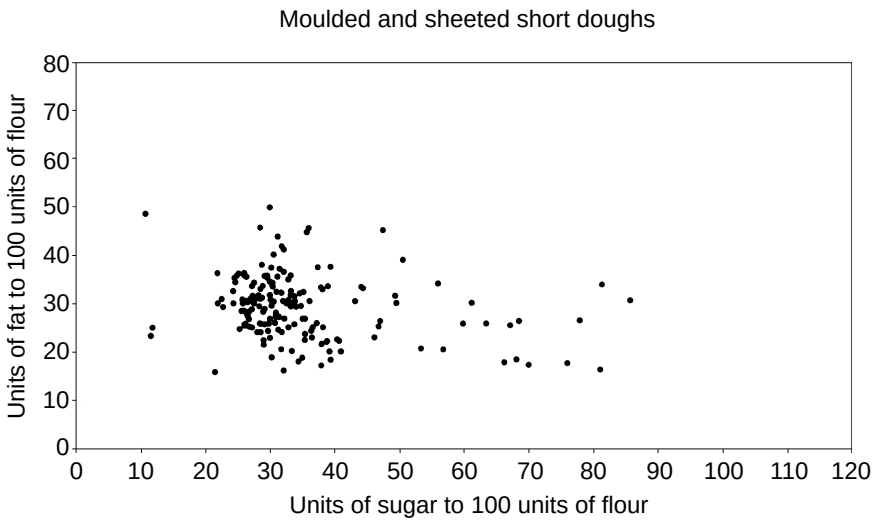
6
Recipes for short doughs

6.1 Introduction

Biscuits in this group make up most of the worldwide biscuit market. It is a very diverse group ranging from varieties high or low in fat and high or low sugar in more or less any combination. Biscuits in this group are used in all types of secondary processing thereby increasing the diversification of products. There is a clear distinction between these short doughs and the hard doughs which have lower sugar and fat contents (and therefore more water). This was shown in Fig. 2.2. However, there is no clear distinction between recipes in this group and those of subsequent groups which are formed by extrusion or deposition. Both of the latter allow the formation of products that are well distinguished from those in this group in terms of their appearance and shape.

Doughs from recipes in this group are distinguished from those called hard doughs in that they lack extensibility and elasticity, they readily break when pulled and this is where the term 'short' comes from. A significant amount of fat is usually involved and this is how dough fat comes to be called 'shortening'.

To achieve a tender eating quality it is important that the mixing of the dough does not allow development of much gluten. This will not happen if there is a lot of fat present (and therefore not much water) but if the fat level is relatively low the amount of mixing when flour is in the dough should be as little as possible. Overmixing is a common fault and gives harder, tougher and less acceptable biscuits. It is the fat that contributes mostly to a tender eating quality and the effectiveness of the fat in the dough can be increased by using a small quantity of emulsifier. There are many emulsifiers available



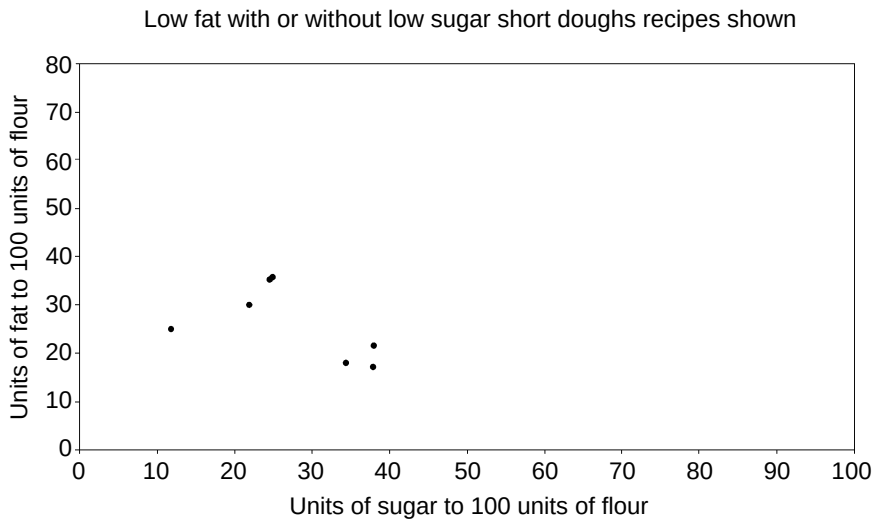
6.1 Enrichment of moulded and sheeted short doughs.

