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RESEARCH ARTICLE

Medicinal cupping in the eyes of Graph Theory

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ABSTRACT - Medicinal cupping is one of the traditional treatment methods that is trusted to give many benefits to the human health and still practising by various culture and societies around the world. The purposes of this treatment are to allow the toxin leaves the body,to stimulate the muscles and also helping in healing process for various diseases. The process start by placing special heated cups on specific points to create suction, then the points will be punctured. Each disease has specific cupping points to be cupped which located on the human nerves system. All the points actually connected to each other where a simple graph can be formed. Since there are limited studies that discuss medicinal cupping in a mathematics view, thus this research is conducted to introduce the easiest way on demonstrating the cupping points on the human nerves system by using the idea of graph. Hence, new definition of nerve vertex, nerve edge and nerve graph will be defined. Moreover, the idea of graph colouring will be applied to determine the optimal number of cupping points.

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1. INTRODUCTION

Graph theory is one of the important topics in mathematics that turned many real problems become easier to be solved. The idea of the graph theory is to represent the problems in a form of graph which is much easier to be analyzed. Hence, the purpose of this research is to introduced the new relationship between medicinal cupping with the idea of the graph theory.

Medicinal cupping is a process of removing toxin from human body where it is trusted to give many benefits for health improvement. Though this method is an ancient method that have been practicing by various nations thousand years ago, but because of the assistance, people are still looking this treatment as an effort of healing process besides of the numerous benefits [1-2]. As examples, this olden treatment proven to improve blood circulation, control level of cholesterol, help in increase immune system of human body and others [3-4]. In the meantime, this treatment also can avoid the use of drug in treating the illness. Countless studies have been conducted to prove the effectiveness of this treatment such as, it can reduce the migraine headache, help in lowering sugar level for diabetes patients and also as a support treatment for those have a kidney problem [5-8]. Based on the finding, most of the previous study that related to mathematics is about collecting data and perform statistical analysis of health improvement [6,9]. Just a few studies have been conducted in the recent years that relate the concept of graph theory in medicinal cupping but not have been discussed in detailed [10-12]. Therefore, this study is very important in order to discuss in depth the relationship of graph theory with medicinal cupping.

The most important process in medicinal cupping is how to determine the cupping points to be cupped. There are three conditions for points selections [13]. Firstly, it will be based on patients's complaints. Second, if there is no complaints, it will be based on the disease that the patients have. Last conditions, treatment will be start by cupped the basic cupping points than followed by random points as patients request [13]. All the cupping points are connected to each other by human nerves system. The function of human nerves system is to coordinate and regulate body activities by sending nerve impulses part to another [14]. Hence, from here, medicinal cupping points have big opportunity to be mapped as a graph based on the idea of the graph theory. Thus, new terms regarding to nerve vertex, nerve edge and nerve graph can be introduced.

Randomly choose the points during the treatment will may give the negative effects to the human body [15]. Thus, the right selection of cupping points will affect the treatment. Besides, the approach are not guarantee the optimal number of cupping points. Hence, there is a needed to find a way to determine the optimal number of cupping points. Thus, the idea of graph colouring can be implemented in medicinal cupping in order to determine the optimal number of cupping points in avoiding the randomly choose method. Both of this idea, graph theory and graph colouring are very important as it will be the bases of this research.

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2. METHODOLOGY

Since, all the cupping points are connected to each other by the human nerves system, hence a simple graph can be formed where the idea of graph theory can be applied. Graph theory is one of the convenient methods in analysing problems on two different things that have relationship which is almost applies in many real problems. Converting the connection in a form of graph will make it easier to be analysed and solved [16]. The basic graph must consist of points and also lines or curves that connected between the points. In drawing a graph, it must be started by drawing a dot as a vertex and then drawing a line or curve between the vertices. Thus, different problem that transformed in a graph will represent different meaning to the points and the lines or curves. For example, the points can represent as people, places, center, transport, molecules while the lines can represent link, joining pairs and others [17-19]. In [16], mentions that graph is used to find the pattern of spread disease or parasite. Moreover, in operational research like finding the shortest path for the travelling salesman problem or looking for a matching job also can be solved by using graphs. In chemistry, graph is used to model the complex chemical compound. Besides, graph also are helping medical industry in analysing patient's motor activities for those have schizophrenia and depression [20]. Therefore, this study will model the graph for medicinal cupping point by using the idea of the graph. As a preliminaries, definitions about vertex, edges and simple graph are recall.

