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Short Communication

Evaluation of some physicochemical parameters of selected brands of vegetable oils sold in Ilorin metropolis

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Five samples of selected brands of vegetable oils sold in Ilorin metropolis were investigated for some physicochemical parameters. Relative density, flash point, smoke point, crackle test, cold test and viscosity were determined for each sample. Also, the saponification, acids, ester and iodine values, as well as the fatty acid profile for each sample were investigated. Viscosity of the different brands of oils at varying temperature were significantly different ($P < 0.05$) for A356, A360 and A374, while there was no significant difference between A364 and A370. There were significant differences ($P < 0.05$) in the relative density, flash, and smoke points of samples A374 and A364 compared to the others (A360, A370 and A356) which were not significantly different from one another. All the vegetable oil samples passed the crackle test, but all failed the cold test. There were no significant differences ($P > 0.05$) in the chemical properties investigated for all the vegetable oil samples. The fatty acid profile indicated the presence of oleic and linoleic acids in all the samples while palmitic and stearic acids were present in only two of the samples, and myristic acid was found in only one of the samples. However, all the samples met the set standards for edible oils by regulatory bodies.

Key words: Vegetable oils, physicochemical parameters, fatty acids profile, NIS standards.

INTRODUCTION

Vegetables oils are derived from plant sources like soyabeans, melon, groundnut, corn, oil palm, sheabutter, coconut, etc. Some of these vegetable oils are used for domestic (edible) and industrial purposes (oleo chemicals) (Gurr, 1991; Hui, 1996). Nutritionally, vegetable oils are usually preferred to animal fat because of the presence of unsaturated fatty acids (Wardlaw, 1999). Vegetable oils obtained from various sources abound and are solid under different brand names in the society.

Vegetable oils have been recognized as sources of essential fatty acids, carrier of fat soluble vitamins, and enhance the foods we eat by providing texture, mouth feels, impartation of flavours and contribution to the feeling of satiety after eating (Wardlaw, 1999). In Nigeria, the major sources of edible oils are groundnut, palm and soybean. In order to safe guard the health of consumers, regulatory agencies, such as standards organization of Nigeria (SON), National Agency for Food and Drug Administration and Control (NAFDAC) (at the National levels) and at international level, the Codex Alimentarious Commission, International Standards Organization (ISO) sets standard parameters for edible oils. This study investigated selected physicochemical properties of vegetable oils sold in Ilorin metropolis.

MATERIALS AND METHODS

Materials

Five different vegetable oils samples were bought at a Local Market in Ilorin Nigeria, under various brand names and were coded as A356, A360, A364, A370 and A374 respectively. They were bought as packaged in four liter food grade plastic containers, transported immediately and stored under room temperature in the laboratory until required for analysis. All reagents used were of analytical grade.

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Table 1. Viscosity of the oil samples at Temperature Range of 20 - 100°C.

Temperature (°C)	A356	A360	A364	A370	A374
20	$76.7^{d} \pm 0.20$	$79.7^{a} \pm 0.20$	$79.2^{b} \pm 0.20$	$79.3^{b} \pm 0.20$	$78.8^{c} \pm 0.20$
30	$72.4^{b} \pm 0.20$	$74.1^{a} \pm 0.20$	$74.0^{a} \pm 0.20$	$72.8^{b} \pm 0.20$	$73.7^{b} \pm 0.20$
40	$40.1^{d} \pm 0.20$	$67.7^{a} \pm 0.20$	$66.8^{b} \pm 0.20$	$65.1^{c} \pm 0.20$	$66.6^{b} \pm 0.20$
50	$25.2^{c} \pm 0.20$	$28.7^{a} \pm 0.20$	$28.6^{a} \pm 0.20$	$27.1^{b} \pm 0.20$	$28.5^{a} \pm 0.20$
60	$18.8^{c} \pm 0.20$	$21.6^{a} \pm 0.20$	$21.5^{a} \pm 4.88$	$20.5^{b} \pm 0.20$	$21.2^{a} \pm 0.20$
70	$13.7^{c} \pm 0.20$	$16.9^{a} \pm 0.20$	$16.8^{a} \pm 0.20$	$16.7^{a} \pm 0.20$	$15.2^{b} \pm 0.20$
80	$10.3^{d} \pm 0.20$	$13.0^{a} \pm 0.20$	$12.0^{b} \pm 0.20$	$12.8^{b} \pm 0.20$	$11.3^{c} \pm 0.20$
90	$8.9^{c} \pm 0.20$	$10.3^{a} \pm 0.20$	$10.2^{a} \pm 0.20$	$10.1^{a} \pm 0.20$	$9.9^{b} \pm 0.20$
100	$6.3^{b} \pm 0.14$	$8.5^{a} \pm 0.20$	$8.4^{a} \pm 0.20$	$8.3^{a} \pm 0.20$	$8.1^{a} \pm 0.20$

All values with different superscript along the same rows are significantly different ($P < 0.05$).

Table 2. Physical properties of the oil.

Parameter	A356	A360	A364	A370	A374
Relative Density	$0.898^{b} \pm 0.1$	$0.920^{a} \pm 0.003$	$0.916^{a} \pm 0.001$	$0.915^{a} \pm 0.001$	$0.917^{a} \pm 0.001$
Flash point °C	$275^{b} \pm 7.0$	$280^{c} \pm 8.0$	$300^{b} \pm 8.0$	$280^{c} \pm 8.0$	$320^{a} \pm 8.0$
Smoke point °C	$223^{c} \pm 8.2$	$228^{b} \pm 8.0$	$238^{b} \pm 8.0$	$228^{b} \pm 8.0$	$240^{a} \pm 8.0$
Crackle point	Passed	Passed	Passed	Passed	Passed
Cold test	Failed	Failed	Failed	Failed	Failed

Values with different superscripts along the same rows are significantly different ($P < 0.05$).

