

Social Strides: Exploring Walking Clubs through Social Connections

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MSC 2010 Classifications: Primary 00A06; Secondary 90B18, 91D30.

Keywords and phrases: Networks, Social Network Analysis, Walking Club, Correlation.

The authors would like to thank the reviewers and editor for their constructive comments and valuable suggestions that improved the quality of our paper.

Abstract *The relationships between elements in a variety of natural and social systems may be shown using networks. Social network analysis (SNA) will disclose the information exchanged between actors and their interpersonal connections. Individuals who regularly went for walks showed more emotional stability than those who did not. Walking helps relax our nerves; thus, it may make us feel less nervous. We tried to understand how being in the bare feet feels good for one's physical and mental health using SNA. It was also studied if mind-sharing with other walkers results in their feeling mentally relaxed. Establishing a connection with the Earth may imply improve immunity in social network perspective.*

1 Introduction

The past few years have seen a sharp increase in interest in social network analysis. A network or relationships are made up of nodes or actors that are connected through interconnections. Social networks are the connections between people, organisations, or groups. They exchange social connections, friendships, ideas, and other items. The most important factor is how certain individuals inside a social network may inspire others to carry out similar actions. Social network analysis is an awesome tool of sociology, computer science, mathematics, and statistics. By looking at relationship networks, it is feasible to comprehend linked and transient systems. Social network analysis (SNA), a branch of network science, employs networks and graph theory to study social dynamics. We may gain a thorough understanding of the relationships between nodes by using the SNA metrics. Sociograms are a graphical representation of networks that depict people as nodes connected by linkages.

For those who are familiar with the basics, book [1] includes topics such as network data gathering and assessment, diffusion modeling, and other related topics. Despite being relatively new for contemporary research, social network analysis approaches are currently being thoroughly studied in this sector of assessment. The advantages of SNA for formative evaluation are described in the article [2]. The manual [3] is a priceless resource; it provides a thorough introduction to the primary concepts, supporting issues, key techniques, and prevalent conversations. Readers will rely on the guidebook as a one-stop reference in the near future rather than examining a variety of journals and books. Book [4] provides less emphasis on the specific issues that arise when the structural and data-centric elements of the network interact, instead concentrating just on the social, structural, and cognitive components of social networks. The idea of social network analysis is discussed in the book [5], which also provides a sociological viewpoint and the mathematical underpinnings that enable us to develop metrics and calculate measures to actually examine the network. Book [6] challenges some of the conventional wisdom about the difference between corporate strategy management, project management, and program management. Applications of these systems can be found in many different research fields and subfields, including biology [7], neuroscience [8], behavioral science [9], education [10, 11], political science and many others [12].

It has been proven through expert studies that walking stimulates circulation and blood flow to the brain and nervous system, which improves our mood. It has a beneficial effect on our central nervous system's Hypothalamic Pituitary Adrenal axis. Even if walking was their major source of physical exercise and one who resided in polluted regions, regular walking had a positive influence on their mental well-being. Walking barefoot, in principle, more nearly recovers our normal walking pattern. This might possibly help people to improve their balance and maintain control over their foot position, among other possible benefits. Walking barefoot can be beneficial to our health; this is due to the fact that the negative ions in the earth counterbalance all the positive ions in our bodies. According to naturopathy, everything has its own energy. While people walk barefoot, reflexology principles come into play. The purpose is that our soles are squeezed harder, which regulates the functionality of our organs. Our current way of life isolates us from touching soil and grass. Scientific investigations now show that the connection between nature and humans is a key factor in physiological malfunction and illness.

It is believed that the nerves in the eyes are connected to a pressure point on the foot. This pressure point may be stimulated by walking barefoot, which will also improve our overall vision. It can activate some acupuncture points on the foot, which will stimulate our nerves and veins and hence improve our nervous system. Walking barefoot regularly may provide relief for diabetics and people with varicose veins. It stimulates the nervous system, strengthening the body and reducing vulnerability to illness while improving immunity. Whenever your hormones are out of balance, you will have physical and emotional issues. Women with premenstrual syndrome frequently experience mood changes, headaches, stomach discomfort, weight gain, constipation, and other symptoms. Many of these symptoms can be alleviated by walking barefoot on the ground. Damage to our body's cells triggers inflammation, which can result in difficulties including ageing, heart problems, and other disorders. Additionally, it makes your body's blood circulation better, which leads to a healthy cardiovascular system. When we walk barefoot, our stress levels naturally decrease because the stimulation of the nerves in our feet releases tension. Our blood pressure stabilizes when our stress level decreases. The purpose of [13] is to encourage walking, physical activity, and the development of a cheerful attitude. The book [14] is especially beneficial for those who sit at a desk all day, who need to exercise but don't enjoy it, and who want more out of their workouts. This book will help with its realistic tactics that you may use while walking.

