



Promotion of Turmeric for the Food/Pharmaceutical Industry in Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author JON designed the study, wrote the protocol and wrote the first draft of the manuscript. Author GNA reviewed the experimental design and all drafts of the manuscript. Authors HNA and BCO managed the analyses of the study and performed the statistical analysis. All authors read and approved the final manuscript.

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ABSTRACT

This paper seeks to promote turmeric (*Curcuma longa* Linn) through increased awareness of the potentials of the crop in the food, cosmetic and pharmaceutical industries in Nigeria. Nigeria can take the lead in turmeric production but this potential has not been fully tapped as the techniques needed for its production have not been properly understood by the farmers which have led to low production. Increased production and processing of turmeric as highlighted in this paper, has the potential of making a significant impact on the economy. This is because it has diverse uses and it is highly valued at the international market. Turmeric is used as a spice and is the major component of curry powder. Besides its use as a spice, turmeric finds a place in the cosmetics industry for its brilliant yellow colour and characteristic perfume. It is also being used as a dye for colouring fabrics. It is medically used for the prevention and treatment of diverse kinds of diseases as also highlighted in the paper. It is thus recommended that there should be adequate awareness on the potentials of turmeric especially in the southern part of Nigeria where the Research Institute that has the mandate to research into the crop is located. There is also need to develop improved

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varieties of the turmeric to boost production. Farmers should be provided with inputs like fertilizers and other agro-chemicals at subsidized rates in order to increase their production.

Keywords: Awareness; turmeric; food and pharmaceutical industry; Nigeria.

1. INTRODUCTION

Turmeric is a shallow-rooted crop and an herbaceous plant with thick and fleshy rhizomes. It belongs to the genus *Curcuma* and to the family, *Zingiberaceae*, and consists of many species. *Curcuma longa* Linn is the highest yielding turmeric of commercial value. Its origin has been traced to South and Southeast Asia. Turmeric is used as a spice and is the major component of curry powder. Among the several spices, turmeric ranks second with regard to its foreign exchange earning being next only to chilli [1 In: 2]. Besides its use as a spice, turmeric finds a place in the cosmetics industry for its brilliant yellow colour and characteristic perfume. It is also being used as a dye for colouring fabrics among other uses. It is medically used for the prevention and treatment of different kinds of diseases. As reported by [3], turmeric has yellow food pigment called curcuminoid (6%) and essential oils (5%) [4] and it's a major source of foreign exchange in the international market. Curcuminoids, the active principles in turmeric-rhizomes, have anti-inflammatory, antimutagen, anticancer, antibacterial, anti-oxidant, antifungal, antiparasitic and detoxifying properties [5; 6 In:3].

India is the world's largest producer of turmeric supplying 94% of the world's demand [7 In: 2]. In India, turmeric is cultivated on a large scale and exported as dried rhizomes which are later processed into other products for various end uses.

According to [8], there are two important types of turmeric found at the international market: 'Madras', and 'Alleppey', both named after the regions of production in India. The orange-yellow flesh Alleppey turmeric is predominantly imported by the United States, where users prefer it as a spice and a food colorant [10]. Alleppey turmeric contains about 3.5% to 5.5% volatile oils, and 4.0% to 7.0% curcumin. [9-11 In: 8]. On the other hand, the Madras type contains only 2% of volatile oils and 2% of curcumin [9 In: 8].

In Nigeria, turmeric is cultivated mostly on subsistent bases in about 19 states and given different local names depending on the area [12]. It is called *atale pupa* in Yoruba; *gangamau* in

Hausa; *nwandumo* in Ebonyi; *ohu boboch* in Enugu (Nkanu East); *gigir* in Tiv; *magina* in Kaduna; *turi* in Niger State; *onjonigho* in Cross River (Meo tribe) [13].

As reported by [14], turmeric can grow under diverse tropical conditions with altitudes ranging from sea to 1500 m above sea level [15] on a well drained sandy or clay loamy soil and temperature ranging between 20-30°C with an annual rainfall of 1500 mm or more.

