doi.org/10.36721/PJPS.2025.38.2.REG.13133.1

Physical, physicochemical and preliminary phytochemical analysis of siddha poly herbal drugs used for treating of diabetes mellitus in northern province, sri lanka

Merin Dinushiya J[1], Nilanusha S[1], Sugansika M[1], Sivasinthujah S[1*], Sivarangini S[2] and Ravimannan N[3]

[1]Department of Pharmacy, Faculty of Allied Health Sciences, University of Jaffna
[2]Unit of Siddha Medicine, University of Jaffna
[3]Department of Botany, Faculty of Science, University of Jaffna

Abstract: The Siddha system of medicine uses natural herbal products for the treatment of Diabetes Mellitus (DM). In Northern Province, Sri Lanka *Madhumeha chooranam, Neerizhivu chooranam* 1 and *Neerizhivu chooranam* 2 and are the famously used ones among the most prioritized drugs for DM. Therefore, this study aimed to formulate the crude drug, evaluate the physical properties, physiochemical properties and phytochemical screening of crude drugs as there is a necessary to standardize this formulation for the safety of the stakeholders. Plant materials were collected and powdered. *Madhumeha chooranam, Neerizhivu chooranam* 1 and *Neerizhivu chooranam* 2 were prepared using siddha literature. Organoleptic properties, physical physiochemical parameters were evaluated for the crude drug. The crude drug was macerated with methanol separately for 48 hours at room temperature and phytochemical were analysed for each crude extracts. The results of physical and physiochemical were analyzed with one-way ANOVAs using SPSS 23. All three drugs showed the presence of alkaloids, flavonoids, carbohydrates, reducing sugars, tannins, steroids, proteins, amino acids, glycosides, phenol, terpenoids and anthraquinones. The results of physical and physiochemical parameters were conformity and can be used for setting standards for the selected drugs *Neerizhivu chooranam 1, Neerizhivu chooranam 2 and Madhumeha chooranam.*

Keywords: *Madhumeha chooranam, Neerizhivu chooranam 1 and Neerizhivu chooranam 2,* Physical, physicochemical and preliminary phytochemical

Submitted on ---------- Revised ---------- Accepted on ----------

INTRODUCTION

Diabetes Mellitus (DM) is a metabolism associated pathological condition, which is characterized by hyperglycaemic condition. DM arises due to the deficiency of insulin secretion or resistance to insulin or both. This causes several metabolic irregularities including carbohydrate, fat and protein metabolism (Baynest, 2015) (Bhatia *et al*, 2019). If collective conditions persists for a long time the diabetic patient can attain the chronic state (Skyler, 2004). This chronic condition results in end organ damage and organ failure (Alam *et al.*, 2014).

According to the World Health Organization (WHO), the DM prevalence in 2017 was 425 million. By the year 2045, it is expected to reach 629 million. Over 120 million people were affected in Southeast Asia and western pacific (Glovaci, Fan and Wong, 2019). Particularly, the prevalence of DM in Sri Lanka was 9.8 % in 2021 (IDF 2021). Specifically in Jaffna district was 30.8 % (Prasan Rannan-Eliya *et al.*, 2023).

There are lots of allopathic medicines given to the treatment of DM. In additionally there are polyherbal medicines given to the diabetes mellitus patients in Siddha, Ayurvedic, Unani systems of Medicine. These polyherbal contains different types of phytochemicals, mainly alkaloids, flavonoids and saponins are responsible for the antidiabetic effect of the drug (Ardalani *et al*, 2021). In addition, these phytochemicals can act collectively to give a combined pharmacodynmics along with synergism (Suvarna *et al.*, 2021).

In Northern Province the siddha polyherbal formulations *Madhumeha chooranam, Neerizhivu chooranam* 1 and *Neerizhivu chooranam* 2 are used for the treatment of DM in the Siddha hospitals as powder formulations.

Madhumeha chooranam is made from totally four ingredients which are *erminalia chebula, Emblica officianalis, Murraya koenigii* and *Gymnemia sylvestre* (Pon.Ramanathan, 2000). While the *Neerizhivu chooranam* 1 is made of totally three ingredients which are *Terminalia chebula, Emblica officianalis* and *Murraya koenigii* (Narayanaswami V, 1995) *Neerizhivu chooranam* 2 is made of totally seven ingredients, that *are Terminalia chebula, Emblica officianalis, Murraya koenigii, Syzygium cumini, Tinospora cordifolia, Phylanthus amarus* and *Cyperus rotundus*.