2 Objective of the study

The purpose of our research is to comprehend the advantages of barefoot walking for both the body and the mind. A selected group of regular walkers is chosen from a walker's club. As part of the study, participants who typically wear shoes will be asked to walk barefoot in order to examine its advantages. In addition, we are attempting to comprehend the rise in their mind-sharing and determine the extent of the mental pleasure it provides.

3 Terminology

Graphs are mathematical structures that are used to represent pairs of relationships between different items in social network analysis. The study of graphs includes the study of a set of vertices or nodes, and a set of edges, also known as links, that connect pairs of nodes or vertices. Small networks with a manageable number of nodes and linkages are frequently used in the social sciences. Graphs can be either directed or undirected. Undirected connections are those that connect two nodes but have no direction in them. Direct connections denote a connection between two separate nodes that has a direction. A newer but rapidly expanding multidisciplinary field that combines social, statistical, mathematical, and computer sciences seems to be the analysis of social networks. The network metrics and general topology of the network are frequently computed using a mathematical technique. The statistical technique is frequently used to examine the findings of network analysis, describing some pertinent features and peculiarities of the network, its distribution, outliers, communities, clusters, etc. A link between two nodes

seems to be there when there is a tie between them. If a tie is missing, the relationship doesn't exist. In diagrams used to depict networks, vertices are often symbolized by points, arcs by lines with arrowheads, and edges by lines without arrowheads. The fundamental information for analysing a social network is the number of vertices and arcs in the network, which is utilised to determine the parameters' values. $G = (V, E)$ will be a graph if V indicates the set of vertices and E represents the set of edges. The order and size of the graph G are commonly referred to as the number of vertices $N_V = |V|$ and the number of edges $N_E = |E|$ accordingly. Graphs are excellent tools for understanding a variety of social situations. Use an adjacency matrix is another typical method for expressing network data. A is an $n \times n$ adjacency matrix of graph G when its elements are of the form

$$A_{ij} = \begin{cases} 1 & \text{if } i \rightarrow j \\ 0 & \text{otherwise} \end{cases}$$

where n is the number of nodes and i and j denotes nodes. A node's degree d is determined by how many connections it has to other nodes in the network. There are two levels of degree for directed networks. The number of connections at a vertex that point inward is known as the in-degree. The number of connections that start at one vertex and extend outward to other vertices is known as the out-degree. The proportion of relationships that are actually existent in the network is shown by the density measure. Its value varies from 0 to 1, having networks with no relations at the lower limit and networks with all conceivable relationships at the top limit. The ratio of reciprocal edges over all of the edges in a graph G is its reciprocity. A network's transitivity or clustering coefficient serves as a measure for the nodes' tendency to group together. A network with a high transitivity is one that has numerous internal connections between node communities or groupings. For a graph G , f_d is the number of vertices having degree d divided by the total number of vertices. That is, if there is N_{ad} vertices with degree d in a graph G having total number of vertices N_V then $f_d = N_{ad}/N_V$. The collection $\{f_d\}_{d \geq 0}$ is called the degree distribution of G .

4 Methodology

For our research, we used data from a walking club in Kerala State, India. In our study, 32 adults who frequently go for morning walks, were included. There are 5 individuals under the age of 18 (represented as A_1, A_2, A_3, A_4, A_5), 16 individuals between the ages of 18 and 60 (represented as B_1, B_2, \dots, B_{16}) and 11 individuals beyond the age of 60 (represented as C_1, C_2, \dots, C_{11}). The majority of those were walking in their regular workout shoes.