but the one most commonly used, because it is a natural product, is soya lecithin. In its liquid form this is an unpleasant material to handle and to be most effective it should be well blended with the fat. Powder lecithin is also available but this is the liquid form spray dried onto a powder such as that of skimmed milk and is therefore more expensive. It is best to use lecithin at a rate of about 2% of the fat rate. At higher rates the effectiveness is not particularly enhanced and the taste of the lecithin is not attractive. It will be seen in the following recipes that many have not followed this recommendation for lecithin or other emulsifiers. They probably experience some economic loss as a result.

During baking it is common for the dough pieces to expand in length and width. They should never shrink, as those of hard dough do, though this may happen if the dough has been overmixed. The expansion, often called 'spread', during baking puts some constraints on the type of baking band. Those that spread significantly must be baked on steel bands, not wire bands, as they would be impossible to remove after baking if they had sunk down into the wire. Those that spread most are rich in sugar. Others less rich in fat and sugar spread only a little so can be baked on wire bands or perforated steel bands.

The following recipes are grouped together for convenience. It would not be ethical to show recipes for well known brands, and the names would not be understood in all parts of the world, so the aim has been to give a number of representative recipes to show what is possible in terms of fat and sugar enrichment and also to show how manufacturers use a wide range of ingredients. All the recipes are of products that are, or have been, produced commercially.

The enrichment of moulded and sheeted short doughs is shown in Fig. 6.1.



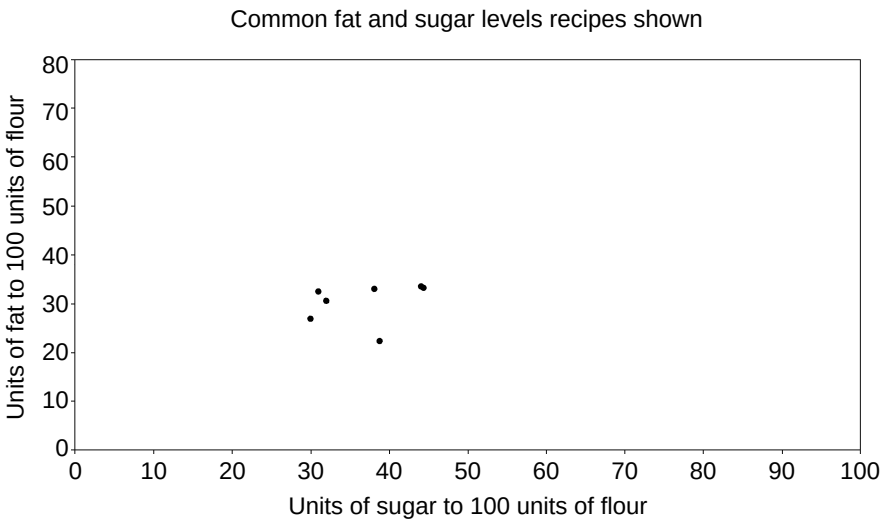
6.2 Enrichment of low fat with or without low sugar recipes shown.

