

Forward Chaining Algorithm to Identify *Haid* and *Istihadhah* based on Quran-Hadith

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Abstract. One of Muslim woman is lack of knowledge about distinguish *haid* or menstrual blood and *istihadhah* blood. A lot of women who are still confused and do not know the rules from Quran and Hadith in this regard. In addition, many people do not know about the term of *istihadhah* and how to define it. This study aims to build application that can help people, especially Muslim woman, to identify *haid* and *istihadhah* clearly. We used forward chaining algorithm in this study, because it is simple and considered suitable for determining the identification of *haid* and *istihadhah* and also because the facts, rules, and goals have been clearly defined. We tested our system with questionnaire of 50 respondents. The result showed that 86% of *haid* and *istihadhad* cases was correctly identify.

Keywords: forward chaining, haid, istihadhah

1 Introduction

Menstrual period for women is important. Especially for Muslim women, menstrual periods affect their worship activities. Many women are still confused to distinguish menstrual blood and *istihadhah* blood. *Haid* in the meaning of language is "flowing". As for the shari'a, *haid* or menstruation is the blood that comes out from the inside of a woman's womb at certain times that is known, not because of illness or calamity, but a natural state created by God in woman [1], [2]. While, *istihadhah* is blood that goes outside the days of menstruation and childbirth, not with good causes (a disease) that out from the womb. There are several factors and differentiation of menstrual blood and *istihadhah* blood, either based on the type and color of blood, the time of blood discharge, the duration of blood, and so forth.

With Information System (IS) in this era, knowledge of menstruation and *istihadhah* can be stored and accessed at any time. IS is a combination of information technology and human activity that uses computerized technology [3]. Information system is a system that processes data in an organized way [4], information system has a high level of flexibility that allows development into a better system [5]. Based on many research findings, the information system has advantages in terms of: good data accessibility [6], time efficiency [3], accuracy [7], supporting decision appropriately [8], efficient/ low cost [9], broad accessibility [10], improving

user understanding[11], increasing productivity[12], providing good data and information[13], and used as data storage media[14].

Implementation of IS can help women to identify menstrual blood and *istihadhah* with accurate and detailed. This certainly helps dispel doubts whether a woman is having menstruation or *istihadhah*. So, this study this study utilizes technology with Forward Chaining algorithm to identify menstruation and *istihadhah*. Forward Chaining is a rule-based algorithm that is simple and easy to implement[15][16]. Many studies use Forward Chaining to solve problems, such as decision support[17], [18], predicting a case study[19], [20], expert systems[21], [22], and so on. The level of accuracy that produced by the forward chaining algorithm is also quite high, depending on whether the rules are given have been completed or not yet. Because Forward Chaining requires clear rules and goals. Based on previous research, there are no research that spesific to build the system to solve and identify about *haid* and *istihadhah*.

Haid and *Istihadhah* are identified and grouped into 7 categories, among others[1]: *Mubtadiyah Mumayyizah*, *Mubtadiyah Ghairu Mumayyizah*, *Mu'tadah Mumayyizah*, *Mu'tadah Ghairu Mumayyizah Dzakirotun Li Adatiha Qodron Wa Waqtan*, *Mu'tadah Ghairu Mumayyizah Nasiyatun Li Adatiha Qodron Wa Waqtan*, *Mu'tadah Ghairu Mumayyizah Dzakirotun Li Adatiha Qodron La Waqtan*, and *Mu'tadah Ghairu Mumayyizah Dzakirotun Li Adatiha Waqtan La Qodron*. For each category will be explained completely including with its laws based on the Quran and Hadith in Section II.

2 Research Methodology

This research is a conceptual design that developed from prototype of information system for the identification of menstruation and *istihadhah*. Systematics and design stages use the Research and Development (R&D) model with the final product of software. The design of prototype is limited to conceptual design. R&D model is dominant applied for technology development[23] that have 3 activities, among others basic research, applied research, and development research. In this study, knowledge about menstruation and *istihadhah* is used as basic research, and for applied research we have Forward Chaining algorithm for identifying *haid* and *istihadhah*. Then, in development we used software engineering with object oriented analysis and design, because it is powerfull modeling [24]–[27].