**Corresponding author:* e-mail: Sivasinthujah@gmail.com

The physical, physicochemical analyses of drugs are crucial in determining powder properties, quality, drug stability during storage and to confirm their pharmacokinetic properties. Preliminary phytochemical analysis is needed to estimate the efficacy of the drug. Standardization of the drugs is very important to find its efficacy and safety for the patients under the therapy. Therefore, this study aimed to provide the knowledge on the quality of the antidiabetic polyherbal drugs *Madhumeha chooranam, Neerizhivu chooranam* 1 *and Neerizhivu chooranam* 2 as the quality of drugs has not been evaluated so far in Sri Lanka.

MATERIALS AND METHODS

Sample preparation

The plant ingredients used in this study were purchased in the siddha herbal shops, Jaffna. The collected materials were cleaned and powdered using grinding mill. The powdered ingredients were sieved with 45-mesh sieve plate, and they were stored in a moisture free dry place.

Preparation of in-house formulation

Madhumeha chooranam

Madhumeha chooranam was prepared as per the procedure mentioned in Siddha literature (Pon.Ramanathan, 2000). 50 g of each powdered ingredients of *Terminalia chebula, Emblica officianalis, Murraya koenigii* and 25 g of *Gymnemia sylvestre* were mixed in the ratio of 2:2:2:1 and stored in an airtight container (table 1).

Neerizhivu chooranam 1

Neerizhivu chooranam 1 was prepared as per the procedure mentioned in Siddha literature (Narayanaswami V, 1995). 50 g of each powdered ingredients of *Terminalia chebula, Emblica officianalis* and *Murraya koenigii* were mixed in the ratio of 1:1:1 and stored in an airtight container (table 2).

Neerizhivu chooranam 2

Neerizhivu chooranam 2 was prepared as per the procedure mentioned in Siddha literature (Narayanaswami V, 1995). 50 g of each powdered ingredients of *Terminalia chebula, Emblica officianalis and Murraya koenigii,* and each 25 g of powdered ingredients of *Syzygium cumini, Tinospora cordifolia, Phylanthus amarus* and *Cyperus rotundus* were mixed in the ratio of 2:2:2:1:1:1:1 and stored in an airtight container (table 3).

Preparation of methanolic extracts

A powdered drug of *Madhumeha chooranam* (30 g) was macerated with methanol for 24 hours at room temperature. The supernatant was decanted and filtered through Whatman No 1 filter paper (11µm) using a suction pump under reduced pressure. The solvent was removed using rotary evaporator under reduced pressure at 45 ℃. This procedure was repeated for *Neerizhivu chooranam* 1 and *Neerizhivu chooranam* 2.

Microscopic analysis

The powder granules shape and microscopical identification were observed under the microscope. The shapes of granules were pictured, and necessary other features were recorded.

Organoleptic properties analysis

Organoleptic properties of three formulations were evaluated according to the method as described in the Ayurvedic Pharmacopoeia of India (India, 2016).The organoleptic characters including taste, appearance, colour and odour were recorded.

Determination of Physical properties

Physical parameters of three formulations were analysed include angle of repose, bulk density and tapped density and Carr's Compressibility and Hausner's ratio were calculated according to the standardized methods mentioned in the World Health Organization (WHO) 1998 guidelines of quality control methods for herbal materials (WHO, 1998) and Ayurvedic Pharmacopoeia of India (India, 2016). Each test was carried out as triplicates for each sample and values obtained were expressed as mean ± standard deviation.

Determination of physicochemical properties

Physicochemical properties of three formulations such as pH, moisture content, total ash value, water soluble ash value, acid insoluble ash value, water soluble extractives and ethanol soluble extractives were tested according to standardized methods as described in WHO 1998 guidelines of quality control methods for herbal materials (WHO, 1998) and the Ayurvedic Pharmacopoeia of India (India, 2016) for each drugs. Each test was carried out as triplicates for each sample and values were expressed as mean ± standard deviation.

Phytochemical qualitative analysis

The methanolic extract of *Madhumeha choornam, Neerizhivu chooranam* 1 and *Neerizhivu chooranam* 2 were subjected to preliminary phytochemical screening as per the standard protocols mentioned by Manish Gupta *et* al (Gupta *et al.*, 2023) for each drugs. Observations for each test were carried out by visual inspections(Banu and Cathrine, 2015);(Shaikh and Patil, 2020).

DATA ANALYSIS

Each physicochemical test and physical characteristic were carried out in triplicated, and the mean value was calculated and presented as mean ± standard deviation. The statistical significance was evaluated by the analysis of variance (ANOVA) followed by Tukey's test by using a software, SPSS version 23. Differences between means

were considered significant if p-values lower than 0.05 ($p<0.05$).

