Herbal plants for children diseases' cure in Perambalur, Tamil Nadu, India

Ganesan Balamurugan, Arumugam Karthick & Karuppiah Sasikumar*,+

PG and Research Department of Botany, Periyar E.V.R College (A), Tiruchirappalli, India

E-mail: +sasikumarkeerthana@gmail.com

The present study aims at identification and documentation of the medicinal plants which are traditionally used to manage children diseases in Perambalur district of Tamil Nadu, India. Semi-structured interviews were used to collect ethnomedicinal plants during the month of December 2017 and January 2018. Data was statistically analysed using Use value (UV), relative frequency of citations (RFC), utility ratio (UR), relative information (RI) and informant agreement ratio (IAR). Forty three medicinal plants which were identified and documented belong to 30 families. Most of the species belong to Solanaceae and Leguminosae families. Most frequently used plant part and life form are leaves and herbs. Decoction method was used for delivering the oral dose and oral intake was the major route used for administration. *Ocimum basilicum* had highest UV, RFC, UR, RI and IAR. Maximum plant species were able to cure gastrointestinal diseases followed by fever, liver disorders, respiratory disorders, dermatological problem, ENT problems, etc. The results of this study revealed that Perambalur district has rich plant diversity and people have broad indigenous knowledge of role in curing children diseases. Hence, further phytochemical, pharmacological and toxicological investigation on floras that scored highest RFC and UV values is necessary for discovering new drugs.

Keywords: Child disease, Ethnobotanical survey, Medicinal plants, Perambalur district, Tamil Nadu

IPC Code: Int. Cl.[19]:A61K 39/135, G01C 15/00, A61K 36/00

Children are more prone to viral, bacterial and fungal infections due to low immune system. Respiratory disorders, liver, urinary, kidney disorders, gastrointestinal problems, dental related anomalies, ear nose throat (ENT) diseases and eye infection are some of the common diseases that occur in children across the world. Diarrhea and malnutrition are epidemic among children in Asia, South America and African continents. In 2005, the United Nations (UN) has reported that about 2.35 million (M) children died in India, which is equivalent to 20% of the world's under-five deaths, more so than any other country (http://esa.un.org/peps/peps_interpolated-data.htm; http://www.childinfo.org/mortality.html). Five main causes which accounted for 62% of all children deaths in India are pneumonia, diarrhea, premature birth & low birth weight, infections of the neonate & birth asphyxia and birth trauma. Hence, there is a need to decrease infant and child morbidity and mortality in India.

Various categories of human diseases are treated using medicines from plants which are major sources of medicines. Historically all medicines were derived from plants, as plant parts or crude extracts, mixtures, etc. Herbal medicines harbour valuable antimicrobial plant compounds and are potential source for the anti-diarrheal drugs/medicines which has been well documented[1]. As per a WHO report, around 4 billion people have trust in the therapeutic properties of herbal medicine and use them regularly in developing countries[2]. In the developing countries, the use of herbal plants is widely known among the local people in rural areas whereas in developed countries plants and their derivatives contribute to 25% of the medical drugs. Plants serve as the source for the development of a sizeable number of drugs which are active against number of diseases[3] by the isolation of the active ingredient and its subsequent modification.

Interestingly, Perambalur district of Tamil Nadu has floristic biodiversity and secular knowledge on healing properties of plants. To date, biochemical composition has been systematically studied for only less than 10% of the plants. Therefore, there is a need to explore this district to document plant species, traditional recipes, including preparation methods, dose and mode of ingestion used for the treatment and prevention of various health problems related to children diseases using a quantitative approach. This study is the first kind of report on children diseases

—————

*Corresponding author

from India to perform statistical analysis of data using quantitative ethnobotanical indexes.

Material and methods

Description of the Study Area

Perambalur district is situated $10^\circ54'$North and $11^\circ30'$North and between $78^\circ40'$East and $79^\circ30'$East at an elevation of 88 mamsl. The district has total area of 1,752 km². In 2011, the population was 5,65,223 and sex-ratio was 1003:1000 (female to males ratio). The death rate at 7.7 as compared to that of the birth rate which was at 21.6 The population density was 281 persons/km². The literacy rate was 65.88%. Ariyalur (east), Cuddalore district (north), Tiruchirappalli district (south), Namakkaland Tiruchirappalli districts (west) surrounds this district (Fig.1). The most predominant soils types are red loamy and black soil. It has a semi-arid climate with an average rain fall of 908 mm. Around 68% of irrigated area is contributed by tube wells and wells. Paddy, groundnut, sugarcane and millets are the major crops grown in this district.

Field visits

The current study was carried out from December 2017 to January 2018. A total of 56 (45 females, 11 males) informants were interviewed from Perambalur district of Tamil Nadu. Information about the plants possessing medicinal properties against various children diseases were collected from the traditional

medicine men through discussions and interviews. Data on medicinal activity of plants were collected according to Jain and Rao (2014)[4]. Interviews were performed in the local language (Tamil). Focus of the questionnaire was on the traditional believes and ethnobotanical claims of the people. In this present study, medicinal plant species reported in vernacular or local names by the local informants were collected from the fields, identified (scientific name) and photographed. Voucher specimens for herbarium preparation were collected.

Plant identification

Herbal plants mentioned in this study were known by their vernacular names and by the aid of floras[5,6] and specimens existing at the Rapinat Herbarium, St. Joseph's College, Tiruchirappalli, Tamil Nadu, India. The name and family of the plants were further validated with The International Plant Name Index (IPNI). Habitat ecology of plants was verified with the available Indian literatures on medicinal plants[6]. The method of Jain and Rao (2014)[4] was followed for herbarium preparation. The voucher specimens of each plant were deposited for future reference in the herbarium of Department of Botany, St. Joseph's College, Tiruchirappalli, Tamil Nadu, India.

Ailment Categories

Based upon the facts collected, the ailments were characterized into 11 categories which include treating respiratory problems, gastrointestinal disorder, eye related diseases, dermatological problems, ENT diseases, liver disorders, fever and circulatory diseases, urinary problems, kidney problems and dental problems.

Data analysis

The plant species were listed alphabetically along with their botanical name, vernacular name, family, habit, plant part (s) used, route of administration, mode of preparation and disease treated. To determine the relative important of the plant species in the study area the data was further analysed through 04 different quantitative indices like RFC, IAR, RI and UV.

