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Diagnosis Of Nephrotic Syndrome in Children with The Mobile Web-Based Demster Shafer Method

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ABSTRACT

Children's health is certainly a concern for parents, especially coupled with various types of viruses that became outbreaks in 2020. Therefore, parents' concerns about their children become greater. Without proper treatment and handling, usually Nephrotic Syndrome disease will assume everything that is done is right even though it deviates. The accuracy of the diagnosis of a disease and the speed of the process of determining the diagnosis are very important in the world of health. Misdiagnosis will cause delays in determining treatment solutions so that it has a negative impact on the patient's health. However, doctors who can serve are sometimes limited in number. The Dempster Shafer method is a method that acquires the trust value of experts based on their knowledge, to produce precise, fast and accurate diagnoses. This study aims to implement the Dempster-Shafer method in diagnosing diseases. The result of this study is an expert system, which is able to detect the presence of disease in a person based on the symptoms felt, without having to ask directly to the expert. Testing of this system includes the validity of the system's accuracy value which is carried out by comparing the results of expert diagnostics with the results produced by the system, high accuracy.

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1. INTRODUCTION

Children's health is certainly a separate concern by parents. The increase in nephrotic syndrome in Indonesia, especially in children aged 2-8 years. Nephrotic syndrome (SN) is a disease of the renal glomerulus characterized by symptoms of massive proteinuria, hypoalbuminemia, edema, and hyperlipidemia. The glomerular kidney of SN patients is damaged so that proteins can pass through the glomerular membrane and come out in the urine. This condition is called proteinuria. Damage to the glomerular membrane of SN sufferers is usually great so that a lot of protein comes out into the urine. This condition is referred to as massive proteinuria. [1].

Based on its theology, SN can be divided into Primary SN (indiopathic) and Secondary SN, primary SN occurs due to diseases that only attack the kidneys, but are based on important organs. [2].

Treatment of nephrotic syndrome is to reduce or eliminate proteinuria, improve hypoalbuminemia, prevent and overcome comorbidities such as infections, thrombosis and kidney damage in acute renal failure and so on. If therapy is not carried out as early as possible, it will cause damage to the kidney glomeruli, affecting the ability of the kidneys to filter blood. This can lead to acute or chronic kidney failure.

[3]. Generally, the therapy given is a low-protein and low-salt diet, corticosteroids, diuretics and antibiotics. Generally, the therapy given is a low-protein and low-salt diet, corticosteroids, diuretics and antibiotics. Antibiotic therapy can reduce mortality due to infection while diuretics can help the kidneys in regulating salt and water excretion [4].

Based on the exposure that has been described, this study aims to diagnose nephrotic syndrome in children with the Web-Mobile-based Demster-Shafer method. It is hoped that the existence of this system can minimize nephrotic syndrome in children.

2. RESEARCH METHODE

2.1. Nephrotic Syndrome

Nephrotic syndrome is one of the clinical manifestations of glomerulonephritis characterized by anasarcan edema, massive proteinuria > 3.5 g / day, hypoalbuminemi
< 3.5g/dl, hypercholesterolemia and lipiduria. In the initial process or mild SN to establish a diagnosis it is not necessary for all symptoms to be found. Massive proteinuria is a typical sign of SN, but in severe SN accompanied by low serum albumin levels, protein excretion in the urine is also reduced. Proteinuria also contributes to various complications that occur in SN. Hypoalbuminemia, hyperlipidemia, and lipiduria, nitrogen balance disorders, hypercoagulability, calcium and bone metabolism disorders, and thyroid hormones are often found in SN [5].

2.2. Demster Shafer

The Dempster-Shafer method is also known as the belief function theory. This method uses Belief, which is a measure of the strength of evidence in support of a set of propositions. If the value is 0 (zero) then it indicates that there is no evidence, and if the value is 1 indicates certainty [6]. The following can be formulated belief function

$$Bel\ (X) = \sum_{Y \subseteq X} m(Y), \qquad (1)$$

As for Plausibility (Pls) it can be formulated as:

$$Pls\ (X) = 1 - Bel(X') = 1 - \sum_{Y \subseteq X'} m(X'), \qquad (2)$$

Description :
Bel(X) = Belief (X)
Pls(X) = Plausibility (X)
m(X) = mass function dari (X)
m(Y) = mass function dari (Y)

Plausibility is also worth 0 to 1, if you are sure of X' then it can be said that Belief (X') = 1 so that from the formula above the value of Pls (X) = 0. In the Dempster-Shafer theory, there is also known to be a frame of discernment denoted with . FOD is a universe of talks from a set of hypotheses so it is often called the environment [7], where:

$$\Theta = \{\theta 1, \theta 2, \ldots\ldots, \theta n\} \qquad (3)$$

Description :
Θ = FOD or environment

1....n elements in an environment environment contain elements that describe possibilities as answers and there is only one that will correspond to the answer needed. This possibility in Dempster-Shafer theory is called the power set and denoted by P(Θ), each element in this power set has an interval value between 0 and 1 [8].

$$M = P(\Theta) \rightarrow [0,1] \qquad (4)$$

So that it can be formulated :
P(Θ) = *power set*

M (X) = *mass function* dari (X)

While the mass function (m) in the Dempster-Shafer theory is the level of confidence of evidence, often referred to as evidencemeasure so that it is denoted with (m) [14].

