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**SENSORY EVALUATION OF FRENCH-FRIES  
FRIED IN TRANS-FAT FREE FRYING OILS OVER PRODUCTION CYCLE**

A Thesis in  
Hotel, Restaurant and Institutional Management

by  
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## ABSTRACT

Deep fat frying is one of the popular cooking method due to unique taste of fried food and its convenient cooking process. However, deep fat-fried foods have posed some health risks because of its high fat contents, especially trans-fat. To avoid the health risk, trans-fat free oils have been recommended as a substitute for trans-fat oil. This study aims to compare consumer sensory attributes of French-fries cooked in four different commercial trans-fat free frying oil blends throughout a ten day frying process. Participants' perceived taste, texture, color and overall liking for two types of French-fries are measured through sensory evaluations for ten days. Based on the findings, industry practitioners can identify the characteristics of different types of trans-fat free oils for French-fries.

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## Chapter 1

### Introduction

Deep-fat frying is one of the most popular cooking methods for food preparation. The process uses the high temperatures of frying fats and produce inexpensive and convenient food product. The flavor of fried food has been appreciated by many people because of its unique flavor with dry, crispy outside and tender inside. However, deep-fried foods have also posed some health risks due to its high fat contents, especially trans-fat, and the abusive oil usages.

First, fried foods contain significant amounts of fats and have high energy density. High fat content of frying foods has been a concern, especially because of trans-fats that bear potential risks of coronary heart diseases. United State Food and Drug Administration first proposed requirement that manufacturers inform the amount of trans-fat on Nutrition Facts labels in 1999 because consumption of trans-fats increases a risk of coronary heart disease. The requirement became effective in 2006 (FDA Website, 2014), and all food products now indicate their trans-fat content on their labels. Many consumers have started to avoid food with trans-fat and food production companies and restaurants started to respond to the demand and have reduced the amount of fat in their product and dishes.

Second, cooking food with over-used frying oil can lower food product quality and create chemical compounds with adverse nutritional effects and potential hazards in

human health (Sanibal & Mancini-Filho, 2004; Weisshaar, 2014). For this reason, understanding quality and stability change of frying oils over repeated usages are important for food practitioners and customers.

### **Purpose of the study**

The purpose of the study was to evaluate ‘high and medium’ grade trans-fat free frying oils by sensory analysis of French fries as the frying medium. Appearance, color, taste, texture, and overall liking of the French fries were measured in the sensory evaluation to identify the taste acceptability factors of the oils as they became oxidized and saturated for a ten-day controlled session. The four brand oils tested were divided into two sets based on their oleic acid fatty acid content.

### **Significance of the study**

As the risk of consuming trans-fat has been widely acknowledged, reformulating deep-fat frying oils is necessary in many food service and manufacture companies. Although substituting trans-fat free oil is a healthy option, there is a concern that the trans-fat free oils are low in stability and taste. In the previous study, the comparison among trans-fat oils and trans-fat free oils was performed (Bordi, Stokols, Hack, Rager, & Hessert, 2007). Based on the nutrition, sensory and performance analysis of the oils, trans-fat free oils equally performed with the trans-fat oils. In the present study, the focus



is on the trans-fat free oils. High and medium grade trans-fat oils are measured in their performances while used for frying French fries.

### **Funding Source**

This study was funded by Eat'n Park, and the initial choices of oil brands were made by Eat'n Park with the purpose of comparing oil performances of the currently used oil and new oils. However, the analysis and final results were not influenced by representatives from the company.

## Chapter 2

### Literature Review

**Frying Process.** Deep fat frying is cooking food items immersing into a heated frying fat that can stay at the appropriate temperature during the cook time. When the food is added to the hot oil, the surface temperature of the food increases rapidly and the water at the surface starts to boil and evaporate. Due to the evaporation of the water, dehydration of the surface occurs. The places that water evaporated would be replaced by oil. The surface dehydration and fat absorption create the crispy surface (crust) of food. For example, the crust of French fries consists of 2-3% of water and 8-10% of oil. Water inside of the food also heated and be cooked. Steam is emitted during the entire cooking process until the food is removed from the oil. As the frying process last, the moisture of the surface decreases and the temperature of the surface exceeds the boiling temperature. At this point, the physical and chemical changes of food happen and change the color and texture. Not only the moisture, will several compounds also release from the food to the oils. Staying in the high temperature, the compounds will cause the degradation of the oils (Erickson, 2007; Mellema, 2003; Saguy & Dana, 2003).

