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The Implications Philosophy of Science on Metabolism Education and Kidney Failure Prevention

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ABSTRACT

The philosophy of science serves as a framework for understanding and teaching scientific knowledge, including metabolism, to promote health and prevent chronic diseases such as kidney failure. This study explored students' perspectives on kidney failure among young adults and the implications of the philosophy of science in metabolism education. A qualitative case study approach was employed, involving six science education students in East Java. Data were collected through in-depth interviews and analyzed thematically. The findings reveal that students have positive experiences with metabolism education, enhancing their understanding of metabolic processes and their role in kidney health. The program also encourages lifestyle changes, such as increased healthy food consumption and physical activity. However, limited access, academic stress, and inadequate facilities persist. These findings demonstrate the science philosophy's relevance in metabolism education by encouraging students to connect biological mechanisms with social contexts that influence health outcomes. This study provides valuable insights for designing philosophy-based, case-centered learning approaches in health education curricula. It supports public health policies emphasizing preventive measures through community-based education and digital technologies.

Keywords: Philosophy of Science; Metabolism Education; Healthy Lifestyle; Kidney Failure.

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1. INTRODUCTION

Philosophy of science is a basic framework for understanding scientific inquiry's nature, scope, and limitations. Examining the principles underlying scientific reasoning and methodology offers insights into how knowledge is constructed, validated, and applied (Moore, 2010; Umpleby, 2014; Truran & Truran, 2013). The field also addresses the relationship between science and metaphysics, emphasizing the interaction between empirical evidence and theoretical interpretations (Barberousse et al., 2018; French, 2016). As science advances, especially with the rapid development of technology, the philosophy of science has expanded to include consideration of its social and ethical implications (Agazzi, 2021; Magnus, 2013). These reflections are essential to guide responsible scientific practice and ensure that progress is aligned with society's values and needs.

In education, philosophy of science is essential in shaping how scientific knowledge is taught and understood. It encourages critical thinking and the exploration of fundamental questions, such as the reliability of the scientific method and the ethical dimensions of research. These considerations are particularly relevant in interdisciplinary fields such as metabolism, where scientific inquiry intersects with health and societal challenges. Integrating the philosophy of science principles into the curriculum can help students appreciate the broader implications of their studies and foster a more nuanced understanding of science as a dynamic, context-sensitive endeavor.

Metabolism education provides a unique opportunity to apply the philosophy of science through innovative teaching strategies. Historical scientific achievements, such as Sir Hans Krebs' explanation of the metabolic cycle, offer valuable case studies to illustrate scientific discovery's iterative and collaborative nature (Medina et al., 2022). Highlighting such examples allows students to understand how scientific knowledge develops over time. Moreover, incorporating modern teaching techniques, such as problem-based learning and collaborative group activities, can enhance understanding and foster deeper connections between theoretical knowledge and practical applications.

New approaches, such as cinema education, show potential for creativity in teaching complex scientific topics (Dutta et al., 2022). Educators can increase student engagement and retention by using movie clips to explain complex concepts related to metabolic disorders. This method exemplifies how the philosophy of science can inform pedagogical innovation by emphasizing the importance of making abstract scientific ideas accessible and relevant. Ultimately, integrating these various educational strategies ensures that metabolic education conveys essential knowledge and inspires students to think critically about the broader implications of their learning.

Lifestyle habits play an essential role in influencing the risk and progression of chronic kidney disease (CKD). Dietary choices significantly impact kidney health, with excessive sodium and protein intake exacerbating kidney damage. In contrast, adopting nutritional patterns such as DASH (Dietary Approaches to Stop Hypertension) and the Mediterranean diet has been shown to reduce the risk of CKD and slow disease progression. These diets emphasize the consumption of fruits, vegetables, whole grains, and healthy fats while limiting processed foods, which often contain much sodium. Therefore, encouraging

patients to adopt this evidence-based diet is essential to CKD prevention and treatment strategies (Matsumoto & Nakao, 2008; de Melo et al., 2021).