Methods

Standard methods were employed in all the determinations. The AOCS (1993) method was used in determination of the viscosity, relative density, smoke and flash points, Crackle test, as well as the cold test. Saponification, acid, ester and iodine values were also determined using AOAC (1993) methods, while the fatty acid profile was determined using gas liquid chromatography as described by Igwe et al., 2005 and was carried out at the Central Laboratory of the Obafemi Awolowo University (OAU), Ile-Ife, Nigeria.

All determinations were in triplicates. All data were subjected to appropriate statistical analysis (Duncan, 1955).

RESULT AND DISCUSSION

Table 1 shows the data obtained for the viscosities of the oil samples at different temperatures 20 - 100°C. Viscosity is the thickness (resistance to flow) of an oil.

This study shows that the higher the temperature, the lower the viscosity of the various oils, an indication that high heat alters the structure of the fatty acids in vegetable oils.

The results of physical properties of the various samples of oil investigated were shown in Table 2.

The relative densities ranged from 0.898 for A356 and 0.920 for A360, A364, A370 and A374 respectively. The high relative densities could be an indication of high molecular weight and unsaturation as the density of an oil increases with increasing molecular weight and unsaturation (Onyeka et al., 2005) and falls within the set standard of 200°C.

The smoke point, which is the temperature at which a fat or oil produces a continuous wisp of smoke when heated, ranged from 223°C in sample A356 to 240°C in sample A374. This meets the standard requirement for frying oils which should have a smoke point above 200°C (A.O.C.S, 1993); an indication that these vegetable oils are suitable for frying purposes (Kirk and Sawyer, 1991). Sample A360, A364 and A370 were not significantly different from each other but were significantly different from the others.

The flash point of all the vegetable oil samples ranged from 275°C in A356 to 320°C in A374. The values were significantly different ($P < 0.05$) from each other with samples A370 and A374 not significantly different from the others although they all fell within the standard range which is 290 - 320°C (Falola et al., 2008).

Crackle test indicates the presence of moisture in fat and oils. All the oil samples showed no indication of moisture which indicates long self (Omosuliet, 2008).

The cold test which shows whether oil remains unclouded when held at 4 or 0°C for 15 h was failed by all the samples as they all turned cloudy under these conditions.

The chemical properties of the various oil samples are shown in Table 3. The saponification values ranged from 188 ± 0.32 to 196 ± 0.32 mg/KOH/g in samples A356 and

Table 3. Chemical properties of the oil sample.

Parameter	A356	A360	A364	A370	A374
Saponification value mg/KOH/g	$188^{c} \pm 0.32$	$191^{b} \pm 0.32$	$187^{c} \pm 0.32$	$192^{b} \pm 0.32$	$196^{a} \pm 0.32$
Acid value mg/KOH/g	$0.4^{d} \pm 0.03$	$0.5^{c} \pm 0.05$	$0.6^{b} \pm 0.03$	$0.6^{b} \pm 0.03$	$1.2^{a} \pm 0.03$
Ester Value	$187.6^{c} \pm 0.03$	$190.5^{b} \pm 0.03$	$195.4^{a} \pm 0.03$	$191.4^{b} \pm 0.03$	$185.8^{c} \pm 0.03$
Iodine (g)	$91^{d} \pm 0.32$	$94^{c} \pm 0.32$	$98^{d} \pm 0.32$	$82^{e} \pm 0.32$	$119.4^{a} \pm 0.1$

Values along the same rows with different superscripts are significantly different ($P < 0.05$).

Table 4. Fatty acid content of the oil samples.

Fatty acid composition %	A356	A360	A364	A370	A374
Palmitic acid	2.60	0.005	ND	ND	ND
Stearic acid	2.40	0.06	ND	ND	0.06
Linoleic	1.9	3.8	2.5	32.7	69.7
Myristic	1.7	ND	ND	ND	ND
Oleic	0.023	2.0	0.003	0.5	1.8

A374 respectively. There were significant differences between the oils as sample A360 was significantly ($P < 0.05$) different from samples A360 and A370, which were also significantly different from sample A356 and A364 respectively. However, these values all fell within the range of 188 - 198 mg/KOH/g set by the international codex standard for edible oils (Pearson, 1981 and NIS, 1992).

Samples A364 and A370 had similar acid values but these values were significantly different ($P < 0.05$) from the others, with sample A374 having the highest value of 1.2 mg/KOH/g. the values when compared to the standard range of 0.5 - 1.5 (Pearson, 1981). This shows that the oils will not go rancid easily.

Sample A374 had iodine value of 119.4 ± 0.1 which was significantly ($P < 0.05$) different from all the others, while samples A356 and A360 had similar values but were significantly different from samples A364 and A370. These values indicate a high degree of unsaturation and therefore a high susceptibility to oxidative rancidity.

Table 4 shows the result of the fatty acid analysis. Five major fatty acids were found in the oil samples. Myristic acid was detected only in sample A356, while linoleic and oleic acids were the major constituents of all the vegetable oils as in the case with most edible vegetable oils (Ayodele et al, 2004). The major saturated fatty acid in the oil samples were palmitic and stearic acids in sample A356 and A360 respectively. The presence of linoleic and oleic acids in the oil samples could account for the high iodine value, and is also an indication that the shelf life of the oil samples may be short.

Conclusion

The present study indicates that except for failing the cold test, all the oil samples of different brands met the NIS (1992) standard for vegetables oils with the best of them being A374.

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