Urine analysis and nutrition status among elderly in Griya Werdha, Surabaya

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Abstract

Background. Aging is a natural process in the body that everyone will experience as they get older. However, aging is not the same in each individual due to several differences such as diet, lifestyle, genetics, and overall health. Therefore, the Surabaya city government is trying to help elderly people who do not have any caregivers by scouting and gathering them at Griya Werdha.

Objective. This study aimed to provide a feeding program for the elderly and determine the risk of kidney failure experienced by the elderly living in Griya Werdha.

Materials and Methods. This research was a cross-sectional study with 44 elderlies as the samples. The data collected included elderlies' blood pressure, weight, height, and urine. Moreover, the elderly were also interviewed on food waste, exercise habits, and sleeping habits using questionnaires. Data were analyzed using binary logistic regression and the chi-square test to find the association between the variables.

Results. The results showed a significant association was found between education and blood in the urine (p=0.036) and the association was not found between education and nutritional status (P=0.392) also systole blood pressure (P=0.373). Association also was not found between glucose in urine (P=0.522), positive leukocyte (0.184), positive blood in the urine (P=0.671), and the risk of CKD.

Conclusions. In conclusion, the elderly with low education can be at risk for certain diseases.

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Key words: blood pressure; chronic kidney disease; education; elderly.

Conflict of interest: the authors declare no potential conflict of interest.

Funding: This research was funded by Airlangga University under International Research Collaboration Top #300 Program 2021 with grant number 1537/UN3.15/PT/2021
Ethical approval and consent to participate: This study was granted ethical approval by the Health Research Ethics Commission, Faculty of Dental Medicine, Universitas Airlangga, Surabaya, Indonesia on April 8, 2022, with approval number 152/HRECC.FODM/IV/2022.

Availability of data and material: data and materials are available by the authors.

Informed consent: the manuscript does not contain any individual person's data in any form.

Received for publication: 22 October 2022.
Accepted for publication: 24 February 2023.

Journal of Public Health in Africa 2023; 14(s2):2563
doi:10.4081/jphia.2023.2563

Introduction

Conventionally, the term "elderly" is used to refer to people who are 65 years of age or older; those between the ages of 65 and 74 years are referred to as "premature aging", while those over 75 years are referred to as "late aging".[1] Aging is a natural process in the body that everyone will experience as they get older. However, aging is not the same in each individual due to several differences such as diet, lifestyle, genetics, and overall health. Thus, chronological age reflects the heterogeneity observed in the "elderly population", particularly in pharmacokinetic and pharmacodynamic factors, independent of other important patient characteristics (e.g., cognitive, polypharmacy, comorbidities, and functional impairments). Any strategy or tool for personalized therapy (including clinical practice guidelines) must take into account the characteristics of the aging process.[2]

Aging is characterized by a gradual decline in the functional capacities of all organs in the system, a decrease in homeostatic mechanisms, and an altered response to receptor stimulation.[3] To this date, most studies on the elderly have classified older adults into a single group. Even if there are various ways to categorize this population, several studies have categorized elderly adults between the ages of 65 and 74 as the youngest, those between 75 and 84 as middle age, and those over 85 as the oldest.[4]

All physiological functions are impacted by normal aging. It has been demonstrated that most organs have subtle, irreversible changes in function during their third and fourth decades of life, with aging-related decline. Human organ systems experience physiological changes with age, such as increased blood pressure, arte-

riosclerosis, and low cardiac output. The lungs can be seen to have inadequate gas exchange, diminished vital capacity, and slower expiratory flow rates.[5] The human body is made up of water, bones, fat, and lean tissue (muscles, and organs). After age 40, people start to lose lean tissue. The liver, kidneys, and other organs start to lose some of their cells.[6] As we age, the volume and weight of the kidneys gradually diminish, and by the ninth decade, the kidneys are roughly 70% smaller than they were in the third. In addition, From approximately 1,000,000 below the age of 40 to approximately 700,000 by the age of 65, the total number of glomeruli per kidney falls over time. Albuminuria is most usually observed in conjunction with hypertension and diabetes, both of which are age-related diseases and are risk factors for renal and cardiovascular disease (CVD).[7-9] Age-related condition albuminuria (30 mg albumin/gram creatinine) is most prevalent in adults aged 70 to 79 (21.2%) in the general population.[10]