**Oil Degradation.** Frying oils for French fries are reused for several times at some point that the oils reach to their useful life and are discarded. According to Frying Oil Quality Curve (Blumenthal, 1991; Stier, 2013), the oil goes through five stages throughout its life (see Table 1). The stages are Break-In, Fresh, Optimum, Degrading, and Runaway. In the Break-In and Fresh stage, the food being fried pick up little oil.

Because the fresh oil has few surfactants, the oil and food do not remain contact for a long enough time to properly cook the food. Fries are light in color and do not have rich flavor. As surfactants build in the oil, fries start to be slightly brown at the edge. In the Optimum stage, the oil create the best fries with golden-brown color, crispy surfaces, and distinctive flavor due to optimal oil absorption. Many foodservice companies eager to find out when the optimum stage is and how to maintain this stage for a longer period. When the oil reaches to Degrading and Runaway stages, their colors become darken and have a thick texture. In these stages, excess amount of oil pick-up takes places. They may contain deposits from the frying materials and create foams. For the result, the product fried in the overused oils could acquire an acrid flavor with unfavorable appearance (Rossell, 2001). In order to understand the optimum state of the oil analytically, a number of test methods can be used. Measuring flavor, color, and free fatty acid are basic testing methods (Erickson, 2007). In this study, the differences of the degradation process in the type of fat used in the frying process is main focus.

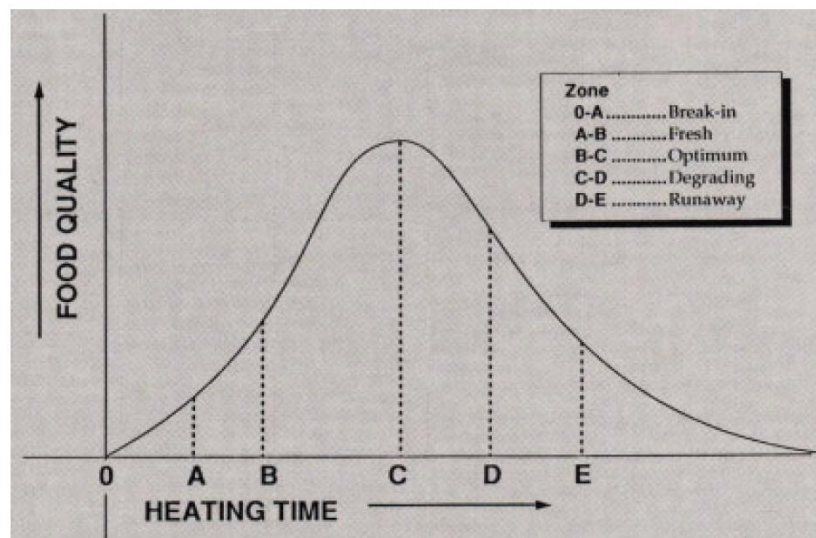


Figure 1-1. The Frying Oil Quality Curve

**Trans-Fat and Hydrogenated Oil.** Trans-fat can be found naturally in some foods, such as beef, lamb, and full-fat dairy products, and be created during cooking process. Some trans-fatty acids are produced intentionally in the process of hydrogenation to increase stability of oils. Hydrogenation is a chemical interaction between hydrogen gas and oil. Through the hydrogenation process, oils are converted to semi-solid or a solid fat. Solid fat tend to be less spoiled or rancid so that it prevent oil oxidation and expand its shelf life (Dietary Guidelines Advisory Committee, 2010). Hydrogenation makes oils containing unsaturated fatty acids solid at room temperature. Trans fat increases the risk of coronary heart disease compared to any other nutrient (Mozaffarian, Katan, Ascherio, Stampfer, & Willett, 2006). Comparing to other types of fats, trans fat oils raise the level of low-density lipoprotein (LDL) that is known as “bad” cholesterol, and it lowers the level of high-density lipoprotein (HDL, “good” cholesterol).

**Trans-Fat Free Oil.** To enhance public health and nutrition, the report of dietary guideline for American 2010 (Dietary Guidelines Advisory Committee, 2010) suggests to reduce the consumption amounts of trans fat. Since consumers have also acknowledged the adverse health effects of trans-fat, food service companies continue to reduce and eliminate the trans-fats used to cook French fries in order to meet the consumers’ demand.