Table 1: Composition of *Madhumeha chooranam*

Botanical name	Parts
Terminalia chebula	Pericarp
Embilica officianalis	Fruit
Murraya koenigii	Leaf
Gymnemia sylvestre	Leaf

Table 2: Composition of *Neerizhivu chooranam* 1

Botanical name	Parts
Terminalia chebula	Pericarp
Embilica officianalis	Fruit
Murraya koenigii	Leaf

Table 3: Composition of *Neerizhivu chooranam* 2

Botanical name	Parts
Terminalia chebula	Pericarp
Embilica officianalis	Fruit
Murraya koenigii	Leaf
Syzygium cumini	Seeds
Tinospora cordifolia	Leaf
Phylanthus amarus	Leaf and fruit
Cyprus rotundus	Tuberous root

RESULTS AND DISCUSSION

Please separate this section as per format of PJPS

The microscopic, organoleptic, physical, physicochemical and preliminary phytochemical property analysis were carried out for the three drugs *Madhumeha chooranam*, *Neerizhivu chooranam*1 and *Neerizhivu chooranam* 2. The microscopic observations are mentioned in fig. 1, 2 and 3 respectively. The results of organoleptic, physical, physicochemical and preliminary phytochemical properties are shown in table 4, table 5, table 6 and table 7 respectively.

The herbal materials can be evaluated via microscopes for their characteristics. These characteristics are useful here in order to assess the powder unique characteristics and to find the adulteration of the powders (Organization, 1998). The microscopic characteristic of the powders was shown in the fig. 1, 2 and 3. This microscopic evaluation indicated the appearance of Epidermis, Starch granules, Vessels and Parenchyma (Maurya *et al.*, 1923).

Organoleptic properties analysis

The organoleptic characters are commonly referred to as pharmacognostic characters. In this study all three drugs were seemed to be almost similar characters except the colour of *Neerizhivu chooranam* 2 (Table 4). All were fine powders with greenish brown to brown colours and all were astringent in taste and aromatic in odour.

Physical properties analysis

The physical properties of polyherbal drugs were tabulated in table 5. The results of physical properties indicated that *Madhumeha chooranam* showed high bulk density, tapped density, Carr's index and hausner's ratio while *Neerizhivu chooranam* 1 showed high angle of repose. The *Neerizhivu chooranam* 1 showed low values of bulk density, tapped density, Carr's index and hausner's ratio while *Madhumeha chooranam* showed the lowest value for angle of repose. The results of physical parameters such as Angle of repose (^{o}), Bulk density (g/mL) and Tapped density (g/mL) obtained from the study showed that there was a significant difference ($p > 0.05$) among polyherbal drugs as well as between each and other drugs. The results of physical parameters such as Carr's compressibility% and Hausner's ratio obtained from the study showed that there was no significant difference ($P > 0.05$) among polyherbal drugs as well as between each and other drugs.

The bulk and tapped densities are crucial factors which are influencing the final packing quality of the particles. It is an indirect indicator of porosity among the particles. If the bulk density is more, then the porosity is more. When the porosity becomes greater, surface area of the powder is more. Thus, increasing the solubility and dissolution rate. The density of the powder and the spatial arrangement of the powder particles influence bulk density. Tapped density influence the consolidation of powder. More consolidated powders are more resistant to flow (Umme Seema *et al.*, 2022). In the current study the tapped density and bulk density values were in the range from 0.466±0.005 (g/mL) to 0.552±0.007 (g/mL) and 0.419±0.003 (g/mL) to 0.487±0.005 (g/mL) (table 2) respectively. These results indicated that the powder formulations are under the less bulky category. A similar result was reported by Umme Seema *et al*, mention that the tapped density and bulk density values were in the range from 0.60 (g/mL) to 0.67 (g/mL) and 0.50 (g/mL) to 0.56 (g/mL) respectively (Umme Seema *et al.*, 2022).

The angle of repose reveals powder flow ability of the formulation because of its relationship with inter particle cohesion. The flow ability is important in transport and storage processes of drug production (Geldart *et al.*, 2006). If the angle of repose is, less than 30^{o} then it shows free flow property (Mahto *et al*, 2022) and at the same time if it is greater than or equal to 40^{o} then it shows poor flow property (Gupta *et al.*, 2022). In this study the angle repose of *Madhumeha chooranam*, *Neerizhivu chooranam* 1 and *Neerizhivu chooranam* 2 were 32.109^{o} ±0.887, 45.575^{o} ±0.423 and 39.613^{o} ±0.239 respectively. Therefore, *Madhumeha chooranam* showed good flow property than other drugs and at the same time *Neerizhivu chooranam* 1 showed the poor flow property than others.

Neerizhivu chooranam 2 exhibited passable flow property (Gupta *et al.*, 2022). Disha Prajapathi *et al* evaluated the angle of repose of powdered polyherbal tablet for polycystic ovarian syndrome. The value was obtained in the range of 34.2±0.163^{o} to 38.6±0.082^{o} (Prajapati *et al*., 2022) which was correlated with the current study findings.

