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Diagnosis Of Cholesterol Disease In Adolescence Using Certainty Factor Method

Kusuma Wardhani[1], Marto Sihombing[2], Siswan Syahputra[3]

[1,2,3]*Information Systems Study Program, STMIK Kaputama, Binjai*
**kwardhaniy@gmail.com*

Abstract

Expert system is a computer program designed to emulate the abilities of an expert in solving problems in a particular field. This system can assist in making a decision and provide a solution based on the data that has been obtained. Delia General Hospital (RSU) is a hospital in Langkat district that provides health services to the community to cure diseases, one of which is cholesterol. Cholesterol is a fatty substance contained in the blood and produced by the body. Cholesterol has an important role in helping to produce hormones and form cells. However, if the level of cholesterol in the blood is too high, it can cause health problems such as atherosclerosis, stroke, and heart disease. Increased cholesterol levels that occur in adolescents due to unhealthy lifestyles and consuming foods high in fat. Certainty factor is a method in artificial intelligence that is used to determine whether a fact is certain or uncertain, and provides accurate results by calculating the weight of symptoms determined by an expert and can produce answers to uncertain questions.

Keywords: *Certainty Factor, Cholesterol, Adolescence, Expert System*

1. Introduction

Health conditions are those where the physical, mental and social functions normally so that it can be said that a person's health is good. Many factors can cause a person's health to decline or not function according to its function, for example, such as a lack of concern for one's own health so that they tend to live an unhealthy life [1]. Many people do not know that teenagers have the potential to be affected by cholesterol. Cholesterol in adolescents is rarely realized because this condition is usually considered a health problem that is more common in older people. Other problems such as the lack of information about cholesterol disease is caused by some teenagers who avoid going to the doctor due to insufficient funds and the fear of consulting a doctor directly. Dietary cholesterol is often translated literally as the cholesterol in all foods. Cholesterol is only found in foods that come from animal products such as eggs, meat, milk and cheese [2]. Based on the description above, we need a system that can help humans find out information about the cholesterol disease they are experiencing. In making an expert system, a method is needed that will help solve the problem. Certainty Factor can prove whether a fact is certain or unsure in metric form. Certainty Factor can be used in expert systems to solve cholesterol disease problems that occur in adolescents [3].

2. Research Methodology

2.1. Expert System

An expert system is a system designed to utilize the knowledge and expertise of an expert in a particular field to solve problems or provide suggestions and solutions. The system expert is said to be successful if the system is able to produce a decision that is the same as that of the original expert both during the decision-making process as well as the results of the decision. The use of knowledge-based reasoning systems in medicine can help doctors make more accurate and faster diagnoses. due to the system's ability to access and analyze large amounts of information in a short period of time. This knowledge-based reasoning system must be supported by accurate and valid data, so that the results can be trusted and accepted by medical experts. expert system is a computer system that is intended to emulate all aspects (emulates) the decision making ability of an expert. System experts make maximum use of knowledge, especially as an expert to solve problems [4]. During its preparation, an expert system combines rules of inference or inference rules with a certain knowledge base provided by one or more experts in a particular field. The association is stored in a system which is then used in decision making to solve certain problems [5].

2.2. Certainty Factor Method

Certainty Factor is a method used to measure the degree of certainty of a fact or truth based on evidence or expert judgment. This Certainty Factor method uses values to represent the level of confidence of an expert in the existing data. certainty factor method is used when experiencing a problem whose answer is uncertain. This uncertainty is a probability [6]. By using the Certainty Factor, we can combine the elements of belief (belief) and disbelief (unbelief) towards a fact or rule. In certainty theory, qualitative data is represented as a degree of belief. In expressing the level of confidence, a value known as the Confidence Factor (CF) is used to describe the level of confidence of an expert in a data. the notation of certainty factor [7]:

CF[H,E]= MB[H,E]– MD[H,E]
With:
• CF = Certainty Factor in hypothesis H which is influenced by fact E.
• MB=Measure of Belief (level of belief), is a measure of the increase in the confidence in hypothesis H influenced by fact E.
• MD=Measure of Disbelief (level of disbelief), is the increase in disbelief in hypothesis H influenced by fact E.
• E = Evidence (events or facts).
• H = Hypothesis (conjecture).

