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Comparison of nutritional content of commercial and organic food products (Cereals and spices) with special emphasis on UV Spectroscopic method of analysis

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Abstract
The aim of the present study was to focus on comparing the nutritional contents of organic and commercial food products. The food products in our study were collected from various localities in Trichy. Rice, the most widely consumed staple food for a large part of the world's human population and turmeric, the herbaceous plant was chosen for the comparative analysis of nutritional value. The test carried out for determining the content of moisture, protein, fat, ash, carbohydrate, fibre, energy, adulteration and species richness has not showed much difference among them. In this context, it can be concluded that organic foods are preferred to that of commercial products as they are free from pesticide residues.

Keywords: Organic and commercial foods, rice, turmeric, nutritional analysis, adulteration, species richness

1. Introduction
Food processing and organic agricultural practices are wide ranging and foster the development of a food production system which is ecologically, economically, and socially sustainable. The key principles and the practices of organic food production are to encourage and enhance biological cycles within the farming system. According to documented standards, the certified organic food and fibre products have been produced. There are hundreds of organic certifying agencies around the world that establish their own production standards and certification processes. By comparing organic and commercial food production systems, including economics, crop yields, agronomic factors (soil chemical properties, soil physical properties, soil microbiological activity, pest and disease burdens), farm management practices, product quality (nutritional value, taste, shelf life), environmental impacts, biodiversity, farm nutrient inputs and social, trade, and political issues associated with food production, a wide range of factors has been investigated in studies. Clearly, in order to make a valid comparison of the two production systems, a broad perspective needs to be taken. The area that has received much attention in the debate on differences is between organically and commercially produced food quality and what is meant by quality in the context of organic food production system. Adulteration means the addition of ingredients which are not certified food ingredients. They are added because of business profits. Species richness is the total number of different species represented in a landscape, ecological community or region while not taking the abundance of the species or their distribution into account.

2. Material and Methods
The chemical analysis of organic and commercial foods of different brands was collected from Tiruchirapalli district, Tamil Nadu, India. They were ground and stored in aseptic conditions for further use.

Rice
Organic – Sonamasuri rice (S1), Ponni rice (S2), Jasmine rice (S3), Parboiled rice (S4) and white rice (S5).

Commercial – Different commercial brands.

Turmeric
Organic – Collected from house gardens.
Commercial – Collected from commercially available different turmeric brands.

2.1 Determination of fat
The fat in the rice was determined using soxhlet extraction method starting with petroleum ether. 250 ml clean boiling flask was dried in hot air oven at 105– 110 ^{0}C for about 30 min and cooled in a desiccator. 2.5 g of commercial and organic rice were weighed accurately into labelled thimble; sufficient amount of petroleum ether was transferred into boiling flask. The reaction was carried out for 8 hrs. The petroleum ether gets evaporated, and extract was deposited at the bottom of the flask and weighed [15]. The percentageof fat was calculated by equation 2.1.1.The above procedure wasfollowed for organic and commercial turmeric samples.

$$\% \text{ of crude fat} = \frac{(W2-W1)}{S} \text{x } 100 \quad [2.1.1]$$

S = Weight of the sample
W_1 = Weight of the empty flask
W_2 = Weight of the flask with fat

2.2 Determination of protein
Protein was determined by Kjeldhal method. 2 g of grained rice powder was digested in a Kjeldhal digestion flask by boiling it with 50 ml of 0.1 N concentrated H_2SO_4. The mixture was heated at a temperature of 20 ^{0}C – 100 ^{0}C, till it became clear and its volume was adjusted up to 250 ml. The solution was transferred into the distillation apparatus. The mixture was heated in the distillation flask and ammonia was steam distilled in the form of digest after the addition of alkali. The total nitrogen content was determined and multiplied by a factor of 6.25(constant value) to arrive at the amount of crude protein [16]. The protein content was calculated by below mentioned equations. The same process was carried out for organic and commercial turmeric sample.

