

Are Fast Food “Trans-Fat” Claims True? An Infraspec VFA-IR Spectrometer Analysis of Trans-fat content in select food items purchased from Long John Silver’s

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ABSTRACT

Studies linking high *trans*-fat diets to coronary heart disease (CHD) have prompted the need to regulate, limit, or completely ban *trans*-fat from all commercial food products, including fast foods. Many U.S. fast food chains now claim that their food items, particularly French fries, have "no *trans*-fat". In a previous study, our lab tested the validity of *trans*-fat claims made by several popular fast food restaurants by experimentally determining the %*trans*-fat in oil extracted from fast food French fries. In some cases, the *trans*-fat content was nearly twice as high as the amount reported by the restaurant in their literature. Long John Silver's, for example, reported a *trans*-fat content of 25% for their French fries, while our lab actually found over 40% *trans*-fat. The purpose of this study is to broaden our study of Long John Silver's *trans*-fat claims by analyzing a variety of their food items and comparing our findings with the %*trans*-fat reported by the restaurant literature (nutrition fact tables). Variable Filter Array (VFA) IR spectroscopy was used to assess the *trans*-fat content of oil extracted from food samples. Our preliminary findings suggest that nearly every food item under study contained considerably more *trans*-fat than the amount reported in the restaurant's literature.

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1. Introduction

A *trans*-fat (Fig. 1) is a fat molecule containing one or more unsaturated fatty acids in the trans configuration. *Trans*-fats are produced industrially by a process called hydrogenation¹. Studies linking high *trans*-fat diets to coronary heart disease (CHD) have prompted the need to regulate, limit, or completely ban *trans*-fat from all commercial food products, including fast foods^{2–4}. An intake of just 5 grams of *trans*-fat a day has been linked to a 25 percent increase in the risk of ischemic heart disease and Americans intake an average of 5.8 grams of *trans*-fat a day^{5,7}.

In order to help reduce the risk of disease, the American Heart Association recommends limiting the amount of dietary *trans*-fat consumption to less than 2 grams a day⁸. In addition, in 2003 the U.S. Food and Drug Administration, amended its nutrition labelling regulations to require that ‘‘*trans* fatty

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acids be declared in the nutrition label of conventional foods and dietary supplements'' to help consumers make healthy dietary choices⁵. To date, there are no federal regulations or monitoring of *trans*-fat labelling of fast foods purchased from fast food establishments^{5,8}. Consumers rely solely on restaurant establishments to report accurate and up-to-date nutritional data. As of July 2008, New York City banned the use of *trans*-fat in all food service establishments⁹. Since this ban, many fast food restaurants have voluntarily switched to "no *trans*-fat" frying^{1,10,11}.

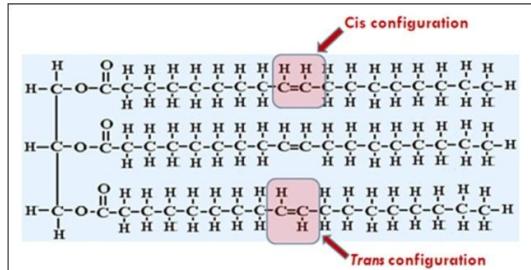


Fig. 1. Fat Molecule (cis/trans)

In a previous study, our lab tested the validity of *trans*-fat claims made by several popular fast food restaurants by experimentally determining the %*trans*-fat in oil extracted from fast food French fries¹². In some cases, *trans*-fat content was nearly twice as high as the amount reported by the restaurant in their literature. Long John Silver's (LJS), for example, reported a *trans*-fat content of 25% for their French fries, while our lab actually found over 40% *trans*-fat. The purpose of this study is to broaden our study of LJS's *trans*-fat claims by analyzing a variety of their food items and comparing our findings with the %*trans*-fat reported in restaurant literature (nutrition fact tables).

Rapid VFA-IR spectroscopy is used to determine the total isolated *trans*-fatty acids in oil samples extracted from LJS's food items¹¹. This type of IR analysis is based on a C-H "out-of-plane" deformation that is characteristic of all compounds containing an isolated *trans* double bond configuration. The *trans* configuration results in a unique IR absorbance band at 966 cm⁻¹ and the intensity of this absorption band can be used to determine *trans*-fat content in a variety of fat samples¹¹.

2. Results and Discussion

Table 1 and Fig. 2 compare the experimental values (as the mean of three trials and standard deviation from mean) and literature values (LJS's nutrition fact table) of the %*trans*-fat and %fat in oil extracted from twelve different food items purchased from LJS's. For all food items studied, the %*trans*-fat was considerably higher than the values reported in LJS's 2010 literature. The fat extracted from "Breaded Fish" was nearly 50% *trans*-fat, which is 4 grams of *trans*-fat in just one serving. Ten out of the 12 food items studied contained over 40% *trans*-fat.

