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CONSISTENCY ANALYSIS FOR DETERMINATION OF AYURVEDIC DOSHAS USING PREVALENT QUESTIONNAIRES

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ABSTRACT

This paper introduces concept of Ayurveda, the three Ayurvedic doshas and consistency analysis for determination of Ayurvedic doshas using prevalent questionnaires. The need of this analysis arises from the fact that no standard questionnaire is available as such. In this study we have collected five different questionnaires from various possible practical sources which are helpful in finding the three doshas present in human body. Each set of these questionnaires are given to 100 subjects. After collection of this data, Root Mean Square Difference (RMSD) between each possible pair of questionnaire is calculated for 12 subjects. In this study we find that the RMSD between the results obtained by all of these questionnaires is more than 5% in all the cases. In some cases, it even exceeds 10%. This may seriously hamper the treatment to be prescribed. It is therefore proposed that Principal Component Analysis (PCA) be applied on the collected data of 100 subjects for further investigations.

Keywords: Doshas, Questionnaires, Principal Component Analysis, Consistency Analysis, Root Mean Square Difference.

1. INTRODUCTION

Ancient Indian culture has many precious gems in its baskets. One of these invaluable gems is Ayurveda, which has been serving the mankind to maintain a healthy and disease free life. There are three basic Ayurvedic human constituents known as Doshas. These doshas are Vata, Pitta and Kapha [1]. It is awe inspiring to note that our ancient physicians have been diagnosing and treating the prevalent diseases without any sophisticated instruments and without any kind of pharmacological formulations or surgery.

Somehow during the British rule this knowledge did not flourish and thus gradually slipped into oblivion. As an instrumentation engineer we often emphasize a lot on various aspect of biomedical instrumentation for diagnosis and curing of the disease. Somehow we have been so far ignoring the fact that we already have a very rich database for achieving this objective in simple non-invasive way, leading to quick healing. It is therefore pertinent that while we update our knowledge of latest advancement in the field of biomedical instrumentation, we also take a peep back in our own heritage and rediscover the hidden treasure. If this ancient science is made to work in conjunction with the precise instruments and vast computational power available these days, a lot can be achieved which may not even be imagined by the so called modern medical scientists. This paper introduces the concept of Ayurveda, the three Ayurvedic doshas and consistency analysis for determination of Ayurvedic doshas using prevalent questionnaires.

The RMSD is used to measure the differences between values predicted by two different questionnaires filled by different subjects. RMSD is a good measure of precision [2].

2. PROBLEM DEFINITION

There are several ways of determining Ayurvedic doshas in a subject. One of the prevalent methods used by many practitioners is by questioning the subject. There are several online sites which propose questionnaires for determining these doshas. The questions in these questionnaires seldom match. It is quite probable that the results obtained for the three doshas of the same subject at same time under same conditions may be different. It is therefore required that a consistency analysis for these questionnaires be made and if found inconsistent, a suitable mathematical technique be proposed.

3. METHOD

The five different questionnaires for determining Ayurvedic doshas are collected from different sources like scientific journal and websites [1, 3-6]. Each of the questionnaires is given to 100 subjects. 12 subjects out of these 100 are selected for determining their percentage of Vata, Pitta and Kapha. RMSD Technique is applied to find the difference between all the five different questionnaires with respect to each other.

The Root Mean Square Difference is defined as below:

$$RMSD(\theta_1,\theta_2)=\sqrt{MSD(\theta_1,\theta_2)}=\sqrt{D(\theta_1-\theta_2)^2}$$
$$=\sqrt{\frac{\sum_{i=1}^{n}(x_{1,i}-x_{2,i})^2}{n}}$$

$$\theta_1=\begin{bmatrix}x_{1,1}\\x_{1,2}\\:\\:\\x_{1,n}\end{bmatrix} \quad \text{and} \quad \theta_2=\begin{bmatrix}x_{2,1}\\x_{2,2}\\:\\:\\x_{2,n}\end{bmatrix}$$

x = Observed value;

n = Range of observed value;

MSD = Mean Square Difference;

D = Difference;

4. RESULTS AND DISCUSSION

The percentage of Vata, Pitta and Kapha for 12 subjects is calculated which is obtained by analyzing the five different questionnaires duly filled by the subjects. Each questionnaire has several questions, each containing three options. These options are selected by the subject under investigation and the three options point to three different doshas. Total score of each dosha is calculated with equal weightage. The result so obtained is representatively shown in table 1 for one subject.