Physical activity is another important factor in maintaining kidney health, especially for patients with CKD. Regular exercise helps to maintain cardiovascular health, improve physical fitness, and enhance overall well-being, which is especially important given the close association between CKD and cardiovascular complications. Nephrologists and other healthcare providers are encouraged to counsel patients about incorporating manageable forms of physical activity into their daily routine, as even moderate exercise can provide significant health benefits (Aucella et al., 2014; Uhlinova et al., 2020; Onyenwenyi & Ricardo, 2015). In addition, lifestyle interventions targeting smoking cessation and weight management are necessary, as smoking and obesity are definite risk factors for CKD (Matsumoto & Nakao, 2008; Ritz & Schwenger, 2005). Addressing these modifiable factors may improve health outcomes and reduce the burden of CKD-related complications.

The case of kidney failure in Indonesia has profound relevance in the local context, especially among university students, who are a productive age group with a dynamic lifestyle but often pay little attention to metabolic health (Inayati et al., 2020; Rahmawati, 2020). The high prevalence of fast food consumption that is high in sodium and low in nutrients, coupled with a sedentary lifestyle due to academic pressure, is a significant risk factor for students' kidney health (Rohmah & Mahrus, 2024; Yuliana et al., 2023; Zatihulwani et al., 2023; Dharmapatni et al., 2024). In addition, low awareness of the importance of a healthy diet and physical activity, particularly in urban areas, often leads to delays in detecting metabolic disorders that can progress to chronic diseases such as kidney failure (Suryani et al., 2022; Zadeh et al., 2021). This is exacerbated by the need for more access to qualified health facilities in some parts of Indonesia, incredibly remote areas, which limits prevention and health education efforts. Therefore, metabolic education linked to the philosophy of science is not only relevant to improving students' understanding of the importance of maintaining kidney health but also plays a role in encouraging changes in mindset and healthier behavior, which can have a direct impact on their quality of life in the future and reduce the burden of chronic diseases at the national level.

This highlights the need for increased nutrition education and awareness among university students. Furthermore, the place of residence and gender of university students can significantly affect their nutrient intake, with variations observed in macronutrient and micronutrient consumption (Rizwanet al., 2023). These findings emphasize the importance of considering various factors when designing interventions to improve university students' eating habits and overall health. Educational initiatives and health awareness campaigns are crucial in encouraging preventive behaviors and promoting early detection of kidney disease. Therefore, it is important to maintain good health to keep the body free from various diseases. Promoting healthy eating habits and lifestyle choices among university students is crucial to improving their academic performance and well-being. Universities and policymakers should focus on implementing a comprehensive approach that includes nutrition education, increased availability of nutritious food options, and stress management resources to effectively meet college students' nutritional needs (Namgha, 2021; Resimo et al., 2024). This article aims to determine the extent of college students' views on kidney

failure disease in young adults and the implications of the philosophy of science in metabolic education.

2. RESEARCH METHODS

This qualitative research uses a case study approach, using the literature study method and in-depth interviews with science education students at one of the universities in East Java. The participants in this study were six students selected by random sampling. Interviews in this study were conducted with a qualitative approach, focusing on an in-depth exploration of students' views on metabolic health and kidney failure disease. The interviews were semi-structured, with an open-ended question format to allow respondents to provide detailed and reflective answers. The duration of each interview ranged from 30 to 45 minutes, depending on the fluency of the discussion and the depth of information provided by the respondents. This approach allowed flexibility in exploring each respondent's unique experiences, understandings, and perspectives while allowing room for clarification where necessary (Creswell & Creswell, 2017; Yin, 2018).

The interview questions were designed based on a conceptual framework linking the philosophy of science with metabolic education, including biological, sociocultural, and behavioral aspects related to kidney health. A grid of questions was asked to respondents regarding "Previous health education experiences, a basic understanding of metabolism so far, the influence of metabolism education on lifestyle changes, and awareness of kidney failure disease with an in-depth understanding of kidney function." Probing techniques also encouraged respondents to provide more in-depth and specific answers (Yin, 2018; Kvale, 2009).

A triangulation strategy was applied to ensure data validity, combining multiple data sources, such as interview results, literature review, and relevant observation. This triangulation aims to minimize bias and ensure that a consistent array of evidence supports the research findings. In addition, data analysis was conducted using a thematic approach to identify key patterns or themes emerging from respondents' answers, which were then compared with theory or previous findings in the literature (Kvale, 2009; Braun & Clarke, 2006).