**High Oleic Oil.** High oleic oils contains more oleic acid (monounsaturated fat) as its name indicates. Also, it has low saturated fatty acid levels, minimal trans-isomer levels, potential to reduce LDL cholesterol in the blood, and high oxidative stability. For

this reason, high oleic oils are considered to have positive health aspects. Liquid oils with high-oleic fatty acid contents have good flavor, high frying stability, better heat tolerance and longer shelf life (Erickson, 2007; O'Brien, 2008). For this reason, high oleic oils have a longer frying life cycle compared to commodity canola oil(Liu & Lassonova, 2012).

## **Chapter 3**

### **Materials and Methodology**

#### **Overall experiment setting**

The study is consisted of two sets, and each set was designed to compare two types of oils for ten-day repeated oil usages. In the first set of tests, two high quality trans-fat oils (MelFry Free and Clear Valley) are compared. In the second set of tests, two medium priced trans-fat oils (MelFry Essentials and Advantage) are tested. Each day every day, researchers cooked same amount of French fries at a research kitchen in a large northeastern university. Sensory test were prepared in each set on day 2, 4, 6, 8, and 10 in the sensory lab located next to the research kitchen. In the sensory test, each panelist has two French fry samples that were prepared in the different types of oils. On the day that there is no sensory test (day 1, 3, 5, 7, and 9), French fries were also cooked in order to make the oil keep deteriorate. The mean sensory evaluation score were compared to identify the deterioration process and sensory differences among four oils.

#### **Materials (Oils and potatoes)**

A total of four types of oils were used for this sensory test from two different manufactures. The researchers used two different oils from each brand. Table 4-1 shows types of oils being used in the test. MelFry Advanced and Clear Valley 65 are high

quality oils consisting of high oleic canola oil. MelFry Essentials and Advantage Cotton Plus oil is medium grade oils compounded of cottonseed oil and canola oil, or cottonseed oil and soybean oil. The same type of potatoes (frozen potatoes: McCain Extra Long French fries) were used in all tests.

Table 4-1. Description of frying oils

Name of oil	Company	Cost	Description
MelFry Advanced	Ventura	High	High Oleic Canola Oil
Clear Valley 65	Cargill	High	High Oleic Canola Oil
MelFry Essentials	Ventura	Medium	Cottonseed Oil & Canola Oil
Advantage Cotton Plus	Cargill	Medium	Cottonseed Oil & Soybean Oil

### **Frying procedure**

All the French fries were prepared in Center for Food Innovation (CFI)'s research kitchen, which is located at a university in the northeastern U.S.A. Each day for ten days, a total of 150 pounds of French fries were fried in two separate fryers. For the first set of the test, one fryer hold MelFry Free (Canola Oil) fry oil, and the other contained Clear Valley (High Oleic Canola Oil) fry oil. 2 ½ pounds of fries were fried in each fryer for 3 and half minutes at 350-Fahrenheit degrees. After frying, baskets were tilted for 15 seconds, and then shaken for 10 seconds. Fries were served within 10 minutes of being cooked to the panelists for sensory tests. The same procedure was repeated for the second set of the test using MelFry Essential (Cottonseed Oil & Canola Oil) and Advantage (Cottonseed Oil & Soybean Oil).

### **Sensory procedure**

Sensory data were collected on days 2, 4, 6, 8 and 10 in CFI's food sensory laboratory. The panelists are untrained customers in the CFI's participant pool. The panelists were asked to evaluate each sample based on the previously stated attributes in individual booths. The attributes are French fries' temperature, appearance, color, taste, texture, and panelists' Data were collected using Compusense five software and analyzed using analysis on variance, Tukey mean comparison and regression through Minitab and SPSS software.



## Chapter 4 Results and Discussion

### Sensory evaluation analysis

A total of 945 panelists participated in the sensory evaluation test for the two sets of tests for 5 days. Each day from 73 to 124 panelists tested. The specific number of panelists for each test on each day indicated in Table 5-1. Male participants are 48.8% in total participants throughout the test days.