3 Result and Discussion

3.1 Understanding Haid and Istihadhah based on Quran-Hadith

With information technology in this era, knowledge of menstruation and *istihadhah* can be stored and accessed at any time. Included in helping women to identify menstrual blood and *istihadhah* with accurate and detailed. This certainly helps dispel doubts whether a woman is having menstruation or *istihadhah*. According to the Quran, Surah al-Baqarah verse 222 which means: "*And they ask you about menstruation: say, "It is harmful, so keep away from women during menstruation. And do not approach them until they have become pure. Once they have become pure, approach them in the way God has directed you." God loves the repentant, and He loves those who keep clean.*"", explains that menstruation is dirty blood that

naturally comes out of a woman's womb. This verse shows that God gives clues about the period of menstruation that ends after the sacred, that is after the dry and the cessation of blood. Not depending on the number of days. So that, the basis of law or benchmark is the presence of Haid's blood itself. If there are blood and its nature so it is a menstruation, then apply the law of menstruation. But if not found blood or its nature is not menstrual blood, then do not apply menstrual law to her. Shaykh Ibn Utsaimin added that if there is indeed a certain day limit in the period of menstruation, there must be from the Quran and Hadith that explain this. Shaykh Islam Ibn Taimiyah said: "*In principle, every blood that comes out of the womb is menstruation. Unless there is evidence to suggest that the blood is Istihadhah.*"[28].

The limit of time period of menstruation is also explained according to the Shafi'iyah Ulama the minimum period of menstruation is a day and night, and the maximum limit is 15 days. If more than 15 days then blood is Istihadhah blood and obligatory for the woman to bathe and pray. Meanwhile, Imam Ibn Taimiyah in Majmu' Fatawa said that there is no definite limit on the minimum and maximum period of menstruation. And this opinion is the most powerful and the most reasonable, and agreed by most scholars, including Shaykh Ibn Uthaimin also took this opinion. The indicator of the completion of menstrual period is the presence of white clots or mucus (such as whiteness) that comes out of the way of the uterus. However, if you do not find any white mucus, it can be checked with white cotton is inserted into the vagina. If the cotton does not contain any spots, and is completely clean, it is mandatory to take a bath and pray. The law of women who are menstruating according to Islamic law, among others: forbidden at the time of menstruation to have sex, forbidden menstruating women to perform prayers and fasting, forbidden women menstruation do *thawaf* in Ka'ba, and and some other law that there are differences of opinion among fiqh scholars and return to the understanding and belief respectively.

Meanwhile, *istihadhah* is a blood that comes out of the habit, which is not in the period of menstruation and not also due to childbirth so often referred to as blood disease. Imam Nawawi in Sharah Muslim said that *istihadhah* is a blood flowing from the female genitals that are not in time. Women who experience *istihadhah* matters become vague because of the similarity between menstrual blood and *istihadhah*. If the blood comes out of it continuously or for a long time it will be difficult to determine when the time is considered as the period and when the time is considered as *istihadhah* period, where prayer and fasting are not abandoned because of it.

The color of blood coming out of a woman's womb also affects the identification between menstruation and *istihadhah*. The color of the blood include: dark red (dark brown), red, yellowish red, yellow, and yellow whitish (cloudy). Dark Red Blood (Old Brown) is strong blood. Red blood is weak when compared to blood Blackish black (brown old), and strong when compared to yellowish red blood. Yellow blood is stronger than Yellow blood. Yellow blood is stronger than yellowish white blood (Snoring).

In terms of circumstances Istihadhah divided into 7 Groups, following the name of the class and its explanation:

1. *Mubtadiyah Mumayyizah* is the first woman to menstruate and able to distinguish the blood of both nature and color. The laws are the strong blood (see color difference) is menstruation, the weak blood is *Istihadhah*. With detail conditions, among others: strong blood is not less than the minimum limit of menstruation (more or more 24 hours), strong blood does not exceed the maximum limit of menstruation (15 days, 15 nights), weak blood is no less than the sacred minimum (15 days, 15 nights), or weak blood must be continuous (unbroken). If one of the those conditions does not exist, then it can not be classified to *Mumayyizah*. For example: there was a woman

who that the blood flow for the first time for 20 consecutive days, 3 days red blood black (strong blood) and 17 days red blood (weak blood). So we can identify that the menstruation period is 3 days, and the *istihadhah* is 17 days. Another example, there is a woman has black blood for 5 days, yellow blood for 17 days, and black blood again for 6 days. So, the menstruation period is 5 days, *Istihadhah* is 17 days and menstruation again for 6 days.