Dempster-Shafer theory decision making uses a rule better known as Dempster's Rule of Combination which aims to overcome a number of evidence in decision making [8].

$$m1 \oplus m2\ (Z) = \sum_{X \cap Y = Z} m1(X)m2(Y) \quad (6)$$

Description :
m1⊕m2(Z) = mass function dari evidence (Z)
m1(X) = mass function dari evidence (X)
m2(Y) = mass function dari evidence (Y)
⊕ = operator direct sum

In general, the formulation for Demster's Rule of Combination is :

$$m1 \oplus m2\ (Z) = \frac{\sum_{X \cap Y = Z} m1(X)m2(Y)}{1-k} \quad (7)$$

Description :
k = sum evidential conflict

The magnitude of the evidential conflict (k) is formulated by :

$$m1 \oplus m2\ (Z) = \sum_{X \cap Y = \theta} m1(X)m2(Y) \quad (8)$$

So if equation (7) is substituted into equation (8) it will be:

$$m1 \oplus m2\ (Z) = \frac{\sum_{X \cap Y = Z} m1(X)m2(Y)}{1-\sum_{X \cap Y = \theta} m1(X)m2(Y)} \quad (9)$$

Description :
m1⊕m2(Z) = mass function dari evidence (Z)
m1(X) = mass function dari evidence(X)
m2(Y) = mass function dari evidence (Y)
k = sum evidential conflict

2.3. Expert System

Expert Systems are systems that seek to adopt human knowledge into computers, so that computers can solve problems as experts usually do [6]. The basic concepts of expert systems contain expertise, experts, transfer of expertise, inference, rules and the ability to explain [4]. The expert system is composed of two main parts, namely the development environment and the consultation environment. The development environment is used by expert system builders to build components and incorporate knowledge into the knowledge base [13] and [2].

3. RESULT AND ANALYSIS

3.1. Data Identification

The type of research carried out is applied research because this research has produced an expert system for diagnosing nephrotic syndrome in children. This research was conducted [9] at Sari Mutiara Lubuk Pakam Hospital.

Table 1. Table of disease risk factors

No.	Name of the disease	Disease risk factors
1.	Primary nephrotic syndrome	1. Congenital or genetic: Damage to the glomerulus itself 2. Congenital (autosomal) abnormalities 3. Idiopathic Hispathological: thickening/thinning of the glomerular capillary wall Infection of the glomerulus (glomerulonephritis)

2.	Nephrotic skunder syndrome	1. Malignant diseases: lymphoma, colon cancer, bronchogenic carcinoma, lupus/SLE 2. Autoimmune reactions: pollen allergy, mold, cow's milk 3. Use of certain drugs (nonsteroidal anti-inflammatory), ampicillin, gold, lithium, mercury, etc. 4. Systemic diseases: malaria, metabolic, DM, hepatitis and syphilis infections, immunological, HIV

Table 2. Table of Signs and Symptoms

No.	Signs and symptoms
1.	Proteinuria
2.	Edema around the eyes, scrotum, then feet and hands
3.	Hypobilirubinemia, increased lipid synthesis and decreased albumin in the liver
4.	Foamy urine due to the presence of protein in the urine
5.	Diarrhea
6.	Nauseous
7.	Fatigue, lethargy, and loss of appetite
8.	Weight gain due to accumulation of body fluids
9.	Blood Clotting
10.	High Blood Pressure

Based on the data obtained, the discussion of this news is carried out with the following steps:
1. Collecting data
2. Literature study (interview)
3. Rule-based
4. Application of the damser-shafer method

In analyzing the data, an analysis flow is used which is prepared with steps in the form of a flow chart as below:

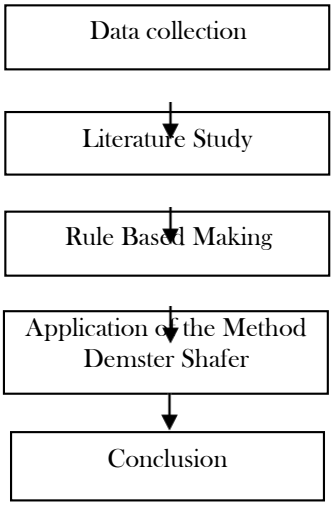

Figure 1. Analysis flow

3.2. Application Page Implementation
Web Login Page

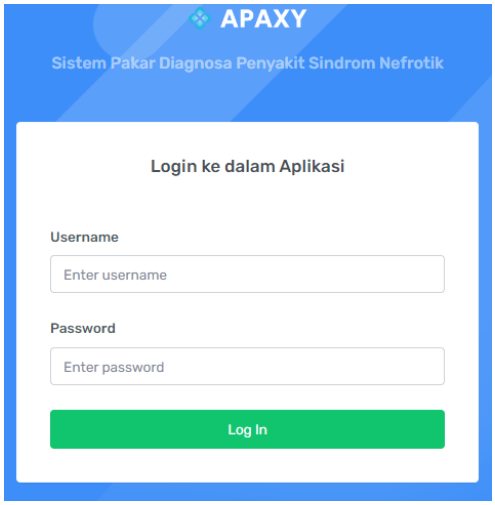

Figure 2. Member registration page (Web)

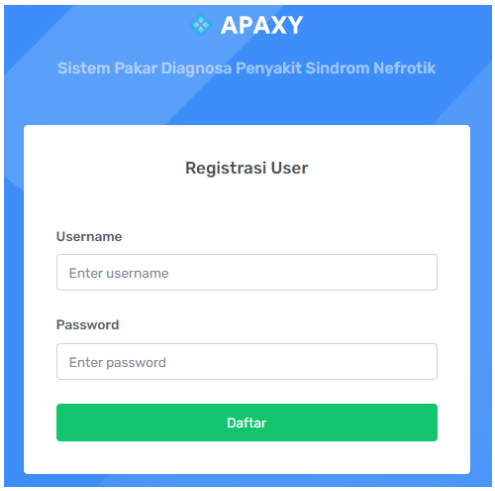

Figure 3. Dashboard Page (Web)

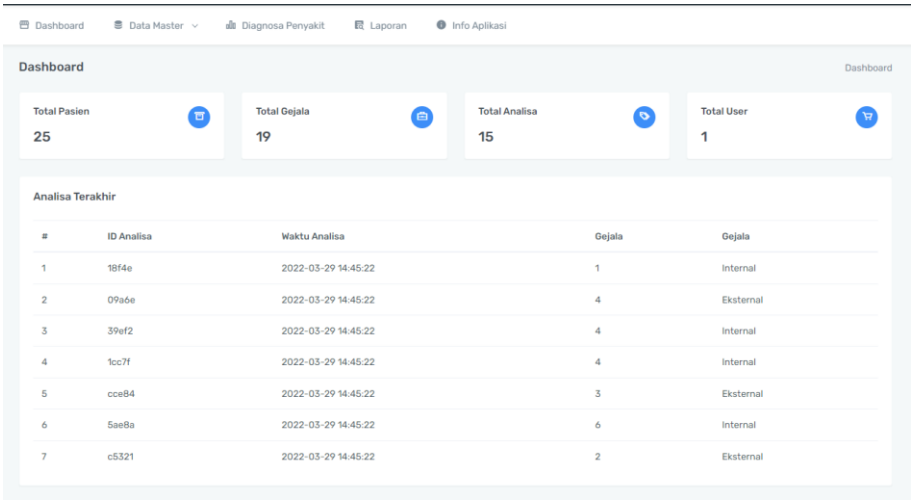

Figure 4. Symptom Data Page (Web)