3. RESULTS AND DISCUSSION

a. Health Education Experience

The results of interviews with science education students found that most students expressed positive experiences related to health education. One student explained, "*Participating in the education program on metabolism is very interesting and useful. The program starts with a basic introduction to metabolism, including its processes and types of healthy food*". This shows that the education program provided new insights and encouraged students to understand metabolic health's importance better.

The results of this study reinforce previous findings on the importance of health education in promoting healthy lifestyle adoption but also reveal some unique differences

relevant to the local context of university students in Indonesia. Several studies have shown the positive effects of educational interventions on various aspects of health and well-being. A quasi-experimental study involving university students found that a 4-month educational intervention based on gamification significantly improved healthy lifestyle habits, particularly in areas such as breakfast adherence, meal frequency, reduced soft drink consumption, and increased physical activity levels (Ayaz et al., 2019). However, these results also revealed that time constraints and academic pressures were significant obstacles for university students in adopting healthy habits, which was rarely mentioned in other global studies. Similarly, research on adolescents showed that health education and healthy lifestyle practices positively influenced academic performance in Biology, with health education, awareness of risky behaviors, and good health values as significant predictors of student performance (Goetz & Teixeira, 2020). Health education and promoting healthy lifestyle habits play an important role in improving overall health outcomes and academic performance.

In addition, this study expands the understanding of the social relevance of health education, showing that behavior change is not only driven by biological knowledge but also by cultural norms and social environment. This aligns with the findings of Denisov et al. (2020), who identified the mismatch between knowledge and motivation as a barrier to healthy lifestyle adoption. In this context, this study emphasizes that integrating education with philosophical reflection can help students connect biological mechanisms with their impact on daily life, providing a new dimension in efforts to overcome barriers to healthy behavior adoption.

Furthermore, this finding differs from studies in developed countries, such as those conducted by Liu and Fernando (2024), where access to sports facilities and healthy food is more equitable. In the Indonesian context, these results highlight the importance of an educational approach that also includes strengthening access to health support facilities. Thus, this study emphasizes the need for a combination of educational and policy approaches to improve the enabling environment for healthy lifestyles.

The results also shed new light on integrating digital technologies in health education. This aligns with the study by Froze et al. (2019), which showed that digital platforms can significantly improve health literacy. The interview results show that not all students have access to the program. One respondent who had never participated stated, "*I have never participated in a metabolic education program, so the information I know is only from social media and independent learning*." The students interviewed indicated the potential of digital technology to overcome time constraints and provide practical guidance in practicing healthy habits. This confirms that technology-based interventions must be widely adopted to expand the impact of metabolism education.

Health education and promoting healthy lifestyles are important components of community health and wellness programs. Integrating these elements into educational curricula, ranging from primary school to university, can provide multiple benefits, including improved health outcomes, academic performance, and overall quality of life (Arce-Larrory et al., 2024; Li et al., 2021; Robiner et al., 2013). However, it is crucial to address the gap between knowledge, motivation, and behavior to ensure the effectiveness of such

interventions in fostering long-term healthy habits. Incorporating the philosophy of science into health education enriches students' learning experience by bridging theoretical knowledge with practical applications. This holistic approach prepares students for their professional roles and fosters a deeper appreciation of the scientific principles underlying health practices.

Overall, this study enriches the literature by highlighting how the philosophy of science can be a unique approach to bridging the gap between theoretical knowledge and everyday practice. This approach reinforces the importance of health education and provides new insights into how to overcome local challenges and encourage the adoption of healthy lifestyles, particularly among university students.

b. Understanding of Metabolism

Students generally have a basic understanding of metabolism; as one student said, "*Metabolism is the chemical process that occurs in the body to convert food into energy*." Metabolism is a complex series of chemical reactions within cells to sustain life, providing energy for cell function (Judge & Dodd, 2020). In addition, an understanding of the role of metabolism in kidney health was also expressed; for example, "*Metabolic processes support kidney function in removing unnecessary metabolic waste through urine*."