$$N = \frac{(B-T) \text{ x Normality x } 0.014 \text{ x } 100}{\text{Weight of sample}} \quad [2.2.1]$$

[Blank = 77.4]

$$\text{Protein content} = \text{N x } 6.25 \quad [2.2.2]$$

$$\text{Protein on dry basis} = \frac{\text{Protein content x } 100}{100 - \text{moisture content}} \quad [2.2.3]$$

2.3 Determination of ash
The ash of the rice sample was determined by furnace incineration described by AOAC based on the vaporization of water and temperature maintenance. Water and other volatile materials get vaporized; organic substances were burned in the presence of oxygen in air to CO_2, H_2O and N_2. 2g of finely ground dried sample was weighed into 277 tared porcelain crucible and incinerated at 600 ^{0}C for 6hrs in an ashing muffle furnace until the ash was obtained. If an analysis is being carried out to determine the concentration of one of these substances, then it is advisable to use an alternative ashing method at low temperature [11]. The ash content in the rice sample was calculated by the equation 2.3.1. The same process was carried out for organic and commercial turmeric samples.

$$\text{Total ash on dry basis \% by weight} = \frac{W2-W}{W1-W} \text{ x } 100 \quad [2.3.1]$$

W = Weight of empty crucible
W_1=Weight of crucible with sample before ashing
W_2= Weight of crucible with sample after ashing

2.4 Determination of moisture
Moisture was determined by standard official method of analysis using AOAC. The moisture content in each sample was determined by drying a 4g of sample in air forced draft maintained over at a temperature at 105 ± 5 ^{0}C as the loss in weight of the dried rice bran samples. The petriplate was dried in an oven at 105 ^{0}C for 30 minutes and allowed the sample was cooled in a desiccator. 5g of the sample were transferred into the petriplate and the values were measured. The samples and petriplate were again dried and measured at the same temperature, until the constant weight is achieved [3]. Then the moisture content of the rice sample was calculated by the equation 2.4.1. The same process was carried out for organic and commercial turmeric.

$$\text{Moisture \%} = \frac{W1-W2}{W1-W} \text{ x } 100 \quad [2.4.1]$$

W =Weight of empty disk
W_1=Weight of disc + material before drying
W_2=Weight of disc + material after drying

2.5 Determination of fibre
Crude fibre was determined by using the method of AOAC. 2.5 g of defatted sample wastaken in 200 ml of round bottom flask. Few drops of ethanol were added to the sample. Glass beads were added to the solution to prevent bumping. The flask was rotated for a few minutes. The condenser setup contains the solvent at temperature 20 ^{0}C. Extract was kept in room temperature. The residue was transferred into the beaker and the solution was cooled using a desiccator. The residue was filtered using Whatman filter paper and transferred into a round bottom flask and then the mixture was kept till it starts boiling. The solution was allowed to become cool and the gooch empty crucible filter was weighed to extract the filtrate. Residues were kept in hot air oven at a temperature 105± 1 ^{0}C for 3 hours and allowed to cool [5,4]. Then the values were calculated for every 30 min. The % crude fibre in the rice sample was calculated by the equation 2.5.1. The same process was repeated for organic and commercial turmeric samples.

$$\text{Crude fibre \% by weight} = \frac{W1-W}{W} \text{x } 100 \quad [2.5.1]$$

W_1=Weight in ‘g’ of gooch crucible + contents before ashing
W_2=Weight in ‘g of gooch crucible + asbestos and ash
W=Weight of sample taken for test

2.6 Determination of carbohydrates
The carbohydrate method involves the addition of the total values of crude protein, lipid, crude fibre; moisture and ash constituents determined individually, summed and subtracted from the total weight of the food [7]. The % of carbohydrate values can be obtained. The same process was repeated for the organic and commercial turmeric samples.

