

Blending Hydrogenated Soybean Oils to Ground Beef Patties: II. Effects on Colour Measurements and Cooking Losses.

I.M. Tibin and C.C. Melton*

*Department of Meat Science, Faculty of Animal Production,
University of Khartoum, P.O. Box 32, Khartoum North,
Sudan.*

SUMMARY

In a previous experiment (Tibin & Melton, 1997) 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 contained, 0,25 and 50 percent of vegetable fat. Further investigations were reported here to examine the effects of blending hydrogenated vegetable oils on colour measurements and cooking losses. Total fat levels have significantly ($P < 0.05$) affected the lightness of colour which increased with the increase of total fat level. Also the lightness (L) and redness (a) were significantly affected by the percentage vegetable fat. The lightness values increased linearly with the increase in percentage vegetable fat while there was a minimum value for redness at 25 percent vegetable fat.

INTRODUCTION

Processed meat products, which offer consumers variety and convenience, are economical meat items and are the most popular choice of meat products. As meat prices continue to rise, better utilization of the lower quality grades of beef will become necessary.

Foods from animal sources, such as meat, milks and eggs, typically contain more saturated than polyunsaturated fat; in foods from vegetable sources, the reverse is true. Recently the consumers in the

** Department of Food Technology and Science, P. O.Box 1071,
University of Tennessee. Knoxville, Tennessee 37901, U.S.A.*

developed countries have become more prejudiced against animal fats in their diets. This is mainly due to the studies and reports which showed that high levels of blood serum cholesterol was associated with atherosclerosis (a common form of cardiovascular disease) in which fatty deposits (or plaques) containing cholesterol build up in and on the walls of the arteries (Mattson, 1975, 1980).

Hydrogenation may be defined as a process where by a part, or in some cases, nearly all the unsaturated fatty acids in an oil combine with hydrogen under the influence of a catalyst.

Hydrogenation changes a liquid oil to a semi-solid or solid fat which has more utility and better flavour stability.

Technological advances have made more vegetable fats available for use as foods (Mattson, 1980). These vegetable fats might be substituted for animal fats in some processed meat products such as burgers and sausages. In this paper, the effect of substituting some of the animal fat with hydrogenated soybean oils on colour parameters and cooking losses of ground beef patties were determined.

MATERIALS AND METHODS

The beef lean, beef fat, hydrogenated soybean oil with 70 iodine value described in the first part of this series (Tibin and Melton, 1997) were used here for the preparation of semi-dry sausage (thuringer) as described before in part one.

Colour measurements of ground beef patties

containing 70 iodine value vegetable fat:

The colour of the raw patties was measured with a Hunter Lab Colour Difference Meter Model D 25 which was standardized with the white calibrated standard No.

C2 – 136 ($L = +93.4$, $a = -1.1$ and $b = +1.9$). Each patty was placed on a meat tray, covered with Good year prime wrap and then the colour was measured from two sides and an average value was recorded. Three replications were done for each raw and cooked patty blend.

Cooking losses of ground beef patties

containing 70 iodine value vegetable fat:

Total cooking losses were calculated as differences between raw cooked weight of the patty. Drip loss was calculated from the differences in the weight of the cooker and weight of cooker and drippings after cooking. Evaporation loss was calculated as the

difference between total loss and drip loss. Three replications were done for each blend. All cooking losses were expressed as percentage of the raw weight.

Statistical analysis

Data for colour measurements and cooking losses of the products 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

Colour measurements of ground beef blends

containing 70 iodine value vegetable fat:

Table 1 shows the effect of total fat level and percentage vegetable fat on the colour of raw beef patties. There was a significant difference among the total fat levels for lightness ($P < 0.001$).

Both linear and quadratic effects of total fat level contributed to the variation in the lightness (L). Generally the lightness increases with an increase in total fat level.