Certainty Factor for single premise rules CF[H,E]= CF[E] *CF[rule]
= CF[user] *CF[expert]
Certainty Factor for rules with similar conclusions (similar concluded rules)
CFcombine CF[H,E]1,2= CF[H,E]1+ CF[H,E]2* [1-CF[H,E]1]
CFcombineCF[H,E]old,3= CF[H,E]old + CF[H,E]3* [1CF[H,E]old]

3. Results and Discussion

3.1. Calculation of Certainty Factor

Table 1: Disease Type Data

No.	Disease Code	Type Of Disease
1	P01	Hyperlipidemia
2	P02	Hypolipidemia
3	P03	Low Density Lipoprotein (LDL)
4	P04	Trigliserida

Table 2: Symptoms Data

No.	Disease Code	Name Symptoms
1	G01	Dizziness in the back of the head
2	G02	Neck and shoulders ache
3	G03	Pain in the upper abdomen and nausea
4	G04	Swollen foot
5	G05	Cramps in the legs
6	G06	Hormonal disturbances
7	G07	Hard to concentrate
8	G08	Growth disorders
9	G09	Fever
10	G10	Easily tired
11	G11	Depression
12	G12	Feeling anxious
13	G13	Easily sleepy
14	G14	Hands and feet often tingling
15	G15	Out of breath
16	G16	Bloated
17	G17	Excessive diarrhea
18	G18	Pain and aches in the head
19	G19	Pain in the chest
20	G20	No appetite

No.	Disease Code	Name Symptoms
21	G21	Yellowish bumps appear

Next is CF user weight data as in the table below[8] :

Table 3: Grade Certainty Factor User

Level of Belief	Weight Value
Very Sure	1
Sure	0.8
Sure enough	0.6
Slightly sure	0.4
Don't know	0.2
No	0

Calculation of Certainty Factor for the hypothesis is as follows:
If some evidence is combined to determine the CF from the temperature hypotheses e1 and e2 are observations then:

1. Calculate the CF value with the following formula:
   CF expert * CF *user*
2. Combine CF 1.1 with CF 1.2 with the following formula:
   CF combine (CF1,CF2) = CF[h1,e1] + CF[h1,e2] *(1-CF[h1,e2]) = CFold
   Then combine CFold and CF[h1,e3]
3. Confidence percentage = CF combine * 100%

Sample case:
A teenager experiences some symptoms of cholesterol as follows:

1. G01 = Dizziness in the back of the head (A little sure = 0.4)
2. G02 = Neck and shoulders feel sore (Very confident = 1)
3. G06 = Hormonal disturbance (Don't know = 0.2)
4. G07 = Difficulty concentrating (A little sure = 0.4)
5. G09 = Fever (Slightly sure = 0.4)
6. G10 = Easily tired (Pretty sure = 0.6)
7. G12 = Feeling anxious (Slightly sure = 0.4)
8. G14 = Hands and feet often tingle (Don't know = 0.2)
9. G18 = Pain and aches in the head (Confident = 0.8)
10. G20 = No appetite (Pretty sure = 0.6)

From the symptoms described above, the system will process according to the Certainty Factor method. After the calculation process, it will conclude the type of disease in the patient.

Calculating the value of CF by claiming CFexpert with CFuser type of disease Hyperlipidemia becomes:

CF[h1,e1] $= CF_{pakar} * CF_{user}$
$= 0,8 * 0,4$
$= 0,32$

CF[h1,e2] $= CF_{pakar} * CF_{user}$
$= 0,6 * 1$
$= 0,6$

CF[h1,e6] $= CF_{pakar} * CF_{user}$
$= 0,6 * 0,2$
$= 0,12$

CF[h1,e7] $= CF_{pakar} * CF_{user}$
$= 0,4 * 0,4$
$= 0,16$

CF[h1,e9] $= CF_{pakar} * CF_{user}$
$= 0,6 * 0,4$
$= 0,24$

Combines CF values for calculating MB values in types of Hyperlipidemia. For CF [h1,e1] then do the following calculations:

$CF_{combine}$ $= CF[H_1,E_1] + CF[H_1,E_2] * (1 - CF[H_1,E_1])$
$= 0,32 + 0,6* (1 – 0,32)$
CF_{old} $= 0,728$
$CF_{combine}$ $= CF_{old} + CF[H_1,E_6] * (1 - CFold])$
$= 0,728 + 0,12 * (1 – 0,728)$
CF_{old} $= 0,7606$
$CF_{combine}$ $= CF_{old} + CF[H_1,E_7] * (1 - CFold])$

= 0,7606 + 0,16 * (1 – 0,7606)
CF_{old} = 0,7989
$CF_{combine}$ = CF_{old} + $CF[H_1,E_{10}]$ * (1 - CFold])
= 0,7989 + 0,24 * (1 – 0,7989)
CF_{old} = 0,8471
Presentase **= $CF_{combine}$*100%**
= 0,8471 *100 %
= 84,71 %

Calculating the value of CF by claiming CFexpert with CFuser type of disease Hypolipidemia becomes:
CF[h2,e1] = CF_{pakar} * CF_{user}
= 0,4 * 1
= 0,4
CF[h2,e6] = CF_{pakar} * CF_{user}
= 0,8 * 0,2
= 0,16
CF[h2,e7] = CF_{pakar} * CF_{user}
= 0,6 * 0,4
= 0,24
CF[h2,e9] = CF_{pakar} * CF_{user}
= 0,4 * 0,4
= 0,16
CF[h2,e10] = CF_{pakar} * CF_{user}
= 0,4 * 0,6
= 0,24
CF[h2,e12] = CF_{pakar} * CF_{user}
= 0,8 * 0,4
= 0,32
Combines CF values for calculating MB values in types of Hypolipidemia. For CF [h2,e1] then do the following calculations:
$CF_{combine}$ = $CF[H_2,E_1]$ + $CF[H_2,E_6]$ * (1 - $CF[H_2,E_1]$)
= 0,4 + 0,16 * (1 – 0,4)
CF_{old} = 0,496
$CF_{combine}$ = CF_{old} + $CF[H_2,E_7]$ * (1 - CFold])
= 0,496 + 0,24 * (1 – 0,496)
CF_{old} = 0,6169
$CF_{combine}$ = CF_{old} + $CF[H_2,E_9]$ * (1 - CFold])
= 0,6169 + 0,16 * (1 – 0,6169)
CF_{old} = 0,6783
$CF_{combine}$ = CF_{old} + $CF[H_2,E_{10}]$ * (1 - CFold])
= 0,6783 + 0,24 * (1 – 0,6783)
CF_{old} = 0,7554
$CF_{combine}$ = CF_{old} + $CF[H_2,E_{12}]$ * (1 - CFold])
= 0,7554 + 0,32 * (1 – 0,7554)
CF_{old} = 0,8337
Presentase **= $CF_{combine}$*100%**
= 0,8337 *100 %
= 83,37 %

Calculating the value of CF by claiming CFexpert with CFuser type of disease Low Density Lipoprotein (LDL) becomes:
CF[h3,e2] = CF_{expert} * CF_{user}
= 0,8 * 1
= 0,8
CF[h3,e10] = CF_{expert} * CF_{user}
= 0,6 * 0,6
= 0,36
CF[h3,e14] = CF_{expert} * CF_{user}
= 0,8 * 0,2
= 0,16
CF[h3,e18] = CF_{expert} * CF_{user}
= 0,4 * 0,8
= 0,32
CF[h3,e20] = CF_{expert} * CF_{user}
= 0,6 * 0,6
= 0,36
Combines CF values for calculating MB values in types of Low Density Lipoprotein (LDL). For CF [h3,e2] then do the following calculations:
$CF_{combine}$ = $CF[H_3,E_2]$ + $CF[H_3,E_{10}]$ * (1 - $CF[H_3,E_2]$)
= 0,8 + 0,36 * (1 – 0,8)
CF_{old} = 0,872
$CF_{combine}$ = CF_{old} + $CF[H_3,E_{14}]$ * (1 - CFold])

