



Medicinal Plants for Treatment of Neonatal Jaundice by Community of Attars (Traditional Healers) of Several Urban Areas in Mazandaran Province, Northern of Iran

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Authors' contributions

This work was carried out in collaboration between all authors. Author MF designed study, conducted interviews, wrote the first draft and managed the research. Author Mohammad Azadbakht was supervisor of the research project, contributed with original data, designed and managed the research and editing of the draft manuscript. Author SSY conducted interviews, field data collection and wrote the manuscript. Author SNM has done data analysis. Author RF referred the patients and edited the final manuscript. Author Masoud Azadbakht improved the design of the research and edits the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Aims: This study aimed to determine the use of specific medicinal plants based on traditional medicine from community of Attars (Traditional healers) in the province of Mazandaran (North Iran).

Place and Duration of Study: The province of Mazandaran in north Iran, between March until July 2015.

Methodology: Eighty-eight Traditional healers consisting of 62 men (70.5%) and 26 women (29.5%) from among the community of Attars (i.e. The Owners of shops, selling medicinal plants, providing traditional medications and some time act as traditional healer) of the province of Mazandaran in north Iran were randomly selected using questionnaires from March until July 2015.

Results: In this study, 50 plant species belonging to 29 plant families were recommended for treating neonatal jaundice. Asteraceae, Fabaceae and Rosaceae were the most commonly used plant families. The five main plants with the highest reported use included: *Contoneaster discolor*, *Descurainia sophia*, *Cichorium intybus*, *Alhagi camelorum*, and *Fumaria parviflora*. The most important reason for prescribing medicinal herbs was to help detoxify the body, and the most important reason that people visit Attaries (i.e., shops selling medicinal plants, providing traditional medications) to receive remedies was stated as the lower side effects of these traditional remedies.

Conclusion: This study shows that numerous medicinal plants are recommended for treating neonatal jaundice in Mazandaran province by Attars (Traditional healers). To the best of our knowledge, the wide range of herbs used for the treatment of neonatal jaundice has not been previously reported in any other study as extensively as shown here. Naturally, it is necessary to perform comprehensive studies on the above-mentioned medicinal plants to make use of these herbal remedies.

Keywords: Medicinal plants; neonatal jaundice; Iran; traditional healer.

DEFINITIONS

Attari: (i.e., shops selling medicinal plants, providing traditional medications and some time act as traditional healer)

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1. INTRODUCTION

Neonatal jaundice is a global clinical problem that is particularly prevalent throughout south and Southeast Asia. Genetic factors affect the prevalence of jaundice and the cleansing power of the body's bilirubin in different races [1,2]. Almost all Neonates suffer a transient increase in their serum bilirubin levels during the first week of life. Clinical jaundice is observed in nearly 60% of term and 80% of preterm neonates, a small minority of whom may also have a serious underlying disease [3-5]. The importance of neonatal jaundice is mostly associated with the dangerous complications caused by increased bilirubin levels in the brain, which can cause mild to severe and irreversible brain damage, hearing loss (in preterm Neonates), and even death [6-9]. A positive relationship between neonatal jaundice and developmental disorders and autism spectrum disorder has been identified

[10]. Ethnobotanical and ethnomedical studies are the basis for further pharmaceutical and clinical assessments seeking to evaluate the efficacy and safety of herbal medications and to compare the effects of herbal medications and traditional medicine in practice and in laboratories [11]. With a history of more than 1000 years, Iranian traditional medicine recommends the use of medicinal plants and natural products for both the prevention and treatment of diseases [12]. The study population comprises community of Attaris, in which herbal medicines and other traditional treatments are provided [12]. The shop owner is known as Attar. Some Attars are traditional healers, too, but some only own the shop and do not provide treatments, but may collaborate with one healer. In Iran, traditional medicine is divided into written and oral parts [12]. In the oral part, knowledge and skill of traditional medicine are transferred from generation to generation by local or native

healers, and in some cases, by traditional healers [12]. In diseases such as neonatal jaundice, oral knowledge of traditional medicine is more important due to the silence of written traditional medicine. These traditional healers live in families in which their close relatives have been traditional healers for many years, and their knowledge of use of herbs and other treatments is based on their observations, experiences and beliefs according to Iranian traditional medicine. Unfortunately, this knowledge has mostly been transferred verbally from one generation to the next, and will disappear if neglected. Several herbs are traditionally used for the treatment of neonatal jaundice in Iran [13]. Many researchers have suggested that despite availability of modern medicine, people in urban areas still visit herbalists as traditional healers [12,14]. On the other hand According to the World Health Organization, 70% to 80% of people are dependent on medicinal plants recommended by traditional medicine in their countries for their primary health care needs. The WHO has also recommended herbal medicines due to their fewer side-effects [15,16]. Previous research concerned with gathering information regarding the traditional applications of medicinal herbs for treatment of jaundice has been very general [17-19]. In other words, either little research has been conducted on neonatal jaundice or the traditional medicines used to treat it, [17-19] or it might not have been possible to access the relevant research. Therefore, considering the importance of neonatal jaundice, and people's propensity to use traditional medicine for neonatal jaundice [12,15]. This study aimed to explore specific herbal remedies for treating

neonatal jaundice based on traditional medicine from the Attars (Traditional healers) of the Mazandaran province. It is obviously clear use of these resources requires comprehensive studies in different phases to accurately assess their effects.

