

A METHOD TO CLASSIFY KAMPO PREPARATIONS BY MATRICES

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ABSTRACT. *Many clinicians have recently become interested in Kampo for cases that are hard to treat by western medicine. It is very difficult for general clinicians to use Kampo medicines properly, however, because there are many kinds of Kampo preparations, and they often include crude drugs. In this study, we propose a method to distinguish Kampo preparations easily. First, we define a matrix that expresses the kinship relation between Kampo preparations, and then we classify them by that matrix.*

Keywords: Kampo, Efficacy, Crude drug, Matrix, Kinship

1. Introduction. Kampo is traditional oriental medicine derived from plants. Most medicines were brought from ancient China to Japan [1]. Later, Japanese Kampo doctors replaced the material with the Japanese herbs and minerals. Thus, the traditional oriental medicine which has developed in Japan is called Kampo. Needless to say, western medicine cannot be applied to all diseases and disorders, especially, various kinds of chronic pains, some kinds of constipation and atopic dermatitis. In the field of psychiatry, there are some treatment-resistant diseases, such as some kinds of depression, autism [2], dementia [3] and neurosis. It is well known that Kampo medication is effective for some of these diseases, which is why many clinicians pay attention to the Kampo recently. The method of diagnosis in Kampo is very different from that in the western medicine, making it very difficult for many clinicians to diagnose and treat patients from the view of Kampo. In Kampo, “sho” is a very important concept to determine the diagnosis. Kampo specialists consider various examinations which include tongue diagnosis, abdominal diagnosis, palpation, and medical interview to decide “sho”. There are some studies to make this diagnosis process easier. One of them analyzed medical interview to establish an indicator for non-Kampo specialist without technical knowledge to perform suitable Kampo medication [4].

Although “sho” is decided, it is also more complicated to choose one Kampo preparation for the diagnosis because there are many kinds of Kampo preparation. It is thought to be very useful to classify Kampo preparation in the easy way for non-Kampo clinicians. There are few reports which have treated this kind of theme. One study [5] unveiled Kampo medication by factor analysis. However, this method is more complicated than our method.

In this report, we propose a method to distinguish Kampo preparations for constipation easily, using matrices as a first step.

2. Classification of the Preparations for Constipation. Constipation is accompanied by various diseases such as ileus and colon cancer. It often occurs as the result of an imbalance of autonomic nerves or physical deconditioning, making it difficult to diagnose this state as a partial symptom of a specific disease. Kampo, however, has many methods

to estimate this state by many points of view, some of which are called “ki, ketsu, sui” or “kyo, jitsu”. “ki, ketsu, sui” are approximately equal to “the atmosphere”, “the blood”, and “water”, respectively. The concepts of “kyo” and “jitsu” are the most important ideas in Kampo. This concept is called “sho” collectively. In short, “kyo” is supposed to be a “weak condition” and “jitsu” is a “reactive condition”. In the first step of considering constipation, it is important if the state of the stomach is “kyo” or “jitsu”. Secondly, herb doctors have to pay attention to the presence of slowing or pooling of blood from the view of “ketsu” and “sui”. Thirdly, they would examine the nature of stool. Finally, they decide a diagnosis as the result of judging this information generally.

However, it is usually very difficult for most clinicians to distinguish one condition from the others from this point of view.

There are some Kampo preparations for constipation, such as “daijokito”, “daiokanzoto”, “choijokito”, or “mashiningan”. In general, a preparation includes some crude drugs. The combination of the crude drugs varies according to the preparation. We will consider how to classify these four preparations in this study. These preparations which include some crude drugs are represented in Table 1.