= 0,872 + 0,16 * (1 –0,872)
CF_{old} = 0,8925
$CF_{combine}$ = CF_{old} + CF[H_3,E_{18}] * (1 - CFold])
= 0,8925 + 0,32 * (1 – 0,8925)
CF_{old} = 0,9269
$CF_{combine}$ = CF_{old} + CF[H_3,E_{20}] * (1 - CFold])
= 0,9269 + 0,36 * (1 – 0,9269)
CF_{old} = 0,9532
Presentase = $CF_{combine}$*100%
= 0,9532 *100 %
= 95,32 %

Calculating the value of CF by claiming CFexpert with CFuser type of disease Trigliserida becomes:
CF[h4,e6] = CF_{pakar} * CF_{user}
= 0,8 * 0,2
= 0,16
CF[h4,e9] = CF_{pakar} * CF_{user}
= 0,6 * 0,4
= 0,24
CF[h4,e10] = CF_{pakar} * CF_{user}
= 1 * 0,6
= 0,6
CF[h4,e412 = CF_{pakar} * CF_{user}
= 0,6 * 0,4
= 0,24
CF[h4,e14] = CF_{pakar} * CF_{user}
= 0,8 * 0,2
= 0,16
CF[h4,e18] = CF_{pakar} * CF_{user}
= 0,4 * 0,8
= 0,32
CF[h4,e20] = CF_{pakar} * CF_{user}
= 0,6 * 0,6
= 0,36
Combines CF values for calculating MB values in types of Trigliserida. For CF [h4,e6] then do the following calculations:
$CF_{combine}$ = CF[H_4,E_6] + CF[H_4,E_9] * (1 - CF[H_4,E_6])
= 0,16 + 0,24 * (1 – 0,16)
CF_{old} = 0,3616
$CF_{combine}$ = CF_{old} + CF[H_4,E_{10}] * (1 - CFold])
= 0,3616 + 0,6 * (1 – 0,3616)
CF_{old} = 0,7446
$CF_{combine}$ = CF_{old} + CF[H_4,E_{12}] * (1 - CFold])
= 0,7446 + 0,24 * (1 – 0,7446)
CF_{old} = 0,8059
$CF_{combine}$ = CF_{old} + CF[H_4,E_{14}] * (1 - CFold])
= 0,8059 + 0,16 * (1 – 0,8059)
CF_{old} = 0,8370
$CF_{combine}$ = CF_{old} + CF[H_4,E_{18}] * (1 - CFold])
= 0,8370+ 0,32 * (1 – 0,8370)
CF_{old} = 0,8891
$CF_{combine}$ = CF_{old} + CF[H_4,E_{20}] * (1 - CFold])
= 0,8891 + 0,36 * (1 – 0,8891)
CF_{old} = 0,9290
Presentase = $CF_{combine}$*100%
= 0,9290*100 %
= 92,90 %

Based on the CF calculation results, cholesterol disease was obtained in adolescents with a diagnosis of Hyperlipidemia with a confidence value of 84.72%, a diagnosis of Hypolipidemia with a confidence value of 83.37%, a diagnosis of Low Density Lipoprotein (LDL) disease with a confidence value of 95.32% and a diagnosis of Triglyceride disease with a confidence value of 92.90%. then the highest confidence value is found in Low Density Lipoprotein (LDL) with a confidence value of 95,32%.

4. Program Discussion

The following is a design for making an expert system for diagnosing cholesterol in adolescents using the Certainty Factor method :