2. MATERIALS AND METHODS

The present descriptive cross-sectional study was conducted from March to June 2015 in Mazandaran province, located in northern Iran on the southern coast of the Caspian Sea, which features forest vegetation and mountains (Figs. 1,2).



Fig. 1. Map of Iran

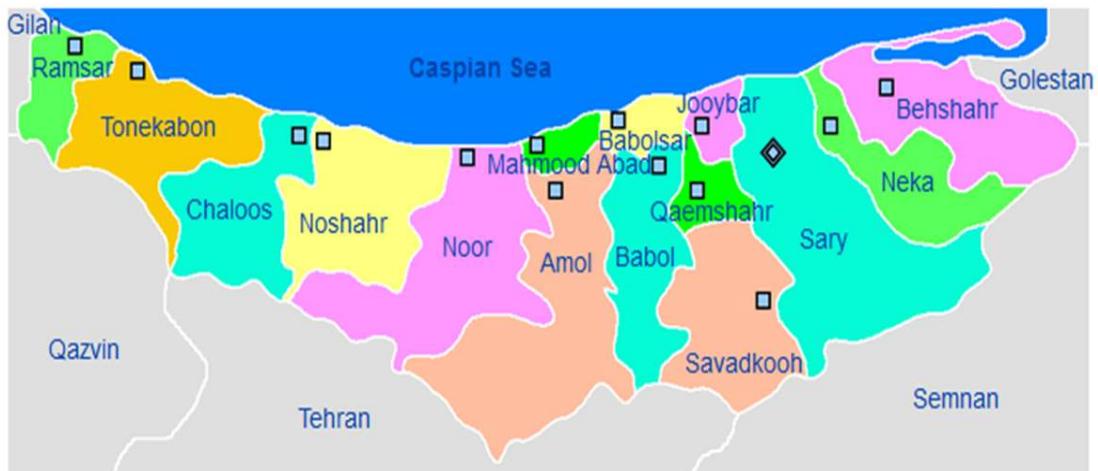


Fig. 2. Map of Mazandaran province

The study population consisted of all of the Traditional healers (Attars) (i.e. The Owners of Attaries shops selling medicinal plants, providing traditional medications and sometime act as traditional healer) working in Mazandaran province with at least a one year history of prescribing medicinal products. First, a list of all of the Traditional healers (Attars) in the province was obtained from the provincial post office. Next, given the province's geographical dispersion, 50% of the shops were selected randomly for data collection using a table of random numbers and with respect to the ratio of Traditional healers (Attars) in each region. Then a written consent form was first given to traditional healers so that they participate in the study after its completion if they wished. The purpose of the study was explained to them and they were reminded that they can be withdrawn whenever they wanted. The data were collected by a questionnaire.

In the event that the shop was closed or the Traditional healers (Attars) were not available at his shop, the researcher visited on another occasion. The data were collected using a questionnaire containing the Traditional healers (Attars) demographic details, questions about the reasons for their clients' visits and the number of herbal, mineral and animal products available in their shop that were recommended for treating neonatal jaundice. The demographic details examined included the Traditional healers (Attars) age, gender, level of education, marital status and work experience. More detailed questions were also posed, including questions about the average number of clients who had visited during the past year for remedies to treat jaundice, the Traditional healers (Attars) sources of information about traditional medicine and treatments for neonatal jaundice, and his recommended methods of treating neonatal jaundice using natural products. The questionnaire items were prepared using sources of traditional medicine and articles written on the subject. The content validity of the questionnaire was assessed by traditional medicine experts

and professors at the Traditional and Complementary Medicine Research Center of Mazandaran University of Medical Sciences. Spearman's correlation coefficient is used in assessment of reliability of study questionnaire in a pilot study on two occasions (with 2 weeks interval) using the test-retest method on a sample of 20 Traditional healers (Attars) selected from the study population ($r=0.75$ for the items and $P<0.001$).