6.2 Plain biscuits

6.2.1 Low fat and/or low sugar

Recipe no. Type product	58 oatcakes	59 Lincoln	60 digestive*	61 digestive	62 Nice	63 Nice	64 milk biscuit
flour, weak	54.00	100.00	81.57	67.23	100.00	100.00	100.00
wholemeal			18.67	26.26			
wheat bran				1.05			
cornflour				5.46			
oatmeal/flakes	46.00						
granulated sugar	11.00		22.00	15.23	35.71		
powdered sugar		21.92					32.38
caster sugar						37.90	
Demerara/ brown sugar				6.30			
cane syrup 80%	1.00		3.18	3.15	2.85		
invert syrup 70%							2.86
malt extract 80%				1.05			
dough fat	25.00	30.00	34.52	25.21	12.50	17.10	17.86
margarine					10.72		
oil				10.50			
lecithin			0.70	0.01			0.10
SMP				2.10	1.44		0.24
whey powder	8.00	2.12				1.78	
amm. bic.	0.10	0.58	0.47	0.38	0.17	0.48	0.17
soda	1.00	0.35	1.69	1.58	0.35	0.58	0.76
ACP				0.05	0.04		0.10
salt	2.00	1.05	1.29	0.86	0.53	0.71	0.29
tartaric acid			0.71				
SMS				0.003			
vanilla/in†		0.10			0.10		
liquid flavour†		0.10		0.10	0.10		0.10
des. coconut					7.15	17.10	
colour†				0.10	0.10		
biscuit recycle							7.14
added water	27	9	9	9	13	19	23

* Digestive biscuits are also known as wheatmeal or granola, particularly in the USA where the use of the word 'digestive' is not permitted as it suggests a medical aid.
† These ingredients are not represented by accurate quantities.



6.3 Enrichment of common fat and sugar recipes shown.

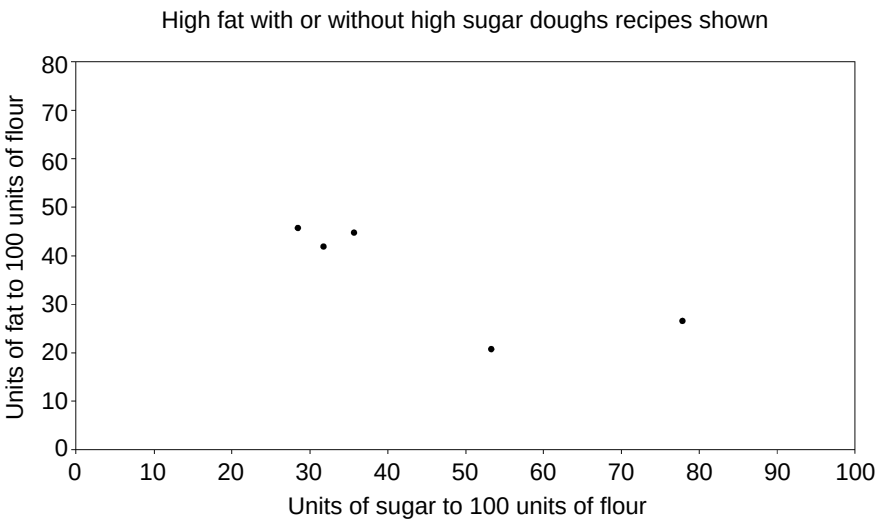
The enrichment of low fat and/or low sugar recipes shown is given in Fig. 6.2.

6.2.2 Common levels of fat and sugar

Recipe no. Type product	65 shortcake	66 malted biscuit	67 oatmeal crunch	68 coconut rings	69 printed biscuit	70 fruit and nut biscuit
flour, weak	100.00	100.00	36.17	100.00	90.00	100.00
oatmeal/flakes			63.83			
tapioca starch					10.00	
granulated sugar			32.34	17.19		22.00
powdered sugar	28.60	25.00		17.19	30.00	13.00
cane syrup 80%	2.50		6.81			7.75
malt extract 80%	1.79	7.50				
glucose syrup 80%			1.28	4.69		4.00
dough fat	29.80	32.10	22.13	25.00	26.25	33.00
oil				7.81		
lecithin	0.60			0.01	0.50	
SMP			3.40	1.56	2.00	
FCMP		0.89				
whey powder						1.50
amm. bic.	0.71	0.54	1.17	0.19	0.90	0.78
soda	0.18		0.89	0.78	0.90	0.78
ACP	0.18					
salt	0.89	1.07	0.89	0.08	0.90	1.55
vanilla/in*	0.14					
liquid flavour*			0.10	0.10		
currants						18.75
des. coconut				31.25		
colour*	0.10			0.10		
nuts						10.00
total added water	13	9	8	20	12	7

* These ingredients are not represented by accurate quantities.