As part of the study, we modified their walking routine. They were instructed to spend the first fifteen minutes of their walk barefoot across the sand and grass. After that, they can go with shoes as normal. Following the walking exercise, there is a 15-minute break during which everyone is free to discuss any topics with any participants in the study they like. With this study, we want to comprehend, at least to some extent, the physical and psychological changes it brings about in people. We kept a record of the individuals with whom they shared ideas in two phases: once when the study started and again three months later. They were also surveyed about their experiences walking through grass and sand as part of the study. We explored several SNA measures in an effort to comprehend the nature of the data. Graphs are visualised through sociograms, which show interconnections as lines joining nodes and nodes as points. Where the nodes should be put inside the plot is the main choice to be made while creating these plots. Green colour nodes in Figures 1 and 2 denote individuals under the age of 18, yellow colour nodes denote individuals between the ages of 18 and 60, and maroon colour nodes denote those above the age of 60. The network's layout was clear from the given sociograms.

5 Results and Discussion

Using the R programming language, we determined the network metrics. R has a number of tools for network research.

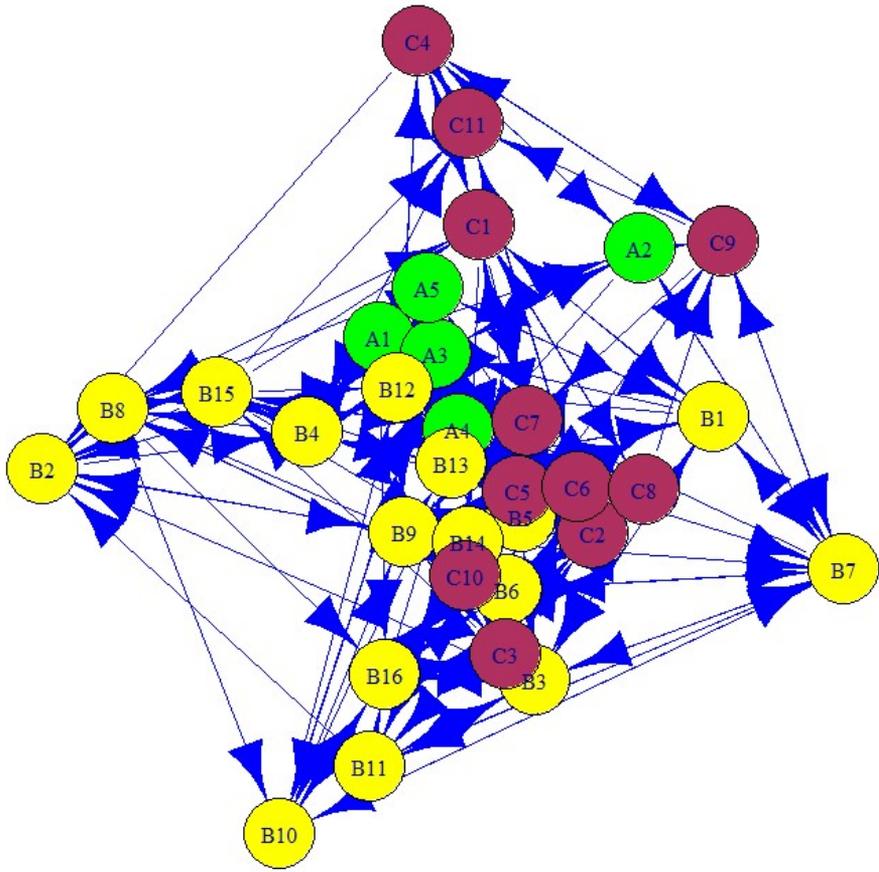


Figure 1. Sociogram connecting all individuals participated under study during first phase

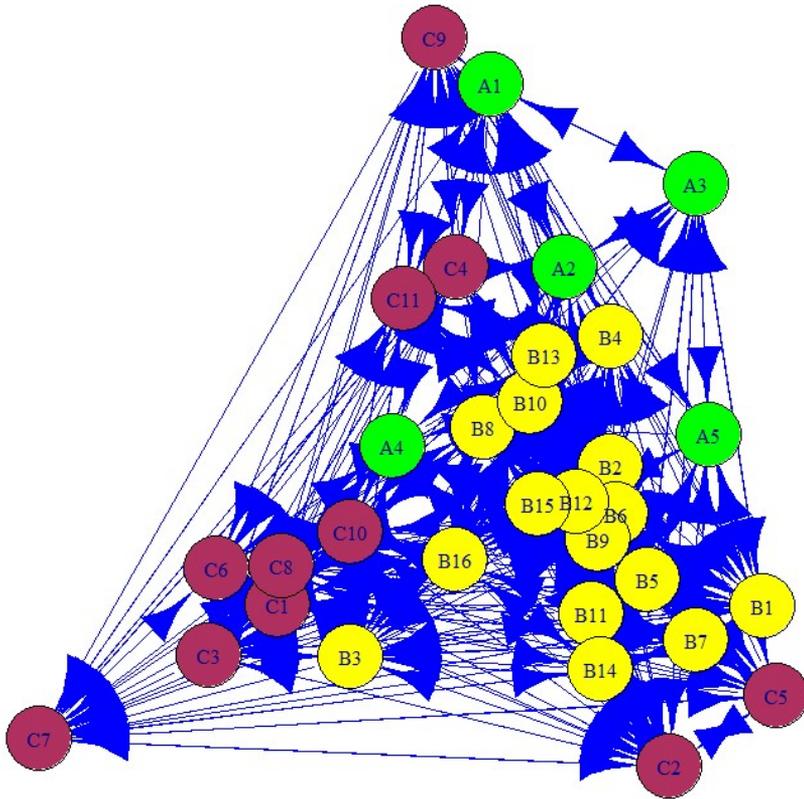


Figure 2. Sociogram connecting all individuals participated under study during second phase

Summary measures	Phase 1	Phase 2
Node size	32	32
Edge count	183	430
In-Degree	4, 4, 5, 4, 4, 5, 7, 7, 7, 7, 9, 7, 6, 5, 4, 8, 8, 4, 5, 8, 6, 5, 5, 6, 5, 5, 6, 5, 5, 5.	13, 9, 10, 11, 10, 15, 15, 15, 12, 16, 16, 17, 12, 19, 13, 9, 17, 13, 14, 17, 14, 14, 14, 13, 17, 10, 13, 14, 12, 12, 13, 11.
Out-Degree	5, 5, 4, 5, 5, 7, 3, 9, 6, 8, 5, 8, 6, 7, 5, 5, 7, 6, 3, 8, 6, 6, 6, 7, 6, 6, 6, 5, 6, 4, 5, 3.	13, 10, 11, 10, 10, 15, 13, 14, 12, 17, 14, 16, 12, 15, 15, 13, 17, 13, 14, 15, 15, 13, 16, 15, 15, 14, 12, 13, 11, 13, 11, 13.
Degree	9, 9, 9, 9, 9, 12, 10, 16, 13, 15, 12, 17, 13, 13, 10, 9, 15, 14, 7, 13, 14, 12, 11, 12, 11, 12, 11, 10, 12, 9, 10, 8.	26, 19, 21, 21, 20, 30, 28, 29, 24, 33, 30, 33, 24, 34, 28, 22, 34, 26, 28, 32, 29, 27, 30, 28, 32, 24, 25, 27, 23, 25, 24, 24.
Edge density	0.1844758	0.4334677
Reciprocity	0.6775956	0.7069767
Transitivity	0.1798561	0.5739910

Figure 3. Table showing the summary measures in both phase 1 and phase 2

The number of links that each node has to other nodes within the network may be determined using the degree measure. One can see that Phase 2 has made significant advancements when compared to Phase 1 in terms of the number of connections a vertex has both inwardly and outwardly. Compared to its value in phase 2, edge density in phase 1 is closer to 0. Consequently, phase 2 had a greater rise in connections than phase 1 had. Reciprocity is the technique of returning a favour to another in order to maintain and fortify a variety of social ties. Figure 3 makes it evident that reciprocity has also significantly increased. We learned that internal linkages between node communities are stronger in phase 2 than in phase 1 because transitivity increases in phase 2.