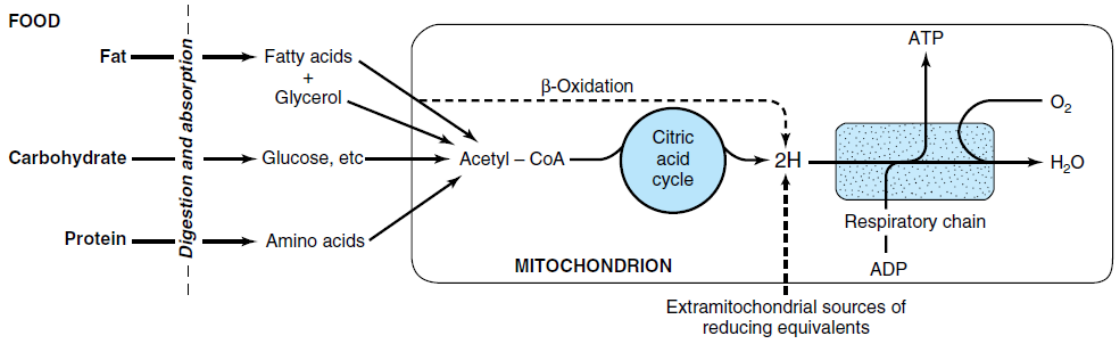

Figure 1. Role of the respiratory chain of mitochondria in the conversion of food energy to ATP (Source: Harper's illustrated biochemistry)

Metabolism encompasses various biochemical processes essential to support cell function, including energy production and nutrient metabolism. The Krebs or citric acid cycle is a major metabolic pathway that plays an important role in providing energy to support kidney function. This cycle occurs in the mitochondria and aims to oxidize acetyl-CoA to carbon dioxide (CO_2) while producing NADH and $FADH_2$, which are used in the electron transport chain to produce ATP (Figure 1). In kidney function, the ATP generated is necessary to support energy-intensive processes, such as glomerular filtration, reabsorption of ions and molecules, and secretion of metabolic waste into the urine. For example, the reabsorption of sodium ions through the sodium-potassium ATPase pump, which is one of the primary mechanisms in maintaining body fluid balance, is highly dependent on the supply of ATP from the Krebs cycle. Energy metabolism converts food into energy required for cellular activities, such as filtration and reabsorption, in the kidney (Zhu et al., 2021; Mount & Power, 2015).

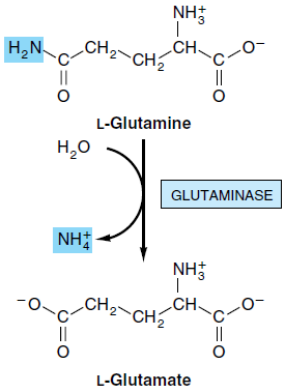

Figure 2. Glutamine to glutamate conversion reaction (Source: Harper's illustrated biochemistry)

The kidney also has a unique role in the metabolism of intermediates, such as converting glutamine to glutamate through a reaction catalyzed by the enzyme glutaminase (Figure 2). This reaction produces ammonia (NH_3), which is used to neutralize acid in the renal tubules, thus helping the body maintain acid-base balance. This mechanism becomes especially important in metabolic conditions of acidosis, where ammonia production increases in response to reducing acid overload. (Nair, 2005). This function demonstrates how the kidney's metabolic trajectory supports energy production and plays a central role in body homeostasis.

In addition, under conditions of metabolic stress or disorders such as hyperglycemia in diabetes, the Krebs cycle can be disrupted due to the accumulation of intermediates such as succinate, fumarate, or malate, which can cause oxidative stress. This oxidative stress negatively affects kidney cells, causing structural and functional damage that may contribute to the development of chronic kidney disease (CKD). Research suggests that nutritional interventions, such as the consumption of antioxidants or a low-protein diet, can help reduce the metabolic burden on the Krebs cycle and protect kidney function from further damage. (Chen et al., 2016). Besides the Krebs cycle, other pathways, such as glycolysis and β-oxidation of fatty acids, are also relevant for kidney function. Under normal conditions, the kidney utilizes glucose as the primary energy source through glycolysis, but under fasting or metabolic stress conditions, β-oxidation of fatty acids becomes dominant. This change in energy pathways demonstrates the metabolic flexibility of the kidney to meet energy needs. However, it is also vulnerable to metabolic disturbances, such as in patients with metabolic syndrome or obesity (Chrysopoulou & Rinschen, 2023).