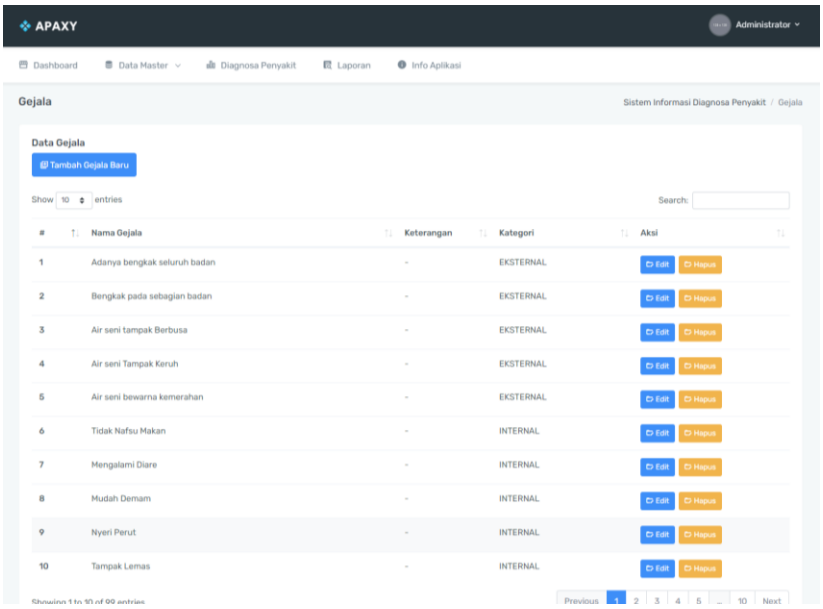

Figure 5. Login Page (Mobile)

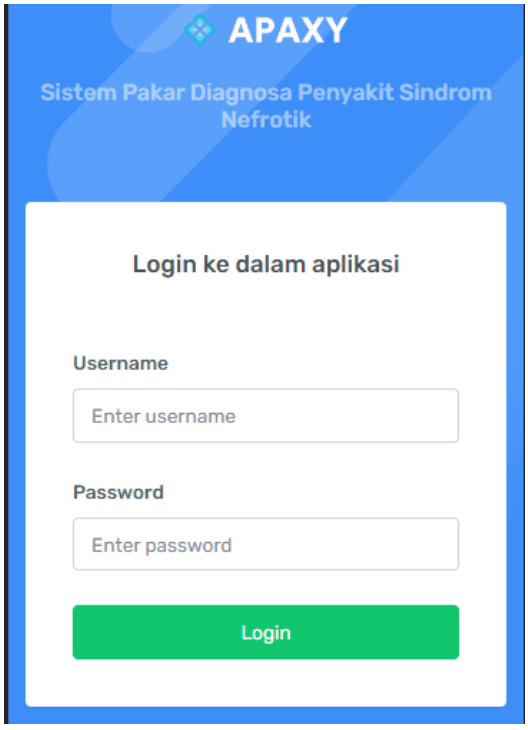

Figure 6. Member registration page (Mobile)

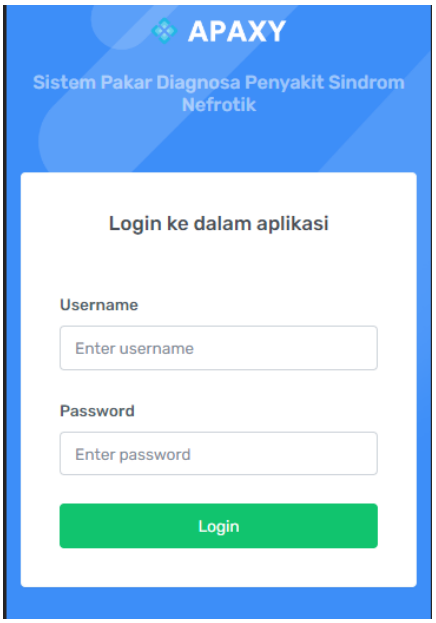

Figure 7. Symptom Data Page (Mobile)

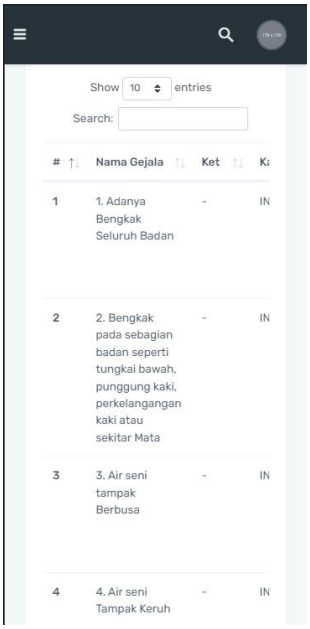

Figure 8. Diagnostic Display Page

4. CONCLUSIOON

In this study it can be concluded that the Demster Shafer method can be used as another alternative before going to the hospital. Demster Shafer can be used as a symptom weighting technique and confidence level calculation. This expert system can provide a confident value of pest and disease diagnosis results based on facts and knowledge entered into the system.

The system is further evaluated for performance to assess the level of user acceptance. Based on user evaluations, the proportion of the three groups of respondents each agreed that the expert system was good even though the percentage of assessment varied. Thus, overall it can be concluded that user ratings of this system are categorized as good.

Although this expert system has been successfully implemented, there are several further research opportunities, including the addition of system features for diagnosis with images of plants affected by pests / diseases. In this way, diagnosis can be made more carefully through observation of images taken with a

camera or smartphone. In addition, the concept of machine learning can also be applied to the process of identifying and classifying pests and diseases of coffee plants.

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