Blending Hydrogenated Soybean Oils to ground beef patties

I. Effects on sensory attributes and chemical aspects. I.M. Tibin and **C.C. Melton***

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SUMMARY

Hydrogenated soybean oils (HSO) with three Iodine values (35, 70 and 100) were blended with ground beef to form patties of 16, 20 and 24 percent total fat levels, each fat level containing 0,25 and 50 percent of vegetable fat. The three HSO having different Iodine values (IV) differed significantly ($P<0.05$) in all the sensory arributes measured except tenderness. The 70 IV sample was prefered to the 35 and 100 IV samples in flavour and juiciness. All the samples with 70 IV were scored above slightly intense beef flavour, slightly juicy and slightly tender.

Generally there was an increase in the scores for juicines and tenderness with an increase in total fat. There was a decrease in flavour intendsity and juiciness as vegetable fat increased.

INTRODUCTION

Recently technological advances have made additional forms of vegetable oils available, through hydrogenation, which might be substituted for animal fats. Allen (1978) mentioned that there are two reasons to hydrogenate oils. First, since the number of double bonds is reduced, the opportunity for oxidation is reduced, and thus the flavour stability is increased. Second, the physical Characteristics are changed so the product has more utility. By control of the reaction conditions, preseure, temperature, agitation and catalyst type and concentration, the desired product may be obtained.

If these oils could be utilized as fat sources in processed meat products, total pounds of meat products would increase and price per pound might decrease in the future as leaner animals are produced. Publicity relating animal fats to heart disease (Mattson, 1975, 1980) has caused some consumers to decrease consumption of meat. The consumers tend to prefer consumption of vegetable fats and would prefer meat products with a lower percentage of animal fat than is available if palatability could be maintained. If vegetable fats could be substituted for animal fat without significant losses in quality these consumers might consume more meat products.

In the developing countries,. the majority of livestock are slaughtered at advanced stages of maturity after a lifetime of continually searching for sufficient forage and water for sustenance. During their life such animals move hundreds of miles seasonally to

find sufficient water and forage. Meat produced from such animals

generally has low fat content and when cooked is tough and dry.

Therefore the addition of vegetable fat might improve the palatability characteristics of ground beef made from such animals in the developing countries. This research is conducted to find out the palatiblity, and chemical characteristics of ground beef blended with Vegetable fat.

MATERIAL AND METHODS

Source of material for ground beef blends:

Beef fat and beef lean used in this study were purchased from a local packing company. Standard Crade beef was used as lean and fat sources. Short plates which were used as the source of beef fat were boned.and then ground through a course 0.6 cm plate. The beef lean was trimmed to a minimum a mount of fat and ground through a 0.6

cm plate. Flowing the initial grind the beef lean and b.eef-fat were mixed separately in a mechnical mixer. Random samples were taken for fat content determination (AOAC, 1975). The remainder of the ground meat and ground fat were wrapped with freezer paper into smaller lots, weighed, labelled and frosen at – 18 °C.

Hydrogenated soybean oils (HSO) with iodine values (IV) of 35,.70 and 100 were supplied by a local company. Upon receipt each sample was melted, by heating its container (Can) in a water bath. The oil was poured into white plastic containers, cooled, covered, labelled and stored at 1 °C until used. The 100 IV fat was soft enough to be easily mixed with the ground beef. On the otherhand the 35 and 70 IV fats

were too hard to be mixed, therefore each was cut by a knife into smaller pieces, ground through 0.6 cm plate and then mixed with the ground beef.

Experiment with soybean oils of different iodine values:

Ground beef patties containing three total fat levels (16,20 and 24%) were substituted with vegetable fat as 0,25, or 50 percent of the total fat to make patties of nine different blends (Table 1). For each beef blend, the proper ratios of fat (including hydrogenated soybean oil) to lean were calculated by Pearson Square Method (Pearson and Tauber, 1984). A group of patties containing the nine blends was prepared from each of the three hydrogenated soybean oil with iodine values of 35, 70 and 100. Each blend was throughly mixed, ground through a 0.3 cm plate and formed into patties each of about 1.5 cm thick, 10 cm in diameter and 115 g in weight. The patties were wrapped with freezer papers, labelled and frozen at – 18 °C until used. Three replications were run. A replication consisted of all the nine blends (Table 1) for each of the three hydrogenated soybean oils.

Sensory evaluation was conducted by using an eight member trained taste panel who were selected and trained as described by Cross et al ., (1978). The frozen patties to be used for sensory evaluation were randomly selected and thawed overnight at 4 °C prior to cooking. The

patties were cooked in a Preste Burger hamburger cooker. Each Patty wa cooked for three minutes on each side.

The internal temperature of each *patty, which was rough1:7 determined by inserting a meat thermometer immediately after the patty was removed from the cooker, ranged between 65-70 °C. Each cooked patty was then divided by a knife into eight portions and kept warm (approximately 54 °C) on a heated serving tray. Every panelist was served one – eight of each of the cooked patties at random in individual booths under a dim red light. Every sample was given a random three digit code number which was changed in each session.

