

Research Article

Science teachers' perception of explored use and potential medical benefits of (*Tamarindus indica* L.) In Federal University of Education Kontagora for economic stability

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Abstract

This study evaluated science teachers' perception of explored uses and potential medicinal benefits of *Tamarindus indica* L. in Federal University of Education Kontagora for Economic stability. Structured Questionnaire with Average Weighted Response (AVR) was distributed to staff of School of Secondary Education Science Programmes and Research questions and hypothesis were formulated to guide the study. The results from the findings showed that many science lecturers on the explored uses and potential medicinal benefits believed that tamarind tree can be eaten as vegetables, the fruit pulp can be used as refreshing drinks and that the leaves contain vitamin C, that it can also be used to treat inflammation, stomach pain, used in wound healing and to promote bowel movements while some science lecturers also disagreed on some of the explored uses and potential medicinal benefits such as that it does not help in weight loss, it does not regulate fluctuations in glucose and insulin levels and it cannot be used to improve semen quality and life span of sperms in men. The study recommended that based on the unique flavour and nutritional profile, tamarind can be made a promising ingredient for food production development and also further research should be conducted to validate the efficacy, safety and mechanism of action of tamarind through scientific study.

Keywords: Tamarind, Explored, Medicinal, Perception.

1. Introduction

According to Abubakar *et al.*, (2023), *Tamarindus indica* L. is a leguminous tree that belongs to the family Fabaceae with subfamily caesalpiniaceae and is indigenous to tropical Africa, Particularly in Nigeria. Also Chimsah *et al* (2020) stated that the plant is described by some botanist as a pan-tropical species which stretches from Senegal to Eritrea, from Sierra Leone to Cameroon, from Ethiopia and Somalia to Mozambique and the tree was long ago introduced into and adapted to India such that it has often been reported been indigenous from there. Also as stated by Chimash *et al* (2020), the trained tree is well adopted to semi-arid regions of the tropics and can withstand drought conditions relatively well. It can tolerate a great diversity of soil types that does well in deep, well-drained soils, which are slightly acidic or saline. The tree will not tolerate cold and continuous wet soils. The tree is fairly large in size and can produce up to

175kg as fruit yield per year.

According to Dantani *et al* (2020), tamarind tree is best known for its delicious fruit. The edible portion of fruit is brown, steely and sour in taste with a particular flavour that is used in a variety of dishes and drinks. That the usefulness of the tamarind tree does not end with its fruits. The tamarind tree is widely distributed or more appreciated as an ornamental plant in the tropics. It produces many valued foods, medical, wood and construction products. The tree is drought resistant, strong and performs well as wind break. It also prevents soil erosion, protects people's homes, crops and animals in harsh environments and also plays crucial beautification role. The tamarind tree according to Okello *et al* (2017), also play major and important roles in many aspect of life from food, pharmaceutical and textile industries, to being used as timber, fodder and as a source of

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fuel. The fruit pulp of tamarind is edible and is considered more appealing and palatable as it becomes sweeter and less sour as the fruit matures. Therefore, this study was carried out to seek the science lecturers' perception on the explored uses and potential health benefits of *Tamarindus indica* L.

Tamarind produces multiple products that support the livelihoods of many people and these tamarind products include the following:

Fruit pulp: Tamarind fruit pulp according to Emmy *et al* (2010), is used for seasoning, as a food component to flavour confections curries and is the main component in juices and certain beverages. The refreshing drinks from the fruit pulp are very popular and is mixed with sugar to make a pleasantly acid drink. Commercially according to Ferrara (2019), is used as raw material for the manufacture of numerous industrial food products such as tamarind juice, concentrate, curries, tartaric acid, tamarind pulp powder, ice cream and alcoholic beverages. It can also be used in the production of ethanol (Menon *et al.*, 2010).

Seeds: Tamarind seed is a by-product of tamarind pulp and is often discarded after extraction of the pulp. However, Chimash (2020) stated that some processors gather the seeds and use them as feed for animals especially pigs and it has also been shown in recent times that the composition of tamarind seeds is very similar to that of cereal seeds and is a good source of food (Okello *et al.*, 2017).