Turmeric is propagated through vegetative means using the rhizome and is ready for harvest at about 7 to 10 months after planting which is indicated by the drying of the plant. The rhizomes are carefully harvested with a spade after loosening the soil with a small digger, and clumps manually lifted. It is advisable to cut the leaves before harvesting the rhizomes. Rhizomes are cleaned up by soaking them in water, as well as removal of long roots and leaf scales. Rhizomes are then further cured and processed, or stored for the next year's planting [16-18;11 In: 8]. Rhizomes for next year's planting should be stored in well-ventilated rooms and covered with dry leaves to prevent dehydration; or stored in pits covered with sawdust, sand, or panal (*Glycosmis pentaphylla*) leaves that may act as insect repellent [16;18 In:8].

Nigeria can play a leading role in turmeric production considering the prevailing favourable soil and climatic conditions in the country. Despite this, its potential has not been fully tapped as the techniques needed for its production have not been properly understood by the farmers which have led to low production [12]. The production of turmeric per unit area is very low because of the poor knowledge on proper cultivation technology of the farmers [6 In: 3]. Weeds can lead to reduction in the crop yield and adds to the total labour cost. As reported in [3], weed results in 65% reduction in yield of root and tuber crops and takes 25% of total labour use in production [19].

Turmeric powder is the major constituent of curry powder used in confectionery industries for food seasoning and in the international market as a

functional food due to its health promoting properties [2]. Turmeric is used in many religious observances, as a cosmetic, a dye, and it enters in the composition of many traditional remedies [17;20;9 In: 2]. As spice, turmeric is used in adding flavor and color to dishes. Turmeric is also used as herbal medicine in the treatment of ulcers and liver disorders. The anti-bacterial and antiseptic properties of turmeric are well known. According to [2], scientists have discovered that turmeric is a natural protectant, having an effective cancer chemo-preventive agent. On account of its flavour and medicinal properties, turmeric is also used in the preparation of cosmetics, soaps, ointments, face creams, toothpastes etc. [21].

As reported by [2], Curcuminoids the active ingredient in turmeric rhizomes is known to have some medicinal properties and has been used efficiently in the treatment of circulatory problems, liver diseases, dermatological disorders and blood purification [6]. The average composition of turmeric is moisture (6.0%), protein (6.5%), ash (6.0%), crude fibre (3.0%), starch (5.0%), fixed oil (3.5%), volatile oil (4.5%) and curcumin (3.1%) [22]. Table 1 shows the nutritive value per 100 g of turmeric.

2. TURMERIC AND ITS POTENTIALS

Turmeric can be used in the prevention and treatment of some ailments like osteoarthritis, Alzheimer's disease, cancer, diabetes to mention but a few. It can also be used in the food and cosmetic industries.

3. PRIMARY PRODUCTS

The primary products of turmeric according to [8] are as follows:

3.1 Dried Rhizome

Turmeric is mainly imported whole and then processed into powder or oleoresin used in the industrial sector and in confectionaries [9;16]. Rhizomes appear as fingers, bulbs and splits. Rhizome quality is judged by a clean and smooth skin, uniform skin and flesh colors, and a clean snap when broken [11].

3.2 Turmeric Powder

As reported by [8], turmeric rhizomes are ground to approximately 60-80 mesh particle size [10].

Turmeric powder should be packed in a UV protective packaging and stored appropriately because the color deteriorate with light and to a lesser extent, under heat and oxidative conditions [10]. Turmeric powder is a major constituent in curry powders and pastes. It is mostly used to color and flavor food in the food industry [9].

4. SECONDARY AND DERIVED PRODUCT

4.1 Curry Powder

Turmeric is an important ingredient in curry powder. The turmeric content in curry powder blends ranges from 10-15% to 30% [16 In: 8]. Typical Indian curry powder for meat and fish dishes contains 20-30% turmeric [16] while curry mixes for vegetarian dishes contain less turmeric, in the range of 5 to 10%, because of the bitter flavor it would impart to the dish.

4.2 Oleoresins

Oleoresins from turmeric are obtained by solvent extraction of the powdered or comminuted rhizome [8]. This process yields about 12 % of an orange/red viscous liquid, which, depending on the solvent used for extraction and on the turmeric type and cultivar, contains various proportions of the coloring matter, i.e. the curcuminoids, the volatile oils which impart the flavor to the product, and non-volatile fatty and resinous materials [16 In:8].

