



# Women's health *vis-a-vis* traditional foods used in *Thiruvathira* - a folklore festival of Kerala, India

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## Abstract

Traditional festivals represent an expression of culture and lifestyle resulting from the local climatic, agricultural and economic principles. Kerala, which is endowed with amazing range of festivals is renowned for the food specially made in these festivals. *Thiruvathira* is one such festival celebrated with much fervour and gusto. In this study, importance of traditional food consumed during *Thiruvathira* along with its method of preparation, time of consumption and its significance in maintaining women's health were discussed. On observing the food used in *Thiruvathira*, one can understand that, tuber crop is the main ingredient in most of the dishes, further indicating hints of its association in regulating or modifying women's health.

**Keywords:** Ethno-nutrition, Functional foods, *Thiruvathira*, Traditional festival, Tuber crops, Women's health

## 1. Introduction

Kerala, the God's own country is a narrow strip of land in southern India bewitched between Arabian sea on the west and Western Ghats on the east. Amazing range of glittering festivals of Kerala marks the calendar with its unique culture and traditions. Traditional festivals of Kerala have been greatly influenced by its centuries old unique culture, exquisite geographic patterns and perfect seasonal variations exhibiting vast diversity. *Thiruvathira* is one such festival celebrated with much fervour and gusto especially by the women folk of Kerala.

*Thiruvathira* in the Malayalam month of *dhanu* (mid-December to mid-January), is considered as the birth *nakshatra* or 'star' of Lord Shiva, the Hindu deity. Usually, that day coincides with a full moon. *Thiruvathira* festival starts seven days before the commencement of *Thiruvathira* star in the month of *dhanu*. Some *brahmin* communities celebrate the whole month as part of this festival. In Kerala, *Thiruvathira* is an important festival

along with other popular festivals like *Vishu* and *Onam*. This festival is celebrated throughout Kerala with immense devotion. Though, *Thiruvathira* is celebrated by all Hindus, it is popular among *brahmin*, *warrier* and *nair* communities since time immemorial. In the state, it is a festival of women combining fine arts, games, food, etc., in order to attain marital bliss. The exquisite and enchanting festival associated with drooling culinary delicacies aims for better health. Traditional food represents an expression of culture and lifestyle resulting from the local climatic, agricultural and economic principles. '*Aharo hi maha bhaishajyam*', (*Kasyapa samhita*) the concept of food as a great medicine is one of the basic principles of Ayurveda *sastra*. This concept reflects in all traditional ethnic cultures serving the purpose as a functional food (food beyond basic nutrition). This study aims at collecting the data regarding traditional food in *Thiruvathira* along with method of preparation, time of consumption and its health benefits.

## 2. Materials and methods

Food practices during the *Thiruvathira* festival of different communities were interviewed directly. Elderly traditional knowledge holders were interviewed. The primary information gathered were further compared with the available literature for finding out its ethno-nutritional aspects.

## 3. Results and discussion

Variety of foods and beverages according to the nature of festival were prepared. A day before *Thiruvathira* ritual, one who performs the ritual observes abstaining from rice-based food called *makayiram orikkal* (either take food prepared with rice for one meal only or take only one meal), a type of intermittent fasting along with delightful food preparations mostly made of tubers.

### 3.1. Special foods in *Thiruvathira*

- *Thiruvathira puzhukku*
- *Thiruvathira ettangadi*
- *Koova payasam*
- *Makayiram nurukku*
- *Thiruvathira ila ada*
- *Thiruvathira kali*
- *Thiruvathira thalakam kuzhambu*
- *Thiruvathira ada naivedyam*

#### 3.1.1. *Thiruvathira puzhukku*

The typical meal *Thiruvathira puzhukku*, a delightful mix of tubers like yam, taro, beans, raw banana, etc., is cooked with a thick paste of freshly ground coconut. It is a kind of delicious savoury which is eaten along with lunch. In some places it is also called as *ettangadi puzhukku*, considering the ingredients (Table 1) present. Ingredients vary from place to place.