Leaves: According to Hailaly *et al* (2020). Tamarind flowers and leaves can be eaten as vegetables and are prepared in variety of dishes. That the foliage has high forage value, though is rarely harvested for this purpose because it affects fruit yield. Tamarind trees growing in wood lands are often eaten by wild animals, such as Elephants or Giraffes, for which tamarind is a preferred plant, probably because of high crude protein content. According to El-siddig *et al.*, (2006), both leaves and bark are rich in tannins, that leaves yield a red dye, which is used to give a yellow tint to cloth previously dyed with indigo. Also that tamarind leaves are fair source of vitamin C and B-Carotene and that the mineral content is very high, particularly Potassium, Phosphorus, Calcium and Magnesium and that Vitamin C in tamarind helps in improving the semen quality and life span of sperms in males.

Bark: The bark and leaves as reported by Chimsah *et al.*, (2020), contain tannins. The bark is rich in tannins reaching up to 70% and such has found a place for use in the tanning industry. The bark as also reported by El-siddig *et al.*, (2006), is also used for tanning and dyeing hides and as masticatory alone or as a substitute of lime. The tamarind wigs are also used as chewing sticks.

Wood: Tamarind wood is used to make furniture, boats, carvings, chopping blocks and other wood items such as nortart, pestles, tent pegs, canoes, side planks for boats etc. (Brailo *et al.*, 2021).

Tamarind has played important roles in traditional medicine. In beverage form, as stated by Hailary *et al.*, (2020) was commonly used to treat diarrhea, constipation, fever and malaria. Also the bark and leaves were used to promote wound healing. The fruit as observed by Emmy *et al* (2020), exhibits Laxative effects due to toilet high quantities of malic acid, tartaric acid and potassium bitrate

and that extract of steamed and sun-dried tamarind pulp are used to treat skin problems like rashes and irritation and it can also be ingested after dilution as an abortifacient.

The health benefit of tamarind as studied by Mohammed (2019), includes its ability to reduce inflammation throughout the body, improves vision, boost respiration health, heal skin conditions and improve the digestive system. Tamarind also relieves pain strengthens the immune system, reduces fever, lowers cholesterol and improve cardiovascular health, treats pile and protects against parasites and worms. That vitamin C in tamarind helps in preventing sperm deaths in testicles and increase sperm count in men.

According to Razali *et al* (2015), tamarind is a very good source of iron and a single serving can provide more than 10% one's daily requirements. A healthy supply of iron in the body can ensure appropriate oxygenation of different muscles and organs to function properly. It was also reported that one of the unique compounds of tamarind called Hydroxycitric Acid (HCA) is connected to weight loss because it has been shown to inhibit an enzyme in the body that specifically helps to store fat.

Along with the ability to stop weight gain Mohammed (2019), also reported that tamarind also inhibits enzyme alpha-amylase which stops carbohydrate from being absorbed and as such can be used to manage Diabetes. A carbohydrates heavy diet can increase the chances of uncontrolled glucose and insulin levels which is the biggest problem for people suffering from diabetes. That tamarind can help to monitor and control those fluctuations.

Tamarindus indica L. commonly known as tamarind is a tropical tree with a wide range of explored used and potential health benefits. Despite the uses of tamarind in various cultures for nutritional and medicinal properties there is lack of comprehensive evidence to support its explored uses and potential health benefits. This knowledge gap limits the widespread acceptance and utilization of *Tamarindus indica* as dietary supplement and therapeutic agent. Thus, this study was carried to seek perception of science lecturers on the explored uses and potential health benefits of tamarind.

The following research questions were asked to guide the study:

1. What are the perceptions of Science lecturers on the explored uses of Tamarind for Economic stability?
2. What are the perceptions of Science lecturers on the potential medical benefits of Tamarind?

Ho1: There is no significant different in the perception of male and female lecturers on the explored uses and potential medical benefits of tamarind for economic stability

Ho2: There is no significant difference in the perception of science lecturers of various department on the explored uses and possible medical benefits of Tamarind for Economic stability.

2. Methodology

2.1 Research Design

The research is a survey type that uses questionnaire to gather data on science lecturers' perception of explored uses and potential benefits of tamarind

Study area: The research was carried out in Federal College of Education Kontagora Niger State, Nigeria. Niger state is a state in the Northern central region of Nigeria and Kontagora is located between Latitudes $10^{\circ} 24' 11.5''$ N and Longitudes $5^{\circ} 28' 14.9''$ E

2.2 Sampling Procedure

Federal College of Education Kontagora has seven schools, and staff of school of Secondary Education Science Programmes were selected as a representative sample of the schools.

2.3 Instrument for Data Collection

Structured Questionnaires with Average Weighted Response (SQAWR) was used for this study. The questionnaire contained relevant information on the topic

and they were distributed to Science Lecturers in Federal College of Education, Kontagora.

2.4 Data Analysis

Data collected for this study were subjected to descriptive statistics by using tables, frequency distributed and percentage. Analysis of Variance (ANOVA) were used to test the significant differences in the gender and Departmental perception on the explored uses and possible medical benefits of Tamarind.

3. Results and Discussion

The data collected was analysed and the results are presented and discussed in this section

3.1. Answers to research questions

3.1.1 Research Question 1

Research Question 1: What are the perceptions of Science Lecturers on the explored uses of Tamarind for Economic Stability?

Table 1: Frequency and Percentage of Explored uses of Tamarind

S/N	ITEM	SA(%)	A (%)	Responses D(%)	SD(%)	DEUIM
1.	The leaves of tamarind can be eaten as vegetables and are prepared in variety of dishes	5(14.7)	18(52.9)	10(29.4)	1(2.9)	Agreed
2.	The fruit pulp of tamarind is edible and is considered more appealing, and palatable as the fruit matures	8(23.5)	25(13.5)	1(2.9)	-	Agreed
3.	Tamarind are rich in Tannins (i.e Water soluble polyphenols that are present in many plants food)	3(8.8)	25(73.5)	6 (17.6)	-	Agreed
4.	Tamarind is used a raw material for the manufacture of numerous industrial food products	5(14.7)	15(44.1)	14(41.2)	-	Agreed
5.	Tamarind is used in the production of ethanol	2(5.9)	13.(38.2)	19(55.9)	-	Disagreed
6.	The Tamarind seeds cannot be processed and fed to animal	2(5.9)	11(32.4)	19(55.9)	-	Disagreed
7.	Tamarind leaves are deficient of vitamin C and B-carotene	3(8.8)	4(11.8)	24(70.6)	3(8.8)	Disagreed
8.	Tamarind bark pollute activities for tanning hides and also in dying	12(35.3)	21(61.8)	-	1(2.9)_	Agreed
9.	Tamarind wood breaks down easily when used to make furniture, boards, vanishings etc	-	9(55.9)	13(38.2)	2(5.9)	Agreed
10.	The tamarind is not appreciated as ornamental plants	2(5.9)	11(32.4)	20(58.8)	1(2.9)	Disagreed

Table 1 showed that the respondents agreed with the option on item 1, 2, 3, 4, 8 and 9 while they disagreed with options on items 5,6,7, and 10. This result implies that Tamarind leaves can be eaten as vegetable and prepared in variety of dishes, its fruit pulp is edible and considered more appealing and palatable as fruits matures, its rich in tannins, used as raw material for the manufacturers of numerous food products, its bark polluted activities for tanning and dying hides, and tamarind wood is found not to be durable for furniture purposes. Tamarind was not considered as useful to feed animals its leaves were considered to be deficient of vitamin C and B-carotene but was appreciated as ornamental plant. The result of findings in item 1,2,3,4, 8 and 9 in table

one are in line with the works of (Emmy *et al.*, 2010, Feriara, 2019 and Hailay *et.al.*, 2020), who studied the potential uses of the tamarind and found out that the various parts of tamarind tree such as fruit pulp. Leaves are used for various purposes as stated in item 1,2,3,4, 8 and 9 while the findings of the results from item 5,6,7 and 10 contradicted the work of (El-sidding *etal*, 2006, Okello *etal.*, 2017 and Brailo *etal*, 2021) who found out that various parts of the tamarind such as seeds, bark and wood can be used in the production of ethanol, as feed for animals and as attributed to individual staff limitation of exploiting the extent to which the tamarind tree could be used.

Table 2: Frequency count and Percentage of perceived potential medicinal benefits of Tamarind

S/N	ITEM	Responses				DEUIM
		SA(%)	A (%)	D(%)	SD(%)	
1.	Tamarind is used to treat inflammation, stomach pain, throat pain and Rheumatoid in traditional medicine	9(26.5)	10(29.4)	15(44.1)	-	Agreed
2.	Tamarind is used in wound healing, abdominal pain, diarrhea, dysentery	6(17.6)	12(35.3)	16(47.1)	-	Agreed
3.	The polyphenols (i.e natural occurring plant compounds that have health benefits) in tamarind have antioxidant and anti-inflammatory properties and thus can protect against heart disease, cancer and diabetes	6(17.6)	12(35.2)	16 (47.1)	-	Agreed
4.	Vitamin C in tamarind helps in improving the semen quality and life span of sperms in males	4(11.8)	11(32.4)	13(38.2)	6.(17.6)	Disagreed
5.	Tamarind promotes regular bowel movement alleviating gastrointestinal health	9(26.5)	24.(70.6)	1(2.9)	-	Agreed
6.	Tamarind does not help in weight loss	1(2.9)	19(55.9)	9(26.5)	5(14.7)	Agreed
7.	Tamarind cannot be used to regulate fluctuations in glucose and insulin levels	3(8.8)	19(55.9)	9(26.5)	3(8.8)	Agreed
8.	Tamarind fruit extract does not contain antioxidants that counter free radicals damage to the liver	4(11.8)	17(50.8)	10(29.4)	3(8.8)	Agreed
9.	Tamarind is used to fight against certain bacterial and fungi because of its anti-microbial properties	3(8.8)	13(38.2)	18(52.9)	—	Disagreed
10.	Tamarinds-based treatments and products are not used to improve hair quality, reduce dandruff and support scalp health	2(5.9)	20(58.8)	11(32.4)	1(2.9)	Agreed

3.1.2 Research Question 2

Research Question 2: *What are the perceptions of Science Lecturers on the potential medicinal benefits Tamarind?*

Table 2 revealed that the respondents agreed on the opinions raised on item 1,2,3,4,5,6,7,8 and 10 in the instrument while a disagreed decision was rewarded for opinions on items 4 and 9. This implies that tamarind could be used for the treatment of inflammatory stomach pain, throat pain and rheumatoid in traditional medicine, used in wound healing, abdominal pain, diarrhea and dysentery, its polyphenols have antioxidant and anti-inflammatory properties which makes potent for protection against heart diseases, cancer and diabetes, it promotes regular bowel movement thereby alleviating constipation and improving gastrointestinal health, it does not help in weight loss, cannot be used to regulate fluctuation in glucose and insulin levels, its fruit extract does not provide protective effect for the liver as it does not contain antioxidants that counter free radical

damage to the liver as well as treatment, and tamarind products based are not used to improve hair. On the other hand, the Vitamin C in tamarind cannot help in improving semen quality and life span of sperms in male and cannot be used to fight against certain bacterial and fungus despite its anti-microbial properties.

The result of findings from item 1,2,3,5 agreed with the findings of Hailay *et al* (2020) who studied the potential health benefits of the tamarind and discovered that the tamarind tree could be used for various medical purpose

while the findings in item 6,7,8 and 10 believed that tamarind cannot be used for medical values attached to such items, the findings therefore contradicts the work of (Mohammed 2019, Razali *et al.* 2015 and Emmy *et al.* 2020), who studied the tamarind tree and found out that the tree has potential health and medical purposes as stated in the

literature. The differences in responses to these items stated in both positive and negative medicinal directions could also be attributed to inadequate perception of the medicinal chemical constituents of the tamarind by staff. Also, it could be attributed to the respondents' different science background, as those from the life sciences could have adequate knowledge of the medicinal value of tamarind tree than those in the physical sciences. The findings of results from item 4 and 9 also controlling weight and also to fight against certain bacteria and fungi infection.

The findings from items 4 and 9 on weight control and fight against bacteria and fungi could be attributed to non-discovering of the plant by staff across the departments

3.2. Hypotheses Testing

3.2.1. Hypothesis 1

Hypothesis 1: *There is no significant different in the perception of male and female lecturers on the explored uses and potential medical benefits of tamarind for economic stability,*

Table 3 shows that, there was no significant Gender difference on the perceived explored

Table 3: T-test of perceived explored uses and potential medicinal benefits of Tamarind based on gender

Variance	Sex	N	X	SD	Std Error Mean	df	T	Sig (2tailed)
Explored uses	Male	28	24.11	3.035	.574	32	.42	.833
	Female	6	23.83	1.722	.703			
Potential Health Benefits	Male	28	22.86	3.923	.741	32	.845	.404
	Female	6	24.33	3.670	1.498			

uses of tamarind ($t=.212$ at $\alpha=.833$) as well as on the perceived potential health benefits of tamarind ($t=.845$ at $\alpha=.404$), the hypothesis was therefore accepted. The findings of the results from table 3 could be attributed to male staff

not using more products from tamarind than their female counterparts. It could also be attributed in staff strength or numbers as male staff are higher in number than female staff.
Ho2:

Table 4: ANOVA of perceived explored uses and potential medicinal benefits of Tamarind on the basis of Departments.

Variance		Sum of Sequence	df	Mean quence	Se- F	Sig
Explored uses	Between Groups	49.475	.6	8.246		
	Within Groups	214.882	27	7.941	1.038	.423
	Total	263.882	33			
Potential Health Ben-efit	Between Groups	100.118	6	16.686		
	Within Groups	393.412	27	14.571	1.145	.364
	Total	493.529	33			

3.2.2. Hypothesis 2

Hypothesis 2: *There is no significant difference in the perception of science lecturers of various department on the explored uses and possible medical benefits of Tamarind for Economic stability.*

Table 4 shows that there was no significant department difference on the perceived explored uses of tamarind ($F=1.038$ at $\alpha=.423$) as well as on the perceived potential health benefits of tamarind ($F=1.145$ at $\alpha=.423$), the hypothesis is accepted as a result. The findings of the result in table 4 based on departments could be attributed to many departments under school of sciences falling under physical sciences and may not be well disposed to understanding the uses and potential health benefits of tamarind tree.

5. Conclusion

From this research, it is clear that several authors have reported the explored uses and potential medicinal values of *Tamarindus indica L.* virtually every part of this tree has either nutritional or medicinal value and thus may serve as income for economic stability but sadly, little attention is accorded to the plant in order to tap the benefits in Nigeria. With all these potentialities of tamarind tree, it is

underutilized in Nigeria as could be seen in many of the responses given to the items both for explored uses and potential medicinal values. Therefore, the potential of the tamarind tree, its products and utilization should be further investigated to enhance human nutrition and medicinal needs for economic stability.

Recommendations:

Based on the findings, the following recommendations were made:

- Tamarind could be explored as a dietary supplement for its potential health benefits
- Based on its unique floral and nutritional profile, tamarind can be made a promising ingredient for food product development
- Also further research is needed to validate the efficiency, safety and mechanisms of action of tamarind through scientific studies.

Abbreviations

AVR	Average Weighted Response
HCA	Hydroxycitric Acid
SQAWR	Structured Questionnaires with Average Weighted Response
ANOVA	Analysis of Variance

Author Contributions

Oti, Elizabeth C.: Conceptualization, methodology, Writing- original draft,

Arowolo. Jacob Gbemiga: Methodology , analysis of result, **Isyaku, Amina:** Writing- Review and Editing

Ojoko, Augusta Ndidi : Writing- Review and Editing.

Conflicts of Interest

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