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Can Beef Tallow Make a Comeback?

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Summary

A study was conducted to evaluate the use of soybean oil (SBO), beef tallow (TAL) and a 50% SBO 50% TAL blend (50/50) in frying three fast-food type products (french fries, chicken nuggets, and beef fingers). Frying french fries in SBO resulted in higher cooking yields ($P<.05$) than frying in 50/50 or TAL. No differences among oils were seen ($P>.05$) in color development during frying french fries. Consumer taste panelists preferred the flavor and overall acceptability ($P<.05$) of french fries fried in SBO and 50/50 over those fried in TAL. The cooking yield of chicken nuggets was highest ($P<.05$) for SBO followed by 50/50 ($P<.05$) followed by TAL. Chicken nuggets fried in 50/50 were darker ($P<.05$) than those fried in SBO. Consumer taste panelists could not distinguish ($P>.05$) between oil types for flavor, crispness, or overall acceptability of chicken nuggets. Beef fingers fried in 50/50 were the most red in color ($P<.05$) followed by TAL ($P<.05$) followed by SBO. Consumer taste panelists were unable to differentiate between oils ($P>.05$) for flavor, crispness, or overall acceptability of beef fingers.

Key Words: Beef Tallow, Soybean Oil, Fried Foods

Introduction

Fats and oils have universal appeal. To date no other food product can match the functionality and versatility of fats and oils. Foods fried in oil offer special properties, including a smooth mouthfeel, pleasant flavor, and desired texture. Recent consumer trends toward fat reduction in the diet have put pressure on processors to reduce the fat in the final product. Despite such trends, fried foods have held a constant place in the American diet. Even with some fried food containing as much as 45% fat, consumers seem to enjoy them and keep them as part of their diet. Yearly per capita consumption of fats and oils is estimated at 62.7 lb in the United States. This has remained fairly constant despite healthy trends. This per capita consumption far exceeds the Dietary Guidelines recommended by the National Research Council. It seems that consumers are concerned about fat, but they are not willing to sacrifice the enjoyment they get from consuming fried foods.

Traditionally fried foods were cooked in a variety of oil types including those from animal sources. With the linking of dietary cholesterol to an increased risk of coronary heart disease, many fast-food restaurants and snack food companies opted to use vegetable oils to avoid the cholesterol debate. In an effort to improve the perceived healthiness, some of the flavor and functionality of the oils was lost. Due to stability problems with unsaturated fatty acids in most vegetable oils, hydrogenation became popular.

Hydrogenation of vegetable oils adds to the stability of the oil. It also increases the saturation of the fatty acids and shifts natural *cis* bonds (hydrogen atoms on the same side of the carbon-carbon bond) to the *trans* configuration (hydrogen atoms on opposite sides of the carbon-carbon bond). Due to the structural change in the molecule, the fatty acids will pack together tighter creating a solid rather than a liquid oil. A shift in the bond structure causes a number of responses in the body. The body perceives *trans* fatty acids as saturated. The result is an increase in low density

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lipoprotein cholesterol and a decrease in high density lipoprotein cholesterol levels in the blood. Both of these conditions have been linked to an increased risk of coronary heart disease. Recent publicity of the health problems associated with hydrogenated oils coupled with the hypothesis that consumers like foods fried in animal fats has opened a window of opportunity for the beef tallow industry.

The objectives of this study were to compare the color, flavor, and cooking performance of three products (french fries, chicken nuggets, and beef fingers) in three cooking oils (100% beef tallow, 100% soybean oil, and a 50% beef tallow 50% soybean oil blend).

Materials and Methods

Oils used in this study were 100% beef tallow, 100% soybean oil, and a 50% beef tallow 50% soybean oil blend. Oils were obtained from the Cargill Oil Division (Chicago, IL). Oils were formulated to contain 150 ppm Tennox 20 (a commercial antioxidant).

Products fried in this study were french fried potatoes (similar to those in fast-food restaurants), breaded chicken nuggets, and breaded beef fingers. All products were obtained from Harkers Distribution (LeMars, IA). All products were produced in the same plant from common raw materials.

Products were fried in commercial type fryers to a constant endpoint (preliminary tests determined the time and temperature for optimum performance of each product). Products were fried on three consecutive days. Five batches (1 lb each) of each product in each oil were prepared for a total of 45 lb of each product in each oil.

Color was measured on each cooked product using a Minolta hand held spectrophotometer programmed to measure L*, a*, and b* values. This color system is used to measure sample lightness/darkness (L*), redness (a*), and yellowness (b*). A series of five measurements was taken per cooked batch. A consumer taste panel was conducted on each product. Each panel ran three consecutive days with a minimum of 60 participants per day. Factors evaluated included flavor, crispness, and overall acceptability. Panelists were seated in individual stalls and presented samples of products fried in each oil. Random three digit numbers were used to mask the identity of each sample. Panelists were given a response sheet with a series of boxes ranging from dislike extremely to like extremely and asked to check the box that best described the sample presented. A number was later assigned to each box to create a nine-point hedonic sensory scale. All panel stalls were under red lighting to mask perceived color differences.

Data were analyzed using the GLM procedure of SAS as appropriate for a randomized complete block design. Mean separation was accomplished using individual contrasts.

Results and Discussion

Frying french fries (Table 1) and beef fingers (Table 3) in SBO resulted in higher cooking yields ($P<.05$) than frying in 50/50 or TAL. The cooking yield of chicken nuggets was the highest ($P<.05$) for SBO followed by 50/50 ($P<.05$; Table 2).