Carr's index indicates the powder compressibility. Free flowing powders has less inter particle interactions thus they have less Carr's index value (Umme Seema *et al.*, 2022). The Carr's index value is greater or equal to 25% which indicates the poor flow ability and less or equal to 15% indicates the good flow property (Saraf and Ajazuddin, 2010). In this study, the values of Carr's index obtained in the range from 10.0% to 14.4% which indicated the good flow properties of all three polyherbal drugs. A study done on Carr's compressibility by *Disha Prajapati* for different formulations of the tablet for polycystic ovarian syndrome. The obtained values were in the range of 16.29±1.149 to 40.77±8.844 (Prajapati *et al*, 2022). These values deviated from the current study. It may be due to the different composition and different formulation patterns of the compounds.

The Hausner's ratio is in relation to inter particle friction. It also influences powder flow properties. The powders showing less than 1.25 values are having good flow properties. If the value is greater than 1.25 then it indicates poor flow (Saraf and Ajazuddin, 2010). In this study, the values obtained for *Madhumeha chooranam*, *Neerizhivu chooranam* 1 and *Neerizhivu chooranam* 2 were 1.132±0.0235, 1.112±0.0185 and 1.132±0.0115 respectively. These three formulations were showed less than 1.25. Therefore, all are formulations are under free flowing category (Saraf and Ajazuddin, 2010). A similar result was obtained for a polyherbal capsule which was 1.14±0.04 (Mahto *et al.*, 2022).

Physicochemical properties analysis

According to the table 6, *Madhumeha chooranam* showed higher values for ethanol and water soluble extractives. The *Neerizhivu chooranam* 1 showed high total ash and water soluble ash values. The *Neerizhivu chooranam* 2 exhibited high moisture content, pH and acid insoluble ash values. The *Madhumeha chooranam* showed low moisture content, pH, total ash, water soluble ash and acid insoluble ash values. While the *Neerizhivu chooranam* 1 showed low water and ethanol soluble extractives values. The results of physiochemical parameters such as moister content (%), and ethanol extractive value (%) obtained from the study showed that there was a significant difference ($P > 0.05$) among polyherbal drugs as well as between each and other drugs. The results of water-soluble ash obtained from the study showed that there was not a significant difference ($P > 0.05$) among polyherbal drugs as well as between each and other drugs.

The pH is a measure of alkalinity or acidity of powders. It is usually related to microbial contamination. The low pH in the range of 3-4 is more vulnerable (Anbarasi *et al*., 2018). The pH of the powder influences the absorption, distribution, metabolism, excretion and toxicity of drugs(Manallack *et al.*, 2013). The pH variation can lead to poor dissolution of the drugs thus leading to poor absorption(Chandrasekaran *et al.*, 2018). In the current study, the three formulations got the pH range corresponding to the acidic pH. For *Madhumeha chooranam* 3.493±0.015, for *Neerizhivu chooranam* 1, 3.55±0.02 and for *Neerizhivu chooranam* 2, 3.73±0.066 values were obtained. The reason behind the acidic pH value might be the presence of Ascorbic acid. In another study, where Hinguwastak churna was evaluated by Gathika, the pH was found to be in the range 4.92 to 5.09 (Dassanayaka *et al*., 2024).

The moisture content in a drug product might get evaluated as the presence of water molecules (Monika *et al*. 2020), can encourage the microorganism's growth(Organization, 1998). Low moisture content is desirable to store the drug for a long period (Viljoen *et al.*, 2014). This study indicated that the moisture content varied from 10.093±0.083% to 11.933±0.306%. Loss on drying is used as a measure of moisture content and volatile matter in sample (Aziz *et al.*, 2019). The moisture content must lie within 10 % of the weight(Anbarasi, *et al*., 2018). In the current study moisture contents were found to be 11.46±0.14% for *Madhumeha chooranam*, 10.44±0.05% for *Neerizhivu chooranam* 1 and 12.8±0.82% for *Neerizhivu chooranam* 2. Here the values were close to 10%. A similar study on the standardization of *Safoof-E-Sana* by Ajazuddin *et al* where the moisture content was found to be 8.25±0.582 %. They mentioned that the acceptable range of moisture content was 5 to 8 % in which the formulation can be kept for a particular long period without any microbial attack (Saraf and Ajazuddin, 2010).