**Table 1.** Ingredients of *Thiruvathira puzhukku*

Sl. No.	Common name	Botanical name	Part used	Quantity
1	<i>Kachil</i>	<i>Dioscorea alata</i> L.	Tuber	100 g
2	<i>Chembu</i>	<i>Colocasia esculenta</i> L.	Corm	100 g
3	<i>Chena</i>	<i>Amorphophallus paeoniifolius</i> (Dennst.) Nicols. var. <i>campanulatus</i> (Decne.) Sivad.	Corm	100 g
4	<i>Ethen kaya</i>	<i>Musa paradisiaca</i> L.	Fruit	1 no.
5	<i>Mathan</i>	<i>Cucurbita maxima</i> Duchesne	Fruit	100 g
6	<i>Koorka</i>	<i>Plectranthus barbatus</i> (Andrews) Benth. ex G. Don	Tuber	100 g
7	<i>Madhura kizhangu</i>	<i>Ipomea batatas</i> (L.) Lam.	Root tuber	100 g
8	<i>Vanpayar</i>	<i>Vigna unguiculata</i> (L.) Walp.	Seed	100 g
9	<i>Jeerakam</i>	<i>Cuminum cyminum</i> L.	Fruit	2.5 g
10	<i>Thenga</i>	<i>Cocos nucifera</i> L.	Endosperm	200 g
11	<i>Manjal podi</i>	<i>Curcuma longa</i> L.	Rhizome	2.5 g
12	<i>Mulaku podi</i>	<i>Capsicum annum</i> L.	Fruit	5 g
13	<i>Velichenna</i>	<i>Cocos nucifera</i> L.	Endosperm	5 ml
14	<i>Kariveppu</i>	<i>Murraya koenigii</i> (L.) Spreng.	Leaf	2 stalks
15	<i>Veluthulli</i>	<i>Allium cepa</i> L.	Bulb	5 no.

Method of preparation: Cut the vegetables into cubes and put them in a cooking pot along with overnight soaked large beans. Add some water enough to cook these vegetables. Along with this, add turmeric powder, chilli powder and salt. Close and stir occasionally. Grated coconut, garlic pods and cumin seeds are made into coarse paste. When the vegetables are cooked well, add grounded coconut paste. Mix well and cook for 2 minutes. Turn off the flame, add coconut oil and fresh curry leaves. Seasoned chopped coconut, red chillies and urad dhal (*uzhunnu*) can also be added to make it taste better (Fig. 1b). The dish gives out a pleasing aroma. Can be served for about 4-8 adults.

### 3.1.2. Thiruvathira ettangadi

*Ettangadi* consists of eight kinds of tubers (Table 2) that are consumed steamed or roasted. *Ettangadi* is prepared as two food delights, one is salty and the other sweetish. Sweet *ettangadi* is offered to God as *naivedyam*. *Ettangadi* is consumed during *thiruvthira* eve. In some places *ettangadi* is consumed after breaking the fast in the evening of *thiruvthira*.

**Table 2.** Ingredients of *Ettangadi*

Sl. No.	Common name	Botanical name	Part used
1	<i>Chembu</i>	<i>Colocasia esculenta</i> (L.) Schott	Corm
2	<i>Chena</i>	<i>Amorphophallus paeoniifolius</i> (Dennst.) Nicols. var. <i>campanulatus</i> (Decne.) Sivad.	Corm
3	<i>Madhura kizhangu</i>	<i>Ipomoea batatas</i> (L.) Lam.	Tuber
4	<i>Nana kizhangu</i>	<i>Dioscorea wallichii</i> Hook. f.	Tuber
5	<i>Cheru kizhangu</i>	<i>Dioscorea esculenta</i> (Lour.) Burkill	Tuber
6	<i>Kavathu</i>	<i>Dioscorea alata</i> L.	Tuber
7	<i>Koorka</i>	<i>Plectranthus barbatus</i> (Andrews) Benth. ex G. Don	Tuber
8	<i>Ethen kaya</i>	<i>Musa paradisiaca</i> L.	Fruit