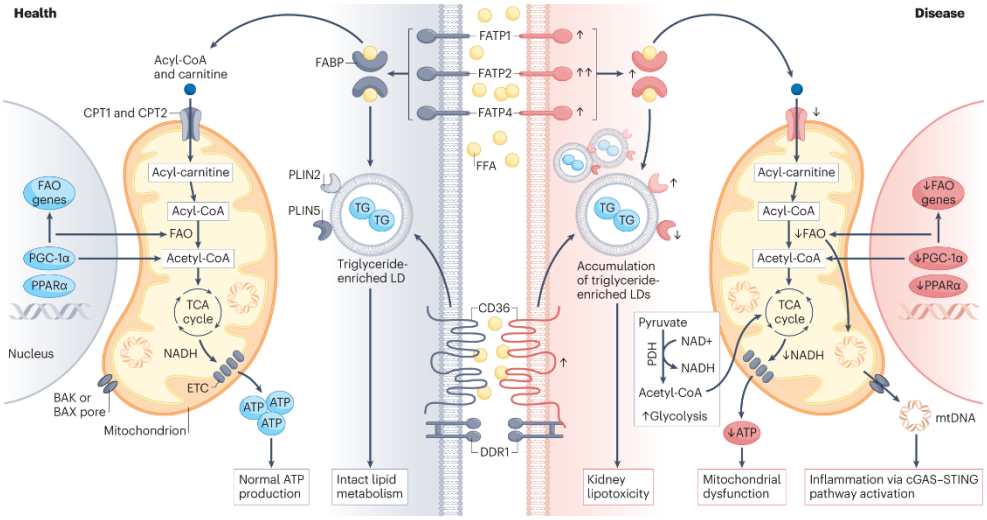

Figure 3. Kidney Lipid Dysmetabolism

The kidney's energy requirement is one of the highest in the body due to its continuous filtration, reabsorption, and secretion activities. Figure 3 explains that disruption of energy metabolism can impede these processes and contribute to chronic kidney disease (CKD). Mitochondria, which function as energy factories in cells, are highly abundant in kidney cells to support these energy requirements. Mitochondrial dysfunction can cause energy deficits and trigger kidney diseases, including renal fibrosis, which is one of the characteristics of CKD (Guo et al., 2024). In addition, the kidneys maintain the body's acid-base balance by excreting nonvolatile acids and reabsorbing bicarbonate, a process that is critical for metabolic and pH stability (Hamm et al., 2015; Angéloco et al., 2018). The management of ions and nutrients, such as calcium, phosphate, and magnesium, through filtration and reabsorption further emphasizes the central role of the kidney in metabolic processes (Blaine et al., 2015). From a molecular point of view, lifestyle modifications such as a diet low in phosphate and protein and increased consumption of antioxidants through a healthy diet can help neutralize oxidative stress, improve cellular function, and reduce the progressivity of kidney damage. Thus, this approach prevents the accumulation of toxic metabolites and strengthens the body's defense mechanisms to maintain renal homeostasis.

In-depth knowledge of metabolic pathways such as the Krebs cycle provides important insights into how these processes support kidney function and maintain body homeostasis. However, there are differences in the level of understanding among students. One respondent mentioned, "*I only understand metabolism as something related to burning energy, but I do not know the details of the chemical processes*." This inhomogeneity reflects the importance of educational methods that can deepen knowledge, such as case-based or problem-based learning (PBL). Problem-based learning (PBL), which emphasizes real-world problems and student-led learning, is increasingly used in health education to foster critical thinking and application of philosophical concepts. In addition, understanding these mechanisms enables the development of better intervention strategies, such as nutritional management or metabolic-based therapies, to prevent and manage kidney disorders. It also emphasizes the relevance of integrating the philosophy of science in metabolic education, which can help students understand the relationship between biochemical processes and health implications holistically.

c. Influence of Education on Lifestyle

The effect of metabolic education positively impacted the students' lifestyle changes. One student stated, "*I eat more nutritious food, reduce saturated fat, and make it a habit to exercise three times a week*." Education also encourages other habits, such as drinking enough water and sleeping regularly, as expressed by another student: "*I am more careful in my food choices, drink water more often, and make sure I get enough sleep every day*."