Use value (UV)

The relative importance of plants known locally can be studied from the UV which is calculated using the formula[7]

$$UV= \Sigma\ Ui/\ N$$

Where,

Ui = number of uses mentioned by each informant for a given species and

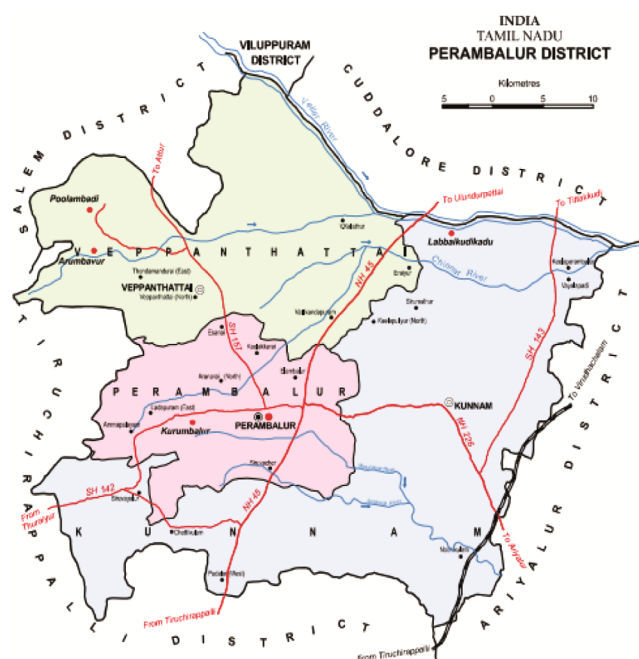

Fig. 1 — Map of Perambalur district

N = total number of informants

Relative Frequency Citation (RFC)

RFC is calculated by

$$RFC_S = \frac{FCs}{N} = \frac{\sum_{i-i1}^{iN} URi}{N}$$

RFC is obtained by dividing the number of informants mentioning a useful species (FC or frequency of citation), by the total number of informants in the survey (N). RFC value varies from 0 (plant without any use) to 1 (when all the informants mentioning it as useful)[8].

Relative Importance (RI)

The RI of different plant species is calculated as follows[9]:

RI = PP + AC

Where

PP = the number of reported specific ailments attributed to a species divided by the maximum number of properties attributed to the most resourceful species

AC = the number of ailment categories treated by a given species divided by the maximum number of ailment categories treated by the most resourceful species

The highest possible value for RI is 2, which signifies the most versatile species with the maximum number of medicinal properties[10].

Informant Agreement Ratio (IAR)

IAR for each species helps in estimating the importance of the individual species[11] which is calculated by the formula:

IAR = n_r-n_a/(n_{r-1})

Where,

n_r is the total number of citations registered for species

n_a is the number of illness categories that are treated with this species

These values range between zero (when the number of illness categories equals the number of citations) and one (whereby all the participants agree upon the exclusive use of the species for the particular illness)[12].

Results

Demographic data of informants

A total of 56 interviews (45 females and 11 males) were carried out for this study for children diseases in Perambalur district. The informants were separated into 5 different age groups starting from 20 years to more than 66 years. In the study area, informants mostly belong to females (age 56-60 years) as information are widely restricted to women with respect to children disorders. 39.75% of the informants were illiterate (Table 1).

Family importance value (FIV) and most used families

We have documented the use of 43 species related to 37 genera and 26 families which are widely exploited by local people (Table 2). Members of Leguminosae and Solanaceae (4 species each) form the maximum number of plant species succeeded by Apiaceae, Poaceae and Cucurbitaceae families (each 3 species), Meliaceae, Rutaceae, Myrtaceae, Lythraceae, and Piperaceae (each 2 species) and the left out 17 families were represented by single species each (Fig. 2).

Life form of plants used

Among 43 species recorded, Herbaceous plants (37%) were the dominant and the main source of traditional medicine followed by shrubs (28%), trees (26%), grasses (5%), climbing herb and shrub (2% each) in Perambalur district, respectively (Fig. 3).

Table 1 — Demographic characteristics of informants N=56 (Perambalur district)

Age	No. of informants	% of informants
20-35	5	8.92%
36-45	6	10.71%
46-55	8	14.28%
56-65	26	46.42%
66-above	11	19.64%
Gender		
Men	11	19.64%
Women	45	80.35%
Educational background		
Illiteracy Rate	23	41.07%
Completed 5 years	10	17.84%
Completed 8 years	9	16.07%
Completed 10 years	5	8.92%
Completed 12 years	6	10.71%
Graduate (Higher education's)	3	5.35%
Experience		
<5 years	4	7.14%
8-10 years	11	19.64%
11-19 years	15	26.78%
20 years above	26	46.42%
Occupation		
Agricultural	31	55.35%
Self employed	9	16.07%
Homemade practioners	11	19.64%
Clinical practioners	5	8.92%

Table 2 — Medicinal plants of district Perambalur used by local inhabitants for children diseases