The ash is mainly categorized as physiological ash which is the ignited plant tissue and non-physiological which contains residual extraneous matters such as sand or soil. The acid insoluble ash can be used to determine the silica content as sand and siliceous earth matters of the drug powder(Organization, 1998). Water-soluble ash is the water-soluble element of total ash. A high ash values indicates contamination, substitution, adulteration or carelessness in preparing the poly herbal drugs (Abdullahi Abdu *et al.*, 2015) (Patil *et al*., 2022). In the current study, the total ash value of *Madhumega chooranam* was 4.983±0.333 %, *Neerizhivu chooranam* 1 was 5.583±0.144 % and *Neerizhivu chooranam* 2 was 5.083±0.289 %. These values were found to be reasonably low indicating the low contamination. In the current study acid insoluble ash value of *Madhumega chooranam* was 0.283±0.029 %, *Neerizhivu chooranam* 1 was 0.317±0.029% and *Neerizhivu chooranam* 2 was 0.500±0.050 %.

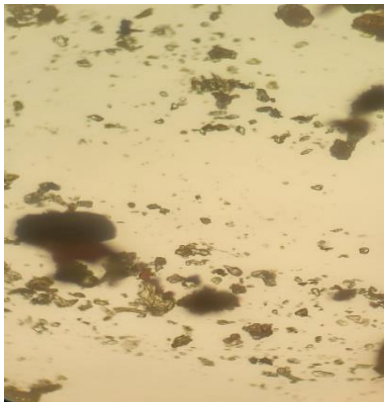

Fig. 1: *Neerizhivu chooranam* 2

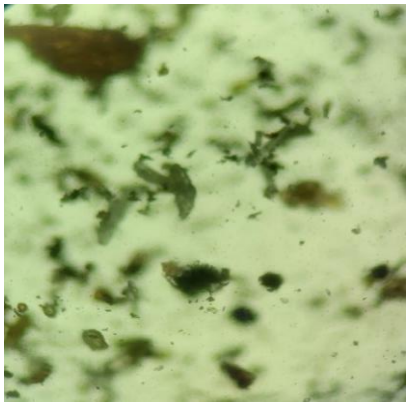

Fig. 2: *Neerizhivu chooranam* 1

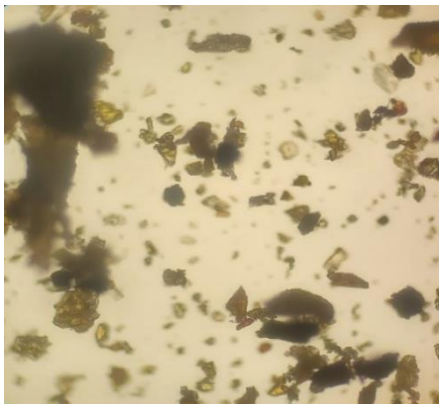

Fig. 3: *Madhumeha chooranam*

Table 4: *Organoleptic properties*

Properties	*Madhumeha chooranam*	*Neerizhivu chooranam* 1	*Neerizhivu chooranam* 2
Colour	Greenish brown fine powder	Greenish brown fine powder	Brown fine powder
Taste	Astringent taste	Astringent taste	Astringent taste
Odour	Aromatic odour	Aromatic odour	Aromatic odour
Appearance	Fine powder	Fine powder	Fine powder

Table 5: *Physical properties*

Properties	*Madhumeha chooranam* Mean±SD	*Neerizhivu chooranam* 1 Mean±SD	*Neerizhivu chooranam* 2 Mean±SD
Angle of repose (°)	32.109±0.887^{c}	45.575±0.423^{a}	39.613±0.239^{b}
Bulk density (g/mL)	0.487±0.005^{a}	0.419±0.003^{c}	0.460±0.004^{b}
Tapped density (g/mL)	0.552±0.008^{a}	0.466±0.005^{c}	0.521±000^{b}
Carr's compressibility (%)	0.144±0.051^{a}	0.100±0.015^{a}	0.116±0.009^{a}
Hausner's ratio	1.132±0.024^{a}	1.112±0.019^{a}	1.132±0.012^{a}

Values are represented as mean±SD; values with different superscripts in the same row differ significantly (P<0.05).

Table 6: *Physicochemical properties*

Property	*Madhumeha chooranam* Mean±SE	*Neerizhivu chooranam* 1 Mean±SE	*Neerizhivu chooranam* 2 Mean±SE
Moisture content %	10.093±0.083^{a}	10.447±0.058^{c}	11.933±0.306^{b}
pH	3.493±0.015^{b}	3.550±0.020^{b}	3.733±0.067^{a}
Total ash %	4.983±0.333^{b}	5.583±0.144^{a}	5.083±0.289^{b}
Water soluble ash %	2.300±0.260^{a}	2.650±0.328^{a}	2.433±0.289^{a}
Acid insoluble ash%	0.283±0.029^{b}	0.317±0.029^{b}	0.500±0.0500^{a}
Ethanol soluble extractives %	19.360±0.684^{a}	5.973±1.921^{c}	11.653±1.000^{b}
Water soluble extractives %	34.747±0.333^{a}	20.400±0.812^{b}	20.827±0.987^{b}

Values are represented as mean±SD; values with different superscripts in the same row differ significantly (P<0.05).