2. *Mubtadiyah Ghairu Mumayyizah* is category for a women who first menstruate who are not able to distinguish blood either nature or color. The law is when she knows or remember the first time her blood flowed, then the menstruation is 1 day 1 night (24 hours), and the sacred for the next days. But, if she does not know or remember her blood flowed time, then she is categorized as *Mutahayiroh*. For example: women come out blood for 17 days with the same color and nature. So, it can be punished menstruation 1 day 1 night, else is *Istihadhah*. Alternatively, the woman bleeds as follows: 20 days of red blood and yellow blood 6 days. Because of the red strong blood longer than the maximum limit of menstruation (15 days 15 nights), then her first menstrual is 1 day and *istihadhah* is 25 days later.
3. *Mu'tadah Mumayyizah* when a women who regularly menstruate and are able to distinguish blood either nature or color. The law is strong blood of menstruation, weak blood of *istihadhah*. Even though, contrary to her menstrual habits. For example, women have a habit of bleeding for 5 days at the beginning of each month (1 to 5). And in the other month he was out blood for 25 days, with dark red blood for 10 days and red blood 15 days, so that the menstruation is 10 days (due to strong blood) and *Istihadhah* is 15 days. Or, the woman has had menstruation experience as follows: yellow blood for 12 days and red blood 7 days, so the menstruation is 7 days and the *istihadhah* is 12 days. In *Mu'tadah Mumayyizah*, determination of menstruation with a look of strong blood did not look at the history of menstruation of the month before.
4. *Mu'tadah Ghairu Mumayyizah Dzakirotun Li Adatiha Qodron Wa Waqtan*, is for a women who do not able to distinguish blood but remember the first time and duration of menstrual habits. The law is returned to custom and time, it means that it can be judged by the habit in the previous month. For example, the women usually menstruate for 7 days at every beginning of the month. This month she bleeds for 17 days. She also can not distinguish the color of blood, or his blood comes out with 1 color. So we can identify that her menstruation is 7 days because in equated with the previous month's curiosity, and the last 10 days is *istihadhah*.
5. *Mu'tadah Ghairu Mumayyizah Nasiyatun Li Adatiha Qodron Wa Waqtan*, women who have been menstruating and forget the customs or habits both the duration and the beginning of menstruation. For example: a woman who bleeds for 20 days and her blood can not be distinguished, it means that her blood is only 1 color, or blood can be distinguished but can not be identified because she forgot about menstruation also its time. The law for her the menstrual law in the matter of the forbidden, such as have a sex, but the sacred law in the matter of Obligation (Salat, fasting, *thawaf*, *thalaq*, *i'tikaf*, and must take a bath every do those obligation).
6. *Mu'tadah Ghairu Mumayyizah Dzakirotun Li Adatiha Qodron La Waqtan*, for a women who have been menstruating and sacred, and also remember the customs or habits for menstruation duration but not remember for the beginning of menstruation time. For example: a woman usually menstruate for 5 days in the first 10 days and she does not know the start. But she knows and believes that the first day she was holy.

And this month she came out full blood for a month. So the law is in the sixth day is menstruation, for firstday is not menstruation same as the last 20 days. As for the second day until the fifth day there is a possibility can be menstruation or can be not. Likewise, for seventh day to tenth there is a possibility like that too (can be menstruation or can not be).

7. *Mu'tadah Ghoiru Mumayyizah Dzakirotun Li Adatiha Waqtan La Qodronis* for a woman who has been menstruating and remember its start time but not with the time duration. For example: there is a woman who usually menstruate at the beginning of the month but do not know how long, and in this month the blood flows for a month. So the law is: The beginning of the monthsure menstruation, and for the next day there is the possibility of menstruation or not.

3.2 Analyzing Rule of Haid and Istihadhah as Knowledge for Forward Chaining

Forward Chaining is one of rule based algorithm that give the best decision or answer or conclusion from the facts (represented by rules). That rules is to be knowledge base for system to learn every facts that given. The mechanism of the forward chaining begins by added a set of facts into memory, then matching those facts to the IF part of the IF-THEN rules. If there is a fact that matches the IF section, then the rule is executed. When a rule is executed, a new fact (THEN part) is added to the database. Each time the matching starts from the top rule. Each rule can only be executed once. The matching process stops when there is no more executable rule or has reached a goal or no longer a rule whose premise matches the with the fact. Searching technique that can be used for forward chaining among others, depth-first search, breadth-first search, and best-first search. In this research we used depth-first search because of the rules are not too many and according to the needs of identifying menstruation and *istihadhah*.