S. No	Botanical name	Family	Practioners and vernacular name	Habit	Parts used	Preparation	Administration	Quantity	Ailment code with disease treated	UR/FC	RFC	USE VALUE	RI	IAR
1	*Acacia nilotica* (L) Delile	Leguminosae	Karuvelam	Tree	Flower	Oil in ear	Ear drop	2 drops	(PAIN) Ear pain-5	5/15	0.267	0.089	0.45	1.000
2	*Allium cepa* L.	Liliaceae	Vengayam	Herb	Bulb	Cooking oil	Topical ear drop / Eye drop	2-3 drops / 2drops	(PAIN) Ear ache-9 / (OCC) Eye infection-8	17/28	0.5	0.303	0.9	0.937
3	*Allium sativum* L.	Alliaceae	Poondu	Herb	Bulb	Heated with mustard oil / Decoction	Oral / Ear drop / Topical/ Oral	3 spoon / 2drops / 5mL	(RESP) Cough-8 / (PAIN) Ear ache-5 / (RESP) Cold-8	21/32	0.571	0.375	1.1	0.9
4	*Azadirachta indica* A.Juss.	Meliaceae	Vembu	Tree	Bark / Bark / Bark / Leaves	Decoction / Decoction / Decoction / Raw form	Oral / Topical / Oral / Topical	2 drops / Olive Oil + Decoction / Decoction 50 mL / Wrapped	(PAIN) Ear ache-19 / (SKIN) Scabies-26 / (GIA) To kill intestinal worms-31 / (WOUND) Wounds nasal infection-10	86/54	0.964	1.535	1.8	0.964
5	*Bambusa vugaris* L. Schard	Poaceae	Moongil	Shrub	Leaves	Decoction	Baby bath	Bath every morning	(SKIN) Skin rashes-9	9/19	0.339	0.160	0.45	1.000
6	*Bidens pilosa* Linn.	Astreaceae	Mookuthy	Herb	Leaves	Infusion	Oral	10mL	(HEM) Jaundice-8 / (MAL) Malaria-6 / (FEV) Typhoid-8	22/32	0.571	0.392	1.35	0.904
7	*Boerhavia diffusa* L.	Nyctaginaceae	Mookkirattai	Herb	Root peel	Decoction	Oral	Roots a necklace	(HEM) Hepatitis-13	13/23	0.410	0.232	0.45	1.000
8	*Bryophyllum pinnatm* (L.) Oken.	Crassulaceae	Kattipottalkuttypodum	Shrub	Leaves	Decoction	External soap	Bath every morning	(HEM) Measles-15	15/29	0.517	0.267	0.45	1.000
9	*Cajanus cajan* (L.) Millsp	Leguminosae	Thuvarai	Shrub	Leaves	Decoction	Baby bath	Use for baby bath	(SKIN) Skin rashes-9	9/16	0.285	0.160	0.45	1.000
10	*Calotropis procera* (Aiton) W.T. Ailton	Apocynaceae	Erukku	Shrub	Latex / Leaves	Decoction	Oral	5mL	(HEM) Jaundice-11	11/19	0.339	0.196	0.45	1.000
11	*Cassia fistula* L.	Leguminosae	Sarakkondrai	Tree	Fruit / Flower	Raw form / Juice / Powder	Oral / Oral / Oral	Small amount / 1 spoon milk Powder with water	(GAST) Abdominal pain-11 / (GAST) Constipation-15 / (RESP) Diphtheria-19	62/53	0.946	1.107	1.55	0.950
12	*Citrullus colocynthis* (L.) Schard	Cucurbitaceae	Peikumatty	Herb	Fruit / Fruit / Fruit	Decoction / Powder / Powder	Oral / Oral / Oral	2spoon / 2spoon paste of fruit powder / Paste of powder	(HEM) Hepatitis-17 / (GAST) Dysentery-16 / (GAST) Constipation-12 / (GIA)To kill intestinal worms-17 / (ED) Diabetes-12	57/49	0.875	1.017	1.55	0.946
13	*Citrus aurandifolia* (Yu. Tanaka)	Rutaceae	Narthampalam	Tree	Seed / Fruit	Raw form / Juice with Honey	Oral / Oral	1-2 seed / 5mL	(RESP) Cold-20	20/35	0.625	0.357	0.45	1.000
14	*Citrus limon* (L.) Osbeck	Rutaceae	Elumitchai	Shrub	Fruit	Juice	Oral / Oral / Oral	3spoon+ water / 5spoon / 3spoon	(GUA) Kidney stone-16 / (GAST) Vomiting-11 / (GUA) Urine problem-12	39/28	0.5	0.696	1.1	0.947

(Contd.)

Table 2 — Medicinal plants of district Perambalur used by local inhabitants for children diseases — (Contd.)

S. No	Botanical name	Family	Practioners and vernacular name	Habit	Parts used	Preparation	Administration	Quantity	Ailment code with disease treated	UR/FC	RFC	USE VALUE	RI	IAR
15	*Coriandrum sativum* L.	Apiaceae	Kothumalli	Herb	Leaves	Infusion raw	Oral	2-5spoon	(GAST) Dysentery-10	31/42	0.75	0.553	1.1	0.933
					Seed	Cooked	Oral	Leaf juice	(OCC) Eye infection-9					
16	*Cucumis melo* L.	Cucurbitaceae	Thumattikkai	Herb	Peel fruit	Paste Powder	Oral Oral	Small amount Powder with honey	(GAST) Vomiting-12 (GAST) Constipation-15	28/38	0.678	0.5	0.9	0.962
					Fruit	Raw form	Oral	Taken orally	(GUA) Kidney stone-13					
17	*Curcuma longa* Linn.	Zingiberaceae	Manjal	Herb	Rhizome	Decoction	Oral	Half teaspoon	(FEV) Typhoid-15	15/21	0.375	0.267	0.45	1.000
18	*Cymbopogon schoenanthus* Spreng.	Poaceae	Elumitchaipul	Grass	Leaves	Decoction	Oral	Little quantity	(FEV) Fever-21	21/32	0.571	0.375	0.45	1.000
19	*Eucalyptus saligna* Smith.	Myrtaceae	Thailamaram	Tree	Leaves	Decoction	Oral	15mL	(FEV) Typhoid-11 (HEM) Jaundice-8	19/29	0.517	0.339	0.9	1.000
20	*Ficus religiosa* L.	Moraceae	Arasamaram	Tree	Leaves	Ash	Oral	15g	(GAST) Vomiting-8	8/15	0.267	0.142	0.45	1.000
21	*Foeniculum vulgare* Mill.	Apiaceae	Peruncheeragam	Herb	Fruit	Decoction	Oral	Half cup	(GUA) Urinary disorders-52 18	52/43	0.767	0.928	1.1	0.960
					Fruit	Decoction	Oral	10mL	(GAST) Dysentery-16					
					Fruit	Powder	Oral	10g powder with milk	(GAST) Indigestion-18					
22	*Jasminum officinale* L.	Oleaceae	Malligai poo	Shrub	Leaves	Decoction	Oral	3spoon	(DENT) Tooth ache-16	16/25	0.446	0.285	0.45	1.000
23	*Lawsonia inermis* L.	Lythraceae	Maruthani	Shrub	Leaves	Infusion	Oral	Half teaspoon	(GAST) Diarrhea-12	12/24	0.428	0.214	0.45	1.000
24	*Manihot esculenta* Crantz	Euphorbiaceae	Marvallikilanku	Shrub	Leaves	Juice	Oral	15mL	(PAIN) Stomach ache-14	14/31	0.553	0.25	0.45	1.000
25	*Melia azedirachta* L.	Meliaceae	Malaivembu	Tree	Leaves	Decoction	Oral	15mL	(ED) Diabetes-25	25/33	0.589	0.446	0.45	1.000
26	*Mimosa pudica* Linn.	Mimosaceae	Thottalsinungi	Herb	Whole plant	Decoction	Oral	5mL	(FEV) Typhoid-7	7/16	0.285	0.125	0.45	1.000
27	*Momordica charantia* L.	Cucurbitaceae	Pagarkkai	Climbing herb	Seed	Powder	Oral	2 g sugar with powder	(GIA)To kill intestinal worms-15	29/33	0.589	0.517	0.9	0.964
					Fruit	Raw form	Topical	Rubbed on wounds	(WOUND) Wounds-14					
28	*Ocimum basilicum* L.	Lamiaceae	Thiruneetrupachilai	Herb	Leaves	Decoction	Gargling	Gargling	(DENT) Tooth ache-23 (RESP) Cough-31	99/56	1.000	1.767	2.00	0.959
					Leaves	Juice	Oral	5mL	(FEV) Fever-26					
					Leaves	Juice	Oral	5mL	(PAIN) Ear ache-6					
					Leaves	Juice	Ear drop	2-3drops	(RESP) Cold-13					
29	*Persea americana* Miller.	Lauraceae	Vennaipalam	Tree	Leaves Fruit	Decoction	Oral	15mL	(FEV) Typhoid-6	6/13	0.232	0.107	0.45	1.000
30	*Piper longum* L.	Piperaceae	Thippili	Shrub	Fruit	Decoction	Oral	1-2 fruit	(DENT) Tooth ache-14	29/31	0.553	0.517	1.35	0.928
					Seed	Powder	Oral	10mL	(FEV) Flu-7					
						Powder	Oral	15mL	(GAST) Complication-8					