The patties were evaluated for flavour intensity, initial juiciness, sustained juiciness, initial tenderness and chew residue on an eight point hedonic scale; where eight was extremely intense, extremely juicy, extremely tender while one was extremely bland, extremely dry and extremely tough respectively. The scores of the eight panelist were averaged for each characteristics and this average represented the quality attribute of that particular parameter.

Chemical analysis of ground beef patties containing 70 Iodine value vegetable fat:

Moisture, protein and fat of the raw and cooked blends containing 70 iodine value hydrogenated soybean oil were determined. Moisture was determined according to AOAC (1975) procedures by drying the samples in a vaccum oven. Percentage crude protein was determined by the kjeldahl procedure according to Ockerman (1969). Percentage fat was determined by the anhydrous ethyl ether extraction, soxhlet method according to Ockerman (1969).

Statistical analysis:

Sensory data for total fat, Iodine value, percent vegetable fat and their inter actions were analyzed by a General Linear Model analysis of variance (Barr et al ., 1979). Where applicable, significant diffetence among means was identified by Duncan's Multiple Range Test (Duncan, 1955) .

Data for chemical analysis of the produCts with 701.V

hydrogenated soybean blends were analyzed by a General Linear model analysis of variance (Barr et al ., 1979). Means for each variable which were significantly different, were separated into linear and quadratic effects.

RESULTS AND DISCUSSION

Sensory evaluation of ground beef patties:

Beef patty samples with three fat levels having different percentages and iodine values differed significantly ($P<0.05$) in the sensory attributes studied (Table 2). The 70 iodine value (IV) sample

was prefered to the two others (35 and 100 IV) in flavour, initial juiciness and sustained juiciness but did not differ significantly in tenderness (Table 2). Both 35 and 1.00 IV samples were scored below a slightly intense beefy flavour. With the ex.cei3tion of the sustained juiciness of the 100 IV samples, the samples were all scored above slightly juicy and slightly tender. The'panelists have commented that the 35 IV samples used to leave a fat coating in the mounth and that

the 100 samples resulted in ground beef that was too soft with a' pronounced non-beef like flavour.

Ground beef patties with the three total fat levels differed significantly ($P<0.05$) in all the sensory parameters measured except flavour (Table 2). This agrees with the findings of Macy et al ., (1964) and Wasserman and Spinelli (1970) who reported that fat is an important factor in affecting some of the palatability parameters of meat products. The 16 percent samples received lower scores in the

parameters measured compared to the 20 percent and 24 percent samples. Generally there was an increase in the scores of all- the sensory parameters with an increase in the total fat level (Table 2).

This was in agreement with Cold et al (1960) who reported that laboratory and family taste panels rated ground beef with 15 percent fat less acceptable than ground beef with 25,35 or 45 percent fat.

On the contrary, Law et al (1965) reported that consumers preferred ground beef with the lowest fat content. Of the three fat levels tested, ground beef containing 15 percent fat was rated best, followed in order by ground beef with 25 percent and 35 percent. Ford (1974) reported that a wide range of fat percentage in ground beef was acceptable to the consumer.

The percentage of vegetable fat in the beef patties had a significant ($P<0.05$) effect on flavour intensity, initial juiciness and sustained juiciness; there were no significant differences in initial tenderness and chew residue scores (Table 2). Samples with zero percent vegetable fat (control) were scored the highest in flavour while those with 50 percent vegetable fat were scored the lowest in flavour. Tenderness scores for all the samples were above slightly tender range and there were no significant differences between the scores for samples with vegetable fat and the controls.

Sample with 50 percent vegetable fat were scored below slightly juicy. These results show that the samples with 50 percent vegetable fat were slightly unacceptable in flavour and juiciness which means that under conditions similar to this study the substitution of vegetable fat in processed meat should not reach the level of 50 percent.

Drake et al (1975), Kotula (1976) and Smith et al (1976) reported higher ratings for all-beef patties in certain sensory attributes than for beef-soy patties. However, Ziprin et al (1981) reported that at 10% substitution of rehydrated oil seed proteins; or in.the prescence of 3.3% dry-oil seed ingredients. the flavour, juiciness, texture and overall satisfaction scores of extended patties were not significantly different ($P>0.05$) from those of all-beef patties.

Chemical analysis of ground beef blends

containing 70 iodine value vegetable fat:

Analysis of variance of the effect of total fat level and percentage vegetable fat on percentage of moisture, protein and fat in raw beef patties is shown in Table 3. There was a significant difference between the total fat levels in percent moisture protein and fat ($P<0.001$). These differences were expected since the patties were formulated to be different in fat content. A significant linear effect was found for moisture while both linear and quadratic effects contributed to the variations in protein and fat. Most of the variation for both of these were due to linear effect. Both percent moisture and protein decreased with those reported in literature (Cross et al ,1980).

The percentage vegetable fat did not significantly influence the percentage of moisture and fat, but there was a significant difference in protein ($P<CO5$). The percentage in protein decreased with the increase in percentage vegetable fat (Table 4). This was mainly due to the lack of muscle in the vegetable fat.

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