Fatty acid Profile of oil Extracted from three Commercially available Noodles in Nigeria Market

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Abstract: Noodles popularity among the different age groups in the country, has made it important to access the fatty acid profile of three different brands of noodles in Nigeria. The oil from noodles was extracted using petroleum ether with a soxhlet apparatus. Their fatty acids profile was determined using a Gas chromatography equipped with a flame ionization detector (FID). A total of thirteen, fifteen and fourteen components were detected from samples A, B and C respectively. 120g of the noodles A, B and C yielded oil of 12.98%, 13.7% and 27.66% respectively. The fatty acids of highest percentage composition are Palmitic acid (36.8±0.1 to 42.6±0.1), Stearic acid (15.8±0.2 to 18.7±0.1) and Oleic acid (11.46±0.1 to 25.5±0.1) of the oil. Sample C had the highest composition of both total saturated fatty acids (TSFAs) and polyunsaturated fatty acids (PUFAs), but had the lowest monounsaturated fatty acids (MUFAs) and total unsaturated fatty acids (TUFAs). The consumption of sample C, having the highest oil yield, could lead to obesity; also, having the highest saturated fatty acid, makes it risky to human health when consumed regularly. The result of this study indicates that sample B contains the least stable oil among the three samples in terms of C18:2/C16:0. The stabilities of samples A and B in relation to C18:2/C16:0 were significantly not different.

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Introduction

Noodles are a food with a thin and elongated shape made from unleavened dough that is usually cooked in a boiling liquid. Noodles are popular in the market today; they are well accepted by the populace because they are convenient to cook. A single serving of instant noodles is high in carbohydrates but low in fibre, vitamins and minerals. They are prepared from wheat flour and/or rice flour and other flours and starches as the main ingredient. They are typically fried as part of the manufacturing process, resulting in high levels of saturated fat and/or trans fat. There is possible presence of oxidation products resulting from poor maintenance of the oil used in the frying process. If the cooking oil is not maintained at the proper temperature or changed as often as necessary, these oxidation products, which are suspected to pose various health risks, can be present in the foods (Gotoh *et al,* 2007).

Fatty acids are aliphatic monocarboxylic acids derived from, or contained in esterified form in, an animal or vegetable fat, oil, or wax. By extension, the term is sometimes used to embrace all acyclic aliphatic carboxylic acids (IUPAC, 1997). The natural fats and oil are mixtures of glycerides of fatty acids. Fatty acids play an important role in the life and death of cardiac cells because they are essential fuels for mechanical and electrical activities of the heart (Honoré *et al,* 1994; Reiffel *et al*, 2006; Landmark *et al*, 2006 and Herbaut, 2006). They can be saturated and unsaturated, depending on double bonds. Studies indicate that like hood of heart disease decrease when the intake of saturated fat is reduced and excessive consumption of trans fat may increase the risk of heart diseases; they have also been implicated in raising the LDL ("bad") cholesterol and lower the HDL ("good") cholesterol, and other harmful effects such as increasing triglycerides and Lp (a) lipoproteins (Mozaffarin *et al*, 2006). It is becoming increasingly clear that unsaturated fatty acids have important health effects, and new research in this area is attracting a huge amount of public interest. Good examples of polyunsaturated fatty acids are linoleic, linolenic and arachidonic acids. These are known as essential fatty acids, since they are required by the body, yet cannot be manufactured by the body, but can in some instances be synthesized by other nutrients. Essential fatty acids (EFA) supplements has been helpful to many people with allergies, anemia, arthritis, cancer, depression, diabetes, dry skin, eczema, fatigue, heart disease, sluggish metabolism, viral infections, and in easing the addiction recovery process (Horia *et al*, 2005; Smyth *et al,* 2005; Mahéo *et al*, 2005; Barascu *et al*, 2006).

In the current study, the fat and fatty acids contents, the quality of the free fatty acids and the saturated fatty acids/unsaturated fatty acids ratio of

three noodles commercially available in Nigeria markets were investigated as they are quality parameters for the consumers of today.