The results of the study were reported in the form of tables of frequency, the main natural products and herbal medicines recommended their scientific name, their plant families, the parts of the plants used and their application. Traditional healers (Attars) were asked to prepare herb samples they prescribe and we paid them the prices. The scientific identification of herbs was accomplished by a systematic herb expert in the research team. After correct identification, the plant samples were kept based on document number (voucher number) in the Department of Pharmacognosy, Faculty of Pharmacy, Mazandaran University of Medical Sciences, Sari, Iran. The data were analysed in SPSS-16 using the Chi-squared test (for the qualitative variables) and the t-test (for the quantitative variables).

3. RESULTS AND DISCUSSION

A total of 88 questionnaires were completed and collected from across the province, 81 of which were completed by local Mazandarani (92.04%). Of the 88 total respondents, 62 (70.5%) were male and 26 (29.5%) were female, 42 (47.7%) had a high school diploma or lower degree of education, 36 (40.9%) had undergraduate degrees and 10 (11.4%) had postgraduate degrees, 73 (83%) were married and 20 (22.7%) were from rural areas. In 68 of the Traditional healers (Attars) shops surveyed (77.3%), more than four clients had visited during the past year with a diagnosis of neonatal jaundice. Table 1 presents further details on the Traditional healers (Attars) and the number of clients they served.

Table 1. Distribution of the demographic characteristics of traditional healers (Attars) in Mazandaran province

Variable	Mean + SD	Median
Age (in years)	37.8±9.9	35
Duration of residence in Mazandaran province (in years)	27.5±16.5	30
Experience (in years)	10±8.3	7
Number of clients visiting with jaundice in one year	43.08±21.4	40

Table 2. The frequency and details of the products recommended by Mazandaran traditional healers (Attars)¹ for Neonates with jaundice and for improving their mother's breast milk in 2015

Local name and voucher no.	Scientific name	Plant family	Part(s) used	Application	Reason for the Recommendation	Frequency of citation by the traditional healers (Attars) ¹
1- Shirkhesht E-27-4151	<i>Cotoneaster discolor</i>		Manna	Oral use by the mother and the Neonate	Laxative, especially good for Neonates and the elderly, bile purgative, liver and stomach tonic, blood purifier, antipyretic	87
2- Khakshir E-26-251	<i>Descurainia sophia</i>	Brassicaceae	Seeds	Oral use by the mother	Antipyretic, stomach and digestive tonic, laxative, anti-swelling, blood and liver purifier	79
3- Kasni E-39-221	<i>Cichorium intybus</i>	Asteraceae	Aerial parts, Roots	Rinsing the Neonate body with Kasni arrack, oral administration of chicory water to the Neonate in combination with cotoneaster or Taranjebin oral use by the mother	Purifier, liver, spleen and vascular decongestant, antipyretic, heart and stomach tonic	72
4- Taranjebin E-27-5110	<i>Alhagi camelorum</i>	Fabaceae	Manna	Oral use either alone or in combination with cotoneaster administered to the mother and the Neonate, infusion manna bath for the Neonate	Laxative, purgative, cleanser, antipyretic, bile removal	55
5- Shahtare E-26-142	<i>Fumaria parviflora</i>	Fumariaceae	Aerial parts	Oral use either alone or in combination with khakeshir, red sugar and lime by the mother, Fumaria bath for the Neonate	Blood purifier, antipyretic, appetizer, opening liver duct obstructions	30
6- Naishekar F-4-71	<i>Saccharum officinarum</i>	Gramineae	Stem	Oral use by the mother	Laxative, opening liver duct obstructions	13
7- Beed E-12-11	<i>Salix alba</i>	Salicaceae	Leaves, bark	Laying the Neonate on Beed leaves, removing liver heat, oral use by the mother	Antipyretic, strong diuretic, anti-jaundice, opening liver duct obstructions, stomach tonic, analgesic	10
8- Banafshe E-215-11	<i>Viola odorata</i>	Violaceae	Flower	infusion viola bath for the Neonate, oral use by the mother	Bile expulsion, mild laxative, blood purifier, antipyretic	9
9- Barhang E-37-21	<i>Plantago major</i>	Plantaginaceae	Leaves and seeds	Oral use by the mother	Anti-inflammatory, wound healing, opening liver ducts, bile expulsion, antipyretic	4
10- Khorfe E-18-41	<i>Protulaca oleracea</i>	Portulacaceae	Seeds	Oral use by the mother, rubbing the extract on the Neonate body	Bile expulsion, antipyretic, cure for stomach and liver inflammation, cooling agent, purifier	4