Table 5-1. Number of Panelists (n=945)

	First Set		Second Set		Total
	MelFry Free vs. Clear Valley	MelFry Essential vs. Advantage			
Day 2	78		109		187
Day 4	74		124		198
Day 6	73		98		171
Day 8	95		102		197
Day 10	100		92		192

Each panelist seated in the individual booth and was served two samples of French fries. The samples were coded with three digit numbers so that the panelists don't have any information about frying oils and can focus on the taste of the French fries. The computer screen in front of the individual booth shows the directions about the test. The beginning of the test, the questions about medical conditions or any food allergies that may prohibit food tasting were asked. Followed by simple demographic questions (age and gender), the panelists followed the directions and tasted the samples in the order the screen indicated. Serving orders were randomly assigned to prevent any chances of carry

over effect. After tasting each sample, the perceived appearance, color, taste, texture, and overall liking were ranked by each panelist. Through the sensory evaluation, 1) the differences among four oils on each day, and 2) the changes of each oil over oil usage period were identified.

**Appearance.** Table 5-2 displays the mean appearance scores for each day based on a 9-point hedonic scale. On each day, no significant mean differences among four types of oils were found. The F value and P value indicate that there is no significant appearance difference in type of the oil in all days. Also, all types of oils have no difference in appearance through ten day frying procedures.

Table 5-2. Appearance mean\* differences among oils and changes over period

	<b>MelFry Free</b>	<b>Clear Valley</b>	<b>MelFry Essential</b>	<b>Advantage</b>	<b>F value</b>	<b>P value</b>	<b>Mean</b>
<b>Day 2</b>	6.36	6.23	6.43	6.22	0.49	0.689	6.31
<b>Day 4</b>	6.31	6.45	6.36	6.51	0.45	0.719	6.41
<b>Day 6</b>	6.60	6.59	6.46	6.60	0.22	0.884	6.56
<b>Day 8</b>	6.47	6.53	6.16	6.41	1.35	0.258	6.39
<b>Day 10</b>	6.76	6.74	6.49	6.46	1.39	0.244	6.62
<b>F value</b>	1.52	1.49	0.94	1.12			
<b>P value</b>	0.194	0.205	0.442	0.344			
<b>Mean</b>	6.51	6.52	6.40	6.45			

\*9 point hedonic scale: 1= Dislike Extremely; 2= Dislike Very Much; 3= Dislike Moderately; 4= Dislike Slightly; 5= Neither Like nor Dislike; 6= Like Slightly; 7= Like Moderately; 8= Like Very Much; 9= Like Extremely.

**Color.** There were no significant differences among samples for mean color scores on each day. However, Advantage oil showed significant differences over period (Table 5-3)

Table 5-3. Color mean\* differences among oils and changes over period

	MelFry Free	Clear Valley	MelFry Essential	Advantage	F value	P value	Mean
<b>Day 2</b>	4.58	4.56	4.73	<b>4.58<sup>b</sup></b>	0.97	0.409	4.62
<b>Day 4</b>	4.61	4.72	4.74	<b>4.87<sup>a</sup></b>	1.91	0.128	4.75
<b>Day 6</b>	4.86	4.77	4.81	<b>4.91<sup>a</sup></b>	0.52	0.672	4.84
<b>Day 8</b>	4.78	4.88	4.74	<b>4.68<sup>ab</sup></b>	0.91	0.436	4.77
<b>Day 10</b>	4.78	4.73	4.91	<b>4.88<sup>a</sup></b>	1.34	0.260	4.82
<b>F value</b>	1.96	1.38	1.05	<b>3.81</b>			
<b>P value</b>	0.100	0.241	0.380	<b>0.005</b>			
<b>Mean</b>	4.73	4.74	4.78	4.79			

\*9 point just-about-right scale: 1= Extremely Too Light; 2= Very Much Too Light; 3= Moderately too light; 4= Slightly Too Light; 5= Just About Right; 6= Slightly Too Dark; 7= Moderately Too Dark; 8= Very Much Too Dark; 9= Extremely Too Dark.

**Taste.** Table 5-4 indicates that there were no significant differences among types of oil in Taste. Advantage oils had significant differences over ten day test period, but the other three oils didn't change significantly.