% Carbohydrate = 100 – [fat – protein – moisture – ash – fibre] [2.6.1]

2.7 Determination of energy
Energy content is calculated based upon the contents of carbohydrates, proteins and fats [12].

Energy = (carbohydrate x 4) + (protein x 4) + (fat x 9) [2.7.1]

2.8 Analysis of extract
The stock solution of curcumin containing 10 mg/ml was prepared in ethanol and its aliquots were transferred in a series of 15 ml volumetric flask in varying fractions. The flask was covered with dark coloured paper and dark conditions maintained, since curcumin was light sensitive. The solution wassonicated for about 20min and the solution was filtered and 5ml of this solution was diluted up to 25ml by adding 95% of alcohol. The wavelength at which maximum absorption takes place in UV detector was selected for further analysis at 425nm [6, 8]. The obtained absorption of samples gives the % of curcumin content found out from calibration curve of standard curcumin sample. Estimation of curcumin content present in extract is by UV visible spectroscopy (UV – 1700 Shimadzu).

2.9 Adulteration
Adulterated food causes both physical and mental disorder along with malnutrition [1].

2.9.1 Turmeric
Turmeric is the major spice used for cooking in India as a component in curry powder. Turmeric powder has been subjected to economically driven, hazardous chemical adulteration due to its high demand in international trade. Both organic and commercial turmeric samples were collected for detection of food adulterants using physical and chemical methods. The tests were carried out by chemical analysis and through visual inspection [1,2].The methods that include detection of adulterants are given below:

2.9.1.1 Detection of Aniline dye
2g of sample (turmeric powder), a few drops of water and 5ml of spirit were added. Disappearance of yellow colour indicated the presence of aniline dye.

2.9.1.2 Detection of yellow lead salts
2g of sample (turmeric powder), a few drops of concentrated hydrochloric acid were added. Appearance of magenta colour indicated presence of yellow lead salts.

2.9.1.3 Detection of chalk
2g of sample (turmeric powder),a few drops of water and hydrochloric acid were added. Brisk effervescence indicated the presence of chalk.

2.9.1.4 Detection of metanil yellow
2g of sample (turmeric powder), a few drops of 13N sulphuric acid were added. Disappearance of red colour on adding distilled water indicated the presence of metanil yellow.

2.9.2 Rice
Rice being a staple food crop for over one third of the world's population has become a potential target for many unscrupulous traders who mix low nutritious adulterants to fetch profits with least efforts. The adulterants in rice are dust, pebble, stone, weed seeds, damaged grains, weevilled grains, insects, hairs and excreta of rodents. The excessive amount of these adulterants can result in risk to health [1,2].The methods that include detection of adulterants are given below:

2.9.2.1 Detection of Urea
1-2 g of same (rice), few drops of distilled water were added. The contents were mixed thoroughly by shaking the test tube. After 5minutes the water content was filtered and four teaspoon of soya beans added to it. A red litmus paper was dipped into a mixture and removed out after 30 seconds. The appearance of blue colour in the red litmus paper indicates the presence of urea in the sample (rice).

2.9.2.2 Dust and stones
The most common adulterants in rice are dust, pebbles and stones. The adulterants were detected through visual inspection.

2.10 Species Richness
2.10.1 Turmeric
The change in species of the ecosystem has been measured in this diversity. Number of species which are unique to each ecosystem has been compared. The change in diversity of species from one environment to another has been measured by using this diversity. It also calculates the number of species which are not the same in two different environments. Common turmeric is considered as the most economically valuable member of the genus. Turmeric has been cultivated over 1, 50, 000 hectares in India [8, 9].

2.10.2 Rice
The diversity of the crops may consist of the landraces and cultivated by the farmers. The cropping patterns change due to climate change and the environmental degradation. The cereals grains are grown in higher quantities when compared to other type of crops worldwide. Rice cultivation is suited tomost of the countries and regions with low labour cost and high rainfall. It can be grown partially anywhere; it can even be grown on steep hillsides. Rice is the world's largest crop, behind maize and wheat [8, 9].