These values were within standard limits according to the previously done quality control values for powdered formulations (Gopala Simha *et al.*, 2008). The water-soluble ash values of prepared *Madhumega chooranam* was 2.300±0.259%, *Neerizhivu chooranam* 1 was 2.65± 0.328% and *Neerizhivu chooranam* 2 was 2.433 ±0.289%. In another study done by Maithani Jyoti to a polyherbal formulation that contains *Syzgium cumini, Mangifera indica, Ficus bengalensis, Lawsonia inermis, Juglans nigra, Terminalia bellirica,* and *Hibiscusrosa sinensis*, which determined the water-soluble ash, value percentage for a polyherbal formulation the value was found to be 2.9% (Jyoti *et al.*, 2012).

The extractives values can be useful for materials without any specific assays for finding its constituents to find out which solvent can extract the maximum constituents (Organization, 1998). In addition, the nature of the chemical ingredients contained in crude medicine is indicated by the extractive value (Nimmi and George, 2012).

Table 7: *Preliminary phytochemical analysis*

Phytochemical	Methods/Tests	*Madhumega chooranam*	*Neerizhivu chooranam* 2	*Neerizhivu chooranam* 1
Alkaloids	Mayer's	+	+	+
	Wagner's	+	+	+
Flavanoids	Alkaline reagent	+	+	+
	Lead acetate	+	+	+
	Ferric chloride	+	+	+
Saponins	Foam	-	-	-
Carbohydrates	Molish	+	+	+
	Benedict's	+	+	+
Reducing sugar	Fehling's	+	+	+
Tannins	Braymer's	+	+	+
	Lead acetate	+	+	+
Steroids	Libermann burchard	+	+	+
	Salkowski	+	+	+
Proteins	Millon	+	+	+
	Biuret	+	+	+
Amino Acids	Ninhydrin	+	+	+
Glycoside	Keller killiani	+	+	+
Phenol	$FeCl_3$	+	+	+
	Phenol iodine test	+	+	+
Terpenoids	Copper acetate	+	+	+
Anthraquinone	Borntrager's	+	+	+

Less extractive value indicates addition of exhausted material, adulteration or incorrect processing during drying or storage or formulating. In this study, Ethanol soluble extractive value of *Madhumega chooranam* was 19.360±0.684 %, *Neerizhivu chooranam* 1 was 5.973±1.921 % and *Neerizhivu chooranam* 2 was 11.653±1.000 %.

All formulations were within the limit in accordance with previous studies (Gupta *et al.*, 2022). A similar ethanol soluble extractive value for a gastro retentive polyherbal formulation was found to be 7.537±0.059 % to 26.513±0.078 % (Gupta *et al.*, 2022). Water-soluble extractive value of *Madhumega chooranam* was 34.747±0.333%, *Neerizhivu chooranam* 1 was 20.400±0.812 % and *Neerizhivu chooranam* 2 was 20.827±0.987 %. In another study the water soluble extractive values for *Madhumehari (Baidyanath), Madhuhari (Shivayu), Madhushoonya (Meghdoot)* were found to be 15.43%, 18.66%, 15.3% respectively (Chandel *et al*., 2011). This study results greatly correlates with the results of the current study.

Preliminary phytochemical properties analysis

The results of preliminary phytochemical screening were tabulated in table 7. Preliminary qualitative phytochemical tests of methanolic extracts revealed the presence of various bioactive substances, which might be responsible for medical activities. As per the table 7, all three drugs showed the presence of alkaloids, flavonoids, carbohydrates, reducing sugars, tannins, steroids, proteins, amino acids, glycosides, phenol, terpenoids and anthraquinones. The saponins were absent. In a similar study done by Arunika Subba to a polyherbal formulation showed the presence of phytosterol, triperpenoids, cardiac glycosides, flavonoids, reducing sugar, resin, and amino acids (Subba and Mandal, 2019). The variations results may have occurred due to the differed quality of raw materials used and the varied method of in-house formulation. In addition, the phytochemical constituents of raw materials may be varied due to geographical location of their occurrence and growth(Dassanayaka *et al*., 2024). Therefore, the researchers cannot have standard amount of active ingredients or phytoconstituents from raw materials and there are no standard parameters for *Madhumega chooranam, Neerizhivu chooranam 1* and *Neerizhivu chooranam 2* to maintain standard minimum levels of phytoconstituents.