Table 5-4. Taste mean\* differences among oils and changes over period

	MelFry Free	Clear Valley	MelFry Essential	Advantage	F value	P value	Mean
<b>Day 2</b>	6.01	5.85	6.14	<b>5.97<sup>ab</sup></b>	0.58	0.629	6.00
<b>Day 4</b>	6.22	6.38	6.19	<b>6.25<sup>ab</sup></b>	0.28	0.839	6.25
<b>Day 6</b>	6.25	6.42	6.28	<b>6.53<sup>a</sup></b>	0.69	0.558	6.37
<b>Day 8</b>	6.16	6.24	5.91	<b>5.88<sup>b</sup></b>	1.40	0.241	6.04
<b>Day 10</b>	6.42	6.30	6.40	<b>6.08<sup>ab</sup></b>	1.19	0.312	6.30
<b>F value</b>	0.93	1.85	1.53	<b>3.03</b>			

<b>P value</b>	0.445	0.118	0.191	<b>0.017</b>	
<b>Mean</b>	6.22	6.24	6.20	6.15	

\*9 point hedonic scale: 1= Dislike Extremely; 2= Dislike Very Much; 3= Dislike Moderately; 4= Dislike Slightly; 5= Neither Like nor Dislike; 6= Like Slightly; 7= Like Moderately; 8= Like Very Much; 9= Like Extremely.

**Texture.** There were no significant differences among oils for mean texture score. Also, the texture of the French fries didn't change over period in all types of oils (Table 5-5).

Table 5-5. Texture mean\* differences among oils and changes over period

	<b>MelFry Free</b>	<b>Clear Valley</b>	<b>MelFry Essential</b>	<b>Advantage</b>	<b>F value</b>	<b>P value</b>	<b>Mean</b>
<b>Day 2</b>	6.18	6.09	6.36	6.27	0.47	0.703	6.24
<b>Day 4</b>	6.35	6.01	6.33	6.27	0.87	0.457	6.26
<b>Day 6</b>	6.12	6.27	6.24	6.46	0.62	0.603	6.29
<b>Day 8</b>	6.35	6.20	6.16	6.17	0.31	0.815	6.22
<b>Day 10</b>	6.46	6.43	6.47	6.25	0.43	0.734	6.40
<b>F value</b>	0.67	0.84	0.61	0.47			
<b>P value</b>	0.610	0.500	0.658	0.761			
<b>Mean</b>	6.30	6.21	6.34	6.30			

\*9 point hedonic scale: 1= Dislike Extremely; 2= Dislike Very Much; 3= Dislike Moderately; 4= Dislike Slightly; 5= Neither Like nor Dislike; 6= Like Slightly; 7= Like Moderately; 8= Like Very Much; 9= Like Extremely.

**Overall Liking.** According to Table 5-6, there is no significant mean difference among four types of oils in overall liking. However, Advantage oil shows significant difference in overall liking as the test continues.

Table 5-6. Overall Liking mean\* differences of oils

	<b>MelFry Free</b>	<b>Clear Valley</b>	<b>MelFry Essential</b>	<b>Advantage</b>	<b>F value</b>	<b>P value</b>	<b>Mean</b>
<b>Day 2</b>	6.12	6.03	6.39	<b>6.14<sup>ab</sup></b>	1.15	0.330	6.18
<b>Day 4</b>	6.23	6.26	6.29	<b>6.35<sup>ab</sup></b>	0.15	0.929	6.29
<b>Day 6</b>	6.33	6.40	6.34	<b>6.60<sup>a</sup></b>	0.69	0.556	6.42
<b>Day 8</b>	6.38	6.36	6.08	<b>6.07<sup>b</sup></b>	1.36	0.256	6.22
<b>Day 10</b>	6.46	6.47	6.40	<b>6.09<sup>b</sup></b>	1.57	0.196	6.36
<b>F value</b>	0.77	1.19	0.85	<b>2.53</b>			
<b>P value</b>	0.546	0.317	0.492	<b>0.040</b>			
<b>Mean</b>	6.31	6.31	6.32	6.26			

\*9 point hedonic scale: 1= Dislike Extremely; 2= Dislike Very Much; 3= Dislike Moderately; 4= Dislike Slightly; 5= Neither Like nor Dislike; 6= Like Slightly; 7= Like Moderately; 8= Like Very Much; 9= Like Extremely.