Aging process may cause a loss of independence in addition to ageism and physical decline. As has already been noted, many older persons continue to be very independent. The biology of aging causes some physical frailty in the elderly. Due to their vulnerability, they are dependent on others for care, sometimes for trivial requirements and assistance with fundamental necessities like eating and using the restroom. Finances might be a problem for the elderly because they often don't have work anymore. After giving their elderly parents all of their energy, many families decide to put them in long-term care facilities in an effort to save their own lives.[11]

Therefore, the Surabaya city government is trying to help these elderly people by catching them and putting them into Griya Werdha where they can eat, live, and gather together with other elderly people. This study aims to analyze the nutrition status and determine the risk of kidney failure experienced by the elderly living in Griya Werdha.

Materials and Methods

This was a cross-sectional study located in Griya Werdha, Surabaya Indonesia. The sample size of this study was 44 elderly. The inclusive criteria in this study were hypertensive elderly who lived and stayed in Griya Werdha during the data collection. We measured the blood pressure of the elderly using a digital sphygmomanometer. Elderlies were asked to collect their urine in the urine jar with a minimum volume of 20 ml. All the urine were collected in the urine jar and were sent to Balai Besar Laboratorium Kesehatan Surabaya within 2 hours. We also measured elderlies' weight and height using a digital scale and stadiometer. After the elderly collected the urine, they were asked to be interviewed by the enumerator on food waste, exercise habits, and sleeping habits using a questionnaire.

A binary logistic regression test was conducted to find the association between urine biomarkers and CKD. A chi-square test was also conducted to find the association between nutrition status, hypertension, and food waste.

Results and Discussion

The results based on data collection and information on the characteristics of the elderly are shown in Table 1 that the most elderly age group in Griya Wreda Jambangan Surabaya City is the age group of 71-80 years, namely 17 elderly (38.63%). The sex of the elderly is mostly women, as many as 30 elderly (68.2%). Nineteen elderly people with elementary school education (43.1%). It was found that the elderly with underweight nutritional status were 7 people (15.9%), normal was 19 elderly (43.2%), pre-obesity was 13 elderly (29.6%), obesity class I was 3 people (6.67%), and two elderly people who were not identified because they were on bed rest at the time. The elderly with normal blood pressure were 2 people (4.6%), categorized as pre-hypertension as many as 16 people (36.3%), hypertension level 1 as many as 8 people (18.2%), hypertension level 2 as many as 6 people (13.6%), and isolated systolic hypertension as many as 12 people (27.3%).

The urine examination carried out had the results listed in Table 2. The reagent examination in the dipstick test was carried out for blood (erythrocytes, free hemoglobin, and myoglobin) in the urine. In 30 elderly (68.2%) no blood was found, in 9 elderly

Table 1. Respondent's characteristics.

Characteristic	Frequency	Percentage
Age		
51-60	3	6.83%
61-70	15	34.09%
71-80	17	38.63%
81-90	9	20.45%
Gender		
Male	14	31.8%
Female	30	68.2%
Education		
No education	13	29.5%
Elementary school	19	43.1%
Junior high school	1	2.3%
Senior high school	8	18.2%
College	2	4.6%
Others	1	2.3%
Nutritional Status		
Underweight	7	15.9%
Normal	19	43.2%
Pre-obesity	13	29.6%
Obesity class I	3	6.7%
Hypertension Status		
Normal	2	4.6%
Pre-hypertension	16	36.3%
Hypertension grade I	8	18.2%
Hypertension grade II	6	13.6%
Isolated systolic hypertension	12	27.3%

Table 2. Urine laboratory test result.