(Contd.)

Table 2 — Medicinal plants of district Perambalur used by local inhabitants for children diseases — (*Contd.*)

S. No	Botanical name	Family	Practioners and vernacular name	Habit	Parts used	Preparation	Administration	Quantity	Ailment code with disease treated	UR/FC	RFC	USE VALUE	RI	IAR
31	*Piper nigrum* L.	Piperaceae	Milagu	Climbing shrub	Seed Seed	Powder Decoction	Oral Oral	5g 10mL	(FEV) Flu-8 (GAST) Complication-7	34/49	0.875	0.607	1.35	0.939
32	*Punica grantum* L.	Lythraceae	Mathulai	Shrub	Seed Peel Fruit Fruit Fruit	Powder Juice Juice Juice Juice	Oral Oral Oral Oral Eye drop	5g powder with boiled egg With milk 10mL 10mL 10mL 2-3 drops	(RESP) Cough-19 (RESP) Cough-21 (GAST) Dysentery-18 (GAST) Vomiting-16 (OCC) Eye infection-10	65/41	0.732	1.160	1.55	0.953
33	*Rosa indica* L.	Rosaceae	Rose	Shrub	Floweress ence Raw form	Raw form	Eye drop Ear drop Topical	2drops 1-2drops Oil rubbed on gums	(OCC) Eye infection-9 (OCC) Ear ache-11 (DENT) Tooth ache-10 (SWELL) Gum swelling-12	42/39	0.696	0.75	1.55	0.926
34	*Saccharum officinarum* L.	Poaceae	Karumbu	Grass	Stem	Juice Juice	Oral Oral	2glass/day 2glass/day	(HEM) Hepatitis-12 (GUA) Kidney stone-17	29/38	0.678	0.517	0.9	0.964
35	*Solanum lycopersicum* L.	Solanaceae	Thakkali	Herb	Fruit	Raw form	Oral Oral	2 Fruits	(HEM) Hepatitis-17 (BLOOD) Anemia-9	26/31	0.553	0.464	0.9	0.96
36	*Solanum nigrum* L.	Solanaceae	Manathakkali	Herb	Leaves	Decoction	Oral	10mL	(HEM) Jaundice-13	13/24	0.428	0.232	0.45	1.000
37	*Solanum surattense* Burm.f	Solanaceae	Kandankathari	Herb	Fruit	Powder Decoction	Inhaled Oral	4g 20mL	(FEV) Flu-6 (ORG) Liver problem-14	20/26	0.464	0.357	0.9	0.947
38	*Solanum trilobatum* Linn.	Solanaceae	Thoothuvalai	Shrub	Leaves	Decoction Juice Juice	Oral Oral Oral	10mL 10mL 10mL	(FEV) Fever-11 (RESP) Cough-16 (RESP) Cold-19	46/51	0.910	0.821	1.1	0.955
39	*Syzygium cumini* (L). Skeels	Myrtaceae	Naval	Tree	Fruit	Raw form Raw form Raw form	Oral Oral Oral	Trice a day Trice a day Trice a day	(ED) Diabetes-6 (GAST) Dysentery-9 (ORG) Liver problem-10	25/32	0.571	0.446	1.35	0.916
40	*Terminalia catappa* L.	Combretaceae	Vathammaram	Tree	Leaves	Infusion	Oral	Half teaspoon	(GAST) Diarrhea-11	11/22	0.392	0.196	0.45	1.000
41	*Trachyspermum copticum* Link	Apiaceae	Omam	Herb	Seed	Infusion	Oral	5drops	(GAST) Vomiting-9	9/17	0.303	0.160	0.45	1.000
42	*Trigonella foenum-graecum* L.	Leguminosae	Ventahayam	Herb	Seed	Powder Powder	Topical Oral	Applied on wounds 1teaspoon with sugar	(WOUND) Wounds-11 (GAST) Dysentery-8	19/26	0.464	0.339	0.9	0.944
43	*Ziziphus jujuba* Mill.	Rhamnaceae	Elanthai	Tree	Fruit Leaves	Raw form Paste	Oral Topical	Given orally Wound	(ED) Diabetes-15 (SKIN) Boil maturation-6	21/32	0.571	0.375	0.9	0.95

Plant parts used

Medicinal plants synthesize many secondary metabolites in various parts and local people exploit this for curing many diseases[13,14,15,16]. The most frequently used plant part was leaves (34%) followed by fruits (28%), seeds (12%), flower (8%), stem and bulb (each 3%), rhizome, bark, latex and whole plant (each 2%) and root peel (1%) (Fig. 4).