Direct comparison of our experimental data with restaurant literature values could be misleading since we were not able to evaluate the statistical significance of the literature values or how the restaurant *trans*-fat analyses were done. Hence, we cannot state the statistical or quantitative significance of our data in comparison with literature values. The new novel instrument used in our analysis is a proven, valid method of *trans*-fat analysis. Therefore, it is clear that our data should raise concern about the significant amounts of *trans*-fat in fast foods and the accuracy of *trans*-fat reporting by restaurants^{12,17}. Our data has serious health implications for consumers; especially since the American Heart Association recommends limiting the amount of dietary *trans*-fat intake to less than 2 grams a day¹².

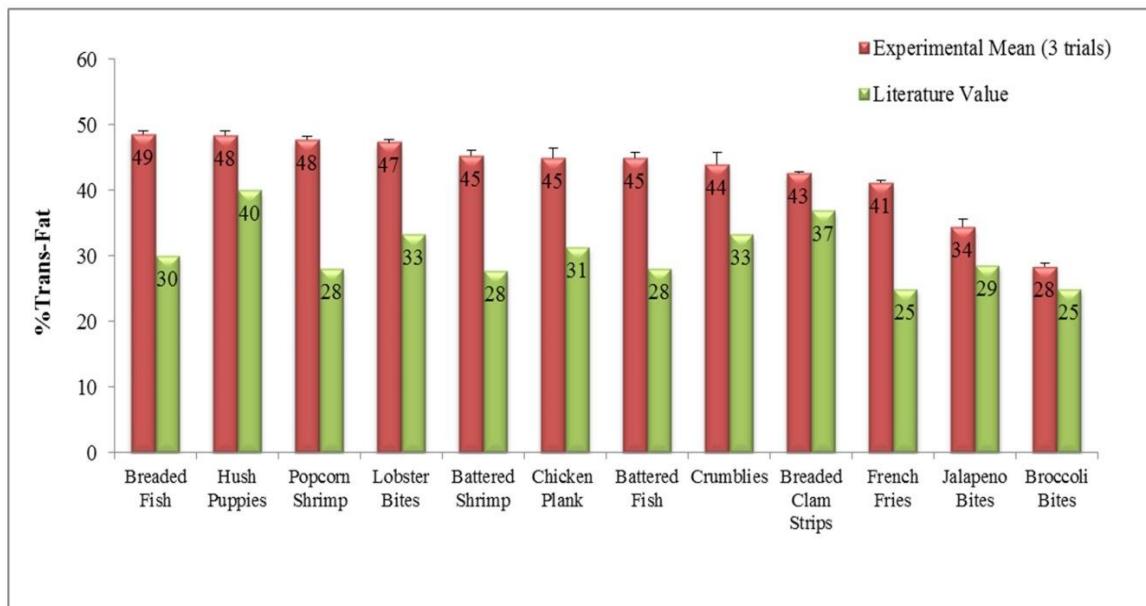


Fig. 2. Experimental and Literature %Trans-fat values for LJS's Food Items studied

Table 1. A comparison of the experimental and literature values for %trans-fat and %fat in oil samples extracted from select LJS's food items. The mean value of three trials and standard deviation from the mean are shown.

Food Items Tested	Mean Experimental %trans-fat (<i>n</i> = 3)	Literature %trans-fat (2010)	Mean Experimental %total fat (<i>n</i> = 3)	Literature %total fat (2010)
Breaded Fish	49.0 ± 0.5	30	10.6 ± 0.2	13
Hush Puppies	48.4 ± 0.6	40	13.3 ± 0.9	9.6
Popcorn Shrimp	47.7 ± 0.5	28	9.9 ± 1.3	19
Lobster Bites	47.3 ± 0.4	33	11.8 ± 1.8	9.9
Battered Shrimp	45.2 ± 0.9	28	24.4 ± 2.6	21
Chicken Plank	45.0 ± 1.5	31	15.5 ± 0.2	15
Battered Fish	44.9 ± 0.6	28	13.4 ± 0.9	17
Crumblies	44.0 ± 1.9	33	45.3 ± 2.3	43
Breaded Clams	42.7 ± 0.2	37	17.7 ± 0.2	22
French Fries	41.2 ± 0.2	25	11.2 ± 3.7	12
Jalapeno Bites	34.4 ± 1.2	29	14.0 ± 1.3	17
Broccoli Bites	28.4 ± 0.4	25	8.8 ± 1.5	13

The %total fat extracted from each food item was compared with %total fat reported in LJS's literature (Fig. 3). Statistically, the experimental values for %fat agreed with the literature values with one exception. Jalapeno bites contained 19% fat instead of the 10% reported in the literature. It is important to note that nine out of 12 food items contained over 40% fat.

3. Conclusions

Our study suggests that at the time of this study (2010) trans-fat content in LJS's food items were much higher than what was actually reported in the restaurant's literature. This could be due to differences in method of trans-fat analysis, inaccurate or out-of-date reporting. Since our lab used one of the latest methods in trans-fat analysis, the data reported here has significant implications and further studies are warranted. There are no U.S. federal regulations of trans-fat content in fast foods;

therefore it is important that trans-fat claims and trans-fat labelling are accurate and up to date so that consumers are able to make healthy and informed food choices when dining in these establishments.

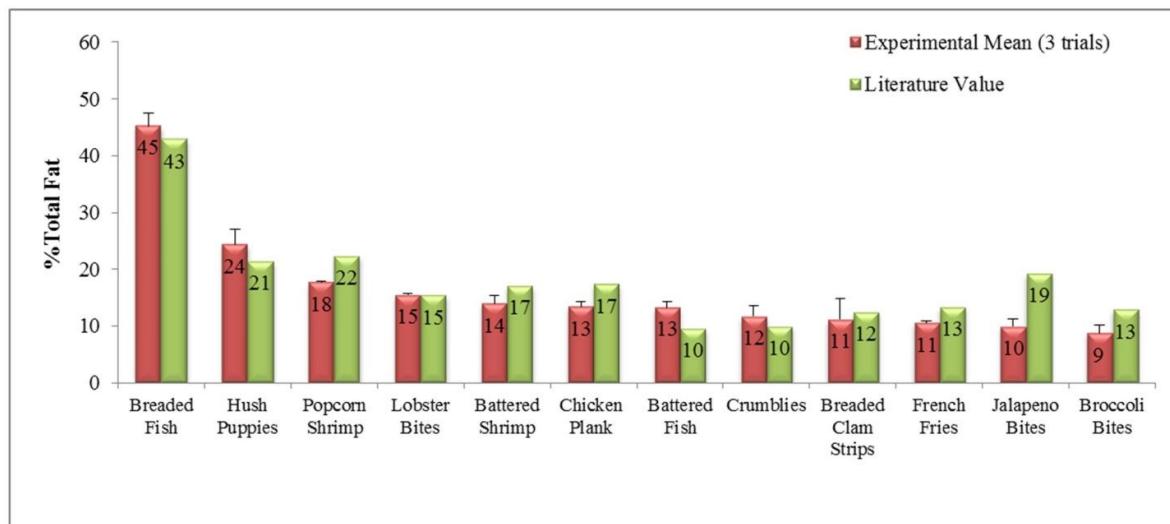


Fig. 3. Experimental and Literature %Fat values for LJS's food Items studied

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4. Experimental

4.1. Materials and Methods.

A detailed method for fat extraction and trans-fat analysis is described in a previous paper¹²; however a brief description is given here.

4.2. Fat Extractions.

On three different days, twelve different food items were purchased from Long John Silver's in Michigan City, a small city in Northwest Indiana. The twelve food items studied were as follows: Breaded Fish, Hush Puppies, Popcorn Shrimp, Lobster Bites, Battered Fish, Batter Shrimp, Chicken Planks, Crumblies, Breaded Clam Strips, French Fries, Jalapeno Bites and Broccoli Bites. On the same day of purchase, the entire order for each food item was massed and homogenized in ligoine (petroleum ether) using a stainless steel blender^{13,14}. Access ligoine was decanted, the oil sample was transferred to a large evaporating dish and remaining solvent was evaporated over a low heat¹² using a hot plate. The oil extracts were stored at -20°C until IR analysis and VFA-IR trans-fat analyses were done within 24 hours of fat extraction. See our previous study for detailed procedure for fat extraction¹². Our previous study shows that evaporation over low heat and short-term storage at -20°C did not affect the %trans-fat results.

4.3 Trans-fat Analysis.

Variable Filter Array (VFA) IR spectroscopy^{11,15} was used to determine the total isolated trans fatty acid in neat oil extracts. The InfraSpec VFA-IR spectrometer (Figure 4) is a newly patented mid-IR instrument that utilizes a detector array with linear variable filter. VFA-IR spectroscopy is based on ATR-FTIR trans-fat analysis and was used to determine the total isolated trans fatty acid in neat oil sample extracts^{11,12,15}. This method of VFA-IR trans-fat analysis can only be applied to oils

and fats with trans-fat levels equal to or greater than about 1.0%. The InfraSpec VFA-IR Spectrometer was equipped with custom software that allowed for multiple calibrations and data storage. After fat extraction from samples, approximately 100 μl of fat extract was needed for VFA-IR analysis.

The VFA-IR instrument has a resolution of 25 cm^{-1} , hence the trans-fat absorption bands of standards and samples occurred at 956 cm^{-1} instead of 966 cm^{-1} which was within the resolution of the instrument. The area under the 956 cm^{-1} trans absorbance band was integrated between the limits of 945 and 990 cm^{-1} in order to obtain the peak area of all samples and standards. The cis fatty acid standard triolein was used as the background spectrum for all VFA-IR analyses^{11, 15, 16}.

The VFA-IR instrument was calibrated using standards prepared from triolein (cis-fat standard) and trielaidin (trans-fat standard). Trielaidin and triolein were purchased from Nu-Check-Prep, Elysian, MN. Triolein is an oleic acid triglyceride containing only cis double bonds, and trielaidin is an elaidic acid triglyceride containing only trans double bonds. Eight trans-fat calibration standards were prepared by mixing trielaiden and triolein to give percentages of trans-fat between one and 50% by mass. Figure 5 shows the VFA-IR absorbance spectra and calibration curve of the eight trans-fat standards. A plot of percent trans-fat versus peak area (945–990 cm^{-1}) of the standards yielded the linear equation, $y = 4.77 \times 10^{-5}x + 1.23 \times 10^{-4}$, $R^2 = 0.9904$ (Figure 5B). See our previous study for detailed procedure for trans-fat analysis¹².

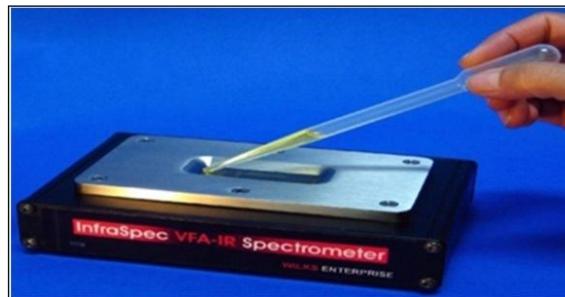


Fig. 4. Wilk's InfraSpec VFA-IR Spectrometer¹⁷

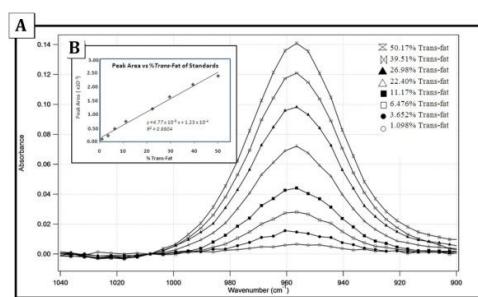


Fig. 5. Figure 5A is a VFA-IR absorption spectra of the trans-fat calibration standards and Figure 5B shows a graph of the percent trans-fat versus peak area (945–990 cm^{-1}) which yields a linear equation, $y = 4.77 \times 10^{-5}x + 1.23 \times 10^{-4}$ ($R^2 = 0.9904$)

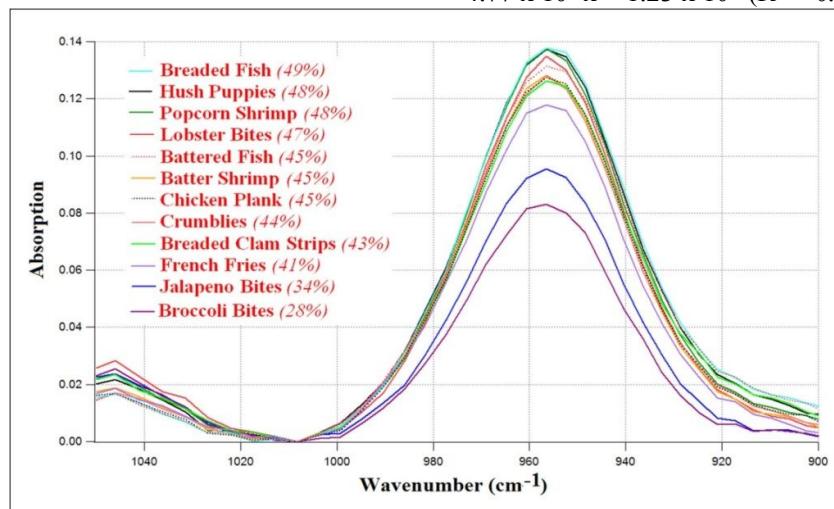


Fig. 6. Figure 6 is a VFA-IR absorption spectrum of sample oil extractions

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