Table 1
Percentage of Vata, Pitta and Kapha of a Subject

Subject 1	*Vata (%)*	*Pitta (%)*	*Kapha (%)*
Questionnaire 1	31.7	46.7	21.6
Questionnaire 2	44.5	33.3	22.2
Questionnaire 3	51.7	34.6	13.7
Questionnaire 4	48.1	33.4	18.5
Questionnaire 5	46.9	26.2	26.9

RMSD is calculated for the 12 subjects so analyzed by these five different questionnaires. Table 2 shows the value of RMSD of Vata, Pitta and Kapha dosha of the 12 subjects for five different questionnaires with respect to each other.

Table 2
RMSD Values of Vata, Pitta and Kapha of 12 Subjects

Questionnaire	*Root Mean Square Difference*		
	Vata (%)	*Pitta (%)*	*Kapha (%)*
1&2	7.6	8.7	7.5
1&3	7.2	9.8	6.9
1&4	6.6	7.1	5.1
1&5	8.0	8.4	6.4
2&3	8.6	9.9	10.6
2&4	7.5	8.0	10.6
2&5	10.6	12.0	11.2
3&4	5.8	7.9	5.9
3&5	5.5	10.0	9.0
4&5	8.0	8.4	5.9

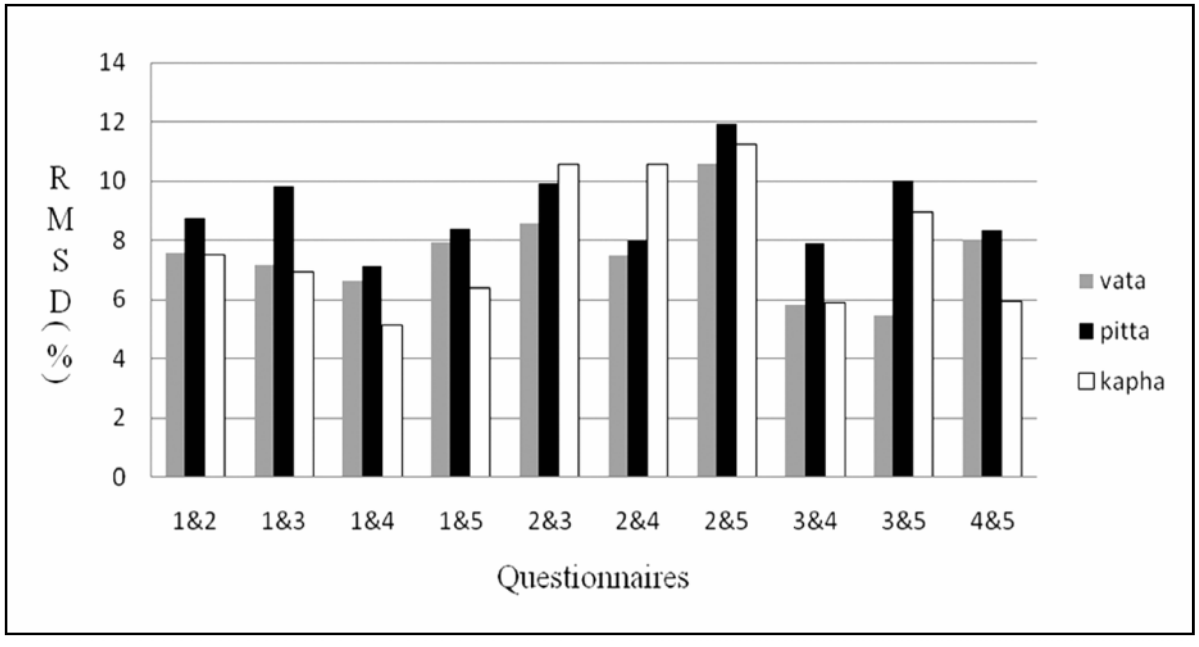

Figure 1: Showing RMS Difference (%) of Vata, Pitta and Kapha Dosha Between the Results of All Questionnaire

5. CONCLUSION

Here we find that the RMSD between the results obtained by all of these questionnaires is more than 5% in all the cases. In some cases, it even exceeds 10%. This may seriously hamper the treatment to be prescribed. Since the results on account of different questionnaire being used vary significantly, the reliability of these questionnaires is under question mark. There is no consensus amongst the practitioners regard to the questionnaire to be used. This study may be extended to combine all the different questions from all possible questionnaires and form one new questionnaire. It is proposed that Principal Component Analysis (PCA) may be applied on the new questionnaire so obtained [7]. This will help in reducing the dimensionality of the problem and may result in an optimum questionnaire.

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