The enrichment of common fat and sugar recipes shown is given in Fig. 6.3.



6.4 Enrichment of high fat with or without high sugar recipes shown.

6.2.3 High levels of fat and/or sugar

Recipe no. Type product	71 short bread	72 fruit shortie	73 butter cookie	74 pepperkarkor	75 ginger
flour, weak	100.00	100.00	100.00	100.00	100.00
granulated sugar	7.10		16.67		52.63
powdered sugar	21.40	32.86	15.15	33.33	
cane syrup 80%		3.57		25.00	31.58
dough fat		44.64		20.56	26.32
butter	54.30		49.70		
fresh egg			3.79		
amm. bic.		0.14	0.45	0.28	0.11
soda		0.40	0.17	0.83	1.05
ACP					0.22
salt	0.31	0.89	0.76	0.83	1.05
spice*				0.83	1.05
liquid flavour*				0.18	
currants		10.71			
colour*		0.10			
added water	2	10	0.00	12	5

* These ingredients are not represented by accurate quantities.

The enrichment of high fat and/or high sugar recipes shown is given in Fig. 6.4.

Critical ingredients The particle size of the sugar may have a strong effect on the spread during baking. The finer the particle size the more the dough will spread. (There are several other factors that affect the amount of spread during baking, see Manley.[1]) As there is generally insufficient water in the dough to dissolve all the crystal sugar the size of the undissolved sugar crystals will also affect the eating quality of the biscuit. It may be desirable to have a gritty, crunchy biscuit with large sugar crystals but a fine sugar will give a smoother eating texture. The fat and syrups will impart flavour. The texture of the fat will affect the dough consistency and the efficiency of the mixing. The fat should be semisolid and plastic: it should be neither liquid nor hard. The flour quality will be largely irrelevant except where wholemeal or branny flour is required.

Mixing For best results this should always be done in at least two stages. The simplest arrangement is firstly to mix together all the ingredients, except the flour, and when the sugar has dissolved as much as possible and the fat has been emulsified with the water to make a semisolid and homogeneous 'cream', the flour is added. Thereafter mixing is for a *minimum* time to produce a homogeneous blend. In a good mixer this may be done in 1 minute but it should never be more than 3 minutes at a slow mixing

speed. The result will be a soft, short and somewhat sticky dough. (It may be found that dough mixed in this way is too short for optimum extraction from the moulds of the rotary moulder. If this is the case the final mixing time may be extended *a little* to toughen the dough slightly and make it more cohesive.) The best development of the biscuit during baking occurs where the water content of the dough is at its *maximum*. Thus in order to have acceptable dough consistency and high water content it is necessary to make the dough as cold as possible. The optimum temperature of short doughs is between 18 and 22 °C. It is often difficult to get this as there is limited opportunity to control the ingredient temperatures.

Dough handling Freshly mixed dough will be too soft and too sticky to handle efficiently on either a rotary moulder or a sheeting and cutting machine. If the dough has been mixed correctly and is allowed to stand for about 30 minutes the consistency will increase and the stickiness decrease significantly. This is because the water is passively absorbed onto the flour and other cereal components. The dough effectively 'dries in'. Water is not lost to the atmosphere so it does not 'dry out' like hard doughs. These changes in dough consistency and quality continue throughout the life of the dough but after 30 minutes these changes take place much more slowly so it is normally still satisfactory to use a dough which is 60 or 90 minutes old. The standing period must not involve dough agitation as this will 'mix' the dough more and may toughen it. After standing for 30 minutes it is much less likely that dough agitation or working of the dough (as for example in a dough feeder, a sheeter or rotary moulder) will result in toughening.

