EXPERT SYSTEM FOR STUNTING DETECTION IN TODDLERS USING DEMPSTER SHAFER METHOD

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Abstract: Stunting is a chronic or chronic malnutrition that can be seen in the height of toddlers shorter than toddlers their age. the prevalence of toddlers affected by stunting nationally was 37.6 percent (2007) and decreased to 35.8 percent (2010). However, it increased to 37.2 percent (2013) and decreased again to 29.9 percent (2018). The data shows an erratic stunting prevalence. Many factors influence stunting, especially parents' knowledge about balanced nutrition that prevents stunting. Prevention of stunting needs to be done by monitoring nutritional status regularly and fulfilling balanced nutrition for toddlers. For early detection of stunting, an expert system using the Dempster Shafer method is needed. The Dempster Shafer method allows decision making based on various possibilities based on symptoms in toddlers. The results of the expert system calculation show that the Dempster Shafer method can detect stunting in toddlers by more than 90%.

Keywords: dempster shafer; expert system; stunting

Abstrak: Stunting yaitu kekurangan gizi menahun atau kronis yang dapat terlihat pada tinggi badan balita lebih pendek dari balita seusianya. pravelensi balita yang terjangkit stunting secara nasional sebesar 37,6 persen (2007) dan mengalami penurunan menjadi 35,8 persen (2010). Namun meningkat menjadi 37,2 persen (2013) dan menurun kembali menjadi 29,9 persen (2018). Data tersebut menunjukkan pravelensi stunting yang tidak menentu. Banyak faktor yang mempengaruhi stunting khususnya pengetahuan orang tua mengenai gizi seimbang pencegah stunting. Pencegahan stunting perlu dilakukan dengan pemantauan status gizi secara berkala dan pemenuhan gizi seimbang Balita. Untuk deteksi stunting sejak dini dibutuhkan seuatu sistem pakar menggunakan metode dempster shafer. Metode dempster shafer memungkinkan pengambilan keputusan berdasarkan berbagai kemungkinan berdasarkan gejala pada balita. Hasil perhitungan sistem pakar menunjukkan bahwa metode dempster shafer dapat mendeteksi stunting balita lebih sebesar 90%.

Kata kunci: dempster shafer; sistem pakar; stunting

INTRODUCTION

The rapid development of information technology has influenced all sectors of life. These developments also offer convenience in accessing information from various sources quickly. This is of course very much needed in problem solving, accelerating and simplifying the decision-making process, including in the

health sector, especially stunting [1].

Stunting is a condition of chronic malnutrition, especially in toddlers, which can be seen from the height of toddlers not according to their age. Stunting in toddlers can inhibit brain development which is very active at the age of a thousand days of a child's life, and can even cause the toddler's body to weaken to mortality [2].

Based on results Riset Kesehatan Dasar (Riskesdas) In Wardani, the national prevalence of stunting among toddlers was 37.6 percent (2007) and decreased to 35.8 percent (2010). However, it increased to 37.2 percent (2013) and decreased again to 29.9 percent (2018) [3]. The data shows that the prevalence of stunting is erratic, so stunting prevention needs to be done by monitoring nutritional status regularly and fulfilling the 4 essential nutrients that prevent stunting continuously. Handling stunting also needs to be done through the presence of posyandu.

Anggrek Posyandu is one of the posyandu located in Sipaku Area Village, Simpang Empat District, Asahan Regency. There are 20 toddlers recorded at the posyandu. Posyandu was built in order to provide services related to nutrition and health of toddlers such as data collection of toddlers and pregnant women, routine weighing of toddlers, provision of additional food, vaccinations and nutrition counseling. Posyandu Anggrek Sipaku Area Village, Simpang Empat Subdistrict, Asahan Regency has no specific system and method for analyzing and classifying stunting to measure the nutritional status of toddlers who lead to stunting.

Usually, cadres are only asked to report to the health center if there are toddlers with weight that has not increased or even decreased for two con-

secutive months. It is rare to measure the height of toddlers at the posyandu, even though measuring the height of toddlers is very important to be monitored to determine the nutritional status of toddlers who lead to stunting. While weighing of toddlers is to detect toddlers with acute malnutrition. So it is feared that the results of weight measurements alone will not be effective in detecting cases of under-five stunting.

To assist in preventing stunting in toddlers in Sipaku Area Village, Simpang Empat Asahan District, it is necessary to utilize technology, especially expert systems to make it easier for parents to monitor the nutritional status of stunting in toddlers early on [4].

An expert system is an application program designed by implementing expert capabilities in the form of knowledge, facts and reasoning techniques with certain programming languages in order to help solve problems like an expert [5]. The Dempster Shafer method is a branch of mathematics that discusses the probability or weight of belief in the occurrence of a fact, this method is also often applied to expert systems because this method has a high level of accuracy in diagnosing diseases. This means that the predictions generated by this method are very effective [6].