Based on the ANOVA results, it can be concluded that the French fries cooked in four types of oils have no difference in specific sensory attributes (appearance, color, taste, and texture). However, Advantage frying oil shows significant changes in French fries' color, taste and overall liking means through ten day frying analysis. Figure 5-1 displays the overall liking mean changes of Advantage Oil. Day 2 started with a low point, and Day 6 had the highest mean in the test period. Overall liking scores become lowers on day 8 and 10. The red line in Figure 5-1 indicates day square regression line. Although the R-square is low (=1.1%), there is a significant inverted U shape over the ten day frying test. Table 5-7 shows that only Advantage oils shows significant coefficient in day square regression analysis. This result is congruent with the oil degradation curve.

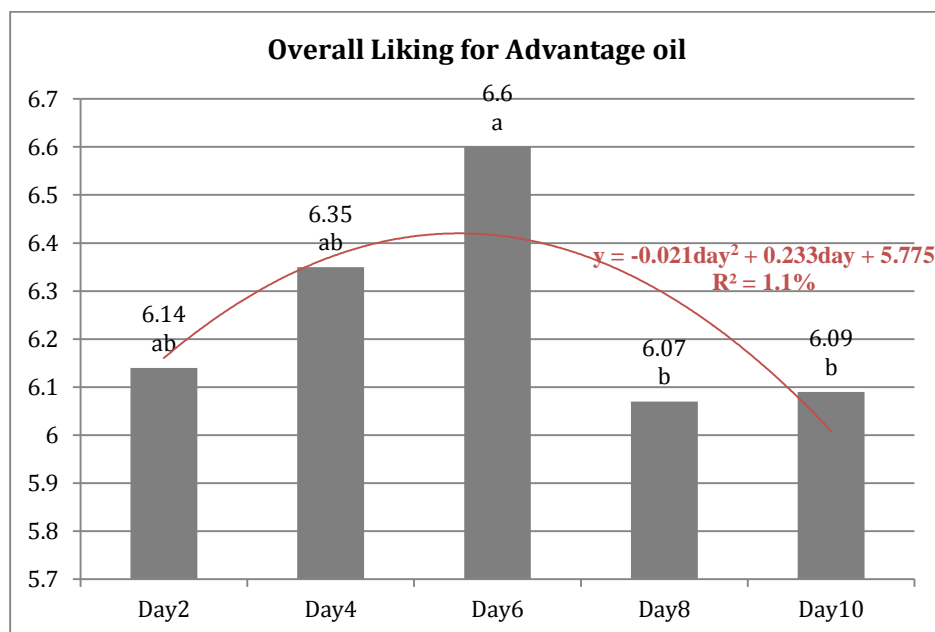


Figure 5-1. Overall Liking Mean Changes of Advantage Oil

Table 5-7. Day Square Regression Analysis

	Quadratic Coefficient	t	P value
<b>Advantage</b>	<b>-0.021</b>	<b>-2.215</b>	<b>0.027</b>
Clear Valley	-0.007	-0.645	0.519
Mel Fry Essential	0.009	0.988	0.323
Mel Fry Free	-0.002	0.010	0.853

In order to investigate oil performance changes in its repeated usages, linear regression analysis was also performed. Although there were no differences in ANOVA analysis, the overall liking trend line shows that Clear Valley and MelFry Free has a significant increasing linear regression line (Table 5-8) over the period while the other two oils have no significant trend line over the test days ( $p$ -value  $< 0.1$ ). Although R-square is low (Clear Valley= 0.95%, MelFry Free=0.72%), the two oils have a marginally

significant increasing trend. Since Clear Valley and MelFry Free are high-oleic oil, this result can confirm that high-oleic oils have longer frying life than commodity oils.

Table 5-8. Regression Analysis Table

	$\beta$	t-value	p-value	R-sq
MelFry Free	<b>0.04166</b>	<b>1.7446</b>	<b>0.082*</b>	<b>0.72%</b>
Clear Valley	<b>0.04864</b>	<b>1.9970</b>	<b>0.046*</b>	<b>0.95%</b>
MelFry Essential	-0.01043	-0.4695	0.639	0.04%
Advantage	-0.01797	-0.7991	0.425	0.12%