**Table 3.** Ingredients of *Koova payasam*

Sl. No.	Common name	Botanical name	Part used	Quantity
1.	<i>Koova</i>	<i>Maranta arundinacea</i> L.	Rhizome	100 g
2.	<i>Sarkara</i>	<i>Saccharum officinarum</i> L.	Stem extract	200 g
3.	<i>Thenga</i>	<i>Cocos nucifera</i> L.	Endosperm	1 piece
4.	<i>Elakka podi</i>	<i>Elettaria cardamomum</i> L.	Fruit and seed	1 g

Method of preparation:

Sweet *ettangadi*: Tubers are cleaned well. Steamed or roasted tuber vegetables are cooked in jaggery syrup and garnished with sliced or grated coconut and sesame seeds. It is a mouth drooling delicacy. In some places cooked large beans is also added for taste (Fig. 1a).

Salty *ettangadi*: Tubers are cleaned well. Salted steamed or roasted tubers are taken along with coconut shredding. In some temples, *ettangadi chuttu naivedyam* (roasted tubers) is given as *prasadam*.

Along with these 8 ingredients sesame seeds, cow pea, etc., are also added.

### 3.1.3. Koova payasam - dessert

Homegrown arrowroot plants are usually taken for preparing arrowroot powder, which is a lengthy and tedious process. Pulled out roots are further cleaned well and ground along with added water. Starch obtained from this is called as *koova nooru*. This powder is further used to prepare *payasam*, a sweet delight. Preparation method varies from place to place (Table 3).

Method of preparation: Arrowroot powder is made into smooth and thin paste by adding water and stirred carefully to avoid lumps. Add this paste to melted jaggery and place this mixture on the stove with low flame and stirred continuously. When the mixture starts thickening, flame is turned off. Add cardamom powder and grated coconut to taste. Ghee or cashew fried in ghee can be added. In some places coconut milk/cow's milk is added to taste (Fig. 1c).

### 3.1.4. Makayiram nurukku- caramelized plantain bites

*Makayiram nurukku* is a sweet dish consumed during the *Thiruvathira* festival. These are caramelized plantain bites prepared on star *Makayiram*, on the previous day of *Thiruvathira* ritual (Table 4).

Method of preparation: Banana is chopped into small pieces (cubes/disc shaped) after peeling its skin. Heat 10 ml of ghee in a pan and roast the chopped bananas in ghee. When one side turns golden brown, flip to the other side and add melted jaggery and cook it for 3-5 minutes. Add a pinch of cardamom powder for flavour (Fig. 1f). Some add coconut gratings for taste.

### 3.1.5. Thiruvathira ila ada

*Thiruvathira ada* is a traditional seasonal sweet delight consumed during *thiruvathira* ritual.

*Adai/ada* consisting of rice parcels encased in dough made of rice flour, with sweet fillings, covered externally in banana/*Macaranga* leaf. Although method of preparation is the same as preparing *ila ada*, an extra ingredient, the root of a local herb, *oruveran* (*Clerodendrum infortunatum* L.) is ground along with the dough during *thiruvathira* (Table 5).

Method of preparation: Add boiling water gradually to the rice powder and mix using a spoon. To the mixture, *Clerodendrum infortunatum* L. root paste is added. Grated coconut, grated jaggery and cardamom powder are mixed. Take a piece of banana leaf/*macaranga* leaf and place a small bolus of dough in the centre of the leaf. Flatten the dough with wet fingers to get nice and evenly flattened dough. Fill the dough with coconut jaggery mixture on one side of the flattened dough and fold from the other side. *Ila ada* is well wrapped in order to avoid spilling of contents. Place the *ila ada* in a steamer and steam it for 15-20 minutes.

### 3.1.6. Thiruvathira kali

An offering to Lord Mahadeva, not practised among kerala hindus, but practiced among tamil brahmins living in Kerala (*pattar*). It is usually consumed along with salty spicy *Thiruvathira thalagam kuzhambu* after *naivedyam* (food offering to deity) (Table 6).

**Table 4.** Ingredients of *Makayiram nurukku*

Sl. No.	Common name	Botanical name	Part used	Quantity
1.	<i>Pazham</i>	<i>Musa paradisiaca</i> L.	Fruit	500 g
2.	<i>Sarkara</i>	<i>Saccharum officinarum</i> L.	Stem extract	Quantity sufficient
3.	<i>Elakka podi</i>	<i>Elettaria cardamomum</i> L.	Fruit and seed	Quantity sufficient

**Table 5.** Ingredients of *thiruvathira ila ada*

Sl. No.	Common name	Botanical name	Part used	Quantity
1	<i>Aripodi</i>	<i>Oryza sativa</i> L.	Endosperm	100 g
2	<i>Oruveran</i>	<i>Clerodendrum infortunatum</i> L.	Root	15 g
3	<i>Sarkara</i>	<i>Saccharum officinarum</i> L.	Stem extract	Quantity sufficient
4	<i>Elakka podi</i>	<i>Elettaria cardamomum</i> L.	Fruit and seed	Quantity sufficient
5	<i>Thenga</i>	<i>Cocos nucifera</i> L.	Endosperm	Quantity sufficient



**Table 6.** Ingredients of *Thiruvathira kali*

Sl.No.	Common name	Botanical name	Part used	Quantity
1.	<i>Ari</i>	<i>Oryza sativa</i> L.	Endosperm	250 g
2.	<i>Cherupayar</i>	<i>Vigna radiata</i> L.	Seed	15 g
3.	<i>Thenga</i>	<i>Cocos nucifera</i> L.	Endosperm	1 piece
4.	<i>Elakka podi</i>	<i>Elettaria cardamomum</i> L.	Fruit and seed	Quantity sufficient
5.	<i>Sarkara</i>	<i>Saccharum officinarum</i> L.	Stem extract	Quantity sufficient

Method of preparation: Washed raw rice and beans are fried in separate vessels till it attains golden brown colour. Grind the fried rice. To the fried beans, 250 ml of water is added and cooked well. Melted jaggery, fried rice powder and all other ingredients are added and stirred well. Cashew fried in ghee is also added for taste (Fig. 1e).

### 3.1.7. *Thiruvathira thalagam kuzhambu*

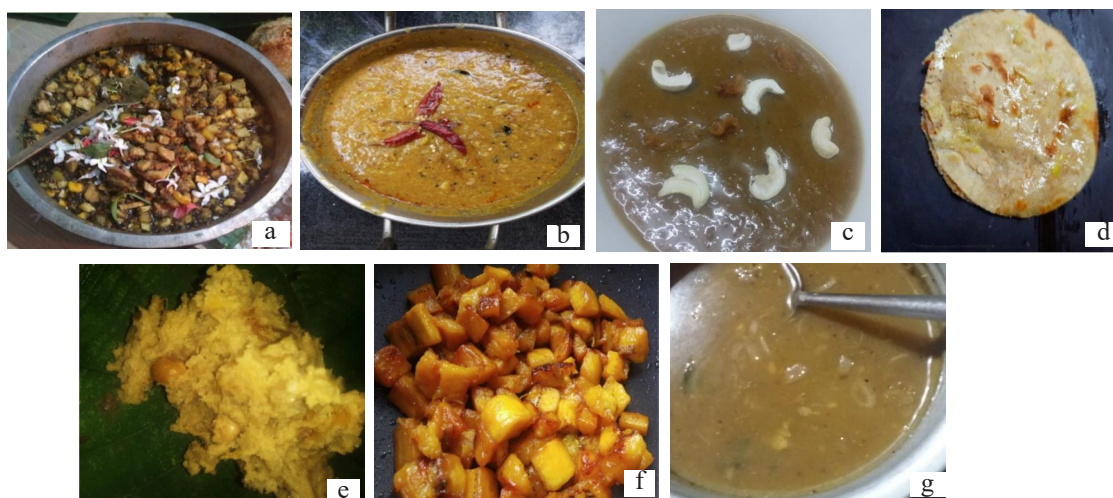
*Thiruvathira thalagam kuzhambu* is also called as *ezhu kari koottu* (Table 7). It is a traditional seasonal food recipe practiced among tamil brahmins dwelling in Kerala (*pattar*). This salty and spicy preparation is given along with sweet *Thiruvathira kali* as an offering to God. After offering and prayers, the dish is consumed to break the fast. *Thalagam* is a good combination with cooked rice in routine.