The compounds of interest in turmeric oleoresin are the curcuminoids (40 to 55%), and the volatile oils (15 to 20%) [16;10 In: 8]. The curcuminoids, which consist mostly of curcumin, and also demethoxycurcumin, and bisdemethoxycurcumin, can be further purified to a crystalline material, and will be used preferably in products where the turmeric flavor is undesirable, such as cheese, ice cream, beverages and baked products [9]. Curcumin has similar color characteristics than the synthetic food colorant tartrazine; however, unlike tartrazine, it is highly sensitive to light and alkaline pH, and is also degraded by heat and chemical oxidants. It is therefore not easy to use in food processes and products destined to long-term storage [8].

4.3 Essential Oil

Turmeric essential oil has little interest in the Western food industry, and it has no commercial value, as opposed to oleoresin [16;11 In: 8]. Turmeric essential oil is obtained by distillation [11], or by supercritical fluid extraction of the powdered rhizome [23].

5. HOW TO USE TURMERIC

According to [24],

- Turmeric can be used externally in poultices to sooth skin and reduce inflammation. It is often used in lotions or preparations for skin with eczema or psoriasis.
- When incorporated into the diet it can be helpful for reducing inflammation in those with arthritis.
- Turmeric can be made into a paste with water or honey to make a skin scrub that cools inflammation and helps stop acne.
- Externally, a paste of turmeric and aloe vera gel can ease pain and itching from burns, bites, chicken pox, poison ivy or eczema.
- In a soothing Turmeric Tea to sooth during illness or improve sleep. This is one of my favorite uses! See my recipe below.
- It is wonderful to add to grilled foods, vegetables, mashed cauliflower, sauces and spice blends. I add a pinch to my eggs in the morning and to most dishes that I cook.
- Turmeric's high antioxidant content benefits the skin which makes it a constituent of some natural sunscreens and bronzers. A paste of Turmeric and strong brewed black tea will temporarily darken the skin and there is some evidence that it might also provide some sun protection.
- Turmeric is said to be great for the skin and can be used in facial washes and scrubs to sooth skin and even out skin tone. Turmeric can cause hair to become less thick so it is often used my Indian women on unwanted facial hair but should be avoided on the head or by men on their faces.

- Turmeric is a wonderful spice to add to soups and stews as it gives them a rich, warm flavor and a beautiful color. If you make homemade bone broth, a couple teaspoons of Turmeric are a great addition.
- Many people take it as a supplement to help reduce inflammation and pain, especially those with arthritis or other inflammatory conditions.

Table 1 reveals that turmeric is high in carbohydrate, dietary fiber, some vitamins and minerals.

Table 1. Turmeric, nutritive value per 100 g

Principle	Nutrient Value	Percentage of RDA
Energy	354 Kcal	17%
Carbohydrates	64.9 g	50%
Protein	7.83 g	14%
Total Fat	9.88 g	33%
Cholesterol	0 mg	0%
Dietary Fiber	21 g	52.5%
Vitamins		
Folates	39 µg	10%
Niacin	5.140 mg	32%
Pyridoxine	1.80 mg	138%
Riboflavin	0.233 mg	18%
Vitamin A	0 IU	0%
Vitamin C	25.9 mg	43%
Vitamin E	3.10 mg	21%
Vitamin K	13.4 µg	11%
Electrolytes		
Sodium	38 mg	2.5%
Potassium	2525 mg	54%
Minerals		
Calcium	183 mg	18%
Copper	603 µg	67%
Iron	41.42 mg	517%
Magnesium	193 mg	48%
Manganese	7.83 mg	340%
Phosphorus	268 mg	38%
Zinc	4.35 mg	39.5%

Source: USDA National Nutrient data base; Cited in www.nutrition-and-you.com

Table 2 shows that in the period under review, the import of turmeric in US was highest in 1999 and the price was on the decline till 2002 when it started increasing.

Table 2. Turmeric imports in the US in the period 1998-2002 (metric tons; US \$1,000)

	1998	1999	2000	2001	2002
Turmeric (MT)	2,284	2,641	2,427	2,404	2,383
Value (US \$1,000)	3,849	3,614	2,904	2,488	2,955

Source: FAO, 2004

5.1 Medicinal Uses of Turmeric

Turmeric has the following medicinal uses (according to [25]):

- Research results reveal that *Curcumin*, a poly-phenolic compound, found in turmeric may inhibit the multiplication of tumor cells, including multiple myeloma, pancreatic cancer, and colon cancer.
- It contains health benefiting essential oils such as *termerone*, *curlone*, *curumene*, *cineole*, and *p-cymene*. These compounds have applications in cosmetic industry.
- *Curcumin*, along with other antioxidants, has been found to have anti-amyloid and anti-inflammatory properties. Thus; it is effective in preventing or at least delaying the onset of Alzheimer's disease.
- The root herb contains no cholesterol; however, it is rich in anti-oxidants, and dietary fiber. Together, they help to control blood cholesterol levels, offer protection from coronary artery disease and stroke risk.
- Early laboratory studies have been suggestive that turmeric is liver protective, anti-depressant, anti-retroviral effects.
- It has been in use since a very long ago as an important ingredient in traditional Chinese and ayurvedic medicines for its anti-microbial, anti-inflammatory, carminative, and anti-flatulent properties.

Little or no toxicity is reported for humans receiving large (8 g/day) therapeutic doses of curcumin, an important major component of turmeric [26 In; 8]. All these revelations about the potentials of turmeric make it a good crop for development of pharmaceuticals, nutraceuticals, or food ingredients with functional properties [8].

6. PROBLEMS FACED BY THE TURMERIC GROWERS

According to the findings of [27], some of the challenges faced by turmeric growers in India are:

- Non-availability of labour
- Pest and disease attack

- High cost of hiring labour
- High costs of fertilizer and plant protection chemicals
- Water scarcity

7. CONCLUSION AND RECOMMENDATION

Turmeric is an important plant with diverse uses. The benefits of the crop are enormous with little or no none side effects. Turmeric production should thus be encouraged by sensitizing farmers properly on the potentials of turmeric especially in the southern part of Nigeria where the Research institute that has the mandate to research into the crop is located. There is also need to develop improved varieties of the turmeric to boost production. Farmers should be provided with inputs like fertilizers and other agro-chemicals at subsidized rates in order to increase their production. There is also need to provide market information like price of turmeric products to the farmers.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Babu V. Physiological studies on weed control efficiency in turmeric (*Curcuma Longa L.*). M Sc. (Agri.) Thesis, Univ. Agric. Sci., Dharwad, Karnataka, India; 2008.
2. Akinpelu CA, Adebayo OS, Adewale OM, Adebisi-Adelani OO. An analysis of turmeric utilisation pattern in Ekiti state, Nigeria. Nigerian Journal of Horticultural Science. 2012;17:68-72
3. Njoku SC, Olojede AO, Melifonwu AA. Effect of the critical period of weed interference on optimum performance of turmeric at Umudike, Nigeria. Journal of Agriculture and Social Research. (JASR). 2012;12(1):84–88.