Metabolic disorders, such as metabolic acidosis, have a significant impact on the body's ionic and chemical balance, which can ultimately affect kidney function. In metabolic acidosis, there is a decrease in blood pH due to the accumulation of nonvolatile acids or loss of bicarbonate. The kidneys respond by increasing hydrogen ion (H^+) excretion through the distal tubules while reabsorbing bicarbonate to neutralize the acidosis. However, in chronic conditions, the compensatory ability of the kidneys may be impaired, leading to electrolyte imbalances, such as hyperchloremia or hyperkalemia. These imbalances can affect muscle function, including cardiac muscle, and add to the kidneys' metabolic burden, thereby increasing the risk of further kidney damage (Blaine et al., 2015; Chrysopoulou & Rinschen, 2023).

In addition, chemical regulation by the kidneys, such as the excretion of urea and creatinine, is essential for maintaining the body's homeostasis. Urea, which results from protein metabolism, and creatinine from creatine phosphate metabolism in muscles, are waste substances that must be excreted through glomerular filtration. If kidney function is impaired, an accumulation of urea and creatinine in the blood (called uremia) may occur, causing toxicity that affects nervous, cardiovascular, and gastrointestinal system functions. Excretion of these substances also regulates body fluid osmolality, which is important for maintaining fluid balance and blood pressure (Hamm et al., 2015; Angéloco et al., 2018).

Metabolic disorders such as acidosis can also trigger structural changes in the kidneys, such as fibrosis or tubular atrophy, which worsen renal excretory function (Kalantar-Zadeh, 2021). This reinforces the importance of healthy lifestyle education to prevent metabolic disorders that affect the body's chemical balance. Metabolic education that teaches the importance of a low-acid diet, such as a diet rich in vegetables and low in animal protein, can help reduce the metabolic burden of the kidneys and maintain their optimal function. By understanding the complex relationship between metabolic disorders and kidney function, students can see the real impact of lifestyle choices on long-term health. The philosophy of science in metabolic education reinforces this perspective, helping students connect biological mechanisms with broader health consequences and encouraging them to take preventive measures based on scientific evidence.

Health education plays an important role in promoting healthy lifestyles and preventing non-communicable diseases. Various studies have shown that integrating health education into school curricula and community programs can significantly influence individuals' health-related knowledge, attitudes, and behaviors (Goetz & Teixeira, 2020; Liu & Fernando, 2024). For example, a study on university students showed that health literacy programs improved lifestyle choices, including increasing physical activity and reducing inactivity levels (Goetz & Teixeira, 2020).

Interestingly, the effectiveness of health education varies across different ethnic and demographic groups. A study in Sarawak, Malaysia, revealed that health literacy and disease knowledge mediated the relationship between sociodemographic factors and healthy lifestyle practices, with differences seen among ethnic groups (Froze *et al.*, 2019). This highlights the importance of culturally sensitive approaches in health education programs.

However, not all students can fully implement these changes. One respondent expressed her challenge, "*Although I know the importance of a healthy lifestyle, it is difficult for me to implement it due to limited time and money to buy healthy food*." This challenge shows the need for environmental support and facilities to help students sustainably adopt healthy lifestyles. Moreover, to maximize the impact of health education, it is important to consider factors such as cultural sensitivity, socioeconomic disparities, and oral health integration in promoting healthy lifestyles (Haber *et al.*, 2022; Wu, 2021). Health education, mainly when focused on metabolic and lifestyle factors, is essential for improving overall health and preventing chronic diseases.

Philosophy of science emphasizes the importance of understanding the underlying mechanisms and the broad implications of metabolic education. Early sociologists have recognized the deep interconnections between the social and natural worlds, suggesting that metabolic processes are not only biological but also social phenomena influenced by human behavior and societal norms (Padovan, 2015; Kendrick, 2016). This perspective underscores that metabolism is not simply a series of chemical reactions in the body but rather a process influenced by social contexts, such as diet, physical activity, and habits formed in a particular culture. Thus, to fully understand metabolism, there needs to be a merger between biological and social science that considers the interaction between the two.