Previous research conducted by Nugroho et al [7] who applied the Dempster Shafer method to diagnose small intestine disease concluded that the Dempster Shafer method produced an accurate diagnosis with a sample of symptom data used by 32% with a diagnosis of a small possibility of having a small intestinal blockage disease. The next research conducted by M. Syahputra [8] using the dempster shafer method to diagnose encephalitis disease concluded that using this expert system application can facili-

tate and speed up the community or sufferers in diagnosing encephalitis disease, this can be proven by the presence of consultation services in this expert system application. Users can make it easier to find out the symptoms suffered by encephalitis sufferers because this application provides a list of symptoms and is supported by a percentage of possible diagnoses of each type of encephalitis disease. This expert system application, users can find out prevention and treatment solutions for each type of encephalitis disease. This can be proven in this application which provides prevention and treatment solutions for each type of disease.

Other research researched by Pulungan et al [9] which also applies the web-based Dempster Shafer method to diagnose nasopharyngeal cancer early on results in the conclusion that the Dempster Shafer method has an accuracy rate for diagnosing nasopharyngeal cancer of 93% based on the symptoms inputted into the system. Based on previous research that has been done, the expert system using the Dempster Shafer method can make predictions based on existing symptoms [10].

Previous research, using the Dempster Shafer method for diagnosing diseases, there has been no research using this method for diagnosing stunting in toddlers. So this research is important to do, especially to reduce stunting rates and prevent stunting during early childhood in the Sipaku Area. The purpose of this research is to build and implement a web-based system to help reduce the incidence of stunting using the dempster shafer method so that stunting can be prevented early and can reduce stunting rates, especially in the Sipaku Area.

METHOD

The research stages are divided into several parts which will be undertaken in this research, including:
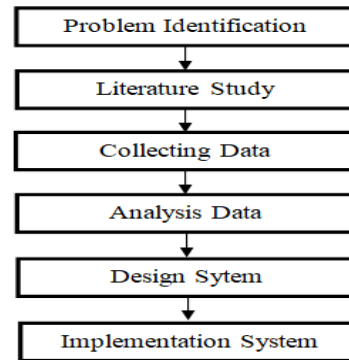

Image 1. Research Stage

Research stage from this research namely, **Problem Identification :** Initial stage with direct observation to the health center and see how the ongoing process of preventing and handling stunting in toddlers.

Literature Study : Conduct a literature study to find information about stunting and the methods used to solve the problem under study. The journals used were the last 5 years of accredited journals. The target of the literature study is to get and understand the research methods needed in detecting early stunting and get information about stunting prevention nutrition.

Collecting Data : Collecting data through interviews with the puskesmas and the community and meeting experts to obtain information about stunting and info about balanced nutrition to prevent stunting of toddlers in this case midwives in the Simpang Empat sub-district.

Analysis Data : After obtaining data on toddlers and information about stunting, the data was analyzed and tested using the calculation of the dempster shafer method using the ms. excel tool.

Design System : The stage of de-

signing a model is carried out in order to get an overview and reference in building an application that is right on target by designing inputs and designing the necessary parameters related to the problem under study.

Implementation System : Implement the design into an application using a web programming language and mysql as a database.

Dempster shafer a mathematical method of uncertainty by combining the weight of pieces of information and producing accurate detection. The weight of the information is the belief value of a symptom obtained from an expert and the plausibility value [11]. Dempster shafer can be calculate with formula :

$$m3(Z) \frac{\sum_{x \cap y = z} m1(X). m2(Y)}{1 - \sum_{x \cap y = \emptyset} m1(X). m2(Y)} \quad (1)$$

Description:
X   : Disease experiencing symptom 1
Y   : Disease experiencing symptom 2
Bel (X) : Belief (X), which is the belief or certainty value of disease X that experiences symptom 1.
Pls(X) : Plausibility (X), which is the value of the uncertainty or uncertainty of disease X experiencing symptom 1.
m2(Y) : Mass function or confidence level of evidence X.
m1(X) : Mass function or confidence level of evidence Y
m3(Z) : Mass function or confidence level of evidence Z resulting from symptom slices.

RESULTS AND DISCUSSION

Knowledge base is data and rules obtained from experts needed in the problem solving process in the system. [12]. The knowledge base in this expert system design is divided into :

Table 1. Symptom Database

Code	Symptom
S1	Toddlers with short height
S2	Toddlers with Very Short height
S3	Exclusive breastfeeding toddler
S4	The toddler's weight is not appropriate, does not increase and even tends to decrease
S5	Lack of energy and appear lackluster or lethargic / Inactive play
S6	Face looks younger than their age / child looks smaller than their age
S7	Late tooth growth
S8	History of maternal illness
S9	Maternal pregnancy history Anemia
S10	Mothers with short height
S11	Irregular consumption of pregnancy supplements or lack of pregnancy nutrition
S12	Environmental health is poor and clean water is limited
S13	Complete toddler immunization
S14	Toddlers with worms
S15	Toddlers get sick too often, fever, diarrhea, etc.
S16	Low family economic status
S17	Very slow motor and cognitive development of toddlers
S18	Often add fish to your daily diet
S19	Frequent provision of fruits or vegetables in toddler's diet

The disease knowledge base in this study uses the technique of determining stunting status based on the height for age index (TB/U) which refers to the anthropometric standards of children as in table 2.