Mode of utilization and route of application

Medicine dosage were administered in different forms which includes decoction, extract, powder, paste, infusion, juice, raw form and cooked. Decoction (34%) form of herbal preparation is most common for child diseases followed by juice and powder (19%), raw form (12%), infusion (8%), oil

(4%), paste (3%) and ash (1%) (Fig. 5). Oral administration (74%) of herbals is the common route of application followed by the topical (14%), ear drops (7%), eye drop (3%) gargling and inhaled (1%) (Fig. 6).

Use categories in children diseases

The diseases were grouped into 11 broad classes based on its ability to cure different ailments. In Perambalur district, the most of species were exploited for curing gastrointestinal diseases (24 species) followed by fever (12 species), liver disorders (11 species), respiratory disorders (10 species), dermatological problem (8 species), ENT (6 species), circulatory diseases (5 species), eye problem and dental problem (each 4 species), kidney disorders (3 species) and urinary problems (2 species) (Fig. 7 & Table 2)
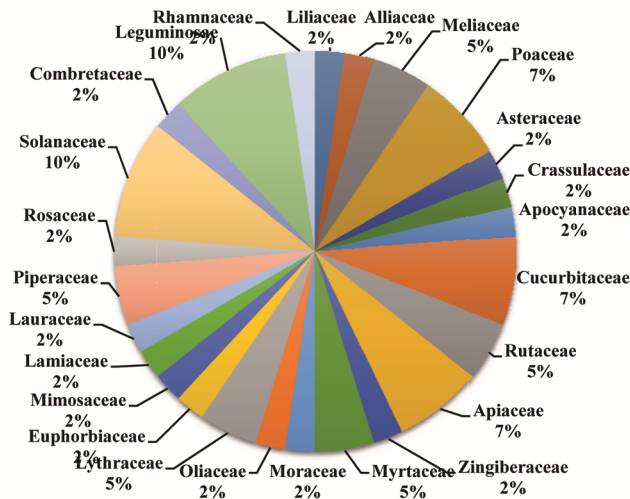
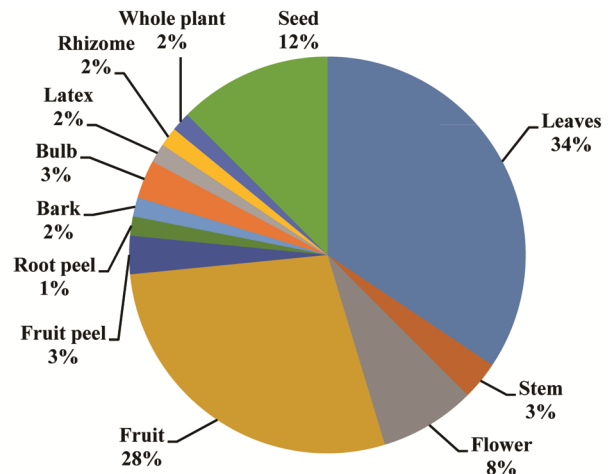Fig. 2 — Percentage of family importance value

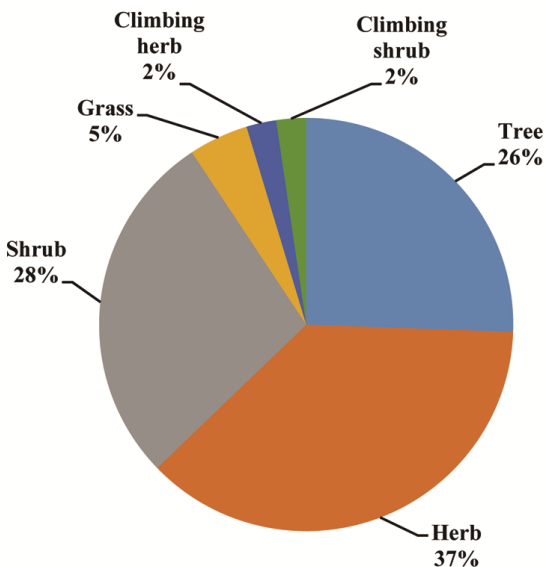Fig. 3 — Life form of medicinal plants used in children diseases

Fig. 4 — Percentage of plant parts used in children diseases
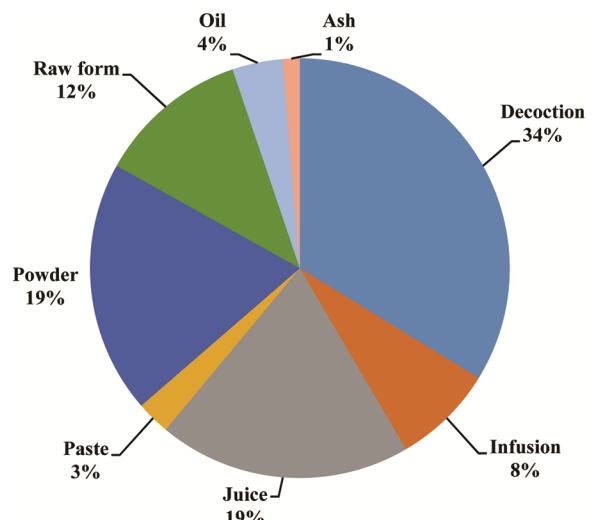