3. Results

Table 1: Nutritional analysis of rice

Nutrients	Organic					Commercial				
	S1	S2	S3	S4	S5	S1	S2	S3	S4	S5
Fat (g/100g)	5.57	4.43	4.91	5.21	5.85	1.67	2.65	1.77	1.62	1.57
Protein (g/100g)	19.04	19.82	18.61	19.99	19.74	18.62	18.32	19.12	18.53	18.73
Ash (g/100g)	0.72	0.54	0.93	0.62	0.81	1.13	0.3	1.27	1.19	1.14
Moisture (g/100g)	0.09	0.12	0.06	0.1	0.07	0.09	0.07	1.01	0.05	0.12
Fibre (g/100g)	0.59	0.64	0.42	0.71	0.55	0.41	0.23	0.46	0.55	0.49
Carbohydrate (g/100g)	114.86	116.69	115.11	116.21	115.32	118.57	106.27	120.09	118.7	118.9
Energy (kcal/100g)	585.76	585.91	579.07	591.69	592.81	563.78	522.21	572.77	563.5	564.7

Table 2: Nutritional analysis of turmeric

Nutrients	Organic					Commercial				
	S1	S2	S3	S4	S5	S1	S2	S3	S4	S5
Fat (g/100g)	7.39	7.21	6.69	6.95	7.46	3.42	3.49	2.98	3.46	2.93
Protein (g/100g)	11.4	11.72	10.98	12.01	11.78	12.42	12.31	11.87	11.98	12.46
Ash (g/100g)	5.32	4.92	5.21	5.19	4.97	6.78	6.68	5.96	6.61	5.89
Moisture (g/100g)	0.07	0.05	0.12	0.04	0.08	0.09	0.06	0.16	0.05	0.08
Fibre (g.100g)	0.70	0.65	0.52	0.75	0.81	0.33	0.43	0.39	0.47	0.45
Carbohydrate (g/100g)	110.09	110.56	110.06	111.04	110.18	116.19	115.99	115.4	115.65	115.9
Energy (kcal/100g)	552.56	554.01	544.37	554.75	554.98	545.2	544.61	535.9	541.66	540.01

Table 3: Absorbance values for curcumin content from turmeric

UV visible spectroscopy	
Sample	**Absorbance (425nm)**
Sample 1 (Organic turmeric)	0.411
Sample 2 (Commercial turmeric)	0.375

Table 4: Adulteration test for rice

Organic (Rice)	Adulterants	Commercial (Rice)	Adulterants
Sample-1	-	Sample-1	Stones
Sample-2	-	Sample-2	-
Sample-3	-	Sample-3	Dust
Sample-4	-	Sample-4	-
Sample-5	-	Sample-5	-

Table 5: Adulteration test for turmeric

Organic (Turmeric)	Adulterants	Commercial (Turmeric)	Adulterants
Sample 1	-	Sample 1	Yellow lead salts
Sample 2	-	Sample 2	Chalk
Sample 3	Chalk	Sample 3	Aniline dye
Sample 4	-	Sample 4	More amount chalk
Sample 5	-	Sample 5	Metanil yellow

