
Range	46	24	19	104	48	67	175	57.6

Table 2. Measurement Results of Adult Male Respondents

Statistics Male (M)	BB (kg)	TB (cm)	BMI	BP (mmHg)		N	GD	AU
				Systole	Diastole			
Average (Mean)	61.19	159.38	24.75	131.56	80.25	75.13	115.94	9.48
Median	61.0	159.0	24.0	130.0	78.5	77.0	93.5	8.9
Mode	47, 54	162	23	128, 132	78	75,	64	6.4
Minimum	41	140	18	110	67	60	64	6.0
Maximum	85	173	32	168	98	88	264	16.4
Range	44	33	14	14.71	31	28	200	10.4

Table 3. Measurement Results of Male and Female Respondents

L and P Statistics	BB (kg)	TB (cm)	BMI	BP (mmHg)		N	GD	AU
				Systole	Diastole			
Average (Mean)	58.60	150.78	26.26	133.35	80.29	79.29	98.81	9.29
Median	58.00	150.0	26.5	134.00	80.00	79	91	8.7
Mode	52	150	28	128	80	87	91	6.7
Minimum	41	136	17	83	57	58	63	5.4
Maximum	89	173	36	187	105	125	264	63.0
Range	48	37	19	104	48	67	201	57.6

Normal standards for uric acid, blood sugar, blood pressure, and body mass index are indicators that can predict a person's risk of developing non-communicable diseases (NCDs). Besides genetic factors, various behavioral factors also influence a person's physical condition. Diseases not caused by bacterial infections include chronic degenerative diseases such as heart disease, stroke, diabetes mellitus, cancer, chronic obstructive pulmonary disease, injuries, and sensory and functional disorders. (Junaidi et al. 2021). The relationship between normal standards of blood sugar, uric acid, and blood pressure is a condition that can predict the presence of non-communicable diseases (NCDs) as part of a hypertension review. Hypertension measurement results follow the JNC VII criteria, namely if systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg. The prevalence of hypertension based on doctor's diagnosis is calculated with the formula: namely household members who have been diagnosed with hypertension by a doctor divided by household members aged greater than or equal to 18 years. The number of diabetes sufferers throughout Indonesia represents a key issue in Indonesia (Riskesdas 2018). NCDs are diseases that can be prevented if risk factors can be controlled.

Uric acid is a crystalline acid that results from the breakdown of purines. Purines are naturally present in the body and in foods from both plants (vegetables, fruit, nuts) and animals (meat, organ meats, sardines) (Dhalimarta, 2008). According to the CDC (2020), gout is a

common and very painful form of arthritis. It usually affects one joint at a time (often the big toe). Repeated attacks of gout pain can lead to gouty arthritis, a worsening form of arthritis (Widyaningrum 2020). The description of the condition of the disease that generally attacks with certainty but cannot be anticipated immediately will have a very significant impact on the health of the community because when this non-communicable disease attacks such as hypertension, stroke, heart disease, and various generative diseases from the causes of gout, hypertension, body mass index, then the suffering will last long, even for years which can cause not only sufferers but all families will be involved in it and will automatically affect the activities of working, thinking, acting from a family network that can hinder economic growth for the family, become a blow and burden on the family and can even affect the burden on the country because it does not produce and even worsens the country's economy.

The results of measurements and blood sampling in the Kumelembuai village community which took place in February and March of 2025 showed that the conditions of uric acid, blood sugar, blood pressure and body mass index can provide an overview of the risk of diseases such as hypertension. The results of the study were obtained from 56 female respondents and 16 male respondents with Mean Body Weight (BB) (58.60 Kg), Mode (Mo 52Kg), Mean Height (TB) 150.78 Cm, Mode (Mo 150 Cm), Body Mass Index (BMI) Mean (M) 26.26, Blood Pressure (BP) Mean (M) 133.35 S/80.29 D, Mode (Mo) 128S/80D, Blood Sugar (GD) Mean (M) 98.81, Mode (Mo) 91, and Uric Acid (AU) Mean (M) 9.29, Mode (Mo) 6.7.

