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INVESTIGACIÓN

Physical properties of mutton tallow

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RESUMEN

Propiedades físicas de sebo de cordero.

Se han determinado las propiedades físicas de sebo de cordero aislado de riñones, lomo e intestino mediante resonancia magnética nuclear de pulso y técnicas de punto de deslizamiento. La grasa de riñón mostró los mayores contenidos de grasa sólida medida en un rango de temperatura de 10-50 ^{o}C seguido por la grasa del intestino y siendo la grasa del lomo la que tuvo el contenido más bajo de grasa sólida. El sebo de cordero contiene ácidos grasos saturados en proporción del 52-64%, índice de yodo que oscilan entre 34-44 y cantidades pequeñas de ácidos grasos trans (3-4%).

PALABRAS-CLAVE: Ácidos grasos saturados – Grasa sólida – Indice de yodo – Punto de fusión – Resonancia magnética nuclear de pulso – Sebo de cordero.

SUMMARY

Physical properties of mutton tallow.

The physical properties of mutton tallows isolated from the kidney, back and intestinal regions were determined by pulsed nuclear magnetic resonance and Mettler dropping point techniques. Kidney fat showed the highest amounts of solid fat measured over a temperature range of 10-50 ^{o}C followed by intestinal fat and back fat showed the least amount of solid fat. Mutton tallows contain 52-64% saturated acids, have iodine values ranging from 34-44 and contain small amounts (3-4%) of *trans* fatty acids.

KEY-WORDS: Iodine value - Melting point - Mutton tallow - Pulsed nuclear magnetic resonance - Saturated fatty acid - Solid fat.

1. INTRODUCTION

Although the fatty acid composition and physical properties of mutton tallow are dispersed throughout the literature (Grompone 1990; Boskish 1993), little information is available on the physical properties of fat isolated from various portions of the carcass. We wish to report some compositional and physical properties of tallows isolated from the kidney, intestinal and back areas of the sheep carcass.

2. EXPERIMENTAL

Samples from the kidney, back and intestinal areas were taken from a 170 lb ewe who had succumbed during lambing. The samples were frozen in dry ice and shipped to the Northern Laboratory. The fat was isolated by the following procedures. Kidney, back and intestinal fat (10 g each) were cut into small pieces and homogenized with 50 ml chloroform for 5 minutes on ice, followed by homogenization with 100 ml methanol 30 seconds and a final homogenization (30 seconds) with 50 ml chloroform. The extracts were allowed to stand for 30 minutes on ice, after which the mixture was filtered through filter paper under vacuum. The filtrate was then rinsed 3 times with chloroform. The combined filtrate was stripped of solute on a rotating evaporator and the residue was treated with 50 ml acetonitrile, the solvent removed. This procedure was repeated. The fat was dissolved in 25 ml hexane and passed through Sep-Pak filters. After removal of the solvent, the sample was treated again with 25 ml acetonitrile. After removal of the solvent, 25.1 g (83%) of purified fat was isolated for further analysis. Thin layer chromatography showed that only triglycerides were present.

Fatty acid composition was determined by gas-liquid chromatography as methyl esters as described previously (Christie 1973). Solid fat content (SFC) and Mettler dropping point determinations were by conducted according to official AOCS methods (Firestone 1989). Dilation

data were taken from the solid fat index (SFI) Dilatometric method AOCS method. Lipase hydrolysis was conducted as reported previously (Neff, et al. 1992). Triglyceride structures were calculated from the lipase data according to Coleman (1961) and Van Der Waal (1960).

3. RESULTS AND DISCUSSION

The physical properties and fatty acid composition of mutton tallow isolated from various areas of the sheep carcass are shown in Table I. A study published in 1990 (Grampone) showed that tallows produced in Uruguay contain higher levels of oleic acid and lower levels of palmitic and stearic acid than those produced in other countries. Tallows from Uruguay contained about 40% oleic acid and about 45% palmitic and stearic acid. Results given in Table II are in accord with this study. The composite prepared from equal amounts of kidney, back and intestinal areas contain 54% saturated acids and 37% oleic acid. The melting point of Uruguayan tallow is reported to be 45.2°C compared to 46.3°C found in the present study. Solid fat content data given in Table 1 show that kidney fat contains more solid fat at temperatures from 10-50°C while intestinal fat is intermediate and back fat has the least. The solid fat content profiles suggest that mutton tallows would perform well as baking shortenings. The major triglycerides of mutton tallows as determined from lipase hydrolysis data are shown in Table II. About 90% of the triglycerides found in mutton tallows are accounted for by 9 triglycerides formed from oleic, palmitic and stearic acids whose melting points range from 5°C to 73°C.

Table I
Fatty acid composition and pshysical properties of mutton tallow

	Fatty Acids							Iodine	% Trans	Drop Melting	Solid Fat Content % Temp (°C)						
Fat	14:0	16:0	16:1	18:0	18:1	18:2	18:3	Value	Acids	Point (°C)	10	21,1	26,7	33,3	40	45	50
Kidney	2,2	20,3	0,9	41,7	31,4	2,4	1	33,8	4,5	51,1	65,6	44,5	40,4	35,1	23,6	13,9	4,9
Back	2,7	24,6	1,0	24,3	44,8	1,6	1,0	43,9	2,7	43,1	34,0	17,7	45	10	4,4	0	0
Intestinal	2,8	23,6	1,0	33,9	35,4	2,3	1,2	37,5	4,1	48,4	56,7	35,9	31,9	26,2	15,4	6,5	0,8
Composite	2,6	22,1	2,5	32,1	37,3	2,3	1,0	38,6	6,0	46,3	50,5	29,9	26,2	21,2	11,0	4,4	0,1

[a] Equal weight of kidney, back, intestinal fats.