The percentage vegetable fat in the patties significantly affected the lightness ($P < 0.001$) and redness ($P < 0.05$) values (Table 1). There was a significant interaction ($P < 0.001$) between total fat level and percentage vegetable fat for the lightness value. This indicates that the effect of any one total fat level or percentage vegetable fat on lightness failed to be the same for each level of the other. It also showed that the two factors are not independent of each other for their effect on lightness. The lightness values increased linearly with the increase in percentage vegetable fat while there was a minimum value for redness at 25 percent vegetable fat (Table 2). **Cooking losses 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 total cooking loss drip loss and evaporation loss of cooked beef patties is shown in Table 3. Total fat level had a significant quadratic effect on total loss and drip loss ($P < 0.01$). This was mainly due to the fact that both total loss and drip loss at the 20 percent total fat level were lower than that of the 16 and 24 percent total fat (Table 4). However it is generally reported in literature (Coleetal; 1960; Cross *et al.* 1980) that total loss and drip loss increase with the increase of total fat level.

—

Table 1 . Analysis of Variance of the effect of total fat level (%) and percentage vegetable Fat (70 Iodine Value) on the colour of raw beef patties.

The percentage vegetable fat also significantly ($P < 0.01$) affected total loss and drip loss. Total loss and drip loss increased linearly with an increase in percentage vegetable fat (Table 4). However even the total loss and drip loss at the highest percentage vegetable fat used (50%) were within normal ranges reported in literature; Irmiter (1967) found the percentage total loss for 20 percent total fat treatments equal to 36.28 percent; while Nielsen (1967) reported total cooking loss, drip loss and evaporation loss as 29.5 percent, 14.3 percent and 15.2 percent respectively in 20 percent total fat hamburger.

Table 4 . Least square means for the effect of total fat level (c¹/0) and percentage vegetable fat (70 Iodine Value) on the cooking losses of beef patties.

Treatment	Total Loss Percent	Drip Loss Percent	Evaporation Loss Percent
Total Fat Level (%)			
16	32.09	21.68	10.46
20	29.32	19.89	9.44
24	32.15	22.87	9.29
Percentage Vegetable Fat			
0	28.47	18.93	9.62
25	31.61	21.10	10.51
50	33.49	24.41	9.06

REFERENCES

Barr, A.J., Goodnight, J.H. Sau, J.P., Blair, W.H., Chilko, D.M. (1979). SAS Users Guide. SAS Institute, Inc., Raleigh, N.C.

Cole, J.W. Ramsey, C.B. and Odom, A.O. (1960). What effect does fat. content have on palatability of broiled ground beef ? Tenn. Farm and Home Sci., Progress Report No. 36, The University of Tennessee Agric. Exp. Sta., Knoxville, TN.

Cross, H.R., Berry, B.W. and Wells, L.H. (1980). Effects of fat level and source on chemical, sensory and cooking properties of ground beef patties. J. Food Sci. 45 : 791.

Irmiter, T.F., Aldrich, P.I. and Funk, K.(1967). Rate of temperature rise, physical and chemical properties of ground beef cylinders fabricated from selected muscles of the round; 1. Effect of fat content. Food Technol. 21 : 779.

Mattson, F.H. (1975). Diet and Coronary Heart Disease.In “Nutrients in Processed Foods”: Fats, Carbohydrates, P.L. White, D.C. Fletcher and M. Ellis, ed. Publishing Science Group. Action, M.A.

Mattson, F.H. (1980). Availability of suitable oils, margarines and shortenings. In “Childhood Prevention of Atherosclerosis and Hypertension” R.M. Lauer and R.B. Shehelle, ed. Raven Press, New York, N.Y.

Nielsen, M.M., Hall, F.T., Monsen, E.R. and Worthington, B. (1967). Eating quality, nutritive value and cost of ground round and hamburger. J Amer. Diet. Assoc. 50 : 201.

Tibin, I.M. and Melton, C.M. (1997). Blending hydrogenated soybean oils to ground beef patties.

1. Effects on sensory attributes and chemical aspects. (sent for publication).

Authors :

Ibrahim Musa Tibin C.C. Melton