Method of preparation: Lemon sized tamarind is soaked in water for some time, juice is extracted.

After washing, all the vegetables are chopped into cubes and cooked along with the tamarind paste, turmeric, asafoetida and salt. Dal is fried in a pan along with sesame seeds, red chillies and cumin till it attains light golden colour. Then add coconut gratings and fried till it becomes light brown colour. After cooling, fried items are ground to fine paste and added to the cooking pot. It is further cooked in low flame for 5 minutes. Some people add soaked rice paste along with this. Some instead of roasted dhal cooked dal paste is added. For seasoning, heat oil in a small pan, splutter mustard seeds and add some curry leaves (Fig. 1g).

### 3.1.8. *Thiruvathira adai naivedyam*

*Thiruvathira adai* is a traditional seasonal food recipe practiced among *pattar* as an offering to God. It is a sweet tasted cardamom flavoured preparation served with little ghee or butter on top (Table 8).



**Fig. 1.** Foods of *Thiruvathira*; a. *Ettangadi nivedyam*; b. *Thiruvathira puzhukku*; c. *Koova payasam*; d. *Thiruvathira adai*; e. *Thiruvathira kali*; f. *Makayiram nurukku*; g. *Thalagam kuzhambu*

**Table 7.** Ingredients of *Thiruvathira thalagam kuzhambu*

Sl. No.	Common name	Botanical name	Part used	Quantity
1	<i>Kachil</i>	<i>Dioscorea alata</i> L.	Tuber	100 g
2	<i>Chembu</i>	<i>Colocasia esculenta</i> L.	Corm	100 g
3	<i>Chena</i>	<i>Amorphophallus paeoniifolius</i> (Dennst.) Nicols. var. <i>campanulatus</i> (Decne.) Sivad.	Corm	100 g
4	<i>Ethen kaya</i>	<i>Musa paradisiaca</i> L.	Fruit	1 no.
5	<i>Mathan</i>	<i>Cucurbita maxima</i> Duchesne	Fruit	100 g
6	<i>Koorka</i>	<i>Plectranthus barbatus</i> (Andrews) Benth. ex G. Don	Tuber	100 g
7	<i>Madhura kizhangu</i>	<i>Ipomea batatas</i> (L.) Lam.	Root tuber	100 g
8	<i>Puli</i>	<i>Tamarindus indica</i> L.	Fruit	10 g
9	<i>Ellu</i>	<i>Sesamum indicum</i> L.	Seed	20 g
10	<i>Thuvara parippu</i>	<i>Cajanus cajan</i> L.	Seed	30 g
11	<i>Kayam</i>	<i>Ferula asafoetida</i> L.	Resin	0.25 g
12	<i>Jeerakam</i>	<i>Cuminum cyminum</i> L.	Fruit	2.5 g
13	<i>Manjal podi</i>	<i>Curcuma longa</i> L.	Rhizome	2.5 g
14	<i>Mulaku podi</i>	<i>Capsicum annum</i> L.	Fruit	5 g
15	<i>Velichenna</i>	<i>Cocos nucifera</i> L.	Oil	15 ml
16	<i>Kariveppu</i>	<i>Murraya koenigii</i> (L.) Spreng.	Leaf	2 stalks
17	<i>Thenga</i>	<i>Cocos nucifera</i> L.	Endosperm	200 g
18	<i>Kaduku</i>	<i>Brassica nigra</i> L.	Seed	15 g