Table 2. Disease Data

Code	Status	Z-Score
K1	Normal Toddlers	> -2 to +3
K2	Short Toddlers	-3 to -2
K3	Very Short Toddlers	< -3

To diagnose stunting requires rules so that the system can analyze based on the symptoms selected. The following knowledge rules are the link between symptoms and diseases in table 3.

Table 3. Rule

Code Symptom	K1	K2	K3
S1		√	
S2			√
S3	√		
S4		√	√
S5		√	√
S6			√
S7		√	√
S8		√	√
S9		√	√
S10			√
S11	√	√	√
S12			√
S13	√		
S14		√	√
S15			√
S16	√	√	√
S17			√
S18	√		
S19	√		

Dempster Shafer

Dempster Shafer calculation had done to determine the suitability of manual tests with system calculations. This test is carried out using child data that has the following symptoms :

Table 4. Sample case

No	Symptoms	Status Stunting	Belief Value
1	Toddlers are very short in height	K3	0,93
2	The toddler's weight is not appropriate, does not increase, even tends to decrease	K2	0,6
		K3	0,78
3	No energy and appears lackluster or lethargic/inactive in play	K2	0,62
		K3	0,88

Settlement,
Symptoms of very short toddler height

$\quad$ M1 {K3} = 0,93
$\quad$ M1 {Ø} = 0,07

Symptoms The toddler's weight is not appropriate, does not increase, even tends to fall

$\quad$ M2 {K2, K3} $= \frac{0,6+0,78}{2} = 0,69$
$\quad$ M2 {Ø} $= 0,31$

So it can be calculated as follows :

$\quad$ M3 {K3} $= \frac{0,62+0,288}{1-0} = 0,93$
$\quad$ M3{K2,K3} = 0,048
$\quad$ M3{Ø} = 1 - 0,93-0,049 = 0,022

Based on the test results of the symptom data entered in the system, the nutritional status of the toddler height index according to age is determined with the highest result code K3 which is very short and a confidence value of 90%.

After analyzing the data, the next step is to make a system design so that the results of the system implementation are appropriate. The design of an expert system for stunting detection in toddlers in image 2.
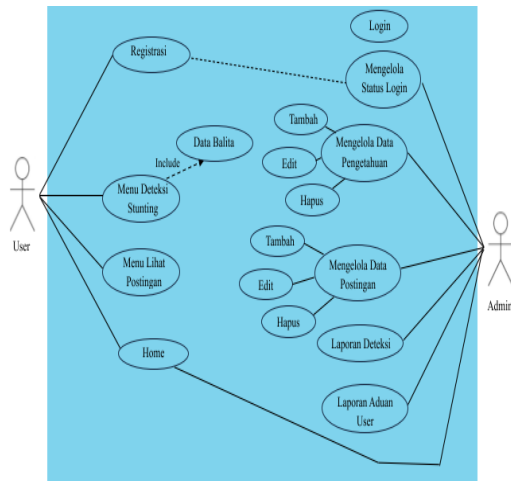

Image 2. Use Case Diagram

After designing the system, the design is implemented using the php programming language and mysql database using the visual studio code editor.

Dashboard Page
The main page of the expert system application that can be accessed without having to log in.

Image 3. Dashboard Page

Page Toddler Data
The first thing the user must do when the user has successfully logged in is to enter toddler data. On the toddler menu, there are toddler forms that must

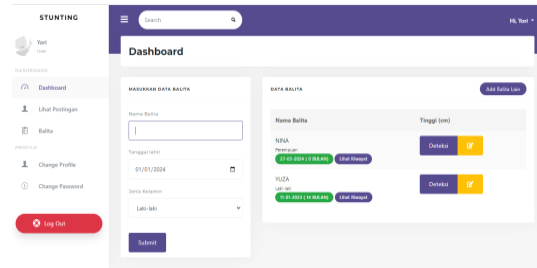be filled in such as name, date of birth, and gender to perform stunting detection.

Image 4. Page Toddler Data

Stunting Detection Page
Displays data in the form of symptom criteria that must be filled in by the user according to the conditions experienced by toddlers. Symptoms displayed can be congenital symptoms or toddler habits that might lead to stunting conditions.
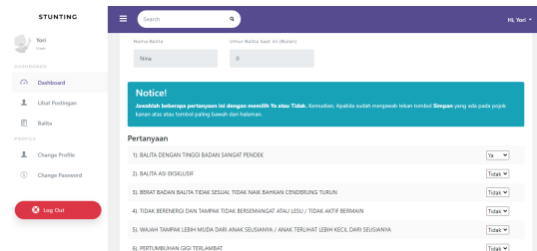

Image 5. Stunting Detection Page

Report Page
The report page can only be accessed by the admin and on this page the admin can print the report for archiving.

Image 6. Report Page

CONCLUSION

The research that has been done is this expert system can help the Sipaku Area Health Center to detect symptoms of stunting in toddlers based on existing symptoms and the accuracy of the expert system using the dempster shafer method in detecting stunt-ing in toddlers is 90%. it can be categorized that the system is good to operate according to the instru-ment of use.

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