Fig. 5 — Percentage of mode of utilization for children diseases
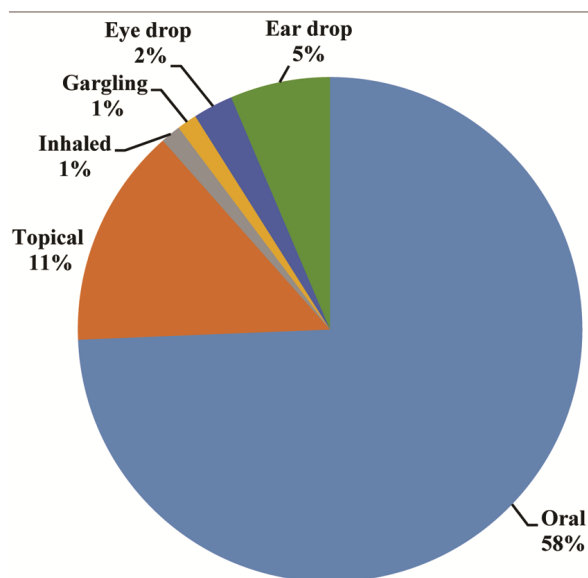
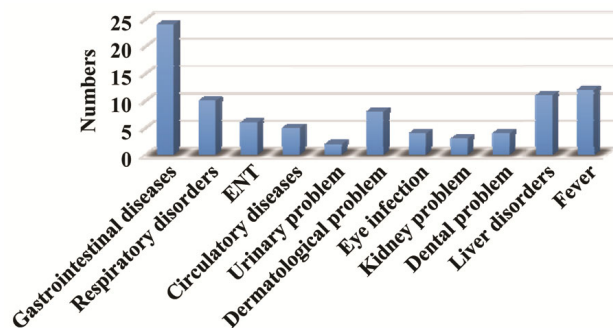Fig. 6 — Route of application of medicines to children disorders

Fig. 7 — Medicinal plants use categories for children diseases

UV of medicinal plants

Ocimum basilicum had the maximum UV of 1.767 (99 use reports and 56 informants) and *Acacia nilotica* had the lowest use value of 0.089 (5 use reports and 15 informants) (Table 2).

RI

The collected ethno-medicinal plants were known to have a number of pharmacological properties. The RI ranged from 0.45 to 2.0 for the plant species cited by 56 respondents. Among the 43 species recorded, RI of 19 species was ≤0.50; RI of 9 species was from 0.51 to 1.00, RI of 10 species ranged from 1.01 to 1.50, and RI of 5 species were between 1.51 to 2.00. *Ocimum basilicum* (RI=2.00) had highest number of ailment categories and illness treated owing to its affordability and high availability in the present study area (Table 2). *Ocimum basilicum* with a value of 1.000 (5/5) had the maximum number of pharmacological properties (PP). *Ocimum basilicum*

had a normalized (AC) value of 1.00 (4/4) and was used to treat 05 ailment categories.

IAR

The IAR ranged from 0.9 to 1.00 for 43 plant species. An IAR of 1.00 was recorded for 20 species. *Allium sativum* recorded a lowest IAR of 0.9 (Table 2).

RFC and UR

RFC ranged from 0.232 to 1.000. RFC was maximum for species *Ocimum basilicum* (1.000) and minimum value was recorded for *Persea americanum* (0.232). Species *Ocimum basilicum* has highest use report value of 99 (Table 2).

Discussion

In this study, all the informants of Perambalur district gave vernacular names of plant that are exploited in the infant diseases treatment which reveals that vernacular names of a particular region play an important part in ethno-botanical study. This is in agreement with Shosan *et al.* (2014)[17] observation, that plants are usually identified by their vernacular names worldwide. Local names are measured as a useful tool for search of new uses of known plants or new plants. Further, they are not suggested for scientific accounts directly as they lack consistency and uniformity.

Majority of the respondents inherited the knowledge on herbal treatment of various diseases from their predecessors via verbal transfer. This knowledge on medicinal plants are acquired over a life time and is passed on from one generation to other[17,18]. The fact that majority of the informants interviewed were senior members (51 to 60 years in age), indicated that older informants possess more knowledge than younger.

Since the prospect of traditional knowledge is threatened being mostly with the older generation there is a burning need for incorporating the data in health education. The female informants possessed higher medicinal plant knowledge for children's diseases' treatment and they participated freely in the interview and shared their knowledge. Similar results were obtained by Pfeiffer and Butz, (2005)[19] and Guimbo et al. (2010)[20] in their studies.

Leguminosae and Solanaceae families had great ethanobotanical importance because they are widely spread and have greater species richness in Perambalur district. Lulekal et al. (2008), Offiah et al. (2010), Bisi-Johnson et al. (2011), Shosan *et al.*

(2014), Shaheen et al. (2017) have documented Leguminosae family as the predominant and frequently used member[17,21,22,23,24]. This is expected as it is the third largest among angiosperms worldwide (730 genera and over 19,400 species). Kadir *et al.* (2010), reported Solanaceae family (98 genera and some 2,700 species) which has great diversity of morphology, habitats and ecology as dominant in his studies[9].

Herbs were the most widely used life form due to their availability and accessibility. Leaves and fruit were largely used in the study areas. As only few specific documented literature are available on children diseases, comparison was made with available ethnobotanical literature in this study. Leaves are used as dominant part as it is comparatively easy for collection and using them as medicine to that of other plant parts and similar results have been previously reported[9,25,26,27,28,29,30]. Further, using leaves may not affect the plant growth as compared to digging out of roots which may lead to death and may put the species under susceptible condition[31,32,33,34]. Leaf extracts of plants are very active or even better when compared to extracts of other plant parts[22,35]. Oral mode is the dominant route of administration and this is similar with traditional medicine where oral administration is frequently preferred[17,22].

Ocimum basilicum had high UVs because of its wider distribution, resulting in the first selection for treatment. Highest RFC value was also reported for the same plant, being most accepted medicinal plants approved by most of the respondents in Perambalur district. *Ocimum basilicum* has various therapeutic properties like immune-modulatory, hypoglycemic, hypolipidemic, anti-inflammatory, hepatoprotective, anti-mutagenic, anti-microbial, anti-fungal, antioxidant, lipid peroxidation, insect repellency, anti-viral, anti-erythmic, depigmenting, antitoxic and CNS activities[36]. The informant agreement ratio were high for 20 plants species which suggests that all respondents have the same opinion about the selective use of medicinal plants recorded which shows the need for documentation of the healers knowledge on medicinal plants. The highest use report against children diseases were documented for *Ocimum basilicum* (99), *Azadirachta indica* (86), *Punica granatum* (65), *Cassia fistula* (62), *Citrullus colocynths* (57), *Solanum trilobatum* (46) and *Piper nigrum* (34) for treating various human disorders. Apart from these plants, *Calotropis procera* is used in