Based on the explanation about mentruation and *istihadhah* above, we have 5 variables or parameters that influence identification process. Then, we have 7 categories as a result of identification of menstruation and *istihadhah* based on Quran-Hadith. Table I describes about code of variables and result, "V" for variables and "H" for result. Then Table II describes about relationship between variables and results that can be represented by decision tree (described in Fig. 1) and rules (describes in Table III).

Table 1. Code of Variables and Result of Haid and Istihadhah

Code	Descriptions
V1	It has been mentruation
V2	Know the characters of blood
V3	Understand the terms of good and bad about menstruation
V4	Remember the menstrual duration.
V5	Remember the first menstrual time
H1	<i>MubtadiyahMumayyizah</i>
H2	<i>MubtadiyahGhoiruMumayyizah</i>
H3	<i>Mu'tadahMumayyizah</i>
H4	<i>Mu'tadahGhoiruMumayyizahDzakirotun Li AdatihaQodronWaWaqtan</i>
H5	<i>Mu'tadahGhoiruMumayyizahNasiyatun Li AdatihaQodronWaWaqtan</i>
H6	<i>Mu'tadahGhoiruMumayyizahDzakirotun Li AdatihaQodron La Waqtan</i>
H7	<i>Mu'tadahGhoiruMumayyizahDzakirotun Li AdatihaWaqtan La Qodron</i>

Table 2. The Relationship between Variables and Result of Haid and Istihadhah

Code	V1	V2	V3	V4	V5
H1		✓	✓		
H2		✓			
H3	✓	✓	✓		
H4	✓	✓		✓	✓
H5	✓	✓			
H6	✓	✓		✓	
H7	✓	✓			✓

Table 3. Rules Representation of Haid and Istihadhah Identification

Rules	Descriptions
R1	IF V1= No AND V2=Yes AND V3=Yes THEN H1
R2	IF V1=No AND V2=Yes AND V3=Yes THEN H1
R3	IF V1= No AND V2=Yes AND V3=No THEN H2
R4	IF V1=Yes AND V2=Yes AND V3=No THEN H2
R5	IF V1=No AND V2=No AND V3=No THEN H2
R6	IF V1=No AND V2=No AND V3=No THEN H2
R7	IF V2=No THEN V3=No, IF V3=No AND V1=No THEN H2
R8	IF V3=No AND V1=No THEN H2
R9	IF V1=Yes AND V2=Yes AND V3=Yes THEN H3
R10	IF V1=Yes AND V2=Yes AND V3=Yes THEN H3
R11	IF V1=Yes AND V2=Yes AND V4=Yes AND V5=Yes AND V3=No THEN H4
R12	IF V1=Yes AND V2=Yes AND V4=Yes AND V5=Yes AND V3=No THEN H4
R13	IF V1=Yes AND V4=Yes AND V5=Yes AND V3=No THEN H4
R14	IF V1=Yes AND V4=Yes AND V5=Yes AND V2=No AND V3=No THEN H4
R15	IF V2=No THEN V3=No, IF V3=No AND V1=Yes AND V4=Yes AND V5=Yes THEN H4
R16	IF V2=No THEN V3=No, IF V3=No AND V1=Yes AND V4=Yes AND V5=Yes THEN H4
R17	IF V1=Yes AND V2=Yes AND V3=No AND V4=No AND V5=No THEN H5
R18	IF V1=Yes AND V2=Yes AND V3=No AND V4=No AND V5=No THEN H5
R19	IF V1=Yes AND V2=No AND V3=No AND V4=No AND V5=No THEN H5
R20	IF V1=Yes AND V2=No AND V3=No AND V4=No AND V5=No THEN H5
R21	IF V2=No THEN V3=No, IF V3=No AND V1=Yes AND V4=No AND V5=No THEN H5
R22	IF V2=No THEN V3=No, IF V3=No AND V1=Yes AND V4=No AND V5=No THEN H5
R23	IF V1=Yes AND V2=Yes AND V4=Yes AND V3=No AND V5=No THEN H6
R24	IF V1=Yes AND V2=Yes AND V4=Yes AND V3=No AND V5=No THEN H6
R25	IF V1=Yes AND V4=Yes AND V2=No AND V3=No AND V5=No THEN H6
R26	IF V1=Yes AND V4=Yes AND V2=No AND V3=No AND V5=No THEN H6
R27	IF V2=No THEN V3=No, IF V3=No AND V1 AND V4 AND V5=No THEN H6