Definition 1 [16]: Vertex

A vertex, V is a point where two lines intersect or meet.

In medicinal cupping, the cupping points will be represented as the vertex of the graph that will be formed. Every disease has unique location and unique numbers of cupping points to be cupped. Some may have many cupping points and some may have less cupping points. It will result to the number of vertices that will be formed later.

Definition 2 [16]: Edge

The edge, E is a link or line between vertices, V.

Refer to the problem stated, the human nerves system will present as the edges that will connects all the related cupping points (vertex) to form a simple graph.

Definition 3 [21]: Graph

A graph $G = (V, E)$ consists of V, a nonempty set of vertices or nodes and E, a set of edges.

The connection between all the cupping points as a vertex based on the human nerves system as an edge will be directly from a simple graph. Thus, based on the basic definitions, new terms for nerve vertex, nerve edge and nerve graph regarding to medicinal cupping can be introduced. After the process of modelling the medicinal cupping into a graph complete, the idea of the graph colouring will be applied to determine the optimal number of cupping points. Graph colouring already proved problems that related in finding optimal numbers can be solved. For examples, it helped in solving traffic passing, solving timetable problems in academic fields, finding efficient ways to assign wi-fi channels and many more [22-23]. Thus, following are the definition of graph colouring.

Defintion 4 [21]: Graph colouring

Is an assignment of colours to every vertex and if two vertices joined each other by an edge, they must have different colours.

The simple graph of medicinal cupping obtained will go through the process of graph colouring in order to determined the optimal number where it is the minimal colour of the graph. The total minimum number of colours was called as chromatic number.

Definition 5 [21]: Chromatic number, $\chi(G)$

The chromatic number, $\chi(G)$ of the graph is the least number of colours required for colouring a graph. When all the vertices of the graph are fully colored, then the chromatic number is the least number of colours are used. In this research, the analysis from the list of $\chi(G)$ is so important in determining the minimum number of medicinal cupping points.

3. RESULTS AND DISCUSSION

3.1 Definition of nerve vertex, NV, nerve edge, NE and nerve graph, NG

In the medicinal cupping, the most important part is practitioners must select the right points to be cupped before undergo the treatment. Every disease has different numbers of points and placed to be cupped. The points selection are based on complaints from the patients, disease that patients suffer or just using the basic points and followed by random points as requested [13]. Then, based on the human nerves system, the cupping points were joined together and indirectly, a simple graph was formed. Thus, new definitions regarding nerve vertex, nerve edge and nerve graph are introduced as below.

Definition 6: Nerve Vertex, NV

Nerve vertex, NV is a vertex that represents medicinal cupping points for a unique disease based on the human nerves system.

Definition 7: Nerve Edge, NE

Nerve edge, NE is an edge that connects between the nerve vertex, NV to form a simple graph based on the human nerves system.

Definition 8: Nerve Graph, NG

A nerve graph, NG consist a set of nerve vertex, NV that connected by nerve edges, NE. In other way, nerve graph represents as $NG = (NV, NE)$.

Based on the definition obtained before, basic cupping points in Islamic medicinal cupping were choosen is to demonstrate the idea. Figure 1 shows the basic cupping points to be cupped based on Islamic medicinal cuppping treatment. There are exactly 11 cupping points that are located at the back of human the body.

Based on the Definition 6, all the 11 basic cupping points will be presented as the nerve vertex, NV . Figure 2 shows an illustration of cupping points in term of nerve vertex, NV.

The 11 basic Islamic medicinal cupping points are labelled start from NV_1 until NV_{11}. All the vertices will be mapped on the human nerves system as in Figure 3 to form a simple graph.