Local name and voucher no.	Scientific name	Plant family	Part(s) used	Application	Reason for the Recommendation	Frequency of citation by the traditional healers (Attars) ¹
11- Esfarze E-37-13	<i>Plantago ovate</i>	Plantaginaceae	Seeds	Oral use by the mother, infusion esfarze bath for the Neonate	Laxative, cough relief	3
12- Niloofer E-24-11	<i>Nymphaea alba</i>	Nymphaeaceae	Seeds, roots, flowers	Infusion Niloofer bath for the Neonate, oral use by the mother	Heart tonic, laxative, cure for bilious fever	1
13- Baharnarenj E-29-141	<i>Citrus bigardia</i>	Rutaceae	Flowers	Topical rinsing of the Neonate's body and face	Tranquilizer, anti-psychotic, ecstatic effect	3
14- Folos E-27-5313	<i>Cassia fistula</i>	Fabaceae (leguminosae)	Pith of fruits	Oral use by the Neonate and the mother	Purgative, anti-jaundice, antipyretic, laxative	7
15- Limoo E-29-142	<i>Citrus lemon</i>	Rutaceae	Fruits	Oral use by the mother	Liver purifier, cure for jaundice	6
16- Gole Ghasedak E-39-222	<i>Taraxacum officinale</i>	Asteraceae	Leaves, Root	Oral use by the mother, laying the Neonate on Gole Ghasedak leaves and swaddling him with the leaves	Helps cure jaundice, bile expulsion, swollen liver treatment	5
17- Annab E-212-121	<i>Zizyphus vulgaris</i>	Rhamnaceae	Fruits	Oral use by the mother, soaked jujube bath for the Neonate	Liver cooling agent, antipyretic, laxative	5
18- Rivand E-17-21	<i>Rheum palmatum</i>	Polygonaceae	Roots	Oral use by the mother	helps cure liver inflammation, laxative, Helps cure jaundice	1
19- Panirak (Khabbazi) E-213-11	<i>Malva silvestris</i>	Malvaceae	Leaves, flowers, seeds	Topical rubbing of the Neonate's body with soaked Panirak	Laxative and purgative, wound healing, opening liver obstructions	4
20- Geshniz E-218-211	<i>Coriandrum sativum</i>	Umbelliferae	Fruits	Oral use by the mother	Body cooling agent, cure for swelling, stomach tonic, tranquilizer, appetizer	4
21- Tokhm Reihan E-36-47	<i>Ocimum basilicum</i>	Lamiaceae	Seeds	Oral use by the mother	Increasing breast milk, diuretic, laxative	4
22- Sedr E-212-122	<i>Zizyphus spina-Christi</i>	Rhamnaceae	Leaves	Benefits the Neonate when used as a topical washing agent	Soothes inflammation, cooling and cleansing agent for the body	3
23- Zereshk E-21-221	<i>Berberis vulgaris</i>	Berberidaceae	Skin, roots, fruits	Oral use by the mother	Bile expulsion, stomach and liver tonic, stomach and liver heat treatment, blood and liver purifier	3
24- Anar E-217-31	<i>Punica granatum</i>	Punicaceae	Fruits	Oral use by the mother	Bile expulsion, blood purifier	2

Local name and voucher no.	Scientific name	Plant family	Part(s) used	Application	Reason for the Recommendation	Frequency of citation by the traditional healers (Attars) ¹
25- Gaz E-215-411	<i>Tamarix mannifera</i>	Tamaricaceae	Manna, leaves	Oral use by the mother,	boiled Tamarix bath for the Neonate Purgative, blood purifier	2
26- Bidmeshk E-12-13	<i>Salix aegyptiaca</i>	Salicaceae	Flower,	Oral use by the mother	Laxative, tranquilizer, anti-inflammatory, stomach tonic	2
27- Razianeh E-218-28	<i>Foeniculum vulgare</i>	Umbelliferae	Roots, seeds	Oral use by the mother	Liver duct obstruction opening, cure for jaundice, boosting breast milk production, menstrual induction	2
28-Gentiana E-35-21	<i>Gentiana lutea</i>	Gentianaceae	Roots	Oral use by the mother	Digestive tonic, liver supplement, anti- swelling	1
29- Parsiavoshan C-11-11	<i>Adiantum capillus- veneris</i>	Pteridaceae	Leaves	Oral use by the mother	Helps cure jaundice, antipyretic	1
30- Gazangabin E-27-5151	<i>Astragalus adscendens</i>	Leguminosae	Manna	Oral use by the mother	Laxative	1
31-Valik (Zalzalak) E-27-4102	<i>Crataegus microphyla</i>	Rosaceae	Flowers and fruits	Oral use by the mother	Bile expulsion, appetizer, reduces nervous irritability	1
32- Gazane E-14-41	<i>Urtica dioica</i>	Urticaceae	Leaves and roots	Oral use by the mother	Diuretic, liver and gallbladder stimulant	1
33- Khatmi E-213-12	<i>Althaea officinalis</i>	Malvaceae	Flowers, seeds, roots	Topical use for washing the Neonate	Helps cure swelling and inflammation, cure for cutaneous stimulation, anti- inflammatory	1
34- Jafari E-218-27	<i>Petroselinum sativum</i>	Umbelliferae	Seeds	Oral use by the mother	Diuretic and appetizer, blood purifier	1
35- Torshak E-17-41	<i>Rumex patientia</i>	Polygonaceae	Aerial parts	Oral use by the mother	Bile expulsion, anti-itching, diuretic, cooling agent, antipyretic	1
36- Bumadaran E-39-219	<i>Achillea millefolium</i>	Asteraceae	Flowers, flowering parts	Infusion Yarrow bath for the Neonate	Anti-infection, anti-inflammatory, anti- flatulent, cramp relief	1
37- Jo F-4-41	<i>Hordeum vulgare</i>	Poaceae (Gramineae)	Fruits and buds	Oral use by the mother, cooked lukewarm barley water bath for the Neonate	Body cooling agent, boosting breast milk production, cure for swelling, high fever relief	13
38- Ghoddume E-26-261	<i>Alyssum homalocarpum</i>	Cruciferae	Seeds	Oral use by the mother	Laxative	1
39- Sepestan	<i>Cordia myxa</i>	Boraginaceae	Fruits	Oral use by the mother	Laxative	1