TABLE 1. Examples of preparation for constipation

	1	2	3	4
	Daijokito	choijokito	daiokanzoto	mashiningan
kanzo		○	○	
gomin				
daio	○	○	○	○
musuibosho	○	○		
koboku	○			○
mashinin				○
kijitsu	○			○
kyonin				○
shakuyaku				○
kankyo				
sansho				
ninjin				

“Mashiningan” contains six kinds of crude drugs, and “choijokito” contains three, according to Table 1. It can be said that two preparations closely resemble if they have many same crude drugs. In this study, when two preparations have one or more of the same crude drugs, it can be said that they are similar to each other.

3. The Expression of the Relationship between Preparations Using the Matrices.

When “ A ” and “ B ” are similar, this similarity is expressed as below.

First, a number is assigned to each preparation as is shown in Table 1. In the next step, the Matrix R is defined as below. If one preparation denoted by “ i ” and another denoted by “ j ” are similar to each other, the entry in the i row and j column of matrix R , which is referred to as the R_{ij} , is assigned the number “1”. If one is not different from the other, the entry in the i row and j column of matrix R is assigned “0”. Therefore, R is symmetric. This procedure produces the matrix R , which is shown below.

$$R = \begin{pmatrix} 0 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{pmatrix} \quad (1)$$

There is a theorem about similarity or kinship.

Theorem 3.1. *The necessary and sufficient condition for all of the elements of one set being similar to each other is*

$$R + R^2 + \dots + R^n > 0 \quad \exists n \tag{2}$$

In this inequality, n is a natural number. When all components of a matrix A are positive, the A is defined as being positive as is shown below.

$$A > 0$$

The proof of this theorem will be shown as follows.

The ij component of the sum of the matrices of left side of this equation can be

$$R_{ij} + \sum_k R_{ik}R_{kj} + \sum_k R_{ik} \sum_l R_{kl}R_{lj} + \dots + \sum_{k,l} R_{ik} \sum_l R_{kl} \dots \sum_m R_{mj}$$

Each term means the expression of the relationship between preparation denoted by i and one denoted by j through the other preparations k, l or more other ones. In this case, each suffix i, j, \dots, m can vary from 1 to 4. For example, the term of the $\sum_k R_{2k} \sum_l R_{kl}R_{l3}$ means the relationship between the preparation denoted by 2 and one denoted by 3. It is expressed in the following Figure 1.

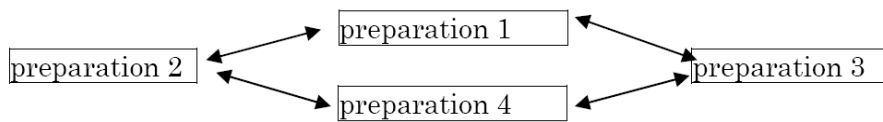


FIGURE 1. The relationship between the preparation

This discussion leads us to the result that if every one component of the sum of those matrices on the left side is not zero, they have relationship between each other.

4. The Result. In this case, the calculation of R^2 and R^3 gives us the following results.

$$\begin{aligned}
 R^2 &= \begin{pmatrix} 2 & 0 & 1 & 0 \\ 0 & 2 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \end{pmatrix} \\
 R^3 &= \begin{pmatrix} 0 & 3 & 0 & 2 \\ 3 & 0 & 2 & 0 \\ 0 & 2 & 0 & 1 \\ 2 & 0 & 1 & 0 \end{pmatrix} \\
 R + R^2 + R^3 &= \begin{pmatrix} 2 & 4 & 1 & 3 \\ 4 & 2 & 3 & 1 \\ 1 & 3 & 1 & 1 \\ 3 & 1 & 1 & 1 \end{pmatrix} > 0
 \end{aligned} \tag{3}$$

The third inequality shows us that all components of the sum of the matrices are positive. According to the above theorem, we can judge that these four preparations have similarity or kinship. That is to say, they are connected with each other through one, two, or three other preparations indirectly.

5. Conclusion. In this paper, we proposed a method to distinguish the Kampo preparations for constipation easily by using matrices. However, there are many ways to classify, such as SOM and factor analysis [5]. We will apply this method to other Kampo preparations and compare this method with other ones.

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