Color (L*, a*, b*) values were similar ($P>.05$) between all oil types when frying french fries (Table 1). As shown by the L* values, chicken nuggets fried in 50/50 were darker ($P<.05$) than chicken nuggets fried in SBO (Table 2). No differences were found ($P>.05$) for a* (redness) and b* (yellowness) values in chicken nuggets (Table 2). Beef fingers fried in 50/50 were the most red ($P<.05$) in color followed by TAL ($P<.05$), followed by SBO (Table 3). Oil type had no effect ($P>.05$) on lightness (L*) or yellowness (b*) of beef fingers (Table 3).

The consumer taste panels represented a cross-section of the university, city, and rural communities. A minimum of 60 panelists per day participated. An approximately equal distribution of sex and age of the panelists was obtained. Panelists preferred the flavor ($P<.05$) and overall acceptability ($P<.05$) of french fries fried in SBO and 50/50 over that of french fries cooked in TAL (Table 4). Oil type had no effect

Table 1. Cooking yield and color analyses of french fries

Variable	Treatment			SE
	SBO	50/50	Tallow	
Cooking yield, %	58.27[a]	56.80[b]	57.40[b]	.17
L*[c]	63.43	62.95	62.96	.18
a*[d]	2.41	2.69	2.67	.14
b*[e]	26.81	27.73	27.32	.29

[a,b]Means within a row lacking common superscripts differ (P<.05).
[c]A higher L* number equals a lighter sample.
[d]A higher a* number equals a more red sample.
[e]A higher b* number equals a more yellow sample.

Table 2. Cooking yield and color analyses of chicken nuggets

Variable	Treatment			SE
	SBO	50/50	Tallow	
Cooking yield, %	80.32[a]	79.36[b]	78.75[c]	.09
L*[d]	48.71[a]	47.66[b]	48.29[ab]	.25
a*[e]	12.38	12.61	12.69	.14
b*[f]	34.17	33.76	34.34	.46

[a,b,c]Means within a row lacking common superscripts differ (P<.05).
[d]A higher L* number equals a lighter sample.
[e]A higher a* number equals a more red sample.
[f]A higher b* number equals a more yellow sample.

Table 3. Cooking yield and color analyses of beef fingers

Variable	Treatment			SE
	SBO	50/50	Tallow	
Cooking yield, %	82.40[a]	81.50[b]	81.82[b]	.09
L*[d]	43.30	42.11	42.80	.40
a*[e]	10.29[a]	11.28[b]	10.80[c]	.10
b*[f]	26.67	26.59	26.47	.16

[a,b,c]Means within a row lacking a common superscript differ (P<.05).
[d]A higher L* number equals a lighter sample.
[e]A higher a* number equals a more red sample.
[f]A higher b* number equals a more yellow sample.

Table 4. Consumer taste panel analyses of french fries

Variable	Treatment			SE
	SBO	50/50	Tallow	
Flavor[c]	5.92[a]	6.02[a]	5.38[b]	.12
Crispness[c]	6.43	6.43	6.12	.12
Overall acceptability[c]	6.19[a]	6.29[a]	5.67[b]	.13

[a,b]Means within a row lacking a common superscript differ ($P<.05$).
[c]1 = dislike extremely; 9 = like extremely.

($P>.05$) on the crispness of french fries (Table 4). Panelists could not distinguish between oil types for flavor, crispness, or overall acceptability ($P>.05$) of chicken nuggets (Table 5). No differences ($P>.05$) were found for flavor, crispness, and overall acceptability of beef fingers across oil types (Table 6). Both the chicken nuggets and the beef fingers were breaded products that contained spices in the breading. The french fries were raw potato strips with no salt or spices added. It seems the panelists were able to pick up the flavors of the oils more on the french fries than from the breaded products. They seemed to find an unfamiliar flavor in the TAL fries but not in the 50/50 fries. The spices in the breaded products may have made it more difficult for panelists to distinguish flavors produced by the oils.

Conclusions

Oils containing up to 50% beef tallow could be used for frying these types of fast-food products with no adverse effects on color or consumer acceptability. Soybean oil has been used exclusively by the fast-food industry for some years now. The flavors associated with animal based frying oils may be unfamiliar to some consumers. Comments were taken from each of the panelists and revealed some interesting trends. Review of the comments led us to believe that the flavor of TAL fried foods may not have been objectionable to the consumers as much as it was unfamiliar. The transition from frying oils of a vegetable base to those of an animal base may take some adjustment by the consumer.

Future Research

Work is currently being conducted in our lab to reveal the chemical composition of these oils and the products fried in these oils. The *cis/trans* bond makeup of the oils and the cooked products will be of great interest to health wise consumers. Further work on the economic feasibility and the possibility of animal vegetable blends should be conducted.

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Table 5. Consumer taste panel analyses of chicken nuggets

Variable	Treatment			SE
	SBO	50/50	Tallow	
Flavor[a]	6.62	6.33	6.41	.22
Crispness[a]	6.53	6.75	6.39	.11
Overall acceptability[a]	6.48	6.80	6.44	.18

[a]1 = dislike extremely; 9 = like extremely.

Table 6. Consumer taste panel analyses of beef fingers

Variable	Treatment			SE
	SBO	50/50	Tallow	
Flavor[a]	6.15	6.46	5.93	.20
Crispness[a]	7.07	7.15	6.89	.08
Overall acceptability[a]	6.43	6.68	6.25	.17

[a]1 = dislike extremely; 9 = like extremely.