Local name and voucher no.	Scientific name	Plant family	Part(s) used	Application	Reason for the Recommendation	Frequency of citation by the traditional healers (Attars) ¹
E-36-22						
40- Moshkanie E-39-212	<i>Eupatorium cannabinum</i>	Asteraceae	Flowering parts	Oral use by the mother	Cleanser, appetizer, diuretic, perspirant, liver tonic, opening liver duct obstructions, liver pain and swelling relief	1
41- Tamr-e Hendi E-27-533	<i>Tamarindus indica</i>	Leguminosae	Fruits	Oral use by the mother	Purgative (more delicate than plum), blood purifier, bile expulsion	1
42- Khar Maryam E-39-215	<i>Silybum marianum</i>	Asteraceae	Seeds	Oral use by the mother	Anti-hepatotoxic, anti-hepatic, antipyretic	1
43- Beed Khesht (Beed Angabin) E-12-12	<i>Salix excels</i>	Salicaceae	Manna	Oral use by the mother	Sweetener, laxative, antipyretic	1
44- Gol-e Mohammadi E-27-4121	<i>Rosa damascena</i>	Rosaceae	Flowers	Oral use by the mother	Laxative, body duct cleanser and opener, bile expulsion	1
45- Taj Khorus E-18-51	<i>Amaranthus caudatus</i>	Amaranthaceae	Leaves, seeds	Oral use by the mother	Stomach and liver heat relief	1
46- Kangar Farangi E39-2121	<i>Cynara scolymus</i>	Asteraceae	Aerial parts	Oral use by the mother	Liver protection, helps cure liver diseases, helps digestion	1
47- Mokahlese E-36-64	<i>Scrophularia striata</i>	Scrophulariaceae	Fruits	Oral use by the mother	Liver and stomach tonic, laxative	1
48- Sandal E-16-21	<i>Santalum album</i>	Santalaceae	Woods	Oral use by the mother	Anti-inflammatory, helps relieve fever, liver tonic, tranquilizer, analgesic	1
49- Chai Sabz E-24-21	<i>Camellia sinensis</i>	Theaceae	Leaves	Oral use by the mother	Body cooling agent, antioxidant	1
50- Aloo E-27-414	<i>Prunus domestica</i>	Rosaceae	Fruits	Oral use by the mother	Laxative, bile expulsion, purgative	11

The results obtained showed that 35 (39.8%) Traditional healers (Attars) had obtained their information about medicinal plants and traditional medicine through word-of-mouth from highly experienced Traditional healers (Attars), 12 (13.6%) had obtained it from traditional medicine reference books, 10 (11.4%) from parents and relatives, 11 (12.5%) from traditional medicine teachers with a university education or traditional medicine physicians, 17 (19.3%) from their own university education and 3 (3.4%) from books, magazines and the internet. In response to the question "What do you recommend for the treatment of neonatal jaundice?", only 14 (15.9%) of the Traditional healers (Attars) initially referred the Neonate to a physician, 24 (27.3%) attempted to treat the child and 50 (56.8%) gave their own recommendations first and only then recommended that the clients visit a physician. Table 2 presents the frequency distribution of the Traditional healers (Attars) opinion about the herbal medicines prescribed for Neonates with jaundice or for their mothers. In the other words Table 2 presents the treatments recommended by Traditional healers (Attars) of Mazandaran for neonatal jaundice and for boosting breast milk.