\*  $p < 0.1$

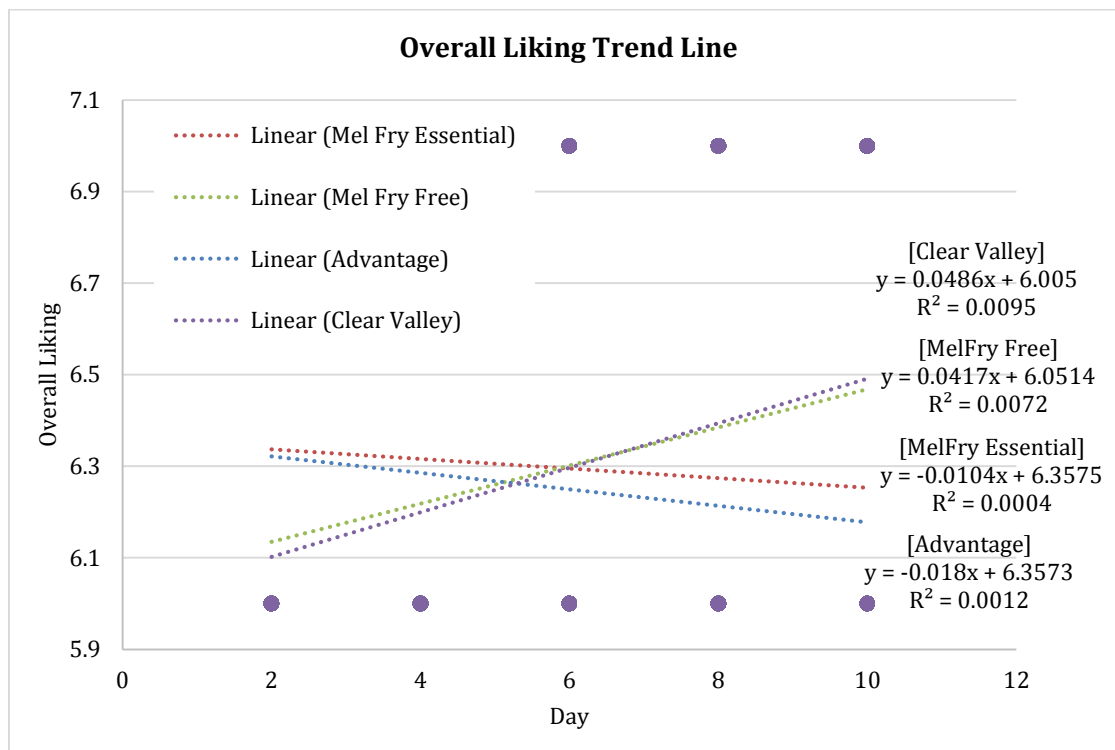


Figure 5-3. Overall Liking for four types of oils Trend Lines

## Chapter 5

### Conclusions

This study was designed to compare the sensory characteristics of four trans-fat free oils for a ten day test procedure. On each day comparison, the results suggest that the four types of oils have no significant differences in the sensory scores for French fries, such as appearance, color, taste, texture, or overall liking scores. The results indicate that the grade or brand of trans-fat free oils doesn't affect the customers' sensory score of the French Fries. Also, this study found that the four trans-fat free oils are acceptable for frying French fries, since the sensory overall liking scores are more than 6 point (like slightly) in 9 point hedonic scale in all types of oils, and there are no differences in the sensory score on each day.

The oil life cycle wise, Advantage oil showed statistically significant differences for color, taste, and overall liking over the test period. Based on the sensory score, it can be concluded that Advantage oil has its best taste on day 6 and starts to degrade after then. The change of Advantage oil is congruent with the oil degradation curve mentioned earlier. The rest of oils have no significant differences in sensory scores changes during ten days test period in ANOVA test. However, the regression analysis results showed that overall liking score of Clear Valley and MelFry Free significantly increase over the ten day frying test. This indicates that the two oils, high-oleic acid oils, haven't reached to the degradation phase and have longer frying life cycle than the other two oils, MelFry Essential and Advantage oil.



This study found that four different trans-fat oils can be a strong alternatives for foodservice providers who try to reduce the trans-fat amount in fried foods without compromising sensory value. Also, if practitioners would like to use the oil longer period of time or fry a large amount with the same oil, they may chose high-oleic oils, such as Clear Valley and MelFry Free for their convenience and customers' sensory satisfaction. By using trans-fat free oils, foodservice practitioners can help customers to reduce the health risk that trans-fat can cause.