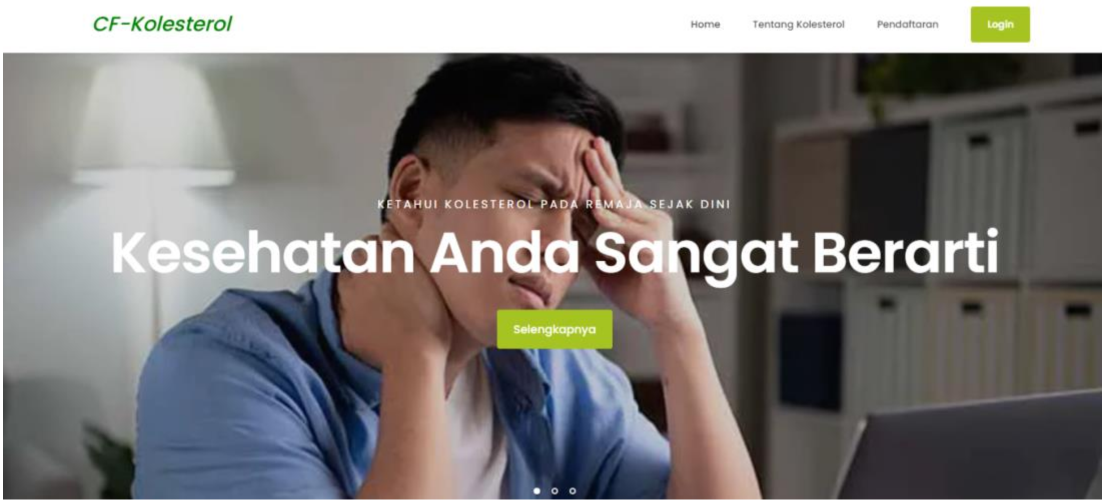


Figure 1: Main Page

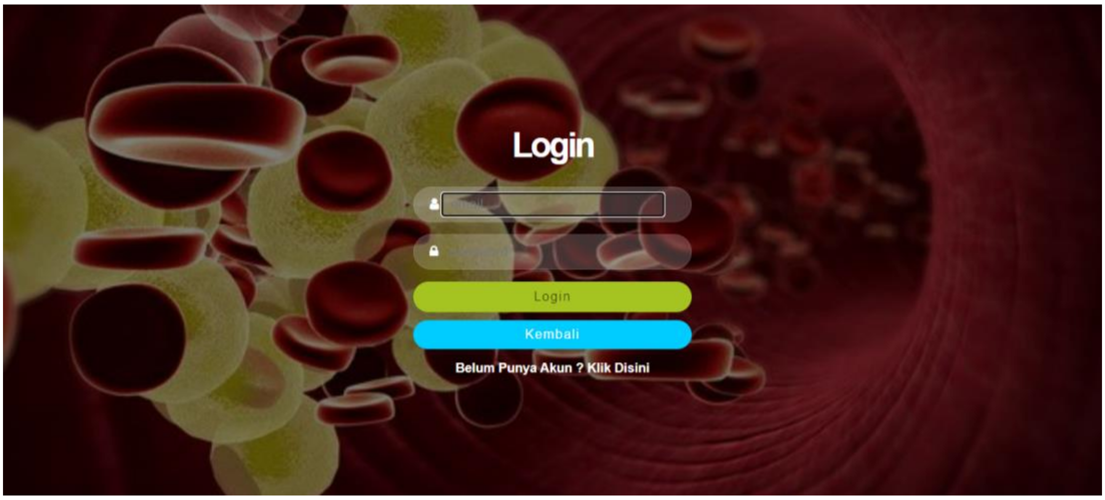
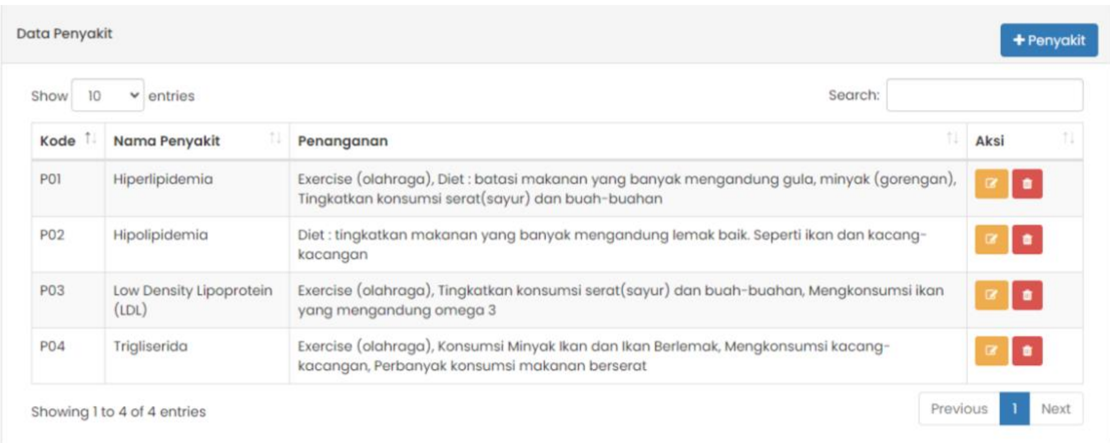


