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RESEARCH ARTICLE

Acceptability of a Standard French Fry Product Cooked in Pastured Lard and Beef Tallow

Jeanne Doherty[1], Lindsay Jaya[2] and B. Burgin Ross[3]*

[1]Dietetic Internship at UNC-Greensboro, North Carolina, USA
[2]Undergraduate student at UNC-Greensboro, Greensboro, North Carolina, USA
[3]Department of Nutrition, University of North Carolina, Greensboro, NC, USA

Abstract

This paper represents a project completed in an experimental food class at the University of North Carolina at Greensboro, as a component of the DPD program in preparing students to enter a Dietetic internship. The project focused on the use of pastured animal fats, particularly beef tallow and pork lard in the preparation of a standard French fry product.

Keywords: Beef tallow; lard; pastured animal fat; conjugated linoleic acid (CLA)

Introduction

Fried foods are a popular item in the American diet, due in large part to the growth of the fast food industry. Unfortunately, some lifestyle related diseases are associated with frequent fried food consumption. Consumer awareness of these health implications has encouraged the fast food industry to modulate such risks by replacing hydrogenated fats with non-hydrogenated, processed oils such as Canola and soybean oil.

A current trend among consumers indicates a return to traditional fats employed in high temperature frying, including lard & tallow. Questions as to the long-term health effects of manufactured oils have been postulated, particularly with regards to Canola oil. Recent research suggests the potential health benefits of both pastured animal fats and vegetable based saturated fats, such as coconut and palm oils.

The objective of this experiment was to investigate the acceptability of French fries cooked in pastured animal fats such as lard & tallow. Fries cooked in palm oil and coconut oil, which are saturated fats, were also tested for acceptability.

Background

The current dietary guidance for cardiovascular health continues to be based on the lipid hypothesis that was introduced into the scientific literature by the researcher Ancel Keys. Keys used epidemiological data from the Seven Countries Study for the observational study he conducted on 286 businessmen in Minnesota in 1947 [1]. While it may have been convincing at the time, Keys' research warrants further examination. Following publication of Key' findings, indicating the need to eliminate saturated fats and cholesterol, dissenters objected to some critical areas of his research design. Specifically, Keys failed to consider the role of carbohydrates in cardiovascular disease risk. Keys excluded the French cohort which was known for a high consumption of saturated fats and low incidence of heart disease. It could be hypothesized that Key's findings may have been impacted by the quality and/or the source of the saturated fats consumed by the subjects.

It must be noted that the sourcing of a nutrient may have an impact on the nutritional profile of the product consumed. It is possible that the nutrients contained in a mole of saturated fat procured from a conventionally raised (CAFO) ruminant be different from a pasture raised ruminant.

Conjugated linoleic acid (CLA) is a micronutrient missing from the American diet since the cattle industry evolved to a factory grain-based feed system. CLA is a fatty acid that can only be obtained from food products of animals whose diets consist mostly of grass and other pasture plants [2]. The benefits of this fatty acid have been associated with reduced risk of heart failure, colon cancer, and breast cancer [3-5]. Furthermore numerous cell and animal studies have shown CLAs to improve lipidemia and promote various anti-obesity mechanisms [6-7]. Recently, Dipasquale [8] et al., observed the anti-inflammatory effects of two CLA isomers in a cell study of bovine mammary epithelial cells treated with lipopolysaccharide (LPS). In their study, only the cells treated with the cis-9, trans-11, CLA isomer demonstrated significantly reduced RNA expressions of both interleukin1 beta (IL-1β) which is associated with

Correspondence to: Burgin B Ross, Department of Nutrition, University of North Carolina, Greensboro, North Carolina, USA, Tel: 336-334-5081; E-Mail: bbgonzal[AT]uncg[DOT]edu

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inflammatory pain sensitivity and peroxisome proliferator-activated receptor alpha (PPARα) which is involved in the regulation of lipid metabolism. These are important findings because increased levels of LPS in the blood stream have been found to contribute to obesity and increased cardiovascular risk and to diseases associated with metabolic endotoxemia [9, 10]. While the research on humans is not yet extensive enough to warrant nutritional therapies for CLAs, Fuke and Nomberg concluded in a recent systematic review, that both of the individual isomers of CLA (cis-9, trans-11 and trans-10, cis-12) have the potential for conferring beneficial health effects [11].

Methodology

Product Preparation

The method by which this team prepared the French fries was based on the recipe created by J. Kenji Lopez-Alt [12]. The blanche/double fry approach of his recipe is grounded in established culinary and food science principles designed to yield the "perfect French fry [13-15]. All fries were made with Yukon Gold potatoes according to the Lopez-Alt method without variation. As the control product utilized Canola oil to fry, the three variations employed pork lard, beef tallow, and red palm oil. All fries were cut to identical size using a mandolin for uniformity of size. All products were prepared by identical methods, cooked at identical temperatures, and held using identical processes.