Table II
Major triglycerides of sheep tallows[a]

	Fat			
Triglyceride (%)	Kidney	Back	Intestinal	Melting Point (°C)[b]
OOO	3,0	8,4	4,3	5,0
POO	5,6	16	8,4	19
OPO	1,1	1,3	1,5	
SOO	11,7	15,4	12,9	22,5
OSO	2,0	1,5	1,7	
POP	2,4	7,5	4,2	37,5
OPP	2,0	2,5	2,8	
SOP	14,0	17,1	15,9	38,0
SPO	4,3	2,8	4,3	
SOS	11,4	7,1	9,5	43,5
SSO	7,6	2,7	5,1	
PPS	5,4	3,6	5,8	62,5
PSS	11	3,7	8,1	63,5
SSS	7,4	1,2	3,8	73
Total (%)	88,9	90,8	88,3	
UUU	3,9	9,7	5,5	
UUS	21,2	35,1	25,6	
USS	18,2	10,7	16,4	
USU	3,4	2,9	3,6	
SUS	28,7	31,9	29,9	
SSS	24,6	9,7	19,1	

[a] By lipase hydrolysis, triglycerides over 1% listed.
[b] From literature.

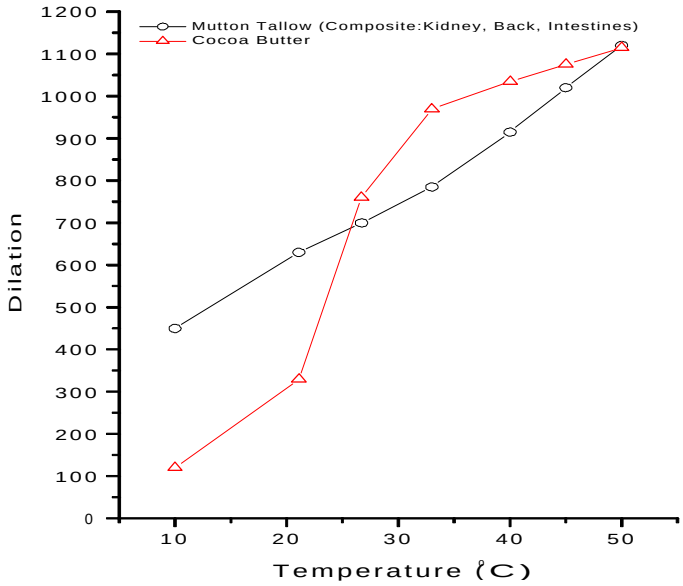

Figure 1
Melting dilations of cocoa butter and sheep tallow.

Because of a basic difference in their structures, nearly all vegetable fats and oils have saturated acids distributed nearly exclusively at the 1 and 3 positions of the glycerol moiety giving rise to symmetrical triglycerides when esterified with unsaturated acids. On the other hand, animal fats are composed of triglycerides where saturated acids are found in the 2 position. As a result, non-symmetrical triglycerides are present.

Although the fatty acid composition of mutton tallow is very similar to cocoa butter, the two fats exhibit very different melting profiles. Cocoa butter is composed of symmetrical triglycerides of the SUS type (where U = oleic and S = palmitic or stearic). Typically, cocoa butter is composed of about 80% POS, SOS and POP (Shukla 1995). Mutton tallow, however, contains a number of both symmetrical and non-symmetrical disaturated triglycerides.

The melting dilations of cocoa butter and sheep tallow are shown in Figure 1, where the melting point dilations are plotted against temperatures ranging from 10 to 50°C. Cocoa butter exhibits a sharp inflection in melting dilation at temperatures between 20 and 30°C which is indicative of its sharply melting properties. Cocoa butter shows a melting point of 29.3°C. On the other hand, mutton tallow shows nearly a linear relationship between melting dilation and temperature indicative of a slowly melting fat. The difference between the two curves can be attributed to basic differences in their triglyceride structures. Cocoa butter, which is comprised of symmetrical triglycerides, melts very sharply compared to sheep tallow, which contains a mixture of both symmetrical and non-symmetrical triglycerides.

REFERENCES

Bockish, M. (1993). Fats and Oils Handbook. AOCS Press, Champaign Il. 153-155.

Christie, W. W. (1973) Lipid Analysis, first edition. Pergamon Press, New York. 85-102.

Coleman, M. H. (1961). Further studies on the pancreatic hydrolysis of some natural fats. *J. Amer. Oil Chem Soc.* 38,685-688.

Grompone, M. A. (1990). Characteristics of Uruguayan mutton tallow. *J. Amer. Oil Chem Soc*. 67, 980.

Neff, W. F. , Zeitoun, M. A. M. and Weisleder.D. (1992). Resolution of lipase lipolysis mixtures from soybean oil by a solid phase extraction procedure. *J. Chromatog*, 589, 353-357.

Official and Tentative Methods of the American Oil Chemists' Society, 4th edition. (1989). D. Firestone. (ed) AOCS, Champaign, IL,. Solid fat index Cd10-57, Dropping point Cc18-86, Solid fat content Cd16-81.

Shukla, V. K. S. (1995). Confectionary fats in developments in oils and fats. R. J. Hamilton (ed) Blackie Academic and Professional, Chapman and Hall, London. 66-94.

VanDerWal, R. J. (1960). Calculation of the distribution of the saturated and unsaturated acyl groups in fats from pancreatic lipase hydrolysis data. *J. Amer. Oil Chem Soc*. 37,18-20.

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