This approach encourages holistic metabolic education that considers lifestyle changes' physiological and sociocultural dimensions. This points to the need for interdisciplinary research to explore how social systems and life practices influence the metabolic health of individuals and communities (Padovan, 2015; Kendrick, 2016). For example, cultural norms, food availability, and health policies often influence healthy eating habits. By integrating science, public policy, and sociological understanding, metabolic education can be designed to increase health awareness and change behavior sustainably at the individual and community levels.

d. Awareness of Renal Failure Disease

Awareness about kidney failure is high among students with a deep understanding of kidney function. One student explained, "The *kidney is a vital organ that functions as a filter for metabolic waste, and maintaining kidney health requires a healthy lifestyle*." Awareness and education regarding *chronic kidney disease* (CKD) are essential for effective management and reducing the economic and public health burden (Fathy *et al.*, 2021). Increasing awareness and education about CKD is essential for early detection, prevention, and management of the disease. Public health education programs and community

outreach initiatives have shown positive results in increasing knowledge and encouraging lifestyle changes (Jain *et al.*, 2008).

However, some felt that the risk of kidney failure was irrelevant to them, as expressed by a student, "*I feel that the risk of kidney failure is low because I do not have a family history or bad habits, so I do not pay much attention to lifestyle*." This highlights the need to emphasize the long-term risks of an unhealthy lifestyle, even without symptoms or immediate risk factors. Interestingly, there is a significant lack of awareness about CKD and its impact on quality of life among patients and the general public. A study in Saudi Arabia revealed low awareness of CKD risk factors and low knowledge of kidney transplantation and organ donation (Rashik, 2023). Similarly, a study in Egypt found relatively poor knowledge scores for CKD, with only 48.6% of participants able to name at least one kidney function (Fathy *et al.*, 2021). Conversely, some misconceptions still exist, with 92.9% believing that CKD can be cured by spiritual means (Fathy *et al.*, 2021). Mass media campaigns and targeted educational efforts in healthcare can play an important role in raising awareness about CKD, risk factors, and treatment options.

Philosophy of science provides a framework for understanding the complexities and implications of the diagnosis and treatment of kidney disease. Although awareness of CKD remains low, efforts to standardize terminology and improve public education are ongoing. However, more than raising awareness may be required to improve disease management outcomes, highlighting the need for a comprehensive strategy that addresses awareness and effective treatment protocols.

A deeper awareness of kidney failure can also be strengthened through a philosophy of science-based educational approach. This education focuses on prevention through a healthy lifestyle and teaches the importance of thinking critically about the factors that cause disease. For example, students can be invited to explore how small lifestyle changes, such as reducing sodium consumption and increasing physical activity, can significantly impact kidney health. This approach combines scientific understanding with ethical and social reflection, helping students understand their own risks and contribute to spreading awareness in their communities. Thus, the philosophy of science is an important tool to build a generation that is more aware of the importance of kidney health.

4. CONCLUSION

The results of this study show that metabolic health education plays an important role in improving understanding, lifestyle changes, and awareness towards the prevention of chronic diseases such as kidney failure among university students. Most students had positive experiences with the education program, which provided insights into metabolism and its relevance to kidney health. However, limited access, academic stress, and lack of supporting facilities are still barriers to implementing sustainable lifestyle changes. Suggestions that can be given from the results of the study are that universities and educators can take concrete steps in implementing the metabolic health education curriculum by designing an integrative program that combines theoretical and practical approaches. One suggestion is to adopt case-based learning that uses real-life examples of metabolic disorders to help students understand the relationship between biological

mechanisms and their clinical consequences. In addition, a collaborative approach involving multi-disciplines, such as biochemists, medicine, and social sciences, is also important to provide a holistic perspective. Universities can utilize digital technologies, such as interactive apps or e-learning platforms, to provide broader access to educational materials and support self-directed learning. By creating an interactive and relevant learning environment, students can more easily integrate this knowledge into their lifestyles while becoming health-promoting agents of change in their communities.

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