When examining female respondents separately (n=56), the results show Mean Body Weight of 57.39 kg (Mode 52 kg), Mean Height of 147.84 cm (Mode 150 cm), BMI Mean of 26.46 (Mode 28), Blood Pressure Mean of 135.54/79.21 mmHg (Mode 134/80), Blood Sugar Mean of 98.02 mg/dL (Mode 91), and Uric Acid Mean of 9.12 mg/dL (Mode 6.7). For male respondents (n=16), measurements revealed Mean Body Weight of 61.19 kg (Mode 47, 54 kg), Mean Height of 159.38 cm (Mode 162 cm), BMI Mean of 24.75 (Mode 23), Blood Pressure Mean of 131.56/80.25 mmHg (Mode 128, 132/78), Blood Sugar Mean of 115.94 mg/dL (Mode 64), and Uric Acid Mean of 9.48 mg/dL (Mode 6.4).

These findings reveal concerning patterns across all measured parameters. The average uric acid levels for both genders significantly exceed normal thresholds, with women averaging 9.12 mg/dL against a normal range of 2.6-6 mg/dL, and men averaging 9.48 mg/dL compared to the normal 3.5-7 mg/dL range. This elevation suggests widespread hyperuricemia in the community, which correlates with increased risks of gout, kidney stones, and cardiovascular complications. The blood pressure measurements also indicate a high prevalence of hypertension, particularly among male respondents with an average systolic pressure of 131.56 mmHg, approaching the diagnostic threshold of 140 mmHg. Female respondents show even higher average systolic readings of 135.54 mmHg, placing many in the pre-hypertension or stage 1 hypertension category according to JNC VII criteria.

Body Mass Index results demonstrate that both groups tend toward overweight classifications, with females averaging 26.46 (overweight to obese range) and males averaging 24.75 (upper normal to overweight boundary). This excess weight contributes to metabolic dysfunction and compounds the risks associated with elevated uric acid and blood pressure. Blood sugar levels present a more complex picture: while female respondents show average fasting glucose of 98.02 mg/dL (within normal range), male respondents average 115.94 mg/dL, which exceeds the normal fasting threshold of 100 mg/dL and approaches pre-diabetic levels.

The convergence of these elevated biomarkers creates a concerning metabolic profile indicative of high NCD risk. The Kumelembuai community demonstrates a pattern consistent with metabolic syndrome—a cluster of conditions that increase the risk of heart disease, stroke, and type 2 diabetes. Cultural factors unique to the Minahasa region, particularly communal

eating traditions featuring rich, purine-heavy foods, likely contribute significantly to these results. The predominantly female sample population, consisting mainly of housewives, may face additional risk factors related to physical activity levels and dietary preparation responsibilities that influence food consumption patterns.

These findings align with broader epidemiological trends in Indonesia, where NCD prevalence has increased substantially over the past decade, but they also reveal community-specific vulnerabilities that require targeted interventions. The data suggest that without prompt action to address these elevated biomarkers through lifestyle modifications, dietary counseling, and regular health monitoring, the Kumelembuai community faces substantial risk of developing serious non-communicable diseases soon.

Conclusion

This research reveals that the Kumelembuai Dua village community exhibits concerning metabolic health indicators that significantly exceed normal standards across multiple biomarkers, placing them at elevated risk for non-communicable diseases. The comprehensive assessment of 72 respondents demonstrated average uric acid levels of 9.29 mg/dL (well above normal ranges of 2.6-6 mg/dL for women and 3.5-7 mg/dL for men), average blood pressure of 133.35/80.29 mmHg (indicating widespread pre-hypertension to hypertension), average BMI of 26.26 (overweight classification), and average blood sugar of 98.81 mg/dL (approaching pre-diabetic thresholds, particularly among male respondents). These findings underscore the urgent need for community-based interventions addressing dietary patterns, particularly the cultural tradition of communal eating featuring purine-rich foods, increasing physical activity levels, and establishing regular health monitoring programs to enable early detection and management of metabolic abnormalities before they progress to chronic disease states. Future research should focus on longitudinal tracking of these biomarkers to assess intervention effectiveness, investigating the specific dietary components and cultural practices that contribute most significantly to elevated risk profiles, expanding the sample to include more male participants for better gender representation, conducting qualitative studies to understand barriers to healthy lifestyle adoption within this cultural context, and developing culturally-sensitive health education programs that respect Minahasa traditions while promoting metabolic health optimization.

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