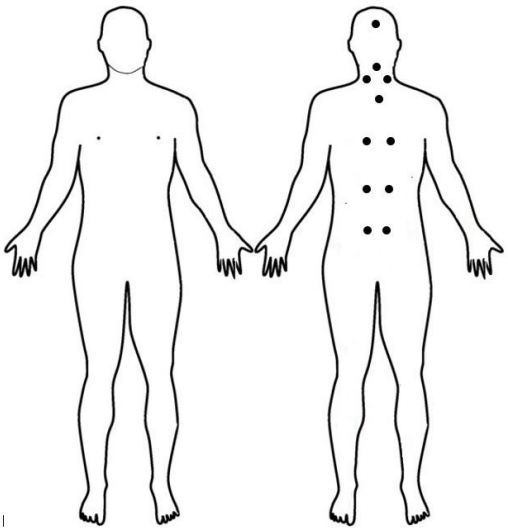

Figure 1. 11 basic cupping points in Islamic medicinal cupping [13]

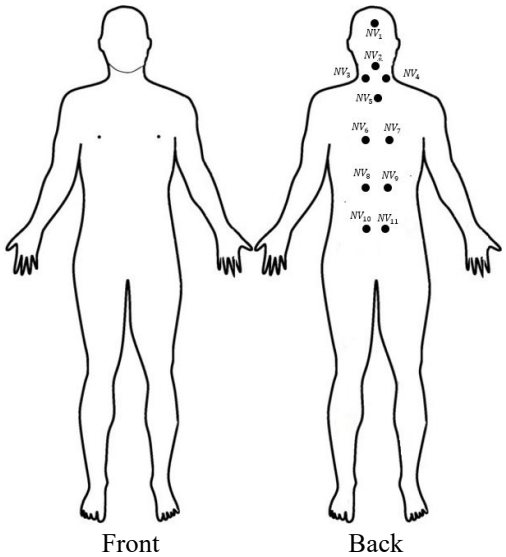

Figure 2. Nerve vertex, NV of 11 basic Islamic medicinal cupping points

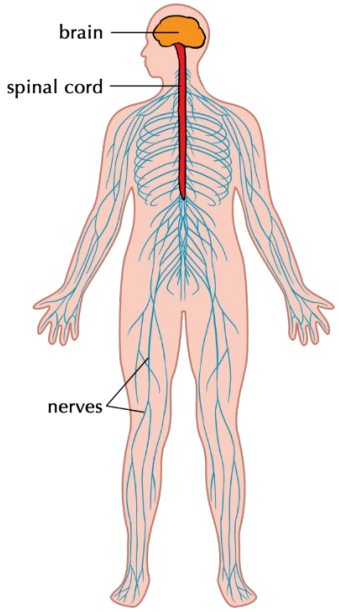

Figure 3. Human nerves system

Since all the vertices are connected to each other to form a simple graph, then the human nerves system becomes the edges of the graph. Thus, Figure 4 below shows the mapping of nerve edges, NE for 11 basic islamic medicinal cupping points.

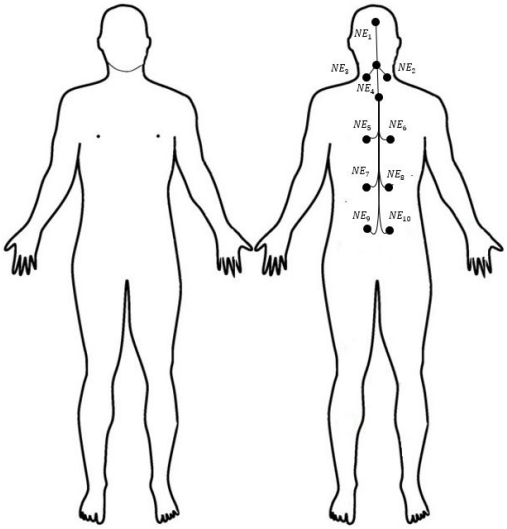

Figure 4. Nerve edges, NE of 11 basic Islamic medicinal cupping points

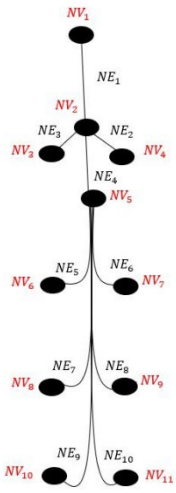

Figure 5. Nerve graph, NG of 11 basic points in Islamic medicinal cupping

There are 10 nerve edges, NE that connect with the 11 nerve vertices, NV. The edges were labelled start from NE_1 until NE_{10}. Based on the Definition 8, the simple graph was form called the nerve graph, NG that consists set of nerve vertex, NV and nerve edge, NE, $NG = (NV, NE)$. Figure 5 shows the simple nerve graph, NG for 11 basic islamic medicinal cupping points that form from the connection of the 11 nerve vertices, NV_1 until NV_{11} with 10 nerve edges, NE_1 until NE_{10}.