Figure 2: Login Page


Data Penyakit

+ Penyakit

Show 10 entries Search:

Kode	Nama Penyakit	Penanganan	Aksi
P01	Hiperlipidemia	Exercise (olahraga), Diet : batasi makanan yang banyak mengandung gula, minyak (gorengan), Tingkatkan konsumsi serat(sayur) dan buah-buahan	
P02	Hipolipidemia	Diet : tingkatkan makanan yang banyak mengandung lemak baik. Seperti ikan dan kacang-kacangan	
P03	Low Density Lipoprotein (LDL)	Exercise (olahraga), Tingkatkan konsumsi serat(sayur) dan buah-buahan, Mengkonsumsi ikan yang mengandung omega 3	
P04	Trigliserida	Exercise (olahraga), Konsumsi Minyak Ikan dan Ikan Berlemak, Mengkonsumsi kacang-kacangan, Perbanyak konsumsi makanan berserat	

Showing 1 to 4 of 4 entries Previous 1 Next

Figure 5: Disease Type Data Page

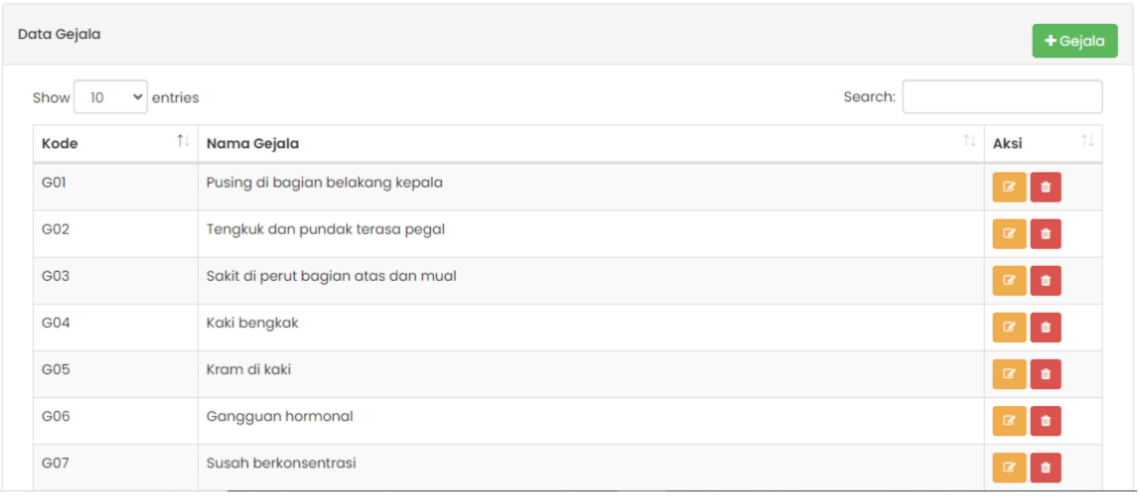


Figure 6: Symptom Data Page

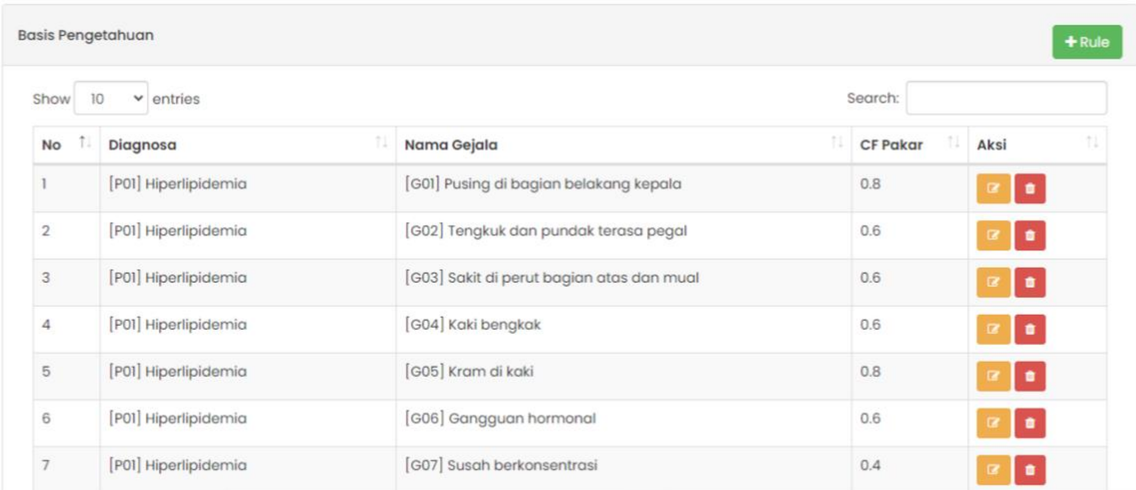


Figure 7: Knowledge Base Page

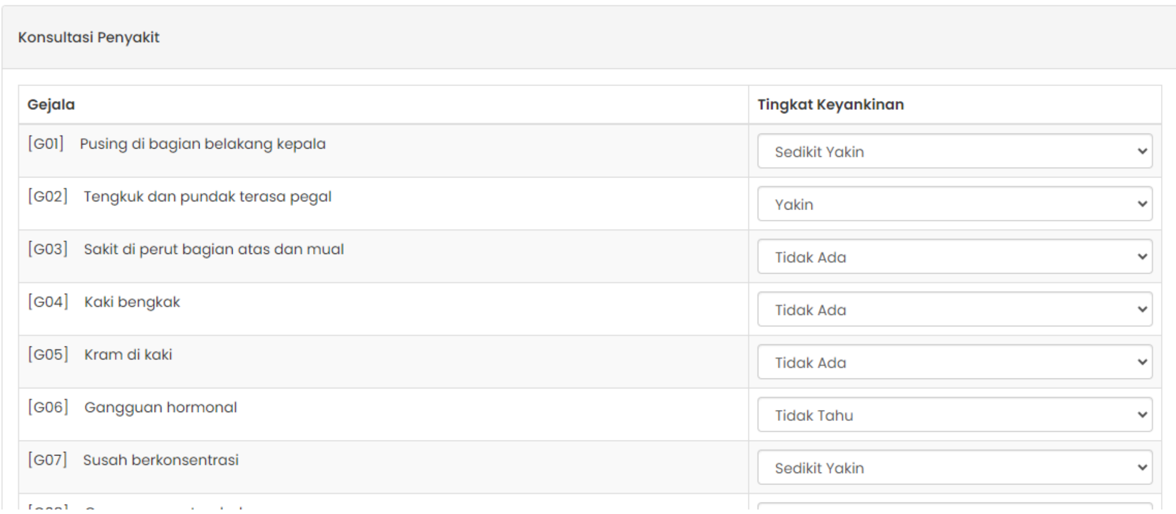
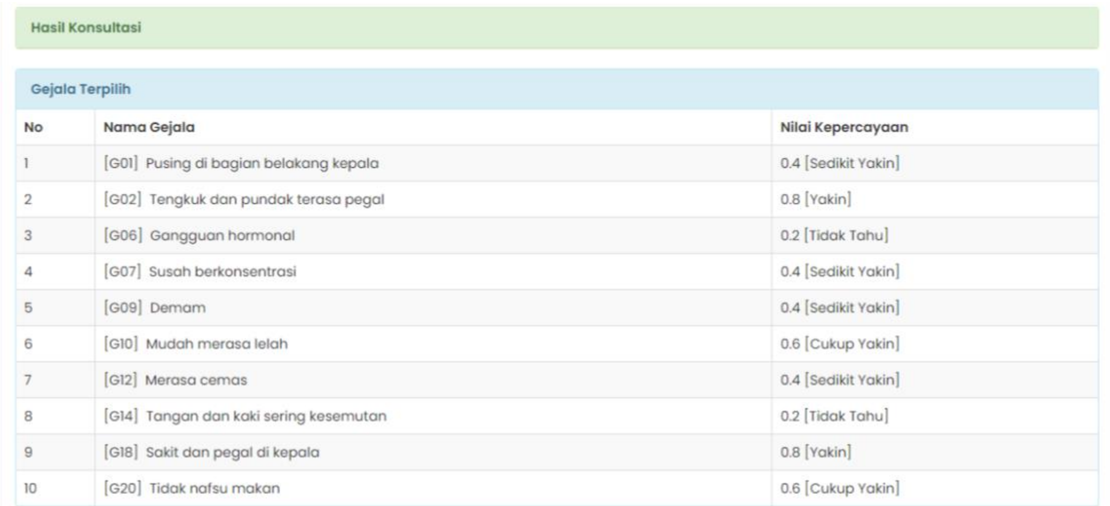


