Journal of Ethnopharmacology 186 (2016) 329–342

Contents lists available at ScienceDirect

Journal of Ethnopharmacology

journal homepage: www.elsevier.com/locate/jep

Quantitative ethnomedicinal survey of medicinal plants given for cardiometabolic diseases by the non-institutionally trained *siddha* practitioners of Tiruvallur district, Tamil Nadu, India

S. Esakkimuthu [a], S. Mutheeswaran [a], S. Arvinth [b], M. Gabriel Paulraj [a], P. Pandikumar [a,*], S. Ignacimuthu [a,c,**]

[a] Division of Ethnopharmacology, Entomology Research Institute, Loyola College, Chennai, Tamil Nadu 600034, India
[b] Department of Botany, PSG College of Arts & Science, Coimbatore, Tamil Nadu 641 014, India
[c] Visiting Professor Programme, Deanship of Scientific Research, College of Science, King Saud University, Riyadh 11451, Saudi Arabia

ARTICLE INFO

Article history:
Received 25 January 2016
Received in revised form
9 April 2016
Accepted 12 April 2016
Available online 14 April 2016

Keywords:
Complementary therapies
Traditional medicine
Hypertension
Type 2 diabetes
Cardiovascular diseases
Obesity

ABSTRACT

Ethnobotanical relevance: The burden of cardiometabolic diseases such as dyslipidemia, hyperglycemia, hypertension, visceral obesity and atherosclerotic cardiovascular diseases and the use of traditional medicine for the management of such diseases are high in India; hence there is a need to document and analyze such therapies.

Aim of the study: This study documented and analyzed the medicinal plants prescribed for cardiometabolic diseases by the non-institutionally trained *siddha* practitioners of Tiruvallur district of Tamil Nadu, India.

Methodology: The field survey was conducted between December 2014 to November 2015. Successive free listing assisted with field-walks was used to interview the informants. After assessing the sampling sufficiency using rarefaction curve analysis, indices such as Informant Consensus Factor (F_{ic}) and Index of Agreement on Remedies (IAR) were calculated for the data. The indicators of informant's medicinal plant knowledge such as Shannon's index, equitability index, etc., were regressed with the demographic profile of the informants.

Results: For this study 70 non-institutionally trained Siddha medical practitioners were approached; the data from 36 practitioners who were treating cardiometabolic diseases were documented. This study recorded the use of 188 species which were used to prepare 368 formulations to treat illnesses categorized under cardiometabolic diseases. In this, 53.04% claims were singletons. Regression analysis showed that single species dominance was reduced and the diversity of medicinal plants was increased with the increase in the age and experience. Increase in the years of formal education increased the equitability in the uses. The plants such as *Nelumbo nucifera* Gaertn. (cardiovascular diseases), *Allium sativum* L. (dyslipidemia), *Cuminum cyminum* L. (hypertension), *Macrotyloma uniflorum* Verdc. (obesity) and *Azadirachta indica* A. Juss. (type 2 diabetes) were the highly cited medicinal plants.

Conclusion: This survey has identified the plants most commonly used by *Siddha* practitioners of Tiruvallur district, Tamil Nadu, India for cardiometabolic diseases. The prevalence of chronic, non-communicable metabolic illnesses such as type 2 diabetes, hypertension and obesity are increasing worldwide due to the rapid changes in the lifestyle. These ailments require a life-long care and in such instances, people tend to use complementary therapies in most cases, alongside with conventional therapies. In view of the high use of traditional therapies for treating cardiometabolic illnesses, this study supports the need for more research to evaluate the potential benefits of the treatments and to identify any safety concern.

Abbreviations: AMP, Adenosine Mono Phosphate; BM, Body Mass Index; ECG –, Electrocardiogram; F_{ic}, Informant Consensus Factor; HDL-c, High Density Lipoprotein Cholesterol; hsCRP, High Sensitivity C – Reactive Protein; IAR, Index of Agreement on Remedies; ISE, International Society of Ethnobiology; KR, Knowledge Richness Index; KSI, Knowledge Sharing Index; LDL-c, Low Density Lipoprotein Cholesterol; PPAR-δ, Peroxisome Proliferator Activated Receptor – δ; T2D, Type 2 Diabetes; WHO, World Health Organization

* Corresponding author.
** Corresponding author at: Division of Ethnopharmacology, Entomology Research Institute, Loyola College, Chennai, Tamil Nadu 600034, India.
E-mail addresses: eriloyola@hotmail.com (P. Pandikumar), eriloyola@hotmail.com (S. Ignacimuthu).

