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Diagnose Digestive Disease and the Selection of Borneo Medicinal Plants as an Alternative Treatment

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Abstract

The human digestive system is the system used in the human body for the process of digestion. The human digestive system consists primarily of the digestive tract or the series of structures and organs through which food and liquids pass during their processing into forms absorbable into the bloodstream. This research develops a system of diagnosis of digestive diseases. The system assists people in knowing about the type of digestive diseases experienced, the diseases: diarrhea, constipation, ulcers, and appendicitis with fifteen symptoms and twenty-five species of medicinal plants from the Borneo rainforest. We use the Certainty Factor Method because it may facilitate the selection of symptoms of digestive disease. The diagnosis system developed to analyzes the symptoms of the disease whose inputted and then processed using the calculation of the Certainty Factor. This study aims to describe the types of digestive disease and display the species of Borneo medicinal plants. Diagnosis results using the Certainty Factor obtained a value of 87.33% for ulcer disease and medicinal plants used as alternative treatments: cinnamon, hiring, and guava leaves.

Keyword: Expert System, Certainty Factor, Medicinal Plant, Digestive Disease

1 Introduction

Health is one of the most important aspects of being able to do several activities. Maintaining a healthy lifestyle can help the body avoid various diseases. Therefore, the body can work optimally. Someone who does not maintain a healthy lifestyle, such as irregular dietary habits, lazy to work, and lazy, will make a person have undisciplined life and could interfere with the body health. The digestive system plays a crucial role in a person's daily activities. Better the dietary habits, the better digestive system in generating energy.

Digestive system diseases can occur by the disturbance of one or more digestive system organs. When the body cannot process foods properly, this condition can interfere the humans' daily activities. Therefore, we need a system that can help provide data regarding the actions to be taken when experiencing a disease in the digestive system. The illness of the digestive system is treatable by utilizing the properties contained in medicinal plants. The medicinal plant is a plant that benefits from curing a confident disease. Medicinal plants have a very beneficial effect as alternatives to traditional medicine. Some ailments are treatable using medicinal plants at affordable prices (Budiman et al., 2019; Ma'rifati & Kesuma, 2018; Putri, 2020).

Therefore, this study focused on an expert system applied by people who want information regarding digestive system diseases, established using the Certainty Factor method.

2 Methodology

2.1 Expert System

An expert system is a system that can solve a problem that an expert can only solve. (Giarantano & Riley, 2002; Widians et al., 2019). Bruce Buchanan and Edwan Shortliffe from Stanford University created an Expert System to perform the diagnostic process. This system is named MYCIN. The expert system has two environments, namely the development environment and the consultation environment. (Widians et al., 2018, 2019; Widians, Puspitasari, & Kurniawan, 2020; Widians, Puspitasari, Budiman, et al., 2020). The components in both parts of the expert system are in Figure 1.

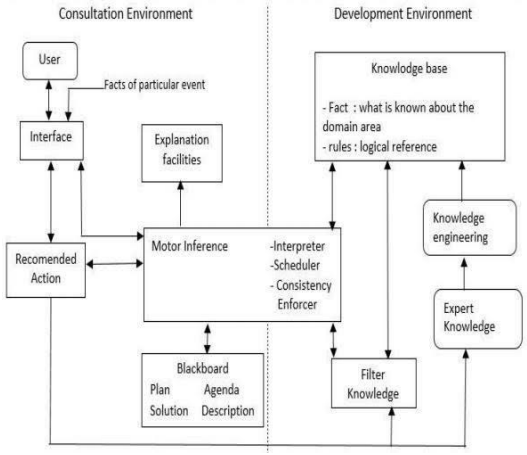

Figure 1. Structure Expert System

Figure 1 illustrates the components of the expert system architecture are the *User Interface*, knowledge base, knowledge acquisition, inference engine, workplace, explanation facilities, knowledge improvement (Hatta et al., 2017).

1. User Interface
   The user interface is a mechanism used by the user and the system to communicate.
2. Knowledge Base
   Base contains knowledge for understanding, formulation, and problem solving.
3. Knowledge Acquisition
   Acquisition is the accumulation, transfer, and transformation of problem solving skills from knowledge sources into computer programs.
4. Inference Engine
   Engine contains decision-making mechanisms such as expert thinking to solve a problem.
5. Workplace
   Workplace is an area of a collection of working memory that serves to record the results and conclusions reached.

6. Explanation Facilities
   Facility is an additional component that will increase the capability of the expert system.
7. Knowledge Improvement
   Expert have the ability to analyse and improve performance as well as the ability to learn from their performance.

2.2 Digestive System Disease

The human digestive system is a system that helps produce nutrients from food to become energy in the body. The organs in the digestive tract consist of the mouth, stomach, esophagus, large intestine, small intestine, and anus. If one digestive organ is disturbed, it will affect the nutrition in the human body (Shanty, 2011). In this study, there are 4 (four) diseases can be diagnose in the expert system, namely diarrhea, constipation, ulcers, and Appendicitis.

2.3 Medicinal Plants

Medicinal plants are plants that may use as medicine in Indonesia country. Demand PERMENKES RI No. 246/MENKES/PER/V/1990 is traditional medicine as ingredients or in the form of a plant, animal, mineral, galenic preparations, or a mixture of these materials, which have traditionally for treatment. Kalimantan is one of Indonesia's islands with various biodiversity, including medicinal plants commonly used by the Borneo people to cure various diseases. A biodiversity information system for databases of medicinal plants in Kalimantan. (Angelina Widians et al., 2018; Budiman et al., 2018).

2.4 Certainty Factor

The certainty factor presents a belief in an event based on an expert's thinking, evidence, and judgment (Widians et al., 2019; Widians, Puspitasari, Budiman, et al., 2020). Certainty factor is defined as follows:

$$CF(H,E) = MB(H,E) - MD(H,E) \quad (1)$$

CF(H,E) : the certainty factor in the hypothesis H due to evidence E
MB(H,E) : the measure of increased belief in H due to E
MD(H,E) : measure of increase disbelief in H due to E
H : Hypothesis
E : Evidence

Suppose another rule also conclides the same hypothesis, but with a different certainty factor (Giarantano & Riley, 2002). The certainty factors of rules concluding the same hypothesis are calculated from the function for certainty factors defined as

$$\begin{aligned} CFcombine(CF1, CF2) &= CF1 + CF2(1 - CF1) && \text{both} > 0 \\ CFcombine(CF1, CF2) &= CF1 + CF2/(1 - \min(|CF1|, |CF2|) && \text{one} < 0 \\ CFcombine(CF1, CF2) &= CF1 + CF2(1 + CF1) && \text{both} < 0 \end{aligned} \quad (2)$$

The formula CFcombine used depends on whether the individual certainty factors are positive or negative. The combining function for more two certainty factors is applied incrementally. CFcombine for two CF values and the CFcombine is combination using formula (2) with the third CF value, and so forth. (Giarantano & Riley, 2002). Table 1 describes the certainty value obtained from the interpretation (term).

Table **1.** Certainty Term

No	Certainty Terms	CF
1	Definitely not	-1.0
2	Almost certainly not	-0.8
3	Probably not	-0.6
4	Maybe not	-0.4
5	Unknown	-0.2 to 0.2
6	Maybe	0.4
7	Probably	0.6
8	Almost certainly	0.8
9	Definitely	1.0

3 Results and Discussion

In this research, an expert system could diagnose human digestive diseases and provide solutions in medicinal plants as an alternative treatment. The research data was obtained from experts or experts in the health sector using the Certainty Factor method. In this study, two experts were Dr. Endang Sulastri on digestive diseases and Noorcahyati on medicinal plants.

The digestive disease diagnosis expert system uses the forward chaining inference method and the Certainty Factor. There is no provision in giving certainty values to symptoms of digestive system diseases in the medicinal field. Users can consult by selecting the symptoms they are experiencing, then the system will check the data the user selected to see whether the data is under the rules in the database. The system's flow in diagnosing digestive diseases using the Certainty Factor method in Figure 2.

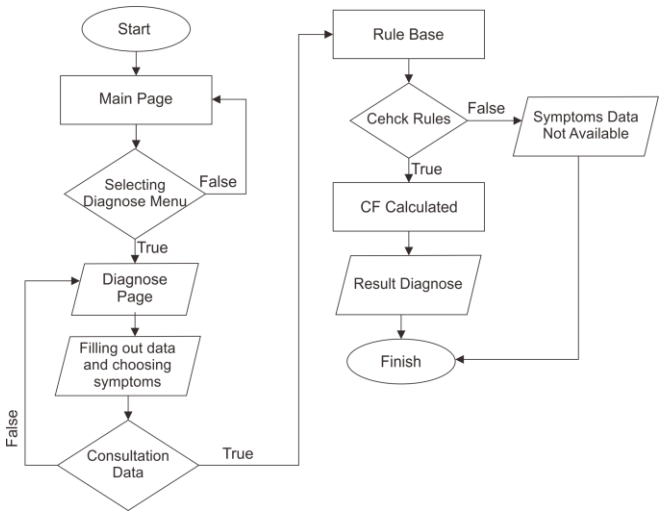

Figure 2. Flowchart Certainty Factor

Figure 2 illustrates expert system with Certainty Factor method.

a. User accesses the expert system, the system will display the main page and several menus.
b. Users can select the diagnostic menu to conduct a consultation.
c. User can fill in inpatient data and choose the available symptoms.
d. Subsequently, input from the user will be processed according to the existing rule base.
e. Calculation of the CF value when user input is in accordance with the existing rule base.

Figure 3 describes the main page. The main page has several menus located on the left side of the page.