Figure 8: Consultation Page

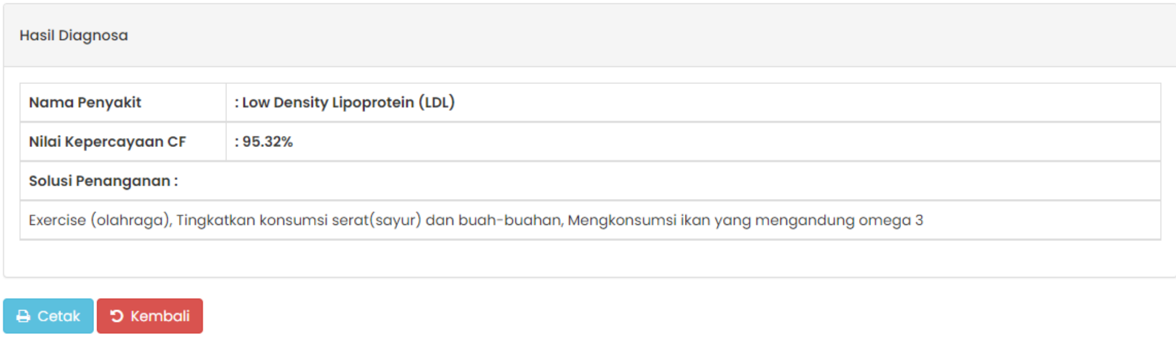


Hasil Konsultasi

Gejala Terpilih

No	Nama Gejala	Nilai Kepercayaan
1	[G01] Pusing di bagian belakang kepala	0.4 [Sedikit Yakin]
2	[G02] Tengkuk dan pundak terasa pegal	0.8 [Yakin]
3	[G06] Gangguan hormonal	0.2 [Tidak Tahu]
4	[G07] Susah berkonsentrasi	0.4 [Sedikit Yakin]
5	[G09] Demam	0.4 [Sedikit Yakin]
6	[G10] Mudah merasa lelah	0.6 [Cukup Yakin]
7	[G12] Merasa cemas	0.4 [Sedikit Yakin]
8	[G14] Tangan dan kaki sering kesemutan	0.2 [Tidak Tahu]
9	[G18] Sakit dan pegal di kepala	0.8 [Yakin]
10	[G20] Tidak nafsu makan	0.6 [Cukup Yakin]

Figure 9: Consultation Result Page



Hasil Diagnosa

Nama Penyakit	: Low Density Lipoprotein (LDL)
Nilai Kepercayaan CF	: 95.32%
Solusi Penanganan :	
Exercise (olahraga), Tingkatkan konsumsi serat(sayur) dan buah-buahan, Mengkonsumsi ikan yang mengandung omega 3	

Figure 10: Results Consultation Report page

5. Conclusion

Based on the results of the analysis of the problems that exist in the diagnosis of cholesterol disease in adolescents using the Certainty Factor method, several conclusions can be drawn, namely as follows:

1. The PHP programming language and MySQL database can build a system for diagnosing cholesterol in adolescents using the Certainty Factor method.
2. Based on data on symptoms of cholesterol disease in adolescents, a diagnosis of cholesterol disease in adolescents can be diagnosed using the Certainty method.

6. Suggestion

1. It is necessary to carry out research using methods other than the Certainty Factor with different algorithms or by combining them with other methods so that better method comparisons can be made.
2. Further research is expected to be able to apply using different programming languages.
3. This research can be developed even better in order to obtain better results.

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