http://dx.doi.org/10.1016/j.jep.2016.04.017
0378-8741/

1. Introduction

Cardiometabolic diseases consist of atherogenic dyslipidemia, hyperglycemia, hypertension and visceral obesity which form the common basis of atherosclerotic cardiovascular diseases (Funahashi and Matsuzawa, 2014). There is an increased concern over managing these illnesses globally, since between 1990 and 2010, the total number of deaths caused by cardiovascular diseases increased by more than 25% and by diabetes it was nearly double (The Global Burden of Metabolic Risk Factors for Chronic Diseases Collaboration, 2014). This study also indicated that hypertension, diabetes and obesity will be the major risk factors of the cardiometabolic diseases and it also indicated the shift of mortality burden by these illnesses from high-income to low and middle income countries; India is one among the top ten countries with cardiometabolic diseases. The unique 'Asian Indian phenotype' promoted the risk of cardiovascular events and diabetes at a low BMI (Singh et al., 2014). The data from WHO indicated that in India nearly 26% of deaths occurred by cardiovascular diseases (WHO, 2014). About 33% urban and 25% rural Indians are hypertensive (Anchala et al., 2014) and about one third of urban population in the major cities of India has metabolic syndrome (Pandit et al., 2012). The National Urban Diabetes Survey indicated the increased prevalence of Type 2 Diabetes (T2D) in cities of South India such as Chennai (Mohan et al., 2007).

The use of complementary therapies is increasing exponentially worldwide and nearly 40% of the adults are reported to use these therapies for lack of conventional care, cost and medical care needs (Kramlich, 2014). The use of such therapies was reported as common in cardiovascular diseases (Grant et al., 2012) and T2D (Birdee and Yeh, 2010). About 60% of the patients consuming such traditional medicines along with conventional therapies were not reporting it to healthcare providers (Eisenberg et al., 2001). There is an urgent need to develop strategies for the safe and effective use of complementary therapies for such chronic illnesses.

Siddha system of traditional medicine is one of the predominant forms of traditional medicines in South India (Mutheeswaran et al., 2014) and the proportion of non-institutionally trained practitioners is considerable in this system of medicine, though the institutions are available for teaching this system of medicine. This study documents and analyses the medicinal plants prescribed for cardiometabolic diseases such as cardiovascular diseases, dyslipidemia, obesity, hypertension and T2D by the non-institutionally trained *siddha* practitioners of Tiruvallur district of Tamil Nadu.

2. Methodology

2. 1. Study area

Field surveys were conducted among non-institutionally trained *siddha* practitioners in various *taluks* (= sub-districts) of Tiruvallur district in Tamil Nadu, India. The district has a mixture of urban and rural characteristics. The eastern part of Tiruvallur district is dominated by urban characteristics while the southern and northern parts of the district have rural areas. This district is comprised of nine *taluks*.

2.2. Interviews

This paper is the outcome of series of interviews conducted from December 2014 to November 2015 consisting of 85 field days. The interview protocols were in accordance with the guidelines of ISE code of ethics for ethnobiological research (International Society of Ethnobiology, 2006). The interviews and field observations were carried out in all the *taluks* according to the methods of Alexiades (1996) and Heinrich et al., (2009). Successive free listing assisted with field-walks was used to interview the informants. The informants practicing medicine were selected for the interviews randomly regardless of age, experience and education. The interview guide for this survey consisted of two parts. The first part dealt with the demography of the informants such as age, gender, education and experience. The second part dealt with the documentation of their local knowledge on medicinal formulations to treat cardiometabolic diseases. The description of the illnesses, the ingredients, parts used, mode of preparation, dose, and duration were documented in this part. Besides, other details such as the availability of resources (easily available - hard to collect) and the source of collection were also documented. The interviews were conducted in the local language *'Tamil'*. All the interviews were video-graphed and the field notes were cross verified with it. By combining these two data, final field data sheet with descriptive notes were prepared for further analysis.

2. 3. Herborization of the samples

The samples of medicinal plants cited by the informants were collected and the voucher samples were maintained in the herbarium of Entomology Research Institute, Loyola College, Chennai. The authenticity of the specimens was confirmed using local flora (Gamble, 1997; Nair and Henry, 1983; Henry et al., 1987, 1989) and the botanical authenticity of the crude drugs were confirmed using macroscopic identification of the samples (Gupta et al., 2015). Validity of the botanical names was confirmed using the website (http://www.theplantlist.org/).

2. 4. Analysis of the data

The data were converted into the use-reports and claims in accordance with the previous works (Chellappandian et al., 2012). Sampling sufficiency was estimated by plotting Shannon Wiener's index and cumulative number of use-reports, for each illness category. For this analysis, Shannon Wiener's index was calculated using PAST3 program by entering the cumulative number of use-reports for each species under an illness category, after every interview. Reaching a clear asymptote of the curve was considered as an indicator for the sufficiency of sampling.

For each informant, the indices viz., Shannon index, dominance index, and equitability index were calculated. Shannon index measures the diversity of the ethnobiological information, and an increased Shannon index values indicated the use of many plants for treating an illness, each with few use-reports. It was calculated using the following formula:

$$H = -\Sigma(n_i/n)In(n_i/n)$$

Dominance index measures the level of dominance of few species and its values range from zero to one. Zero indicates the evenness in the usage of all the species cited by an informant, while higher values indicate the presence of dominance of few species over the others. It was calculated using the following formula:

$$D = \Sigma(n_i/n)^2$$

In both the formulae, 'n_i' indicates the number of use-reports for a species and 'n' indicates the total number of use-reports for all the species cited by the informant.

The equitability index measures the evenness with which individuals are divided among the taxa present. It was calculated using the following formula: