

# Glyceride Structure of Cocoa Butter

THE GLYCERIDE STRUCTURE of cocoa butter has been extensively investigated (1-3). The results of these investigations have indicated that the predominant glycerides are of the SUS type containing mainly stearic, oleic and palmitic acids. However, little attention has been given to possible variations in the fatty acid composition and triglyceride distribution in the various types of cocoa beans employed in the preparation of commercial cocoa butter. In this letter we compare the fatty acid composition and triglyceride structure of cocoa butter obtained from three types of cocoa beans: Seasons Arriba, Main Accra and Superior Bahia (Season Arriba cocoa beans are those of a fine flavor grade Forastero type obtained from South America, West India, Ceylon and Java. Main Accra beans are the common base type of Forastero beans obtained from Ghana. Superior Bahia beans are those beans obtain from Brazil).

The procedures for the pancreatic lipase hydrolysis of groups in the 1,3-positions of triglycerides and for the subsequent preparation of the methyl esters of the liberated acids using diazomethane have been published by Ast and VanderWal (4). Methyl esters of the whole fats were prepared by interesterification with methanol. The fatty acid composition was determined by GLC of the methyl esters (5,6). Percentages of glyceride types and isomeric forms were calculated according to the method of VanderWal (7). (The method of calculation employed by Coleman (9) may also be used. A more recent method of calculation introduced by VanderWal (10) may also be employed; although the formulas as shown by VanderWal contain an error (described to the author by VanderWal, personal communications) as follows: The formula for the calculation of %ABA = (%A1) (%B2) (%B3) (2)/10<sup>4</sup> should read %ABA = (%A1) (%B2) (%A3)/10<sup>4</sup>.)

The fatty acid compositions observed for these types of cocoa butter (Table I) agree well with that obtained by Meara (2) and Scholfield (3). Some variation in fatty acid composition is evident, however. Seasons Arriba cocoa butter appears to contain somewhat more stearic acid in the 2-position and somewhat less oleic acid in this position than the other samples. Both oleic acid and linoleic acid preferentially occupy the 2-position of the glycerol moiety. The finding that linoleic acid also occupies the 2-position preferentially is in contrast to the results obtained by Mattson and Beck (8) where no preference for the 2-position was found.

The data obtained for the triglyceride structure of the cocoa butter samples are in general agreement

(Table II) with data published previously. Superior Bahia cocoa butter agrees very well in triglyceride composition with the cocoa butter data presented by VanderWal (7); the data presented by Youngs (1) and others (2,3) when compared with that obtained by us would seem to represent data which would be obtained from composite samples. The triglyceride composition of a cocoa butter sample reported by Cole-

TABLE II  
Glyceride Composition of Cocoa Butter

Variety	Composition: types				Composition: isomers			
	S <sub>3</sub>	S <sub>2</sub> U	SU <sub>2</sub>	U <sub>3</sub>	SUS	SSU	USU	UUS
Main Accra	7.0	75.4	16.7	0.9	73.8	1.6	0.1	16.6
Season's Arriba	12.5	71.1	15.8	0.9	68.4	2.7	0.2	15.6
Superior Bahia	6.5	68.3	23.3	1.8	66.1	2.2	0.2	23.1
Youngs (1) found	5	73.0	23.0	1.0	66.0	7.0	3.0	20.0
Cale	5	71	27.0	2.0	69.0	2.0	0	22.0
VanderWal (7)	7.1	67.5	23.3	2.1	65.0	2.5	0.2	23.1
Coleman (9)	2.7	81.3	15.3	0.7	80.8	0.5	0	15.3

man (9) contained the lowest amt of S<sub>3</sub> and an increased S<sub>2</sub>U content (primarily SUS). Cocoa butter prepared from Seasons Arriba beans contains more S<sub>3</sub> and less of both SU<sub>2</sub> and S<sub>2</sub>U than samples from Main Accra or Superior Bahia beans. A considerably higher percentage of SU<sub>2</sub> was found in cocoa butter prepared from superior Bahia beans; this increase is apparently due to an increase in the amt of unsymmetrical UUS isomer. Cocoa butter prepared from Main Accra beans exhibited a higher S<sub>2</sub>U content because of an apparent increase in the percentages of the symmetrical isomer (SUS).

G. K. CHACKO AND E. G. PERKINS  
The Burnsides Research Laboratory  
University of Illinois  
Urbana, Illinois

#### ACKNOWLEDGMENT

Samples of cocoa butter prepared from the three types of beans, courtesy of the Hershey Chocolate Corporation.

#### REFERENCES

1. Youngs, C. G., *JAOCS* **38**, 62 (1961).
2. Meara, M. L., *J. Chem. Soc.* 2154 (1949).
3. Scholfield, C. R., and H. J. Dutton, *JAOCS* **36**, 325 (1959).
4. Ast, H. J., and R. J. VanderWal, *JAOCS* **37**, 18 (1961).
5. Perkins, E. G., *JAOCS* **41**, 285 (1964).
6. Ahmed, M. E., L. M. Black, E. G. Perkins, B. L. Walker and F. A. Kummerow, *Biochem. Biophys. Res. Comm.* **17**, 103 (1964).
7. VanderWal, R. L., *JAOCS* **37**, 18 (1960).
8. Mattson, F. H., and L. Beck, *J. Biol. Chem.* **219**, 735 (1956).
9. Coleman, M. H., *JAOCS* **38**, 685 (1961).
10. VanderWal, R. J., *JAOCS* **40**, 242 (1963).

[Received August 14, 1964—Accepted September 8, 1964]

TABLE I  
Fatty Acid Composition of Cocoa Butters

Sample	Main Accra			Season's Arriba			Superior Bahia			Meara (2)	Scholfield & Dutton (3)
	C <sub>1,2,3</sub>	C <sub>1,3</sub>	C <sub>2</sub>	C <sub>1,2,3</sub>	C <sub>1,3</sub>	C <sub>2</sub>	C <sub>1,2,3</sub>	C <sub>1,3</sub>	C <sub>2</sub>	C <sub>1,2,3</sub>	C <sub>1,2,3</sub>
16:0	26.3	40.6	0	28.6	41.7	2.4	25.6	39.5	0	24.4	26.3
18:0	35.5	48.9	8.7	36.2	48.0	12.6	34.2	46.8	9.0	35.4	34.6
18:1	36.1	10.0	88.3	33.4	10.3	79.6	37.9	12.5	88.7	38.1	35.5
18:2	2.1	0.5	4.8	1.8	Trace	5.4	2.3	1.2	4.5	2.1	3.6