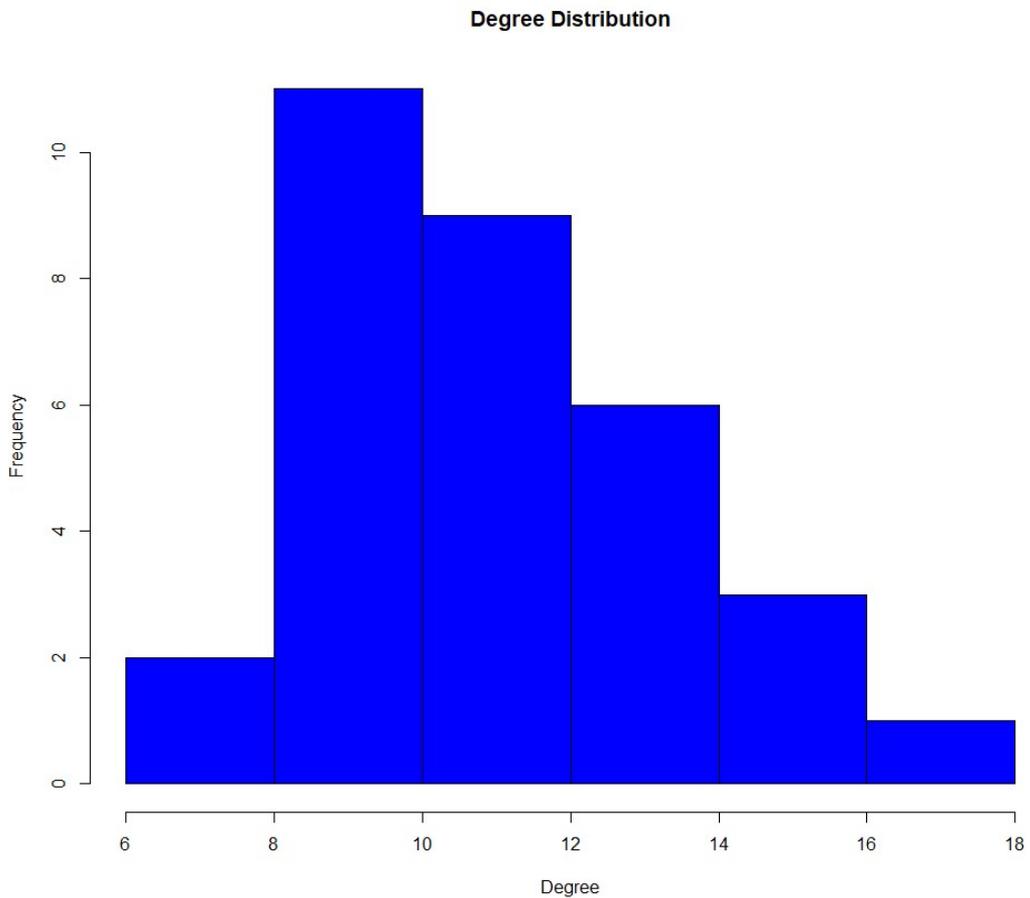


Figure 4. Degree Distribution of first phase

The probability distribution of the degrees throughout the whole network is known as the degree distribution of a graph. It demonstrates how well a network is connected overall. When analysing the distribution of a data set, it is important to characterise the overall structure of the data, including its shape, centre, spread, and any deviations. How centralised or dispersed a network is affects its structure in key ways. It is evident from Figure 4 and 5 that the network in phase 2 is more dispersed than in phase 1.

A useful method for examining the randomness of a data collection is the correlogram. The correlation between each pair of variables is represented by a correlogram. Correlations that are shown to be positive are in blue, while those that are negative are in red. The correlation coefficient is directly proportional to the color's intensity. Thus, the darker the circles, the stronger the relationship. In the R program, in order to find hidden patterns among variables, `corrplot` offers a visual exploration tool on correlation matrices that allows automated variable reordering. The findings of the opinion poll are displayed in Figures 7, 8, 9, and 10 as pie graphs.



Figure 7. Pie chart showing the opinion about physical health after grass walking



Figure 8. Pie chart showing the opinion about mental health after grass walking



Figure 9. Pie chart showing the opinion about grasping capacity after grass walking

6 Conclusion

Social network analysis is frequently utilised in current research to examine various relationships and their overall effects. The information flow between actors and their relationships to one another are to be revealed through SNA. Scientific studies now demonstrate that the interaction between humans and nature is a critical component in physiological dysfunction and sickness. Our contemporary way of living keeps us away from contact with grass and sand. Our stress levels automatically reduce when we go barefoot, since the activation of the nerves in the feet eliminates tension. Walking is good for our health, and when we walk barefoot, we'll feel refreshed both physically and mentally. We used information from a walking club in our study. Study results indicated that people's second-phase mind-sharing has increased from their first-phase levels. Before we began the study, everyone was leaving after the walk. However, we could understand that they are gradually advancing in their relationship because they make time to talk and exchange ideas. Their mental refreshment was further aided by it. As they noticed harmony with the environment and their friends, they grew both mentally and physically. To further comprehend the barefoot walking experience, a survey was undertaken. This led to the realisation that it offers many individuals both mental and physical refreshment. According to them, the relaxation received from such a walk improves in people's ability to absorb concepts more attentively and effectively.

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Figure 10. Pie chart showing the opinion about energy level after grass walking

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