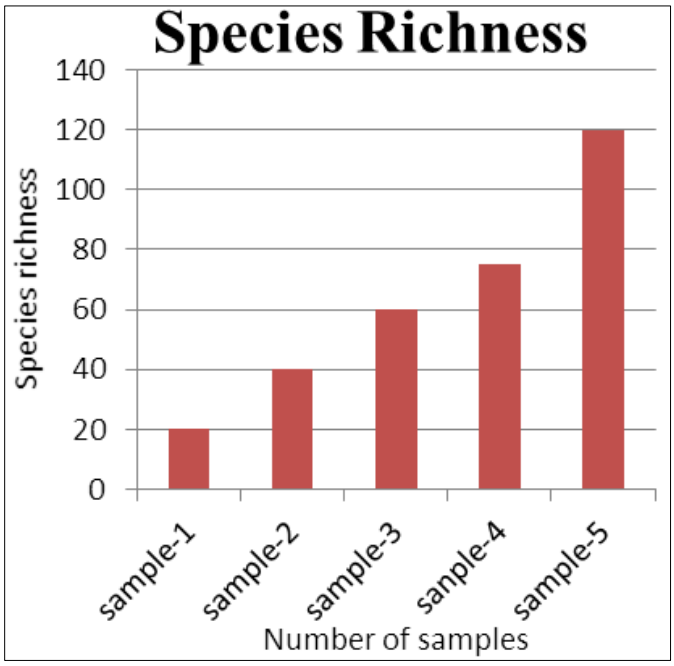

Fig 1: Analysis of species richness from various turmeric

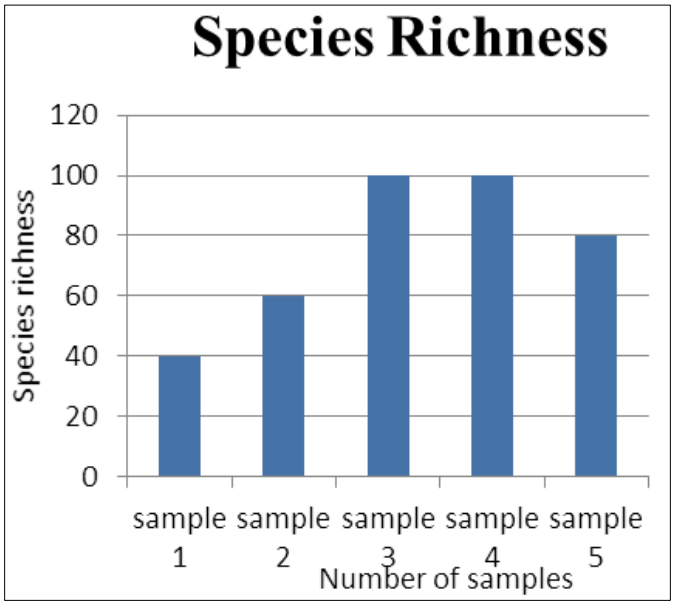

Fig 2: Analysis of species richness from various rice

4. Discussion

The fat, protein, ash, moisture, fibre, carbohydrate and energy content did not show much difference among organic and commercial samples (rice and turmeric).

4.1 Fat

Rice is a good source of essential fatty acids. On interpreting Table 1, it can be seen that the fat content of organic rice was found to be higher when compared to the commercial rice. Similarly the fat content in organic turmeric was also higher than commercial turmeric which helps in the regulation of blood fat level.

4.2 Protein

Protein is an essential macronutrient. On interpreting Table 1, it can be seen that the protein content in organic rice was

found to be higher when compared to commercialrice. Similarly the protein content in organic turmeric was also higher thancommercial turmeric which helps in the regulation of protein levels. When compared to white rice, brown rice contains an appreciable quantity of protein; it wasdue to the lack of adequate amount of essential amino acid lysine to form a complete protein.

4.3 Ash
The analysis of ash content indicates the amount of minerals present in the food. On interpreting Table1, ash content in organic rice was lower than commercial rice. It determines the presence of commercial minerals in commercial rice.
From Table 2, the presence of commercial minerals was higher in commercial turmericwhen compared to organic turmeric.

4.4 Moisture
The moisture contents affect the physical and chemical aspects of food. On interpreting the table 1, moisture content in commercial rice was higher than organic rice. It determines the loss of weight in organic rice. It is due to less moisture content.
From table 2, moisture content in commercial turmeric was higher when compared to organic turmeric.