Method of preparation: Rice flour is roasted well till a light yellow colour appears. Care should be given not to burn the rice flour. To the jaggery syrup prepared, add the roasted rice flour and mix well. Keep stirring to mix the rice flour nicely in the jaggery syrup. Care should be given to avoid forming lumps. Finally add grated coconut and cardamom, mix it well. Make equal size balls out from this *ada* dough. Take plantain leaf and grease it with ghee or oil. Keep one ball of the dough on a leaf or plate in order to make a small circle by kneading with your hands. Heat a pan and add a spoon of ghee and roast the *ada* in low flame. Gently flip to the other side to fry it on the other side (Fig. 1d).

On observing the foods of *Thiruvathira*, one can understand that tuber crops are the main ingredients in most of the dishes, indicating hints of their association in regulating or modifying women's health. Tuber crops are the most important food crops after cereals. They have the highest rate of dry matter production per day and are major calorie contributors (Edison S *et al.*, 2006). Tuber crops find an important place in the dietary habits of Keralites from the days of yore, which is clearly reflected in their traditional festival dishes. On *Thiruvathira*, consumption of water is restricted. Rather, intake of tender coconut water is promoted which will further maintain adverse effects of dehydration and harmonize minerals. Arrow root tubers are

having renowned effect in urinary tract infection (ethnomedical), which will further consider and check the probable harms of dehydration. In short most herbs considered in *Thiruvathira* regimen are having considerable effect in harmonizing women's health at different ages (Table 9).

**Table 8.** Ingredients of *Thiruvathira adai nivedyam*

Sl. No.	Common name	Botanical name	Part used	Quantity
1.	<i>Aripodi</i>	<i>Oryza sativa</i> L.	Endosperm	100 g
2.	<i>Sarkara</i>	<i>Saccharum officinarum</i> L.	Unrefined sugar	Quantity sufficient
3.	<i>Elakka podi</i>	<i>Elettaria cardamomum</i> L.	Fruit and seed	Quantity sufficient
4.	<i>Thenga</i>	<i>Cocos nucifera</i> L.	Endosperm	Quantity sufficient

**Table 9.** Related scientific studies of plants

Herb	Related scientific studies
<i>Dioscorea</i> spp.	<p>Reduce the risk of breast cancer and cardiovascular diseases in postmenopausal women by increasing and maintaining levels of serum estrogen and sex hormone binding globulin (SHBG) (Wen-Huey Wu <i>et al.</i>, 2013).</p> <p>Bone health - Administration of dioscorea to ovariectomised rats decreased the porosity effect on bones and increased the ultimate force of bones indicating its efficacy in maintains bone health. Chronic administration of dioscorea may enhance bone strength and provide insight into the role of bone remodeling and osteoporosis during the menopause (Chiang <i>et al.</i>, 2011).</p> <p>Dioscorea has the ability to reduce the risk of cardiovascular diseases in postmenopausal women (In Suk SON <i>et al.</i>, 2007).</p> <p>High SHBG levels had a protective effect against the occurrence of type 2 diabetes mellitus and coronary heart diseases in women (Ghosh <i>et al.</i>, 2014, Maithili <i>et al.</i>, 2011).</p>
<i>Colocasia esculenta</i> L.	<p>Antimetastatic activity was shown by the water-soluble root extract of <i>C. esculenta</i>. The isolated compounds protein, tarin, and lectin derived from taro that potently and inhibit lung colonizing ability as well as spontaneous metastasis from mammary gland-implanted tumors, in a murine model (Kundu M <i>et al.</i>, 2012).</p> <p>Flavonoid glycoside rich fraction mimics the action of estrogens and exhibited better estrogenic activity in prepubescent, pubescent and adult ovariectomized female rats (Rodrigues <i>et al.</i>, 2018).</p> <p><i>C. esculenta</i> exerted a significant effect on the opening of the vaginal canal in prepubescent rats and on vaginal epithelium (Rodrigues <i>et al.</i>, 2018).</p> <p>Antimelanogenic activity of isolated fraction from the methanolic extract of the tuber barks of <i>Colocasia</i> showed inhibitory effects on melanin production. (Kim <i>et al.</i>, 2010).</p> <p>In a hypolipidemic study out of 130 samples <i>C. esculenta</i> (taro) showed the highest inhibition (55% inhibition at 300 µg/ml) (Sakano <i>et al.</i>, 2005).</p>
<i>Maranta arundinacea</i> L.	<p>Presence of good amount of folate in arrowroot may help in preventing neural tube defect in unborn (Strom <i>et al.</i>, 2018). An organized study result is needed for confirm the affirmation.</p> <p>Arrowroot flour is a potential source of prebiotics (Harmayani <i>et al.</i>, 2011).</p> <p>In vivo and in vitro immunostimulatory effects was shown by arrowroot tuber extracts (Kumalasari <i>et al.</i>, 2012).</p>