CONCLUSION

In this study, there was a significant difference in the physical and physiochemical properties of the powders from all three medicines. Most of the parameters of the physical and physiochemical tested polyherbals; *Madhumega chooranam*, *Neerizhivu chooranam* 1 and *Neerizhivu chooranam* 2 had roughly similar values with previous studies. These tests results can be used for setting

standards for the drugs *Madhumeha chooranam*, *Neerizhivu chooranam* 1 and *Neerizhivu chooranam* 2 as there were no studies done on evaluation of physical, physiochemical and photochemical screening.

ACKNOWLEDGMENTS

The authors acknowledge University of Jaffna to have given the support to complete the experimental work and for financial assistance (URG/2022/NSMRG/01).

REFERENCES

Abdullahi Abdu B, Adamu U, Sani SM and Joshua OO (2015). Physical And Phytochemicals Study Of Some Local Herbal Remedies. *J. Pharm. Biol. Sci.*, **10**(4):5-10.

Alam U, Asghar O, Azmi S and Malik RA (2014). General aspects of diabetes mellitus. *Handbook of Clinical Neurology*, **126**: 211-222.

Anbarasi C, Thanikachalam S and Sathiyarajeswaran P (2018). Phytochemical screening and pharmacognostic evaluation of the Siddha poly herbal formulation Madhumega chooranam. *J. Pharmacogn. Phytochem.*, **7**(5):1701-1706.

Ardalani H, Hejazi Amiri F, Hadipanah A Kenneth T and Kongstad KT (2021). Potential antidiabetic phytochemicals in plant roots: a review of in vivo studies. *J. Diabetes. Metab. Disord.*, **20**: 1837-1854.

Subba A and Mandal P (2019). The standardization of a traditional polyherbal formulation with pharmacognostic study; its phytochemical content, antioxidant, and antidiabetic activity. *Asian Journal of Pharmaceutical and Clinical Research*, **12**(5): 182-190.

Aziz N, Wal P, Wal A and Saxena MS (2019). Evaluation of a polyherbal powder for treatment of diabetes mellitus. *Indian J. Pharm. Sci.*, **81**(6):1070-1077.

Banu KS. and Cathrine L (2015). General Techniques Involved in Phytochemical Analysis. *International Journal of Advanced Research in Chemical Science.*, **2**(4):25-32.

Baynest HW (2015). 'Classification, Pathophysiology, Diagnosis and Management of Diabetes Mellitus', *Diabetes. Metab. J.*, **06**(05):1-10.

Bhatia A, Singh B, Arora R Saroj A (2019). In vitro evaluation of the α-glucosidase inhibitory potential of methanolic extracts of traditionally used antidiabetic plants. *BMC Complement. Altern. Med.* **19**: 74.

Chandel HS, Pathak AK and Tailang M (2011). Standardization of some herbal antidiabetic drugs in polyherbal formulation. *Phacog. Res.*, **3**(1):49-56.

Chandrasekaran B, Abed SN, Al-Attraqchi O, Kuche K and Tekade RK (2018). *Computer-Aided Prediction of Pharmacokinetic (ADMET) Properties, Dosage Form Design Parameters*. Elsevier Inc.pp 732-748.

Dassanayaka GG, Srikokulan S and Christy Jeyaseelan T (2024). Physicochemical and preliminary phytochemical analysis of different brands of Hingwashtak churna; a polyherbal medicine in Sri Lanka. *Int. J. Ayurvedic. Med.*, **14**(4):1082-1086.

Geldart D, Abdullah EC, Hassanpour A, Nwoke LC and Wouters I (2006). Characterization of powder flowability using measurement of angle of repose. *China Particuology.*, 4(3-4):104-107.

Glovaci D, Fan W and Wong ND. (2019) 'Epidemiology of Diabetes Mellitus and Cardiovascular Disease', *Curr. Cardiol. Rep.*, **21**(21): pp. 1-8.

Gopala Simha KR. Laxminarayana V Prasad SVLN and Khanum S (2008).Standardisation of Yogaraja guggulu - An ayurvedic polyherbal formulation. *Indian J. Tradit. Knowl.*, 7(3):389-396.

Gupta, M, Sumaiya S, Ali S, Naved T, Sharma A, Ahmad A, Sikander M and Sarwat M (2023). Pharmacognostical and Phytochemical Evaluation of a Unani Polyherbal Formulation: Dawa ul Kurkum by HPTLC. *Separations.*, **10**(2):1-11.

Gupta MK, Khade MA, Srivastava B, Hyam SR and Gurav PB (2022). Development of a Gastroretentive Polyherbal Formulation and its Standardization. *Pharcog. Res.*, **14**(4): 379-390.