Urine Biomarker	Frequency	Percentage
Blood		
Negative	30	68.2%
Positive	14	31.8%
Bilirubin		
Negative	44	100%
Urobilinogen		
Negative	43	97.7%
Positive	1	2.3%
Keton		
Negative	44	100%
Glucose		
Negative	39	88.6%
Positive	4	11.4%
Albumin		
Negative	19	43.2%
Positive	25	56.8%

(20.5%) ± blood was found including in non-hemolyzed trace (10 erythrocytes/μL) 3 elderly (6.8%) found 1+ (25 erythrocytes/μL), and 2 elderly (4.5%) found 3+ (200 erythrocytes/μL). Overall elderly urine (100%) does not contain bilirubin. Of 44 elderly, 1 elderly (2.3%) found urobilinogen 1+. All elderly (100%) results were negative for ketone examination. On glucose examination, 39 elderly (88.6%) got a negative result, as many as 1 elderly (2.3%) got a result of 1+ (250 mg/dL), 3 elderly (6.8%) got a result of 2+ (500 mg/dL), and 1 elderly (2.3%) got 4+ (>2000 mg/dL). On albumin examination, 19 elderly (43.2%) were negative, 13 elderly (29.5%) ±, 9 elderly (20.5%) 1+, 2 elderly (4.5) %) 2+ and 1 elderly (2.3%) 3+. In this study, the Risk of CKD was assessed using the appearance of albumin in the urine. Table 3 explained the result of logistic regression test between biomarker and the risk of CKD in elderlies who lived in Griya Werdha.

Based on the result of a logistic regression test, there was no association between each urine biomarker with the risk of CKD. Positive glucose in urine did not associate with the risk of CKD (p=0.522; OR=0.453). Positive leukocyte in urine did not associate with the risk of CKD (p=0.184; OR= 0.351). Association was also not found between the positive blood in urine and the risk of CKD but the OR was >1 (p=0.671; OR=1.404). This suggests that blood in urine could increase the risk of CKD by 40.4%. In the chi-square test, we conducted the analysis between education and urine biomarker, nutritional status, and food waste. Table 4 presents the result of the test.

In this study, a significant relationship was found between education and one of the biomarkers indicating decreased kidney function. The biomarker associated with education in this study was blood in the urine. There was a significant relationship between education and blood in the urine (p=0.036). However, the results of the correlation test showed that the relationship between education and blood in the urine was quite weak with a result of r=0.123. The correlation results show a positive number, this means that education with blood in the urine is related in one direction. In this study, 43.2% of respondents had an elementary school education level. Among the respondents who found blood in their urine, 42.8% were respondents who came from elementary schools. Association was not found between educational and nutritional status (p=0.392). Education also did not associate with systole blood pressure (p=0.373).

The average elderly in Griya Werdha has a normal BMI. The absence of a relationship between education and BMI could be due to the fact that the elderly who live in Griya Werdha every day have activities to exercise together and the menu or food eaten daily is also the same. Because the food eaten daily is the same, the elderly tend not to be picky about food so the education level variable that should play a role in food selection cannot be applied by the elderly. However, some elderly have knowledge about the amount and type of food that should be consumed. This knowledge was obtained by the elderly from the health care workers (nurses). There is no relationship between education and blood pressure in this study. Because in this study the elderly who were respondents were elderly who had a history of hypertension. Therefore, the lack of heterogeneity among respondents could be the cause of not finding a significant relationship between education and systolic blood pressure.

Hematuria or blood in the urine experienced by the elderly is caused by various factors, both from the urinary system and from other places.[12] Hematuria can be a sign of a disease of the genitourinary system or a disease that is not related to the body's excretory system.[13] Therefore, the appearance of blood in the urine can be a sign or symptom of a health condition in the elderly and should be investigated further.[14] The finding of a relationship between education and the appearance of blood and erythrocytes in the urine can be a reminder for Griya Werdha officers that the elderly with low education can be at risk for certain diseases. Lack of knowledge, both from formal and informal education, will contribute to individual decision-making to behave in a healthy life, which has an impact on their health.[15] In this case, the education of the elderly will influence their decision-making to implement behaviors that support the health of their kidneys and excretory system.

A urinalysis is a simple test that looks at a small sample of your urine. A urinalysis is used to find or detect health problems such as chronic kidney disease. It also helps to detect the serious diseases in the early stages.[16] Chronic kidney disease (CKD) is a clinical syndrome secondary to the definitive change in function and/or structure of the kidney and is characterized by its irreversibility and slow and progressive evolution. The pathology represents a higher risk of complications and mortality, especially cardiovascular-related.[17] Chronic Kidney Disease (CKD) is caused by many risk factors such as diabetes, hypertension, chronic glomerulonephritis, chronic use of anti-inflammatory medication, prolonged acute renal disease, etc.[18]

Kidneys carry out a number of essential functions such as filtering blood and excessing water from the body. Half a cup of blood is filtered every minute to make urine.[19] Hematuria is the diagnosis of blood in the urine. The blood present in urine is not a normal condition, so it is crucial to find the cause. Hematuria is often caused by urinary tract infections, but can also be caused by kidney disease, to prostate cancer.[20] Hematuria can develop from injury to the glomerular filtration barrier. So that the red blood cells pass into the urinary space. This results in increased oxidative stress, inflammation, and structural damage to the kidneys.[21]

There was no association between positive blood in urine and the risk of CKD found in this study (p=0.671; OR=1.404). No supporting data and a clinical investigation were prompted by the observer of hematuria in the participants so we were unable to identify its source and further understand if the origin of the hematuria comes from kidney disease-specific on renal or come from the urinary tract. Red blood cells in urine not only be a sign of chronic kidney disease but they can also be caused by an infection,

Table 3. Result of logistic regression test between urine biomarker and risk of chronic kidney disease.

Urine Niomarker	Frequency	Percentage
Glucose		
Positive	0.522	0.4530.040-5.129
Negative	Ref.	Ref. Ref.
Leukocyte		
Positive	0.184	0.3510.075-1.646
Negative	Ref.	Ref. Ref.
Blood		
Positive	0.671	1.4040.294-6.708
Negative	Ref.	Ref. Ref.

Table 4. Result of the chi-square test between education and urine biomarker, nutritional status, and food waste.

Variable	P value
Blood in urine	0.036
Nutritional status	0.392
Systole blood pressure	0.373

bladder cancer, IgA nephropathy, acute interstitial nephritis, or other red blood cell (RBCs) injury. A previous prospective cohort study that included 1799 participants demonstrated no association between hematuria and CKD stage 4. The reason the test was used was only by dipstick test, a thin plastic stick with strips of chemicals on it is placed in the urine. The dipstick test has a high sensitivity for hematuria (around 85%) but varies in specificity (65% to 99%). A biopsy and clinical evaluation can be used to optimize the factors associated with hematuria and CKD.[22]

Glycosuria is a condition of the presence of glucose in the urine. Glucose should not be present in the urine.[23] Due to the low sensitivity and high individual variability of the renal threshold of glucose excretion, the role of glycosuria as a screening tool is very limited.[24] Glucose in urine has been analyzed in this study, showing there was no association with the risk of CKD (p=0.522; OR=0.453). This can be caused by urinalysis which does not always reveal an accurate concentration of glucose in the urine due to the influence of certain substances, such as ascorbic acid and strong oxidizing agents.[14] On the other hand, glycosuria is rarely observed in the general population and can be found in patients with diabetic CKD.[23] Diabetic medication in the elderly does not become a consideration in this study. The elderly who takes the medication regularly may have lower glucose contained in their urine. Based on the result, there was no association between positive leukocytes with the risk of CKD (p=0.184; OR= 0.351). Leukocytes play an essential role in the immune system in protecting the body from various infectious diseases and foreign invaders. Leukocytes circulate in the blood and promote inflammatory and cellular responses to injury or pathogens.[25] In patients with CKD condition there is a high inflammatory state, represented by a high level of pro-inflammatory molecules in the plasma; such as Interleukin (IL)-1, IL-6, and Tumor necrosis factor (TNF)-α and activation of immune cells such as monocytes. On the other hand, there is an immunodeficiency, which results in a higher susceptibility to infections. The immune system aberrations in CKD patients are mainly caused by the retention of uremic toxins and cytokines or medical interventions such as in dialysis.[26] The number of leukocytes was generally normal in CKD patients but there was a function change. It causes CKD patients to decrease the body's defenses which can increase the risk of bacterial infection up to four times more than the healthy population.[27] This was in accordance with a theory that the number of leukocytes in CKD patients was usually normal. Previous research conducted in Dr. Soetomo General Hospital Surabaya on the index of leukocytes in CKD patients shows that there was no significant difference between leukocyte count in CKD and normal patients.[28]

Limitations of this study include the laboratory results are not displayed in numbers but only in positive and negative categories. Urinary analysis may not be a gold standard to detect the risk of CKD in the elderly. It can be used as a screening to determine the risk of CKD through several biomarkers such as glucose, blood, and leukocytes contained in urine.

Conclusions

Aging affects all physiological processes in all organ systems. Most of the elderly have a decrease in cardiac output, increasing blood pressure, developing arteriosclerosis, vital capacity decline and may experience slower expiratory rates. Chronic kidney disease (CKD) is one of the diseases that commonly happen in the elderly. Urinalysis is one of the methods that is generally used to detect the risk or development of CKD. We observe 3 biomarkers that are hematuria (blood in urine), glycosuria (glucose in the urine), and leukocyte in urine. There was no association between those 3 biomarkers with CKD in the subject of this study. It can be caused by no further clinical investigation applied in this study and urinalysis is not the gold standard to evaluate the risk of CKD. On other hand, we found an association between education and blood in the urine. The relationship between education and blood in the urine can be a reminder for Griya Werdha officers. The elderly with low education can be at risk for certain diseases. Lack of knowledge, both from formal and informal education, will contribute to individual decision-making to behave in a healthy life, which has an impact to their health status.

References

1. Orimo H, Ito H, Suzuki T, Araki A, Hosoi T, Sawabe M. Reviewing the definition of "elderly." Geriatrics & Gerontology International. 2006;6(3):149–58.
2. Singh S, Bajorek B. Defining "elderly" in clinical practice guidelines for pharmacotherapy. Pharm Pract (Granada). 2014 Oct;12(4):489.
3. Trifirò G, Spina E. Age-related changes in pharmacodynamics: focus on drugs acting on central nervous and cardiovascular systems. Curr Drug Metab. 2011 Sep 1;12(7):611–20.
4. Lee SB, Oh JH, Park JH, Choi SP, Wee JH. Differences in youngest-old, middle-old, and oldest-old patients who visit the emergency department. Clin Exp Emerg Med. 2018 Dec 31;5(4):249–55.
5. Boss GR, Seegmiller JE. Age-related physiological changes and their clinical significance. West J Med. 1981 Dec;135(6):434–40.
6. Neagoe A. Gerontological Social Work: A Family Systems Approach. Scientific Annals of the "Alexandru I o a n Cuza" University, Iaşi New Series Sociology And Social Work Section [Internet]. 2018 Jul 31 [cited 2022 Aug 13] ;11(1). Available from: http://anale.fssp.uaic.ro/ index.php/asas/article/view/518
7. Barzilay JI, Peterson D, Cushman M, Heckbert SR, Cao JJ, Blaum C, et al. The relationship of cardiovascular risk factors to microalbuminuria in older adults with or without diabetes mellitus or hypertension: the cardiovascular health study. American Journal of Kidney Diseases. 2004 Jul;44(1):25–34.
8. Fox CS, Matsushita K, Woodward M, Bilo HJG, Chalmers J, Heerspink HJL, et al. Associations of kidney disease measures with mortality and end-stage renal disease in individuals with and without diabetes: a meta-analysis. Lancet. 2012 Nov 10;380(9854):1662–73.
9. Cao JJ, Barzilay JI, Peterson D, Manolio TA, Psaty BM, Kuller L, et al. The association of microalbuminuria with clinical cardiovascular disease and subclinical atherosclerosis in the elderly: The Cardiovascular Health Study. Atherosclerosis. 2006 Aug 1;187(2):372–7.
10. Garg AX, Kiberd BA, Clark WF, Haynes RB, Clase CM. Albuminuria and renal insufficiency prevalence guides population screening: Results from the NHANES III. Kidney International. 2002 Jun 1;61(6):2165–75.
11. Grossman R. LibGuides: PSY 180 - Psychology of Aging - Summer - Textbook: Challenges Facing the Elderly [Internet]. 2022 [cited 2022 Aug 13]. Available from: https://guides.hostos. cuny.edu/c.php?g=1041812&p=7557096
12. Buowari YD. Haematuria in the Elderly: a Review. Martins IJ, editor. JARH. 2019 Jun 23;2(4):7–10.
13. Mazhari R, Kimmel PL. Hematuria: an algorithmic approach to finding the cause. Cleve Clin J Med. 2002 Nov;69(11):870,

8724, 876 passim.
14. Patel HP. The abnormal urinalysis. Pediatr Clin North Am. 2016 Jun;53(3):325–37, v.
15. Pradono J. Studi Korelasi pada Penduduk Umur 10–24 Tahun di Jakarta Pusat. Buletin Penelitian Sistem Kesehatan. 17(1):7.
16. Ammirati AL. Chronic Kidney Disease. Rev Assoc Med Bras. 2020;66(suppl 1):s03–9.
17. Vassalotti JA, Centor R, Turner BJ, Greer RC, Choi M, Sequist TD, et al. Practical Approach to Detection and Management of Chronic Kidney Disease for the Primary Care Clinician. Am J Med. 2016 Feb;129(2):153-162.e7.
18. Thomas B, Matsushita K, Abate KH, Al-Aly Z, Ärnlöv J, Asayama K, et al. Global Cardiovascular and Renal Outcomes of Reduced GFR. J Am Soc Nephrol. 2017 Jul;28(7):2167–79.
19. NIDDK. Your Kidneys & How They Work | NIDDK [Internet]. National Institute of Diabetes and Digestive and Kidney Diseases. 2018 [cited 2022 Aug 12]. Available from: https://www.niddk.nih.gov/health-information/kidney-disease/kidneyshow-they-work
20. Orlandi P, Fujii N, Roy J, Chen HY, Hamm L, Sondheimer J, et al. Hematuria as a risk factor for progression of chronic kidney disease and death: Findings from the Chronic Renal Insufficiency Cohort (CRIC) Study. BMC Nephrology. 2018 Jun 26;19:150.
21. Yuste C, Gutierrez E, Sevillano AM, Rubio-Navarro A, Amaro-Villalobos JM, Ortiz A, et al. Pathogenesis of glomerular haematuria. World J Nephrol. 2015 May 6;4(2):185–95.
22. You-Hsien Lin H, Yen CY, Lim LM, Hwang DY, Tsai JC, Hwang SJ, et al. Microscopic Haematuria and Clinical Outcomes in Patients With Stage 3-5 Nondiabetic Chronic Kidney Disease. Sci Rep. 2015 Oct 16;5:15242.
23. Hung CC, Lin H, Lee J, Lim L, Chiu YW, Chiang HP, et al. Glycosuria and Renal Outcomes in Patients with Nondiabetic Advanced Chronic Kidney Disease. Scientific Reports. 2016 Dec 1;6:39372.
24. Cherney DZ, Perkins BA. Renal Hemodynamic Effect of Sodium-Glucose Cotransporter 2 Inhibition in Patients With Type 1 Diabetes Mellitus | Circulation [Internet]. 2016 [cited 2022 Aug 12]. Available from: https://www.ahajournals.org/doi/full/10.1161/CIRCULATIONAHA.113.005081
25. Tigner A, Ibrahim SA, Murray I. Histology, White Blood Cell. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 [cited 2022 Aug 12]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK563148/
26. Betjes MG, Litjens NH. Chronic Kidney Disease and Premature Ageing of the Adaptive Immune Response. Curr Urol Rep. 2014 Nov 11;16(1):471.
27. Kahdina M, Mardiana N, Fauziah D. Levels of Hemoglobin, Leukocytes, and Platelets of Chronic Kidney Disease Patients Undergoing Hemodialysis in Surabaya. Biomolecular and Health Science Journal. 2018 May 31;1(1):29–33.
28. Santoso D. Apoptosis Index Between Females and Males in Regular Hemodialysis. Indonesian Journal of Clinical Pathology and Medical Laboratory. 2016 Oct 14;19(3):150–5.