4.5 Fibre
Rice contains an appreciable quantity of crude fibre and by interpreting Table 1,fibre content in organic rice was higher than commercial rice. Brown rice contains more fibre when compared to white rice. It is due to the bran and germ present in the brown rice which provides fibre and several vitamins.
From table 2, fibre content in organic turmeric was higher than commercial turmeric.

4.6 Carbohydrate
Rice is a major source of carbohydrates. Carbohydrate content was found to behigher in commercial rice when compared to organic rice. It was foundthat carbohydrate content increased as the level of polishing increases.

4.7 Energy
Energy is one of the most important properties in food and by interpreting Table 1 and 2; it was observed that higher energy was present in organic content.

4.8 Adulteration
Our study showed that organic rice was found to be free of adulterants in all the samples whereas in the case of turmeric, only sample 3 of organic turmeric contained chalk as an adulterant compared to commercial turmeric in which all the five samples contained adulterants.

4.9 Species Richness
The species richness of rice (sample 1, 2, 3, 4, 5) and turmeric (sample 1, 2, 3, 4, 5) were obtained in households. Households cultivated between one and five turmeric varieties. The quality of turmeric and rice collected from house gardens were different among the others due to the soil richness of different areas. Only 12 households planted a rice variety, while 82 households planted a turmeric variety. Farms with more flat land have greater diversity in rice cultivation.

5. Conclusion
Thus the present study indicates that organic rice as well as organic turmeric can be considered more beneficial than commercial rice and turmeric. The nutritional analysis indicates that there is no major deviation among the organic and commercial food products, though organic foods are more susceptible to microbiological contamination than those of commercial foods and they are free of pesticide residues and adulterants.

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7. References
1. Aadil Abbas, Shahzed Murtaza, Faiza Aslam, Ayesh Khawar, Shakeela Rafique, Sumera Naheed, etc. world journal of medical sciences. 2011; 6(2):68-73.
2. Magomya AM, Kubmarawa D, Ndahi JA, Yebpella GG, International journal of specific and technology research, 2014, 3(4).
3. AOAC 17thedn. Official method 986.21, moisture in spices/ IS specification No IS 1797-1985 methods of test for spices and condiments, 2000.
4. Ameeta Sharma, Neha Batra, Anjalli Garg, Ankita Saxena. International journal for research in applied science and enginnering technology, 2017, 5(3).
5. Dr. William Lockeretz, Professor, School of nutrition science and policy, Tufts University, Medford, MA 12155.Critical reviews in food science and nutrition. 2002; 42(1):1-34.
6. Gaithersburg MD. Association of analytical communities, 17th edition, 2006.
7. Geethanjalli A, Lalitha P, Jannathul Firdhouse M. ISSN 2395–3411.
8. Hardcastle James Edward. A study of the curcumin method for boron determination. Mater's Theses. Paper, 1960, 163.
9. Harshalpawar, Mugdha Karde, Nilesh Mundle, Pravin Jadhavand Kavitha Mehra. Research article open access, 2014, 22.
10. IS Specification No IS 1797-1985 Methods of test for spices and Condiments/ AOAC 17thedn 2000, Official Method 920.164 Preparation of test sample.
11. IS specification No IS 1797-1985 methods of test for spices and condiments/ AOAC 17thedn, 2000 official method 941.12 ash of spices.
12. IS specification No 1797-1985 methods of test for spices and condiments.
13. IS specification No IS 3576-1994 specification for turmeric whole and ground.
14. Lila Miller and Jean Anne Houghton J. Biol. Chem, 1945.
15. N Sangeetha. World journal of the pharmacy and pharamaceutical sciences, 2017, 6(5).
16. Nirmala Devi, G Padmavathi, V Ravindra Babu, Kavitha Waghay. Orginal research article, 2015.
17. Oko AO, Ubi BE, Efisue AA, Dambaba N. International journal of agriculture and forestry. 2012; 2(2):16-23.
18. Shweta Bhosale, Vijayalakshmi D. Current research in nutrition and food science. 2015; 3(1):74-80.