After the nerve vertices, NV, nerve edges, NE, and nerve graph, NG for 11 basic cupping points was determined, then the method of graph colouring was applied to determine the optimal number of cupping points for 11 basic points of Islamic medicinal cupping. Based on the graph colouring, the first colour must be placed as maximum as can before the second colour was put to the vertex. Figure 6 expresses the process of colouring all the 11 vertices until optimal number is determined.

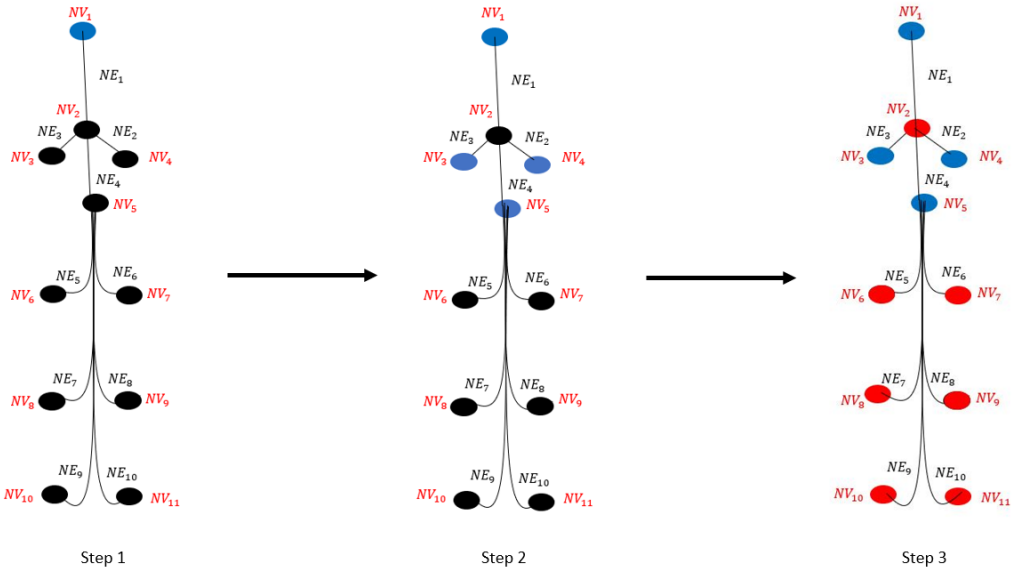

Figure 6. Process of graph colouring for 11 basic points for islamic medicinal cupping

NV_1 is choosen and coloured with blue. Based on the definition of graph colouring, since NV_2 is adjacent with NV_1, then it must be coloured with different colour, example red. Same goes to the NV_3, NV_4 and NV_5. Since the three vertices are adjacent with NV_2, then they can not be coloured with red. These three vertices can be coloured as blue due to the non-adjacent with NV_1. All the process repeats until all the 11 vertices are coloured. To be reminded, the first colour blue must be placed as maximum as in the graph based on the idea of the graph colouring. As a result, the chromatic number required to colour all the vertex is two that is blue and red. There are four vertices are coloured with blue, NV_1, NV_3, NV_4 and NV_5 while there are seven vertices are coloured with red, $NV_2, NV_6, NV_7, NV_8, NV_9, NV_{10}$ and NV_{11} . Therefore, the optimal numbers of cupping points for 11 basic points in Islamic medicinal cupping are four which is the minimum points that coloured by blue and $\chi(G) = 2$. Means, the four points out of 11 are enough to be cupped during the medicinal cupping treatment. Table 1 below represent the result obtained from the process.

Table 1. Result of the graph colouring process

Colour	Result
Blue	4
Red	7
Chromatic number, $\chi(G)$	2

4. CONCLUSIONS

In the medicinal cupping treatment, the first step that is very important before undergo the treatment is determined the disease in order to have the right number of medicinal cupping points. As this research as a basis study, the transformation of the medicinal cupping points in view of graph is hoped to give a better alternative on choosing the optimal points. Moreover, the idea of this study also can be applied to other diseases in order to determine the nerve graph, NG and also the optimal number of cupping points.

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Individual Assistant

NA

DECLARATION OF ORIGINALITY

The authors declare no conflict of interest to report regarding this study conducted.

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