Rules	Descriptions
R28	IF V2=No THEN V3=No, IF V3=No AND V1=Yes AND V4=Yes AND V5=No THEN H6
R29	IF V1=Yes AND V2=Yes AND V5=Yes AND V3=No AND V4=No THEN H7
R30	IF V1=Yes AND V2=Yes AND V5=Yes AND V3=No AND V4=No THEN H7
R31	IF V1=Yes AND V5=Yes AND V2=No AND V3=No AND V4=No THEN H7
R32	IF V1=Yes AND V5=Yes AND V2=No AND V3=No AND V4=No THEN H7
R33	IF V2=No THEN V3=No, IF V3=No AND V1=Yes AND V5=Yes AND V4=No THEN H7
R34	IF V2=No THEN V3=No, IF V3=No AND V1=Yes AND V5=Yes AND V4=No THEN H7

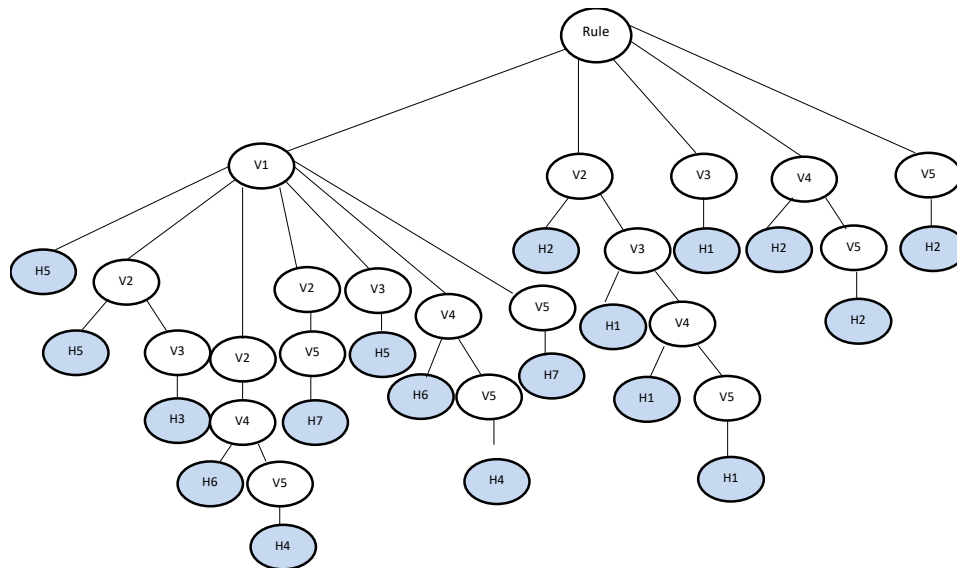


Figure 1. Decision tree representation of Haid and Istihadhah identification

Table 4. Result of Haid and Istihadhah Experiment

No	Variables					Result by System							Manual	Keterangan
	V1	V2	V3	V4	V5	H1	H2	H3	H4	H5	H6	H7		
1	YES	YES	YES	NO	NO			✓					H3	Correct
2	YES	NO	NO	NO	YES							✓	H7	Correct
3	YES	NO	NO	YES	YES				✓				H4	Correct
4	YES	NO	NO	YES	NO						✓		H6	Correct