India, G.O. (2016) *The Ayurvedic Pharmacopoeia of India*. Ministry of Health and Family Welfare Department of Ayush.

Jyoti M, Kshitij A, Vivek S and Prem S (2012). Preparation and Standardization of A Polyherbal Formulation. *J. Adv. Scient. Res.* **3**(2):84-85.

Mahto B K, Patel R, Bapna R and Shukla A K (2022). Development and Standardization of a Poly Herbal Formulation. T*he Scientific. Temper.* **13**(2):118-125.

Manallack DT, Prankerd RJ, Yuriev E, Oprea TI and Chalmers DK (2013). The significance of acid/base properties in drug discovery. *Chem. Soc. Rev.*, **42**(2):485-496.

Maurya N, Vishwakarma R, Bhanap K, Shah S and Patil S (1923). Preparation and quality evaluation of hingwashtak churna: A polyherbal formulation. *J. Pharmacogn. Phytochem.*, **9**(3):1923-1927.

Monika T, Ilavarasi L, Abinaya T, Saravanadevi M D, Karolin Daisy Rani R and Meenakumari R (2020). Standardization of A Classical Siddha poly Herbal formulation "Nannari Mathirai" through organoleptic character. *Physiochem. Phytochem. Anal. Eur. J. Pharm. Med. Res*, **7**: Pp??

Umme Seema N, Jagadeesh SL, Chandrashekhar VM, Sateesha SB, Suresh GJ, Ugalat J and Maruthi Prasad BN (2022). Development and evaluation of the physical properties of polyherbal formulations for antiobesity. *J. Pharm. Innov.* **11**(11):1409-1412.

Narayanaswami V (1995). *Pharmacopoeia of hospital indian medicine*. Madras : Tamil Nadu medical board Madras.Pp??

Nimmi OS. and George P (2012). Preliminary Phytochemical investigation and physicochemical analysis of Polyherbal formulation for antiobesity. *J.*

Pharm. Res., **5**(3):1528-1536.

Organization WH (1998). 'Quality control methods for herbal materials'. Geneva PP - Geneva: World Health Organization. Available at: https://apps.who.int/iris/handle/10665/44479.

Patil SC, Baghel AS, Kamble SB, Rudrappa HC, Shukla VJ and Mehta MD (2022). Pharmacognostical and physicochemical profile of Abhayadi Gutika: An polyherbal formulation. *Journal of Indian System of Medicine*., **10**(4): 221-227

Pon.Ramanathan (2000) *Siddha Pharmacopoeia*. Jaffna: All Srilanka Government service Siddha Ayurvedic Medical Officers Association.

Prajapati D, Patel M and Dharamsi A (2022). Development and Evaluation of a Polyherbal Tablet for Polycystic Ovarian Syndrome (PCOS). *J. nat. remedies.*, **22**(2):161.

Prasan Rannan-Eliya R, Wijemunige N, Perera P, Kapuge Y, Gunawardana N, Sigera C, Jayatissa R, Herath HMM, Gamage A, Weerawardena N, Sivagnanam I, Dalpatadu S, Samarage S, Samarakoon U, Samaranayake N, Pullenayegam C, Perera B and Dissanayake V (2023). Prevalence of diabetes and pre-diabetes in Sri Lanka: a new global hotspot-estimates from the Sri Lanka Health and Ageing Survey 2018/2019. *BMJ Open, Diab, Res, Care.*,**11**:e003160.

Saraf S and Ajazuddin (2010). Evaluation of physicochemical and phytochemical properties of Safoof-E-Sana, a Unani polyherbal formulation. *Phcog. Res.*, **2**(5):318.

Shaikh JR and Patil M (2020). Qualitative tests for preliminary phytochemical screening: An overview. *Int. J. Chem. Stud.*, **8**(2):603-608.

Skyler JS (2004). Diabetes mellitus: Pathogenesis and treatment strategies. *J. Med. Chem.*, **47**(17): 4113-4117.

Suvarna R, Shenoy RP, Hadapad BS and Nayak AV (2021). Effectiveness of polyherbal formulations for the treatment of type 2 Diabetes mellitus - A systematic review and meta-analysis., *J. Ayurveda. Integr. Med.*, **12**(1):213-222.

Viljoen JM, Steenekamp JH, Marais AF and Kotze AF (2014). Effect of moisture content, temperature and exposure time on the physical stability of chitosan powder and tablets. *Drug. Dev. Ind. Pharm.*, **40**(6):730-742.

WHO (2019) 'Status, determinants and interventions on cardiovascular disease & diabetes in Sri Lanka: desk review of research 2000-2018', (October), pp. 1-287.

FDA (2021), available at https://idf.org/our-network/regions-and-members/south-east-asia/members/sri-lanka/