Prior to cooking the potatoes were peeled and cut using a mandolin slicer on a thin julienne setting for a uniform size of ¼ by ¼. The potatoes were placed in a blanching liquid consisting of 4 quarts of water, 4 tbsp of white vinegar and 4tbsp of kosher salt, followed by a ten-minute boil. By acidifying the blanching liquid, the pectin in the potato remained intact. The potatoes were then drained, cooled, and allowed to dry. Each of the frying mediums was heated to 400 degrees Fahrenheit, at which point the potatoes were added, cooked for 50 seconds, and removed again to cool and dry. Upon completion of a 30-minute cooling period, the potatoes were placed in Ziploc freezer bags and frozen overnight. The frying mediums, which had been measured prior to frying, were measured again to determine the amount of oil absorbed and were then stored overnight.

On the following day, the fries were removed from the freezer, the fats were heated to 400 degrees Fahrenheit. Each sample of potatoes were fried for five minutes. Maintaining cooking temperature again presented a challenge as the frozen fries very quickly reduced fat temperatures. Thermo pop thermometers, by Thermo works, were utilized to maintain desired temperatures. Following cooking all fries were held at 200 degrees Fahrenheit until subjective testing commenced. Each batch of product was cooked separately in identical All-Clad stainless-steel pans.

Subjective Testing

For the subjective testing method, a standard rank order test was implemented. The rank order test focused on the following three characteristics of each fry variation: taste, texture, and appearance. The goal was to determine acceptability in terms of these sensory characteristics. In order to "blind" the testing, each fry variation was assigned a random three-digit number. Fries prepared in Canola oil were coded #547. Fries prepared in beef tallow were assigned code #184. Fries prepared in pork lard were coded #451. Fries prepared in red palm oil were given code #392. Codes were recorded on a round plate in an equally spaced manner. The coded samples were then placed on the labeled plate in their respective spaces for tester appraisal. Along with the plate containing the 4 coded samples, each tester received a copy of the rank order test form.

The testers were composed of fellow students in the class, graduate students in the department, and some faculty and staff. As such, these were not professional testers. Testers were instructed to examine and taste each fry, then rank numerically in terms of characteristic (taste, texture, appearance) which was the most desirable, with 1 being the least desirable and 4 being the most desirable. Testers were asked to take sips of water in between tastings to clear the palate. The form consists of three sections per characteristic being tested: taste, texture, and appearance. Below each heading, coded items are listed vertically with space located adjacent for tester to record rank response one through four. Space was allowed for comments although testers were not required to add comments. Once completed rank order forms were collected and analyzed.

Objective Testing

Objective testing focused on oil absorption of potato product throughout the double fry process. Each fat medium (lard, tallow, palm oil, and Canola oil) was measured using 500 mL capacity graduated cylinders. Measurements took place three different times: before the 1st[t] frying process, after the 1st frying process and after the 2nd frying process. The measurements in mL were also recorded onto a formatted objective testing form. Each measurement stage was assigned a letter variable. A = total amount of fat medium present before the 1st frying process occurred. B = total amount of fat medium present after the 1st frying process occurred. C = amount of fat medium present after the final 2nd frying process. Once initial measurements are determined, the values of these letter variables can be mathematically manipulated to determine the extent of fat absorption. Subtracting B from A will indicate the amount of fat absorbed into the French fries after the 1st frying process occurred. Subtraction of B from C will indicate the amount of fat absorbed solely after 2nd frying process occurred. Finally, Subtracting C from A will reveal the total comprehensive amount of fat absorbed over the dual stage frying process.

Results

Rank Order Test Results – Subjective Results of the rank order test consisted of 17 testers' responses. The responses were added and recorded in multiple data tables. (Figure 1) shows the results of tallied responses for appearance. (Figure 2) has results for Taste. (Figure 3) shows the results of tallied

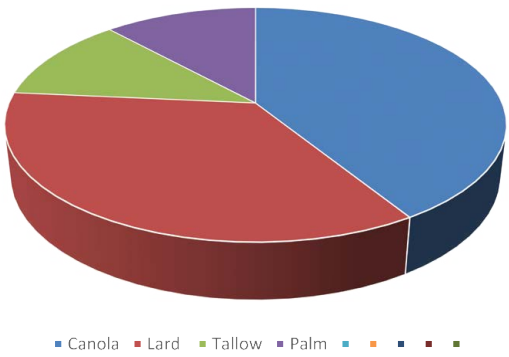

Figure 1:

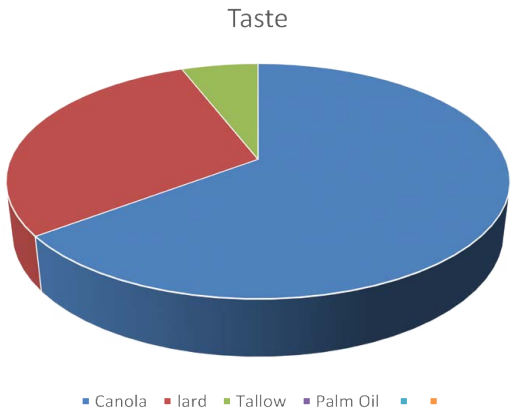

Figure 2:

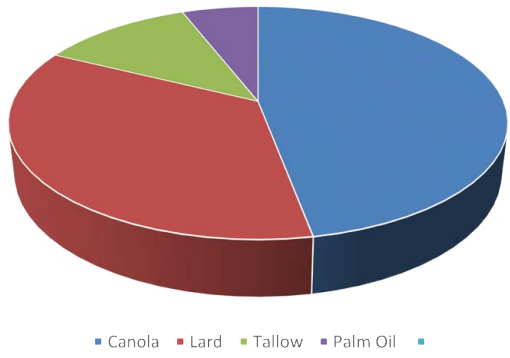

Figure 3:

responses for texture. The canola oil product was ranked most desirable across all three characteristics being tested: appearance, taste, and texture. The product prepared in lard was ranked second most desirable across all three characteristics.

Several testers included comments on forms as well. Fry #547(Canola oil fry) was said to be "full of flavor" and "crispy". Fry #392(red palm oil fry) was said to be "greasy and a bit limp", "reddish color, saggy, oily" with a "salty, savory, buttery flavor". Fry #184(beef tallow fry) was said to be "salty, savory", "soft on the inside & crunchy" and "very good taste". Fry #451(pork lard fry) was said to be "not as crunchy", "regular yellowish color", and "just right, well done".

Oil Absorption Measurement Results – Objective

All frying began with approximately 650 mL of fat or oil. Total oil absorption over dual stage frying process for each product variation is as follows from least to greatest: red palm oil – 177 mL, Canola oil – 155 mL, lard – 153 mL, and tallow – 105 mL. The fries prepared in red palm oil, absorbing the most fat overall, absorbed 81 mL after the 1st fry and 96 mL after the 2nd fry. The fries absorbed 12.4% and 16.8%, respectively, of the red palm oil after each frying stage. The fries prepared in Canola oil absorbed 57 mL after the 1st fry and 98 mL after the 2nd fry, this is 8.8% and 16.5%, respectively, Canola oil absorption after each frying stage. The fries prepared in lard absorbed 87mL after the 1st fry and 70 mL after the 2nd fry, this is 13.3% and 12.4%, respectively, lard absorption after each frying stage. Finally, the fries prepared in beef tallow absorbed 32 mL after the 1st fry and 73 mL after the 2nd fry, this is 5.0% and 11.8%, respectively, beef tallow absorption after each frying stage. Overall, 27.2% red palm oil, 23.8% Canola oil, 23.5% lard, and 19.3% beef tallow were absorbed into their respective final French fry products. With the exception of the lard product, all other variations experienced a larger fat absorption increase after the second frying process.

An indication of correlation between total amount of oil absorbed and acceptability of final product can be seen. The fries prepared in red palm oil that were ranked least desirable in terms of taste, texture, and appearance were the fries that absorbed the most oil. The fries prepared in Canola oil that were ranked most desirable in terms of taste, texture and appearance were the fries that absorbed 2nd to most oil, only 20 mL less.

Conclusion

The results of our experiment reveal that current fry techniques for cooking French fries in traditional fats, including red palm oil, lard and beef tallow do not yield a French fry product that is as acceptable to a majority of tasters compared to a French fry cooked in Canola oil. Kita et al., found that the both the type of frying oil and the cooking temperature impact French fry texture and the amount of fat absorbed suggesting that different frying media may require different cooking temperatures [16]. The results of objective testing indicate varying rates of oil absorption. The least desirable French fry product (palm oil) in terms of taste, appearance and texture absorbed the least amount of oil. Interestingly, both the lard cooked French fries and French fries cooked in Canola oil absorbed similar amounts of oil, 153mL and 155mL respectively. Furthermore, while the subjective data collected did not rank the French fries cooked in lard as being equal to or greater in terms of acceptability, the quantitative results did indicate that fries cooked in lard were almost as acceptable as those cooked in Canola oil. Five of seventeen testers did choose the French fries cooked in lard as being the most desirable in terms of taste. Therefore, of the three traditional fats in the experiments (palm, beef tallow and lard), only lard

yielded a product that was almost as acceptable as the French fries cooked in a manufactured control fat (Canola).

Limitations

Limitations in this experiment are notable. The students involved are neither food science students nor are they professional testers. As the class size was small, the number of testers was small.

Implications

As the trend to utilize pastured animal fats in cooking continues, future studies are needed to discover the best temperature for French fries cooked in each traditional cooking fat to increase product palatability, visual appeal and overall acceptance. It would also be important to examine how temperatures affect the types of fatty acids, nutrients and other end products contained in the foods produced by high temperature frying. Obviously, the research on health outcomes for both unsaturated fats and pastured animal fats will continue to be evaluated.

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