In addition to the treatments presented in Table 2, four Traditional healers (Attars) also recommended topical treatments for jaundice in Neonates, including the application of a poultice prepared from *Zizphus spina*- Christi, yoghurt, Cow milk butter and *Viola odorata* oil. As shown in Table 2, the Traditional healers (Attars) also recommended washing the Neonate with *Citrus bigardia* arrack, *Cichorium intybus* arrack, *Alhagi camelorum* infusion, *Protulaca oleracea* extract and shampooing with Fuller's earth (Bentonite). Other topical cures recommended by the Traditional healers (Attars) included swaddling the Neonate in white cabbage (2 Traditional healers (Attars)), green lettuce (1 apothecary) or willow leaves (1 Traditional healers (Attars)),

placing the Neonate in lukewarm cooked rice (2 Traditional healers (Attars)) or barley (2 Traditional healers (Attars)) and performing wet ear cupping (5 Traditional healers (Attars)). According to results of the study, the Traditional healers (Attars) believed that the main reason for their clients' visits was the reduced side-effects of traditional medicine, and found that the lack of access to hospitals and doctors' offices was the least important reason for their visits (Table 3).

Several comparative analyses were performed in the present study. A comparison was drawn between traditional healers who visited and treated an annual number of fewer or more than 40 newborns with jaundice. Healers who visited fewer than 40 patients prescribed kasni in 8.8% of cases, while those with more than 40 patients used it in 37.7% of cases to treat mothers whose infants suffered jaundice (P=0.003). This indicates that people might have realized the effectiveness of the treatment of healers with more patients, might have done a better advertising, or might have had a better location. Anyway, more research should be conducted in this regard as to what factors are more effective on the increase in their patients. This is not however the question and concern of the present study. Moreover, the healers use more *kasni* perhaps as an effective treatment of jaundice, which must be proved by clinical trials.

One of the notable comparison involved examining the Traditional healers (Attars) prescribed treatments for neonatal jaundice by gender, which showed that 35.5% of the male and only 7.7% of their female counterparts attempted to personally treat the Neonates with jaundice and that 19.2% of the female Traditional healers (Attars) and 14.5% of their male counterparts strictly recommended visiting a physician. This means that male traditional healers have more courage to treat neonatal jaundice by themselves; vice versa female

Table 3. Factors affecting the mothers' visits to traditional healers (Attars) for the treatment of neonatal jaundice and for receiving medicinal products in order of importance and from the traditional healers (Attars) perspective

Factor	Number (%)
The reduced side-effects of traditional medicine	74 (84.1%)
The heavy medical costs incurred by visiting hospitals and doctors' offices	66 (75%)
The low costs of traditional medicine	53 (60.2%)
The easy access to traditional medicine	49 (55.6%)
Satisfaction with traditional medicine	40 (45.4%)
Dissatisfaction with modern medicine	35 (39.7%)
The lack of access to hospitals and doctors for ongoing treatments	18 (20.5%)

traditional healers are more inclined to recommend visiting a physician. In the other words, female traditional healers consider the law more. Male traditional healers are probably more venturous or have higher self-confidence than female healers; they are perhaps more experienced or better accepted and valued by the society. They are therefore less afraid of medical risks, patients' complaints or lawsuits by healthcare authorities in the country. They advise their patients to present to doctors' offices less than their female colleagues. It must be known that 100% of the 88 healers whom were asked whether or not they had been sued for the treatment of jaundice prescribed by them answered no; when they were asked whether people are satisfied with their treatment, the majority answered yes. Research should be conducted on how satisfied patients are with the treatment of Traditional healers (Attars) and how many of them obtained a positive result. This issue is not however among our goals to be delved into more. The Traditional healers (Attars) also discussed the benefits and harms of different types of food. Table 4 presents the details of the Traditional healers (Attars) opinions about different types of food. It is obvious that the foods used by the mother have been investigated.

According to the results of the study, the Traditional healers (Attars) in Mazandaran province use 50 plant species from 31 plant families for the treatment of neonatal jaundice. The plant families used include Rosacea, Leguminosae [Fabaceae] (4 species each), Asteraceae (6 species) Salicaceae, Umbelliferae (3 species each them), Malvaceae, Plantaginaceae, Rhamnaceae, Polygonaceae, Gramineae, Rutaceae (2 species each them) Amaranthaceae, Berberidaceae, Boraginaceae, Brassicaceae, Cruciferae, Fumariaceae, Gentianaceae, Lamiaceae, Nymphaeaceae, pteridaceae, Punicaceae, Portulacaceae, Santalaceae, Scrophulariaceae, Tamaricaceae, Theaceae, Urticaceae and Violaceae (1 species each them). According to the Traditional healers