<i>Musa paradisiaca</i> L.	High content of iron serves as antianemic food (Edet <i>et al.</i> , 2018). Effective in regulating blood pressure (Osim and Ibu, 2009). In many animal trials, banana has been shown to be useful in the treatment of diabetes, due to its antihyperglycemic effect. Antidiabetic effect of syringic acid present in banana and could be used in managing glycoprotein abnormalities (Rai <i>et al.</i> , 2009).
<i>Clerodendrum infortunatum</i> L.	Antihyperglycemic activity-showed significant reduction in blood glucose level in vivo analysis (Sadia, 2017). Proven hepatoprotective effect-Methanolic extract of <i>Clerodendrum infortunatum</i> L. were studied against carbon tetrachloride induced hepatotoxicity (Sannigrahi <i>et al.</i> , 2009). Antitumor activity of root extract (CIE) under in vitro condition showed significant effect (Tiju <i>et al.</i> , 2015). Extensive ethnomedical use reported in gynecological issues like menorrhagia, PCOD, post partum care and infertility.

#### 4. Conclusion

The traditional foods of *Thiruvathira* festival act as functional foods which maintain the health of women of different age groups; prepubescent, reproductive and menopausal age groups. This data entails our wise ancestor's foreseeing. Along with nurturing and nourishing woman's health, these festivals directly or indirectly uphold regional cultivation and thereby the conservation of biodiversity of regional specific plant species. A systemic documentation of this invaluable traditional knowledge is the need of the hour, as these rituals are declining along with ethno-nutritional, sociological and cultural aspects related to *Thiruvathira* festival. Furthermore, advanced scientific studies are required on various traditional recipes related to *Thiruvathira* festival and its relevance on women's health and nutrition that could contribute towards achieving sustainable development goals. The systematic documentation of sociological and cultural aspects related to *Thiruvathira* festival will also enrich the traditional and folk heritage of Bharata.