Figure 3. Main Page

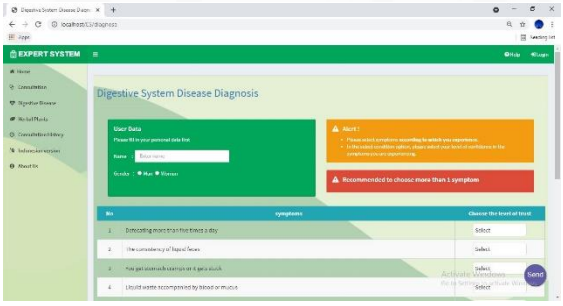

Figure 4. Consultation Page

Figure 4 describes the consultation page where the user selected the evidence, the disease suffered, and information about medicinal plants as an alternative treatment. For instance, the user selects five symptoms are:

1. Liquid stool accompanied by blood = 0,4
2. Feeling nauseous and wanting to vomit = 0,6
3. Stomach feels bloated = 0,4
4. Pain in the pit of the stomach = 0,8
5. The body feels warm or hot = 0,4

Based on these facts, the Certainty factor calculation. The steps for applying the CF method in identifying are as follows rule 3: *IF G08 AND G09 AND G10 AND G11 THEN Ulcer.*
The calculation CF value using equation 1 and CF combination value using equation 2.

$CF_{c1}(CF_1, CF_2)$ = 0.6 + 0,12 * (1 – 0.6) = 0.648
$CF_{c2}(CF_{c1}, CF_3)$ = 0.648 + 0.64*(1-0.648) =0,8733
$CFc_3(CF_{c2}, CF_3)$ = 0,8733+0*(1–0,8733) = 0,8733
Percentage = 0,8733 * 100% = 87,33%

Table 2 describes the results of the calculation of digestive diseases using the CF method.

Table **2.** Results Digestive Diseases Diagnose

No	Disease	Value CF
1	Diarrhea	8%
2	Constipation	0%
3	Ulcers	**87,33%**
4	Appendicitis	16%

Based on the calculation results above, the disease that has the highest CF value is ulcer disease. Accordingly, the diagnosis results of users experiencing ulcer disease are 87.33%, and medicinal plants used as alternative treatments are cinnamon, hiring and guava leaves. Table 3 states that some plants as an alternative treatment for ulcer disease.

Table **3.** Medicinal Plants

No	Medicinal Plant	Disease Name	How to process	Parts used
1	Cinnamon (*Cinnamomum verum)*	ulcer	Boiled	leather

2	Hiring *(Scleria laevis Willd*)		Boiled	leaves
3	Guava leaves (*Psidium guajava*)		Boiled	leaves

Figure 5 describes the results of the diagnosis of digestive diseases, namely ulcers. Patients were declared to have ulcers with a certainty value of 87.33%. Moreover, plants as an alternative treatment.

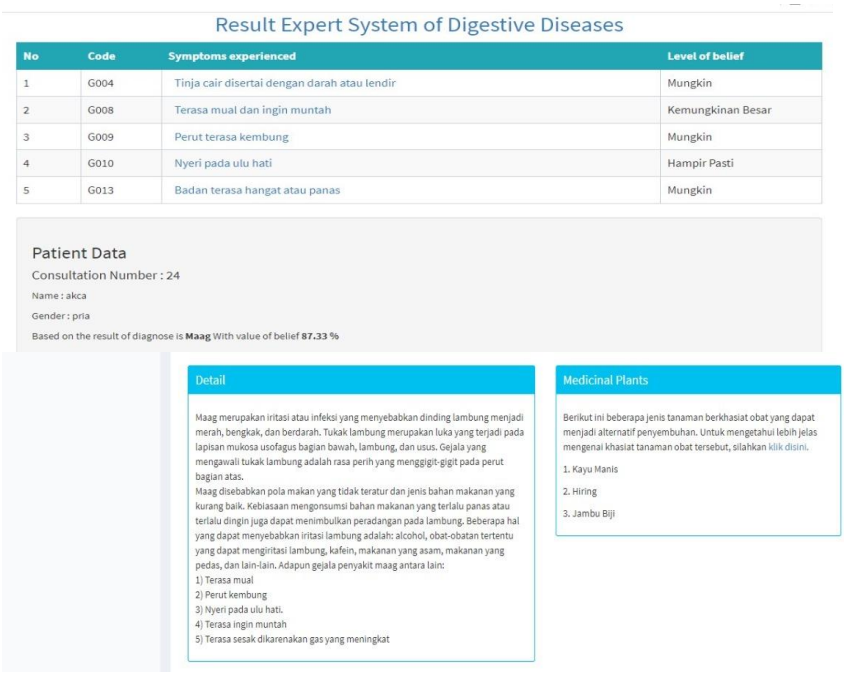

Figure 5. Result Page

4 Conclusions

This research produced an expert system for human digestive diseases. The results obtained in the form of a diagnosis of digestive diseases are ulcers. Patients were declared to have ulcers with a certainty value of 87.33% and the types of medicinal plants used are Kayu Manis (*Cinnamomum burmannii*), Hiring (*Scleria laevis Willd*), and Daun Jambu Biji (*Psidium guajava*).

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