(Attars), the herbal medicines noted in Table 2 were used for 5 purposes. Each medicinal herb tends to have more than one property, but the following classification notes the most prominent properties discussed by the Traditional healers (Attars):

- 1- Medicinal plants that expel toxins from the body through different measures, including laxatives, purgatives, diuretics and blood, liver and kidney purifiers
- 2- Medicinal plants that protect the liver and are effective in the prevention or treatment of liver diseases such as jaundice (hepatoprotective).
- 3- Medicinal plants that enhance the expulsion of bile from the gallbladder and remove bile from the body.
- 4- Medicinal plants that improve and promote liver and gallbladder health and function; for instance, ones that open liver obstructions (i.e., stimulants).
- 5- Medicinal plants that improve and strengthen the health and function of the digestive system and the process of digestion in the body.

The Traditional healers (Attars) believed that neonatal jaundice could be treated in two ways. The first involves treating the Neonate with oral herbal medications and with topical therapies, including applying a poultice, drawing herbal bath, swaddling, bathing and wet cupping; the second involves prescribing medicinal plants to breastfeeding mothers so that their milk content is modified to help cure the Neonate's jaundice. It should be considered that the clinical trial data on the anti-Neonatal jaundice activity of the plants identified in this study is not extensive. This finding is similar to other studies on other diseases [20]. *Cotoneaster discolor* was prescribed or recommended by 87 (among 88 of them) of the Traditional healers (Attars) as a natural product for the treatment of neonatal jaundice. *Cotoneaster manna* (with the scientific name of *Cotoneaster discolor*) constituted the most common herbal medicine discussed in the

Table 4. Benefits and harms of different types of food for neonatal jaundice according to traditional healers (Attars) recommendations in Mazandaran in 2015

Food type	Beneficial number (%)	Harmful number (%)	No information number (%)
Hot foods	1 (1.1%)	69 (78.4%)	18 (20.5%)
Fatty foods	2 (2.3%)	67 (76.1%)	19 (21.6%)
Sour foods	16 (18.2%)	33 (37.5%)	39 (44.3%)
Laxatives	45 (51.1%)	8 (9.1%)	35 (39.8%)
Liquids	72 (81.9%)	1 (1.1%)	15 (17%)

present study. Given the 19 different species of *Cotoneaster* found in Iran, different types of the medicine (the manna) can be administered. A wide range of clinical studies have examined this plant(s), some of which have confirmed its effectiveness on neonatal jaundice [21]. An ethnomedical study conducted in 2014 by Amiri et al. [17] on herbal remedies prescribed for jaundice in north-eastern Iran (Mashhad) found that soaked *Cotoneaster* (from the *Cotoneaster nummularius* species of the Rosaceae family) was one of the most commonly recommended plants. In Mashhad, 37 plants belonging to 32 species and 26 plant families were used for the treatment of adult jaundice. Plant families with the highest number of species used for this property included Fabaceae (5 species), Polygonaceae (4 species), Asteraceae (3 species), Plantaginaceae (2 species) and Salicaceae (2 species). The major medicinal plants reported in Amiri's study that were used for the treatment of adult jaundice included *Cichorium intybus*, *Salix alba*, *Cotoneaster nummularius*, *Descurainia sophia*, *Malva sylvestris*, *Berberis integerrima*, *Rumex acetosella*, *Phyllanthus emblica* and *Alhagi maurorum*. In the present study, similar medicinal plants were used to treat neonatal jaundice (for the breast feeding mothers of Neonates with jaundice), including *Descurainia sophia*, *Cichorium intybus*, *Salix alba*, *Viola odorata*, *Plantago major*, *Protulaca oleracea*, *Plantago ovata*, *Cassia fistula*, *Malva silvestris*, *Coriandrum sativum*, *Tamarindus indica*, *Silybum marianum*, *Salix excels*, and *Cynara scolymus*. In other words, 14 of the plants used for the treatment of neonatal jaundice reported in the present ethnomedical study conducted in Mazandaran were similar to the plants recommended in the study conducted in north-eastern Iran (i.e., Mashhad) and the 5 main plants recommended in Mazandaran according to the present study include *Cotoneaster* spp., *Descurainia Sophia*, *Cichorium intybus*, *Alhagi camelorum*, and *Fumaria parviflora*. *Cichorium intybus* was found to be the most commonly prescribed plant for the treatment of adult jaundice in Mashhad, while *Cotoneaster* was the most commonly prescribed plant for the treatment of neonatal jaundice in Mazandaran which can be used both by neonate and his mother. It is useful if we remember this statement from Turner that "the more widely or intensively a plant is used, the greater is its cultural significance" [22]. The study conducted in Mashhad shows that the local inhabitants of the region tend to trust Traditional healers (Attars)

and their recommendations for treatment, and thus suggests that further clinical experiments should be conducted to assess the potential bioactive effects of this wide range of herbal remedies [17]. The second most commonly used plant for the treatment of neonatal jaundice (for the breast feeding mothers of Neonates with jaundice in Mazandaran was *Descurainia sophia*, which was recommended by 79 of the Traditional healers (Attars) surveyed. *Descurainia sophia* has been used in sources of Iranian traditional medicine for its laxative (when mixed with cold water) and anti-diarrhoea (when boiled) effects [23].