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#### References

- Chiang SS, Chang SP and Pan TM 2011. Osteoprotective effect of monascus-fermented *Dioscorea* in ovariectomized rat model of postmenopausal osteoporosis. *J. Agri. Food Chem.* 59(17)s: 9150-9157
- Edet Akpanyung, Ito Archibong, Idiongo Umoh and Utibe Bassey 2018. Effect of methanol extract of the unripe peels of *Musa paradisiaca* on some haematological and biochemical indices in male albino wistar rats. *Int. J. Agri. Env. Res.* 4(6): 1250-1260
- Edison S, Unnikrishnan M, Vimala B, Santha V Pillai, Sheela M N, Sreekumari M T and Abraham K 2006. Biodiversity of Tropical Tuber Crops in India. *NBA Scientific Bulletin*, Number 7: p. 1.
- Ghosh S, More P, Derle A, Patil A B, Markad P and Asok A 2014. Diosgenin from *Dioscorea bulbifera*: novel hit for treatment of type II diabetes mellitus with inhibitory activity against  $\alpha$ -amylase and  $\alpha$ -glucosidase. *PLOS one.* 9 (9).
- Harmayani E, Kumalasari I D and Marsono Y 2011. Effect of arrowroot (*Maranta arundinacea* L.) diet on the selected bacterial population and chemical properties of caecal digesta of Sprague Dawley rats. *Int. Res. J. Microbiol.* 2: 278–284.
- In Suk Son, Ji Hyun Kim, Ho Yong Sohn, Kun Ho Son, Jong-Sang Kim and Chong-Suk Kwon 2007. Antioxidative and hypolipidemic effects of diosgenin, a steroidal Saponin of yam (*Dioscorea* spp.) on High-Cholesterol fed rats. *Bioscience, Biotechnology and Biochemistry.* 71(12): 3063–3071.
- Kim K H, Moon E, Kim S Y and Lee K R 2010. Antimelanogenic fatty acid derivatives from the tuber-barks of *Colocasia antiquorum* var. *esculenta*. *Bulletin of the Korean Chemical Society.* 31(7): 2051-2053.
- Kumalasari, I D, Harmayani E and Lestari L A 2012. Evaluation of immunostimulatory effect of the arrowroot (*Maranta arundinacea* L.) *in vitro* and *in vivo*. *Cytotechnology.* 64: 131–137.
- Kundu N, Campbell P, Hampton B, Lin CY, Ma X and Ambulos N 2012. Antimetastatic activity isolated from *Colocasia esculenta* (taro). *Anticancer Drugs.* 23(2): 200-211.
- Maithili V, Dhanabal S P, Mahendran S and Vadivelan R 2011. Antidiabetic activity of ethanolic extract of tubers of *Dioscorea alata* in alloxan induced diabetic rats. *Indian J. pharmacol.* 43(4): 455-459.



- Osim E E and Ibu J O 1991. The effect of plantains (*Musa paradisiaca*) on DOCA-induced hypertension in rats. *Inter. J. Pharmacognosy.* 29(1): 9-13.
- Rai P K, Jaiswal D and Rai N K 2009. Role of glyceemic elements of *Cynodon dactylon* and *Musa paradisiaca* in diabetes management. *Lasers Med. Sci.* 24: 761.
- Rodrigues G M, Borges B D, Moreira L G Q, Rossete E A G and Franca S D C 2018. Effects of estrogen-like plant compounds on the vaginal epithelium pituitary, adrenal glands, and uterus of rats. *Exp. Biol. and Med.* 1-12.
- Sadia M 2017. Investigation of antidiarrheal and hypoglycemic activities of *Clerodendrum viscosum* root extract in mice (Thesis). The department of pharmacy Dhaka, Bangladesh.
- Sakano Y, Mutsuga M, Tanaka R, Sukanuma H, Inakuma T and Toyoda M 2005. Inhibition of human lanosterol synthase by the constituents of *Colocasia esculenta* (taro). *Biol. Pharm. Bull.* 28(2): 299-304.
- Sannigrahi Santanu, Mazumder Upal Kanti, Pal Dilipkumar and Mishra Silpi Lipsa 2009. Hepatoprotective potential of methanol extract of *Clerodendrum infortunatum* Linn. against CCl<sub>4</sub> induced hepatotoxicity in rats. *5(20): 394-399.*
- Strom M, Granström C, Lyall K, Ascherio A and Olsen S F 2018. Folic acid supplementation and intake of folate in pregnancy in relation to offspring risk of autism spectrum disorder. *Psychological medicine.* 48(6): 1048-1054.
- Tiju Chacko, Aditya Menon, Shivaprabha V Nair, Entissar Al Suhaibani and Cherupally Krishnan 2015. Cytotoxic and antitumor activity of the extract of *Clerodendron infortunatum*: a mechanistic study. *Amer. J. Phytomedicine and Clinical Therapeutics.* 3(2): 145-158.
- Wen-Huey Wu, Li-Yun Liu, Cheng-Jih Chung, R D, Hei-Jen Jou and Tzong-An Wang 2013. Estrogenic effect of Yam ingestion in healthy postmenopausal women. *J. Am. Coll. Nutr.* 18: 235-243.