International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2013): 4.438

# Characterization of Cold Press Moringa Oil

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**Abstract:** ***Moringaoleifera, a very rapid growing tree found growing in a varying range of climatic condition is a promising tree and has the potential to become a new source of oil. Nutritional importance of moringa oil as the capability to be in addition with olive oil in the market, which is being imported. The present research was designed to extract and evaluate the properties of moringa oil. Moringa oil was extracted by traditional method of cold press and evaluated for its physic-chemical properties like rancidity, viscosity, peroxide value, freefatty acid content, smoking point, tocopherol content and fatty acid composition. According to literature moringa oil,a high mono unsaturated fatty acid (oleic acid) oil which resembles olive oil in properties was compared with olive oil. The physico-chemical properties of moringa oil were analysed three times and the values obtained were subjected to student's t test and significant difference of moringa oil compared with olive oil.***

**Keywords:** Moringa oil, olive oil, cold press oil, oil properties, edible oil.

## 1. Introduction

Vegetable oils constitute an important part of human livelihood all over the world. The widening gap between demand and supply necessitates the need for alternate sources of edible oils to augment global production. To meet the growing demand of fats and oils, concerted efforts have been made to increase the seed yield and by tapping minor oilseeds of tree origin. Due to ever diminishing sources of fats and oils, there is the growing need for the search of new sources of oil as well as exploiting sources that are currently unexploited in order to supplement the existing ones. Moringa seeds has good physicochemical properties in such a way that no additional processing operations methods will be needed for the oil. The oil has good quantity of oleic acid and omega 3; therefore it can be used for frying and other food purposes. Moringa oil is recommended for frying purposes because it contains high amount of oleic acid (57 percent) and omega 3 (13.28 per cent) (Khattab and Shakak, 2012). The purpose of the present research was to extract oil from moringa seeds by cold press and evaluate the physico-chemical properties of the oil which could be compared with olive oil from literature, due to its similarity of the properties.

## 2. Review of Literature

Moringaoleifera seeds contain about 42 per cent of a brilliant yellow, high oleic acid crude oil having a pleasant, peanut like flavour. The oil consists of 82 per cent unsaturated fatty acids, 70 per cent of which is oleic acid (Tsaknis et al., 1998; Foidl et al., 2001; Farooq et al., 2005; Rahman et al., 2009). Apart from the emphasis of modern nutrition on oils that contain high amount of unsaturated fatty acids, high oleic acid oils are known to be healthy alternatives to hydrogenated vegetable oils (Tsaknis et al., 1998; Rahman et al., 2009). Olive oil, the widest known in this category, is seldom used for frying because of its high cost. There are several reports on the composition and characterisitics of moringaoleifera seed oil varietites from different countries of origin, e.g., India (Lalas and Tsaknis et al., 1998), Malaysia (Abdulkarimet al., 2005), Pakistan (Anwar et al., 2006; Manzoor et al., 2007), Bangladesh (Rahman et al., 2009) considering its prospect as an alternative vegetable oil source.

The use of MUFA (mono unsaturated fatty acid) leads to lowering of low density lipoprotein cholesterol and elevation of high density lipoprotein cholesterol which may lead to reduction in the risk of cardiovascular disease. Furthermore; it exerts anti-inflammatory, antithrombotic, antihypertensive as well as vasodilator effect (Cicero and Gaddi, 2001).

## 3. Materials and Methods

The moringa kernels were purchased from private exporter, Coimbatore. The dry kernels undergone traditional cold press oil extraction. The moringa oil sample of about 100ml was given to A to Z laboratory, Chennai, and Tamil Nadu, India to evaluate the fatty acid composition, tocopherol content, free fatty acid, peroxide value, smoking point, rancidity and viscosity. Fatty acid composition was determined by gas liquid chromatography according to the method of Tsaknis et al., 1998. Free fatty acid, viscosity, rancidity and smoking point was determined by IUPAC, 1979. Tocopherolanalysed on HPLC (high performance liquid chromatography) method by Carpenter, 1979. Peroxide value was estimated by method of AOAC, 1997; method no. Cd 8-53. The physico-chemical properties of moringa oil were analysed three times and the values obtained were subjected to student's t test and significant difference of moringa oil compared with olive oil.

## 4. Results and Discussion

The results of moringa oil physico-chemical properties are illustrated in Table 1.

**Table 1:** Physico-chemical properties of moringa oil[#]

| *Physico-chemical properties* | *Moringa oil* | *Olive oil*[*] | *Level of significance* |
|---|---|---|---|
| Viscosity(mPas) | 84.4±0.15 | 74.01±0.17 | p <0.001 |
| Smoking point (C) | 204.5±0.20 | 190±1.9 | p <0.001 |
| Free fatty acids (%) | 1.33±0.12 | 0.98±0.11 | NS |
| Peroxide value (meq O2/kg of oil) | 0.65±0.01 | 0.76±0.85 | NS |
| α-tocopherol (mg/kg) | 5.05±0.01 | 88.50±6.30 | p <0.001 |
| γ-tocopherol (mg/kg) | 25.40±0.12 | 9.90±0.65 | p <0.001 |
| δ-tocopherol(mg/kg) | 3.55±0.01 | 1.60±0.86 | p <0.01 |

[*]Source: Lalas and Tsakins, Characterization of moringaoleifera seed oil variety "periyakulam", J of F Comp and analy, 2002, 15, 65-77.
[#]values are means of triplicate samples and standard deviation.
NS- No significance

The viscosity of moringa oil was 84.4 mPas which was higher than olive oil 74.01mPas, possibly because of the water that was bound in the oil during extraction. The smoke point of moringa oil was 204.5$^{o}$ C higher that of olive oil 190$^{o}$ C. The smoke point required for deep fat frying is 200$^{o}$ C, so moringa oil can be used for deep frying. The present study results for viscosity and smoke point of moringa oil were same as Tsakins et al., 1998. Another study by Tsakins et al., (1999) reported 103 mPas viscosity and 201$^{o}$ C smoke point of moringa oil extracted by cold press.

Khattab and Shakak (2012) reported 44% moringa oil yield and lower viscosity of 35.6 cp. Moringa oil contains free fatty acid of 1.33 %, which was almost near to 1.128% reported by Salah, 2006. The peroxide value (useful to predict shelf life of oil) of moringa oil was found to be 0.65 (meq O2/ kg of oil). This value was higher than 0.59 (meq O2 / kg oil) reported by Anwar and Rashid (2007), while it was lower than 1.83 (meq O2/ kg oil) of moringa oil extracted by hexane compared with peroxide value of moringa oil extracted by cold press which was 0.11 (meq O2/ kg of oil) reported by Lalas and Tsaknis (2002). Also it was lower than 1.80 (meq O2/ kg of oil) for peroxide value of moringa oil extracted by hexane reported by Tsaknis et al (1999). Salah (2006) found that the peroxide value of moringa oil was 9 (meq O2/ kg of oil), this value was higher than the value in this study.

The tocopherol content of moringa oil in the present study was α-tocopherol content was up to 17 times lower than olive oil and δ-tocopherol and γ-tocopherol content was 2 times higher than olive oil. The tocopherol content of moringa seed oil extracted by cold press of PKM1 variety (periyakulam 1), India, showed similar results (Lalas and Tsakins, 2002). The total tocopherols of CPMSO (cold press moringa seed oil) and HEMSO (hexane extracted moringaseed oil) were found to be 95.5 and 90.2 mg/Kg (Ogunsina et al., 2011). Moringa oil of Mbololo from Kenya was much higher than olive oil. Most vegetable oils contain α-, β-, and γ-tocopherols. δ-Tocopherol exists in a few oils such as cottonseed, peanut, wheat germ, soybean, and castor oils (Lalas and Tsakins,2002). The antioxidant activity of δ-tocopherol exceeds that of γ-, β-, and α-tocopherol (Bourgeois and Czornomaz, 1982; Von Pongracz et al., 1984). Thus, tocopherols present in moringa oil are expected to offer some protection during storage and processing (Tsakins et al., 1999). The results of fatty acid profile of moringa oil was given in Table 2.

**Table 2:** Fatty acid composition of moringa oil (g per 100g of moringa oil)

| *Fatty acid* | *Moringa oil* | *Olive oil*[*] | *Level of significance* |
|---|---|---|---|
| Palmitic acid (C16:0) | 12.97 ± 0.15 | 11.2 ± 0.66 | p <0.01 |
| Margaric acid (C17:0) | 1.40 ± 0.15 | 0.01 ± 0.10 | p <0.001 |
| Stearic acid (C18:0) | 2.95 ± 0.04 | 2.80 ± 0.12 | NS |
| Oleic acid (C18:1) | 77.40 ± 0.40 | 74.53 ± 0.82 | p <0.01 |
| Linoleic acid (C18:2) | 1.40 ± 0.01 | 8.82 ± 0.79 | P <0.001 |
| α linolenic acid(C18:3) | 1.39 ± 0.01 | 1.12 ± 0.40 | NS |

[*]Source: Lalas and Tsakins, Characterization of moringaoleifera seed oil variety "periyakulam", J of F Comp and analy, 2002, 15, 65-77.
[#]values are means of triplicate samples and standard deviation.
NS- No significance

Moringa oil is characterized by a high content of oleic acid (77.40%) and belongs to the oleic acid oil category (Sonntag, 1982). The percentage of unsaturated fatty acids was 80.19% which was higher than 76% reported by Sonntag (1982). The major saturated fatty acid was palmitic acid which accounted to 12.97% of total fatty acid and small amounts of other fatty acid in the oil were detected.

The fatty acid composition of CPMSO and HEMSO showed oleic acid as the major fatty acid content of 78–79% (Ogunsina et al., 2011). Moringa seed oil extracted by cold press of PKM1 variety tabulated fatty acid composition of more than 76% unsaturation and 71.60% oleic acid content and 6.40% palmitic acid and trace and small amounts of other fatty acid (Lalas and Tsakins, 2002). Tsakins et al., (1999) reported cold pressure extracted moringa oil of Mbololo from Kenya to be 75.39% of oleic acid and 5.73% of palmitic acid. Khattab and Shakak (2012) reported a lower content of oleic acid 57% in moringa.

This means the moringa oil is stable to food cooking and deep frying process because it contains high percentage of monounsaturated fatty acid (oleic acid). Gunstone and Hilditch (1945) reported that the relative rates of auto oxidation of methyl oleate, linoleate and linoenate were in the order of 1:12:25. Clegg (1973) also reported that the relative rate of oxidation for oleic, linoleic and linoleic acids are 1, 15 and 30 respectively.

The results obtained showed a significant difference of p< 0.001 between viscosity of moringa oil of mean (84.4±0.15) and olive oil mean (74.01±0.17) and smoking point of moringa oil of mean (204.5±0.20) and olive oil mean (190±1.9). The tocopherol content of moringa oil was

significantly different from olive oil. The mean score of α-tocopherol content of moringa oil (5.05±0.01) which was 17 times lower than olive oil mean score (88.50±6.30). The mean score of γ-tocopherol content of moringa oil (25.40±0.12) was 2.5 times higher than olive oil mean score (9.90±0.65). The significant difference of $p<0.01$ between mean score of δ-tocopherol content of moringa oil (3.55±0.01) which was 2 times higher than olive oil of mean score (1.60±0.86).

Free fatty acid content mean score of moringa oil (1.33±0.12) which was not significantly different from olive oil mean score (0.98±0.11). The peroxide value of moringa oil mean score (0.65±0.01) was also not significantly different from olive oil mean score (0.76±0.85). Hence, there was no significant difference of free fatty acid and peroxide value between moringa oil and olive oil.

Moringa oil obtained a mean score (77.40±0.40) of oleic acid that was higher than olive oil mean score (74.53±0.82) and mean score of palmitic acid for moringa oil (12.97±0.15) was higher than olive oil mean score (11.2±0.66). There was a significant difference of $p<0.01$ between moringa oil and olive oil in oleic acid and palmitic acid content. Margaric acid mean score of moringa oil (1.40±0.15) was higher than olive oil mean score (0.01±0.10) and mean score of linoleic acid of moringa oil (1.40±0.01) was much lower than mean score of olive oil (8.82±0.79). There was a significant difference of $p<0.001$ between moringa oil and olive oil content of margaric acid and linoleic acid.

The mean score of moringa oil for α-linolenic acid (1.39±0.01) was not significantly different from olive oil mean score (1.12±0.40). Stearic acid mean score of moringa oil (2.95±0.04) which was also not significantly different from olive oil mean score (2.80±0.12). The results obtained for the characterization of moringa oil was almost similar to that of olive oil.

## 5. Conclusion

The oil extracted from moringa seeds has good physicochemical properties in such a way that no additional processing operations methods will be needed for the oil. Moringaoleifera oil is edible and closely resembles to olive oil in fatty acids composition. The oil has good quantity of oleic acid and therefore it can be used for frying and other food purposes.The functional properties and nutritional importance of moringa seed oil make it a better choice to be another monounsaturated fatty acid oil source for healthy cooking. This result agrees with Morton (1991), who reported that moringa oil can be acceptable substitute for olive oil.

## 6. Acknowledgement

I thank my research supervisor Mrs. Yamunadevi.P, Assistant Professor, Mother Teresa Women's University, Chennai, Tamil Nadu, India for her continuous support and guidance.

## 7. Future Scope

Study on moringa oil sensory and microbial properties. Toxicity of the oil should be analysed.

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