Materials and Methods

Materials

The three brands (deliberately unnamed) of noodles used in this study were bought from Oja-Oba market, Osogbo, Osun state, Nigeria. All other analytical and GC grade chemicals and solvents from various suppliers were of analytical grade.

Methods

Sample Preparation

The samples were obtained by grinding 20.0 g of each brand of the noodles using a manual grinder. The samples were stored in a glass container, labelled A, B and C, and transferred to an air-tight container to prevent moisture change.

Extraction of oil from noodles

10.0 g of each sample was weighed in a thimble, plugged with a wad of cotton wool, and extracted with 150 ml of petroleum ether (50°C) for 6 hours in a soxhlet apparatus (250 ml). The oil was later separated from the solvent by evaporation using a rotary vacuum evaporator at 40^0C.

Fatty Acid Composition (FAC)

A GC equipped with a flame ionization detector (FID) and a SGE BPX70 column (Cat No.CGO-5512, i.d. = 0.25 mm, length = 30 m, film thickness = 0.25 m) was employed for the qualitative and quantitative analyses of the fatty acid composition.

The FAC was determined by the conversion of oil to fatty acid methyl esters (FAMEs) using the method of (Timms, 1978). FAMEs were prepared by adding 20 mg of oil into screw capped tube followed by addition of 0.5 ml methanolic KOH, tube capped and heated in a water bath at 80^0C for 5 min. The tube was then cooled and 1 ml of BF_3 (14% in methanol) was added and then capped and heated in water bath at 80^0C for 10 min. The mixture was slightly cooled followed by the addition of 1 ml of water and 1 ml of hexane to the mixture. It was then cooled securely and vortexed vigorously for 30 sec. The tube content was allowed to settle to form layers; the top layer (hexane) was removed into a tube which contained small amount of sodium sulphate. The tube was swirled to remove any water content from solvent and then transferred to GC vial for analysis.

The GC injection port was equipped with a 0.5 mm i.d. liner to minimize peak broadening. The oven temperature was programmed at 60^0C for 2 min, then increased to 180^0C at 10^0C/min, then increased to 235^0C at 4^0C/min and held for 27.7 min at 235^0C. Helium was used as the carrier gas. The detector temperature was set at 265^0C. For the GC-FID analysis, the injection was performed at 265^0C under split mode (40:1). The data were considered as the percent of the normalized peak area of all the identified FAMEs.

Statistical Analysis

The data obtained from the experimental measurements were subjected to a one-way analysis of variance (ANOVA) to determine the significant differences among the treatments. Significance was defined at $p < 0.05$. The significant differences ($p < 0.05$) between the means were further determined by Duncan multiple Range Test.

Result and Discussion

The total SFA of the oils extracted from the three noodles are presented in table 1. The values ranged between 64.15% and 77.85%. Sample C has the highest percentage of SFA with sample A having the least. For all the extracted oils, the most predominant SFAs are Palmitic acid (C16:0) and Stearic acid (C18:0). Sample C had the highest composition of SFA with palmitic acid and stearic acid having a percentage composition of 42.6% and 18.7% respectively, while sample B had the least value of SFAs with values of 36.8% (palmitic acid) and 15.8% (stearic acid). This renders sample C less desirably recommended for consumption as consumption of food rich in high content of saturated fat are responsible for the cause of elevated cholesterol and low density lipoproteins (LDL) they can have negative impart on our health. (Uauy and Valenzuela, 2000) , while sample A and B with lower SFAs and not significantly different could lead to least risk to these health problems.

The second most predominant fatty acid present in all the oils was oleic acid. This is a monounsaturated fatty acid. They were found to have percentage compositions of 24.92%, 25.5% and 11.46% in samples A, B and C respectively. However, Sample A had the highest total MUFA content (26.65%), while the least composition was found in sample C (11.84%), though sample B also had an appreciable content of MUFA (25.79%). High amounts of monounsaturated fatty acids (MUFAs) in oils are associated with a reduced risk of coronary heart disease (Mensik and Katan, 1990). Therefore, oil with high amount of MUTA induces a desirable effect on the health benefits; this can be most derived in sample A.