## Appendix A.

### French Fries Sensory Evaluation Questionnaire

*WELCOME to the*



By participating in this taste test, you are agreeing to accept the risks associated with everyday eating and drinking.

Thanks for helping with our research in the Sensory Lab.

**Please be KIND to others and remain SILENT during tasting.**

Panelist Code: \_\_\_\_\_

Panelist Name: \_\_\_\_\_

**Question # 1.**

Are you 18 years of age or older?

- Yes
- No

**Question # 2.**

Are there any medical conditions you feel may prohibit you from

participating in or completing this study?

- Yes
- No

**Question # 3.**

Please indicate if you have allergens or intolerances to the following  
foods  
(Check all that apply):

- I do not have any food allergens or intolerances
- Wheat
- Dairy
- Soy
- Egg
- Fish
- Crustacean/Shellfish
- Peanuts
- Tree Nuts
- Alcohol
- Caffeine

**Question # 4.**

Please indicate your gender:

- Male
- Female

**Question # 5.**

Please indicate your age:

- 18-24
- 25-34
- 35-44
- 45-54
- 55-60

**Question # 6 - Sample \_\_\_\_\_**

Please evaluate the french fries on the following attributes:

Temperature

extremely    very much    moderatel    slightly    just about    slightly too    moderatel    very much    extremely

to cool	too cool	y too cool	too cool	right	hot	y too hot	too hot	too hot
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Appearance

dislike extremely	dislike very much	dislike moderate ly	dislike slightly	neither like nor dislike	like slightly	like moderate ly	like very much	like extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Color

extremely too light	very much too light	moderate ly too light	slightly too light	just about right	slightly too dark	moderate ly too dark	very much too dark	extremely too dark
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Question # 7 - Sample \_\_\_\_\_

Please evaluate the french fries on the following attributes:

Taste

dislike extremely	dislike very much	dislike moderate ly	dislike slightly	neither like nor dislike	like slightly	like moderate ly	like very much	like extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Texture

dislike extremely	dislike very much	dislike moderate ly	dislike slightly	neither like nor dislike	like slightly	like moderate ly	like very much	like extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Question # 8 - Sample \_\_\_\_\_

Please indicate how much you liked this product overall (considering ALL characteristics) by selecting one of the descriptors below.

Overall Liking

dislike extremely	dislike very much	dislike moderate ly	dislike slightly	neither like nor dislike	like slightly	like moderate ly	like very much	like extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Question # 6 - Sample \_\_\_\_\_

Please evaluate the french fries on the following attributes:

Temperature

extremely to cool	very much too cool	moderate y too cool	slightly too cool	just about right	slightly too hot	moderate y too hot	very much too hot	extremely too hot
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Appearance

dislike extremely	dislike very much	dislike moderate y	dislike slightly	neither like nor dislike	like slightly	like moderate y	like very much	like extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Color

extremely too light	very much too light	moderate y too light	slightly too light	just about right	slightly too dark	moderate y too dark	very much too dark	extremely too dark
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Question # 7 - Sample \_\_\_\_\_

Please evaluate the french fries on the following attributes:

Taste

dislike extremely	dislike very much	dislike moderate y	dislike slightly	neither like nor dislike	like slightly	like moderate y	like very much	like extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Texture

dislike extremely	dislike very much	dislike moderate y	dislike slightly	neither like nor dislike	like slightly	like moderate y	like very much	like extremely
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Question # 8 - Sample \_\_\_\_\_

Please indicate how much you liked this product overall (considering ALL characteristics) by selecting one of the descriptors below.

Overall Liking

dislike	dislike	dislike	dislike	neither	like	like	like very	like
---------	---------	---------	---------	---------	------	------	-----------	------

extremely	very much	moderately	slightly	like nor dislike	slightly	moderately	much	extremely
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Question # 9 - Sample \_\_\_\_\_

Please let us know any comments you have about the french fries you have just tasted :

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Question # 10.

Which sample do you prefer?

- Sample 102
- Sample 350
- I prefer both samples equally

Now you are *FINISHED* with the taste test.  
*Feel free to take the remainder of your samples with you*  
*- there are plates on the shelf above your head.*

**Once you have taken any remaining sample you'd like, please push your tray forward to the opening so we know you are done and can clear it.**

We appreciate you taking the time to fill out this survey.

**Thank you again!**

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