the treatment of skin infections, asthma, backache, rheumatism, piles problems, cough and dog scorpion and snake bites[37] and the same has been used for joint pain, toothache and abscesses[38]. *Calotropis procera* latex is also used in the treatment of eczema, abdominal cramps, ringworms, snake bites and wound healing[39,40]. *Allium cepa* and *Allium sativum* are used in heart diseases, boils maturation, carminative and insect bite. Fungal infections of skin can be treated by *Citrus limon*[41]. *Cucumis melo* is used for constipation[42]. Jaundice, anemia, and liver inflammation are cured by *Foeniculum vulgare*, abdominal pain can be reduced by *Piper nigrum* and cough by *Ziziphus jujube*[40]. The fact that several of these species are recorded and used by several traditional healers in other communities as medicinal plants provides assurance on their value. Further, the potential pharmacological efficacy is indicated by the use of plant species by different cultural groups.

Many of the ethnopharmacological studies in most parts of the world have reported gastrointestinal disorder as the first use category[43,44,45,46,22]. Gastrointestinal is one of the prevalent problems reported in this region, owing to poor dietary intake, environment and shortage of clean water for drinking. Offiah *et al.* (2011), Ullah *et al.* (2013), Bibi *et al.* (2014) and Sadeghi *et al.* (2014)[47,48,49,22] reported gastrointestinal diseases as a dominant problem in their studies.

Perambalur district has many herbal plants that are exploited for many diseases' treatment and they have rich traditional plant knowledge. Modern medicines accessibility and lifestyle changes of the villagers have lead to the reduction in the role of herbal plant species in the primary healthcare. Effective conservation can be achieved by adopting proper management strategies for the safe use and protection of medicinal plants from unsustainable methods of harvesting, over grazing and urbanisation. The medicinal plant catalogue reported in this study shows the contribution of the natural flora in controlling children diseases.

Conclusion

The Perambalur area has rich plant diversity and traditional knowledge of herbal plants. The present study furnishes information on 43 plant species which are exploited for the treatment of children diseases. The primary healthcare requirements of local people in that region are still met by the traditional medicine which is evident from this study. *Ocimum basilicum*

has scored highest value on all quantitative analysis, so it could be considered as a potential plant for discovering new drugs. Further, phytochemical and pharmacological investigation is required to discover the active compounds of the therapeutic claimed recipes incorporated in the study.

Acknowledgement

Reference

1 Gram LR, *et al.,* Food spoilage- interactions between food spoilage bacteria, *Int J Food Microbiol,* 78(1-2) (2002) 79–97.

2 Rai LK, *et al.,* Conservation threats to some important medicinal plants of the Sikkim Himalaya, *Biol Consery,* 93(2000) 27–33.

3 Principe P, *Causes of neonatal and child mortality in India: nationally representative mortality survey Monetising the Pharmacological Benefits of Plants,* US Environmental Protection Agency, Washington DC. 1991 3769 (2005) (9755):1853-1860.

4 Jain SK& Rao R, *A Hand book of Field and Herbarium Methods,* New Delhi: Today and Tomorrow Printers and Publishers, (1977).

5 Gamble JS, *The Flora of the Presidency of Madras.* Adlard & Son, Ltd., London, (1935).

6 Matthew KM, *The Flora of the Tamil Nadu Carnatic*, The Rapinat Herbarium, 3. St. Josephs College, Tiruchirapalli, India, p. lxxxiv (2154) (1983).

7 Gazzaneo LRS, *et al.,* Knowledge and use of medicinal plants by local specialists in a region of Atlantic Forest in the state of Pernampuco, *J Ethnobiol Ethnomed,* 1(2005) 9

8 Tardio J, & Pardo-De-Santayana M, Cultural importance indices: a comparative analysis based on the useful wild plants of southern Cantabria (Northern Spain), *Econ Bot,* 62(1) (2008) 24–39.

9 Kadir MF, *et al.,* Ethnopharmacological survey of medicinal plants used by indigenous and tribal people in Rangamati, Bangladesh, *J Ethnopharmacol,* 144(3) (2012) 627–637.

10 Oliveira ES, *et al.,* The medicinal animal markets in the metropolitan region of Natal City, north eastern Brazil, *J Ethnobiol Ethnomed,* 130(1) (2010) 54-60.

11 Trotter RT, & Logan MH, Informant consensus: a new approach for identifying potentially effective medicinal plants. In: Etkin, N.L. (Ed.), Plants in Indigenous medicine and Diet, Behavioural Approaches, Redgravie Publisning Company, Bred Ford Hills, New York, (1986) 91-112.

12 Thomas E, *et al.,* Cultural significance of medicinal plant families and species among Quechua farmers in Apillapampa, Bolivia, *J Ethnopharmacol,* 122(2009) 60-67.

13 Croteau R, *et al.,* Secondary Metabolites, *Biochem Mol Bio Plants,* 7(2000) 1250–1319.

14 Shah GM, *et al.,* Phytotherapy among the rural women of district Abbotabad, *Pak J Bot,* 45(2014) 253–261.

15 Shah NA, Antileishmanial, toxicity, and phytochemical evaluation of medicinal plants collected from Pakistan, *Bio Med Res Int,* 10(2014b) 16.

16 Shah NA, Antioxidant potential, DNA protection, and HPLC-DAD analysis of neglected medicinal jurineadolomiaea roots, *Biomed Res Int, 2014* (2014) 726241.

17 Shosan LO, *et al.,* Ethnobotanical Survey of Medicinal Plants Used in Curing Some Diseases in Infants in Abeokuta South Local Government Area of Ogun State, Nigeria, *Ame J Plant Sci,* 5(2014) 3258-3268.

18 Ogbole OO & Ajaiyeoba EO, Traditional Management of Tuberculosis in Ogun State of Nigeria: The Practice and Ethnobotanical Survey, *African J Trad Complementary and Alternative Medic,* 7(1) (2010) 79-84.

19 Pfeiffer JM, & Butz RJ, Assessing cultural and ecological variation in ethnobiological research: the importance of gender, *J Ethnopharmacol,* 25(2) (2005) 240–278.