The polyunsaturated fatty acids (PUFAs) contents of the oils were found to be predominantly linoleic. Total PUFAs recorded for all the samples,

however, shows that sample C contained the highest value (10.28%), while the least was found in sample A with 9.18%. PUFAs are very necessary in the body. Maintaining concentrations of PUFAs is likely to favour enhanced cognitive, learning and memory functions (Youdim *et al.* 2000) and according to Jiang et al, 1998, it is clear that some properties of PUFAs make them attractive options in the treatment of cancer.

The percentage composition of total unsaturated fatty acids USFAs present in the samples are, 35.83%, 35.35%, 22.13% for A, B and C respectively. This could mean better nutrition quality for samples A and B than C. However, they might play a major role in oxidative deterioration of the samples as linoleic (C18:2) a PUFA is susceptible to oxidation.

Table 1: Fatty acid profile of oil extracted from three different brands of noodles.

Fatty acid composition (%)	Sample		
	A	B	C
C4:0	ND	2.91±0.1^{a}	ND
C6:0	6.24±0.1^{a}	6.48±0.3^{a}	8.43±0.2^{c}
C8:0	0.24±0.1^{a}	0.25±0.1^{a}	0.31±0.2^{b}
C12:0	0.53±0.2^{a}	0.97±0.1^{b}	5.02±0.1^{d}
C13:0	0.28±0.2^{a}	ND	ND
C14:0	0.81±0.1^{a}	0.90±0.2^{b}	2.22±0.1^{cd}
C16:0	38.4±0.1^{b}	36.8±0.1^{a}	42.6±0.1^{c}
C18:0	17.0±0.3^{b}	15.8±0.2^{a}	18.7±0.1^{c}
C20:0	0.36±0.1^{a}	0.35±0.3^{a}	0.394±0.1^{a}
C21:0	ND	0.1±0.2^{a}	0.07±0.1^{b}
C23:0	0.13±0.1^{a}	ND	ND
C18:1	24.92±0.3^{cd}	25.5±0.1^{cd}	11.46±0.1^{a}
C18:2	9.18±0.2^{a}	9.32±0.1^{a}	10.11±0.2^{b}
C18:3	ND	0.06±0.2^{a}	ND
C20:1	0.32±0.2^{a}	0.29±0.1^{a}	0.30±0.1^{a}
C20:2	ND	0.08±0.1^{a}	0.08±0.1^{a}
C22:1	ND	ND	0.08±0.1^{a}
C22:2	ND	0.09±0.1^{b}	0.08±0.1^{a}
C24:1	1.41±0.2^{a}	ND	ND
Total saturated	64.15±0.1^{a}	64.62±0.3^{a}	77.85±0.1^{b}
total MUFAs	26.65±0.1^{cd}	25.79±0.1^{c}	11.84±0.2^{a}
total PUFAs	9.18±0.1^{a}	9.56±0.1^{b}	10.28±0.1^{c}
C18:2/C16:0	0.23±0.1^{a}	0.25±0.2^{b}	0.23±0.01^{a}
Total UFAs	35.83±0.2^{b}	35.35±0.1^{b}	22.13±0.3^{a}

The C18:2/C16:0 ratio is a parameter that helps in determining the stability of oils. As shown in table 1, the ratios C18:2/C16:0 were found highest in sample B (0.25), whereas samples A and C recorded the same value (0.23). Though C produced the highest level of saturated Palmitic acid (C16:0) (42.6%), its stability was, however; compensated for by the much linoleic acid (C18:2) (10.11%).

Conclusion

It is evident that sample C had more oil yield compared to others, therefore its much consumption can lead to obesity and create heart disease; it should be noted, however, that it contains the more important polyunsaturated fatty acids. The result of this study indicates that sample B contains the least stable oil among the three samples in terms of C18:2/C16:0 because it contains a relatively high amount of linoleic acid, which could not be compensated for as the oil contains least content of palmitic acid. The stabilities of samples A and C form table 2 are significantly not different.

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