Kasni (with the scientific name of *Cichorium intybus*) was discussed by 72 of the Traditional healers (Attars) surveyed in Mazandaran and constituted the third most commonly prescribed natural remedy for the mothers of Neonates with jaundice; this plant has been used in sources of Iranian traditional medicine for the treatment of liver diseases [23]. In an ethnobotanical study, M. Mosadeq et al. [18] investigated traditional herbal remedies that were commonly used in Kohgiluyeh and Boyer Ahmad, and found that chicory (either the plant itself or its distilled water) was used as a treatment for adult jaundice. Consuming cooked *Cichorium intybus* mixed with yoghurt was also a common practice in this region. *Cichorium intybus* powder was also consumed as a treatment for adult jaundice. Two plants were used and recommended in this region for treating jaundice in Neonates and children, including a local plant called Watercress (*Nasturtium officinale*) from the Brassicaceae family (the aerial parts of this plant are used for herbal fumigation) and a plant called Doon-Mehri, which is a species of the Chenopodiaceae family. This article has not discussed *Cotoneaster* as a remedy for neonatal jaundice. The fourth plant recommended for the treatment of neonatal jaundice was Taranjabin (Manna obtained from *Alhagi camelorum*), which was confirmed by 55 of the Traditional healers (Attars) surveyed. To date, several studies have examined the use of *Cotoneaster* and *Alhagi camelorum* for the treatment of neonatal jaundice [24,25]. In a study conducted by Tarhani et al. [26] the oral intake of Taranjabin was found to have no effects on physiological neonatal jaundice; however, further studies are required on this subject to acquire a final clinical decision. Ugur Cakilcioglu et al. [27] conducted a study to investigate the effectiveness of medicinal plants used for medical purposes in Maden County, located in the eastern Anatolia region of Turkey,

and to establish their local names. The tables presented in Cakilcioglu's study show similarities between the medicinal plants used in Maden County and the ones used in Iran; however, the study does not discuss whether any particular plants can be used for the treatment of adult and neonatal jaundice. The only plant from the Rosaceae family that Cakilcioglu's study discusses is *Cotoneaster nummularius*, which is proposed to be used as an expectorant. These findings show that *Cotoneaster* is not used for the treatment of neonatal jaundice in the examined regions of Turkey. Sharma et al. [19] conducted an ethnobotanical study in India to examine the medicinal plants used in 3 primitive sub-Himalayan societies for the treatment of adult jaundice, and reported the use of 40 plants from 31 plant families and 38 species; however, none of the societies were reported to use *Cotoneaster* as a treatment for neonatal jaundice. Of the 40 plants reported in Sharma's study, five species were very similar to the species discussed in the present study, including *Ocimum basilicum*, *Plantago major*, *Portulaca oleracea*, *Punica granatum* and *Urtica dioica*. Sharma's study argues that despite the major advances in modern medicine, plants continue to have a major role in the treatment of various liver conditions, as a large number of plants and herbal drug formulations are considered to help protect the liver [19].

4. CONCLUSION

The present study investigated the medicinal plants used in the treatment of neonatal jaundice in different parts of Mazandaran province. The Traditional healers (Attars) surveyed used a wide range of herbal medicines as a source for providing the public with traditional medicine. Moreover, this study revealed that despite having access to modern medicine, the people of Mazandaran (based on opinion of Attars) still resort to traditional medicine, trust it, and see it as having fewer side effects than treatments offered by modern medicine. To the best of our knowledge, no other studies have reported as wide a range of plants that is used for the treatment of neonatal jaundice (specially for the breast feeding mothers of Neonates with jaundice) as we have in the current study. Nevertheless, to make use of and benefit from such resources, comprehensive investigations in different phases like pharmacological and clinical fields are required. Thus, more detailed *in-vitro* studies and clinical are recommended. It is also suggested some researches involving the

recipients of the herbal remedies i.e. the mothers and neonates with jaundice, to study their satisfactions and perceptions.

CONSENT

Consent was obtained.

ETHICAL APPROVAL

The study protocol was reviewed and approved by the medical research ethics committee of the Mazandaran University of Medical Sciences (ethical no. 94-1-19-1316).

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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