20 Guimbo ID, *et al.,* Ethnobotanical knowledge of men, women and children in rural niger: a mixed- methods approach, *Ethnobot Res App,* 9(2011) 235–242.

21 Shaheen S., *et al.,* Knowledge of Medicinal Plants for Children Disease in the Environs of District Bannu, Khyber Pakhtoonkhwa (KPK). *Frontiers in Pharmocolo,* 8(2017) 430.

22 Offiah NV, *et al.,* Ethnobotanical survey of medicinal plants used in the treatment of animal diarrhoea in Plateau State, Nigeria, *BMCV et. Res,* (2011) 7-36.

23 Bisi-Johnson MA, *et al.,* A survey of indigenous herbal diarrhoeal remedies of O.R. Tambo district, Eastern Cape Province, South Africa, *African J Biotechnol,* 9(8) (2010) 1245–1254.

24 Lulekal E, *et al.,* An ethnobotanical study of medicinal plants in Mana Angetu District, southeastern Ethiopia, *J Ethnobio. Ethnomed,* 4(2008) 1–10.

25 Mahishi P, *et al.,* Medicinal plant wealth of local communities in some villages in Shimoga District of Karnataka, India, *J Ethnopharmacol,* 98(3) (2005) 307–312.

26 Abo KA, *et al.,* Ethnobotanical studies of medicinal plants used in the management of diabetes mellitus in South Western Nigeria, *J Ethnopharmacol,* 115(1) (2008) 67–71.

27 González JA, *et al.,* Ethnobotanical study of medicinal plants traditionally used in the Arribesdel Duero, western Spain, *J Ethnopharmacol,* 131(1) (2010) 343–355.

28 Telefo PB, *et al.,* Ethnopharmacological survey of plants used for the treatment of female infertility in Baham, Cameroon, *J Ethnopharmacol,* 136(1) (2011) 178–187.

29 Giday M, *et al.,* Medicinal plants of the Meinit ethnic group of Ethiopia: an ethnobotanical study, *J Ethnopharmacol,* 124(3) (2009) 513–521.

30 Poffenberger M,McGean B, Khare A, Campbell L, Field Method Manual, vol. II. *Community Forest Economy and Use Pattern: Participatory and Rural Appraisal (PRA) Methods in South Gujarat, India,* New Delhi: Society for Promotion of Wastelands Development, (1992).

31 Martínez JVA & Bernal HY, *Fundamentos de agrotecnología de cultivo de plantas medicinales iberoamericanas.* FAOUN, 5(2000) 125.

32 Zheng XL, & Xing FW, Ethnobotanical study on medicinal plants around Mt. Yinggeling, Hainan Island, China, *J Ethnopharmacol,* 124(2) (2009) 197–210.

33 Rehecho S, *et al.,* Ethnopharmacological survey of medicinal plants in Nor-Yauyos, a part of the Landscape Reserve Nor-Yauyos-Cochas, Peru, *J Ethnopharmacol* 133(1) (2011) 75–85.

34 Eloff JN, *et al.,* Anti-bacterial activity of Marula (*Sclerocarya birrea* (A. rich.) Hochst. subsp. caffra (Sond.) Kokwaro) (Anacardiaceae) bark and leaves, *J Ethnopharmacol,* 76(3) (2001) 305–308.

35 Shai LJ, Extracts of the leaves and twigs of the threatened tree *Curtisia dentate* (Cornaceae) are more active against *Candida albicans* and other microorganisms than the stem bark extract, *South Afr J Bot,* 75(2009) 363–366.

36 Bariyah SK, *et al.,* 2012. Ocimum Basilicum: A Review on Phytochemical and Pharmacological Studies, Pakistan, *J Chemistry,* 2(2) (2012) 78-85.

37 Saqib Z, *et al.,* Indigenous knowledge of medicinal plants in Kotli Sattian, Rawalpindi district, Pakistan, *J Ethnopharmocol,* 151(2) (2014) 820-8.

38 Bhatia H, *et al.,* Ethnomedicinal plants used by the villagers of district Udhampur, J&K, India, *J Ethnopharmacol,* 151(1) (2014)1005–1018.

39 Marwat SK, *et al.,* Ethnophytomedicines for treatment of various dieases in D.I. Khan District, *Sarhad J Agri* 24(2008) 305-316.

40 Abbasi A, *et al.,* Ethnopharmacological application of medicinal plants to cure skin diseases and in folk cosmetics among the tribal communities of North-West Frontier Province, Pakistan, *J Ethnopharmacol,* 128(2) (2010) 322–335.

41 Ullah S, *et al.,* Ethnomedicinal plant use value in the Lakki Marwat District of Pakistan, *J Ethnopharmacol,* 158(2014) 412–422.

42 Qureshi R, Medicinal flora of hingol national park, Baluchistan, Pakistan, *Pak J Bot* 44(2) (2012) 725–732.

43 Heinrich M, *et al.,* Medicinal plants in Mexico: Healers' consensus and cultural importance, *Soc Sci Med,* 47(11) (1998) 1859–1871.

44 Ghorbani A, *et al.,* Studies on pharmaceutical ethnobotany in the region of Turkmen Sahra, north of Iran (Part 1): general results, *J Ethnopharmacol,* 102(1) (2005) 58–68.

45 Ghorbani A, *et al.,* Ethnobotanical study of medicinal plants utilised by Hani ethnicity in Naban River Watershed National Nature Reserve, Yunnan, China, *J Ethnopharmacol* 134(3) (2011) 651–667.

46 Mosaddegh M, *et al.,* Ethnobotanical survey of herbal remedies traditionally used in Kohghiluyehva Boyer Ahmad province of Iran, *J Ethnopharmacol* 141(1) (2012) 80–95.

47 Ullah M, *et al.,* An ethnobotanical survey of indigenous medicinal plants in Wana district south Waziristan agency, Pakistan, *J Ethnopharmacol* 150(2013) 918–924.

48 Bibi T, *et al.,* Ethnobotany of medicinal plants in district Mastung of Balochistan province-Pakistan, *J Ethnopharmacol,* 157(2014) 79–89.

49 Sadeghi Z, *et al.,* Ethnopharmacological studies of indigenous medicinal plants of Frontiers in Pharmacology, *Front Pharmacol,* (2014) 9-789.