4. Nunes FV. Cultivo da curcumea facile lucrative, Manchete Rural.1989;29:60
5. Sugiyama Y, Kawakishi S, Osawa T. Involvement of the B-diketone moiety in the antioxidative mechanism of tetrahydrocurcumin. Biochem. Pharmacol. 1996;52:519-525.
6. Ishimine Y, Hossain MA, Ishimine Y, Murayama S. Optimal planting depth for turmeric (*Curcuma longa* L) cultivation in dark red soil in Okinawa Island, Southern Japan. Plant Prod.Sci. J. Biol. Sci. 2003;6:83-89.
7. Plant cultures. Turmeric Production and Trade; 2005.
Available: www.plantcultures.org.uk/
Accessed 21/6/2005.
8. FAO. Turmeric: Post-production Management Organisation. Food and Agriculture Organization of the United Nations (FAO), AGST. Prepared by Anne Plotto. Edited by François Mazaud, Alexandra Röttger, Katja Steffel; 2004. Last reviewed: 22/04/2004.
Available:www.fao.org/fileadmin/Post_Harvest_Compndium_-_Turmeric.pdf
9. ASTA. A concise guide to spices, herbs, seeds, and Extractives. American Spice Trade Association. 2002;48-50.
10. Buescher R, Yang L. Turmeric. In: Natural food colorants. Science and Technology. Lauro GL, Fancis FJ (Eds). Marcel Dekker, New York. 2000;205-226.
11. Weiss EA. Spice Crops. CAB. International Publishing, Oxon, UK; 2002.
12. Olojede AO, Iluebbey P, Dixon AGO. IITA/NRCRI Collaborative Germplasm and data collection on minor Root and Tuber Crops in Nigeria. In: Annual report 2005 National Root Crops Research Institute, Umudike. 2005;77-81.
13. Foodhaccp.com. Turmeric, garlic, others offer protection against aflatoxin 'damage', breast cancer.
Available: http://www.ngrguardiannews.com/natural_health/article01/indexn2.html?date=230709&ptitle=Turmeric,%20garlic,%20others%20offer%20protection%20against%20aflatoxin%20'damage',%20breast%20c
14. Olojede AO, Nwokocho CC, Akinpelu AO, Dalyop T. Effect of Variety, Rhizome and Seed Bed Types on Yield of Turmeric (*Curcuma longa* L) under a Humid Tropical Agro-Ecology. Advances in Biological Research. 2009;3(1-2):40-42.
15. Rema J, Madan MS. Turmeric. An extension pamphlet, Agricultural Technology Information Centre. Indian Institute of Spice, Research. Statistical Analysis System (SAS) Statistical Analysis System 2008 edition. 2001;8.
16. Govindarajan VS. Turmeric-chemistry, technology, and quality. Crit. Rev. in Food Sci. & Nutr. T.E. Furia, Ed., CRC Press, Boca Raton, FL. 1980;12:199-301.
17. Dahal KR, Idris S. *Curcuma longa* L. In: de Guzman CC, Siemonsma JS. (Editors): Plant Resources of South-East Asia No 13. Spices. Backhuys Publishers, Leiden, The Netherlands. 1999;111-116.
18. Anandaraj M, Devasahayam S, Zachariah TJ, Eapen SJ, Sasikumar B, Thankamani, CK. Turmeric (Extension Pamphlet). J. Rema and M.S. Madan, Editors.Indian Institute of Spices Research, Calicut, Kerala. API-Ayurvedic Pharmacopoeia of India .1989. New Delhi: Government of India-Ministry of Health and Family Welfare-Department of Health. 2001;45-46.
19. Akobundu IO. Weed science in the tropics. Principles & practices John Wiley and Sons, London. 1987;522.
20. Narayana DBA, Brindavanam NB, Dobriyal RM, Katuyar KC. Indian Spices: An overview with special reference to nutraceuticals. Journal of Medicinal and Aromatic Plant Sciences. 2000;22 (1B):236-246.
21. Pujari PD, Patil RB, Sakpal RT. "Krishna" – A high yielding variety of turmeric. Indian Cocoa, *Areca nut and Spices J*, 1986;14:65-66.
22. Manjunath MN, Sattigeri VV, Nagaraj KV. Curcumin in turmeric. Spicelndi., Manjunath et, al., 1991;4(3):7-9.
23. Gopalan B, Goto M, Kodama A, Hirose T.. Supercritical carbon dioxide extraction of turmeric (*Curcuma longa*). J. Agric. Food Chem. 2000;48:2189-2192.
24. Katie-wellness mama (2013), Herb Profile: Turmeric.
Available: www.wellnessmama.com.
25. 'Turmeric nutrition facts'.
Available: www.nutrition-and-you.com

26. Cheng AL, CH Hsu, JK. Lin et al. Phase I clinical trial of curcumin, a chemopreventive agent, in patients with high-risk or pre-malignant lesions. *Anticancer Research* 2001;21:2895-2900.
27. Karthik V, Amarnath JS. 'An economic analysis of turmeric production in Tamil Nadu India'. *Direct Research Journal of Agriculture and Food Science*. 2014;2(6):66-76.
Available:<http://directresearchpublisher.org/drjafs>.

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