5	YES	YES	YES	NO	YES			✓						H3	Correct
6	NO	YES	NO	YES	YES		✓							H2	Correct
7	YES	YES	YES	YES	NO			✓						Unidentified	Not Correct
8	NO	NO	NO	YES	NO		✓							H2	Correct
9	NO	YES	YES	YES	NO	✓								H1	Correct
10	NO	YES	YES	NO	NO	✓								H1	Correct
11	NO	NO	NO	YES	YES		✓							H2	Correct
12	YES	YES	YES	NO	NO			✓						H3	Correct
13	YES	NO	NO	NO	NO					✓				H5	Correct
14	NO	YES	YES	NO	YES	✓								H1	Correct
15	YES	YES	YES	NO	NO			✓						H3	Correct
16	YES	NO	YES	NO	YES							✓		Unidentified	Not Correct
17	YES	YES	NO	YES	NO						✓			Unidentified	Not Correct
18	NO	YES	YES	YES	YES	✓								H1	Correct
19	NO	NO	NO	NO	YES		✓							H2	Correct
20	YES	NO	NO	NO	NO					✓				H5	Correct
21	YES	YES	NO	NO	NO						✓			H5	Correct
22	YES	YES	YES	YES	NO			✓						Unidentified	Not Correct
23	NO	YES	NO	NO	NO		✓							H2	Correct
24	NO	NO	YES	NO	NO	✓								H1	Correct
25	YES	YES	NO	YES	YES					✓				H4	Correct
26	YES	YES	NO	NO	YES							✓		H7	Correct
27	YES	NO	YES	NO	NO						✓			H5	Correct
28	YES	NO	NO	YES	NO						✓			H6	Correct
29	YES	NO	NO	YES	YES				✓					H4	Correct
30	NO	NO	YES	YES	NO		✓							H2	Correct
31	YES	NO	NO	YES	NO						✓			H6	Correct
32	YES	YES	NO	YES	NO						✓			H6	Correct
33	NO	YES	NO	NO	NO		✓							H2	Correct
34	YES	NO	YES	YES	NO						✓			H6	Correct
35	NO	YES	NO	NO	YES	✓								H1	Correct
36	YES	YES	NO	YES	NO						✓			H6	Correct
37	YES	YES	YES	YES	YES			✓						Unidentified	Not Correct
38	NO	YES	YES	NO	YES	✓								H1	Correct
39	NO	NO	NO	YES	NO		✓							H2	Correct
40	YES	YES	NO	NO	YES							✓		H7	Correct
41	YES	NO	NO	YES	YES					✓				H4	Correct
42	NO	NO	NO	NO	NO		✓							Unidentified	Not Correct
43	NO	YES	NO	YES	NO		✓							H2	Correct
44	NO	YES	YES	NO	NO	✓								H1	Correct
45	NO	NO	YES	YES	NO		✓							H2	Correct
46	NO	YES	NO	NO	YES		✓							Unidentified	Not Correct
47	NO	NO	NO	YES	YES		✓							H2	Correct
48	NO	YES	YES	YES	NO	✓								H1	Correct
49	NO	NO	YES	NO	YES		✓							H2	Correct
50	YES	YES	NO	NO	YES							✓		H7	Correct

3.3 Software Development and Evaluation

We built a web-based application to test whether the Forward Chaining algorithm that we used to identify menstruation and *istihadhah* is well enough and able to provide an accurate conclusion. Using 5 variables or input parameters, 7 result groups, and 34 rules, Forward Chaining successfully identified menstruation and *istihadhah* with an accuracy of about 86%. This accuracy is obtained from 50 case studies of women's menstrual experience (as

respondents). Using a simple statistical formula, 43 of 50 cases can be identified by the system appropriately, while the other 7 are incorrect. This is because some of the possibilities error, such as in the process of identifying input variables is wrong or the absence of results that refer to the answer. This proves that Forward Chaining depends heavily on complete or incomplete, correct or incorrect rules that defined as its knowledge base. Table IV shows the result of experiment of this study.

Blood color analysis can be performed to identify menstruation or *istihadhah*, further development of the system may involve the introduction of color as a database to express menstruation or *istihadhah*. One model that can be developed is software that presents information in the form of multi-media, especially images. Through the use of multimedia, in addition based on the time of menstruation, women can learn to distinguish menstruation and *istihadhah* based on blood color. In education, multimedia can be used as instructional media or personal learning media [29]. The use of multimedia for instructions has enhancing the learning effectiveness of learning [30], enhancing learning motivation [31], and improving the level of understanding [32]. Further development that can be developed is to convey various variants of information from women fiqh, given the fatwa of various scholars have a variety of styles.

4 Conclusion

Haid and *istihadhah* is important knowledge for woman, especially for Muslim because it deals with what should and should not be done during menstruation. Not a few women are confused whether the blood coming out of their wombs is menstrual blood or not. This study helps solve the problem, to identify menstruation and *istihadhah* by applying the Forward Chaining algorithm. Experimental results show that Forward Chaining is able to identify menstruation and *istihadhah* well. The error in the identification due to the rules that do not accommodate the possibility of a particular case. So for future research, rules need to be analyzed and replenished so that all possible cases can be resolved. In addition, this research can be developed into expert system research or data mining so that more powerful.

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