Dough piece forming The most common and efficient method is rotary moulding. It is also possible, in most cases, to sheet and cut short doughs but there are some critical aspects to this method. Gauging a sheet of short dough is not as easy as gauging hard doughs as there is little strength in the sheet to allow it to pass over gaps, as it emerges from a gauge roll, for example. It is thus unlikely to be possible to use more than one gauge roll to give a sheet of correct thickness for cutting. Cutting may be simple, as for hard doughs, or of an embossing type to give a strong relief of the dough piece surface. Removal of the cutter scrap dough can be difficult as a thin sheet has little strength so to lift it away is a delicate operation.

Rotary moulding is not suitable for doughs with currants and does not allow dusting of the dough pieces *before* formation. Sheeting and cutting toughens the dough so that the cutter scrap is not of the same consistency as the fresh dough. This means that in most cases rotary moulding is a superior method of dough piece forming.

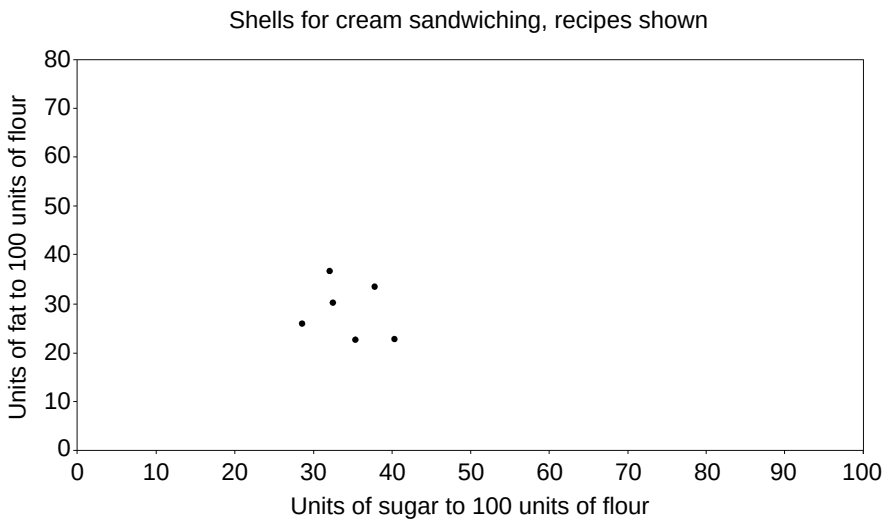
Baking The demands for baking of short doughs are somewhat different from those for hard doughs. There is much less water to extract and complete removal is unnecessary as stress cracking (i.e. checking) is very rarely a problem. The expansion of the dough is in a syrupy and fatty medium

and the contribution of a gluten matrix and gelatinisation of starch to form a rigid structure is very much less apparent. It is therefore best to allow a slow expansion and to let a setting of the structure occur gently. Too fast an expansion will lead to collapse before the structure can hold the gas bubbles. There is always some collapse after expansion but to get the best biscuit textures the collapse should be minimal. Thus the oven temperatures are typically as follows:

- For shortbread 205, 230, 230 °C Bake time 11 minutes.
- For digestives 180, 240, 170 °C Bake time 7.0 minutes.
- For gingernuts 150, 180, 180 °C Bake time 8.5 minutes.

Baking times of between 5.5 and 15 minutes are common depending on the thickness of the dough pieces.

In order to encourage spread a humid first zone of the oven is useful and this may be enhanced by injecting steam into the mouth of the oven. The increase in humidity softens the top of the dough piece and then allows more expansion upwards and sideways followed by collapse and cracking of the surface. This cracked surface is an attractive feature of such biscuits as gingernuts and crunch.



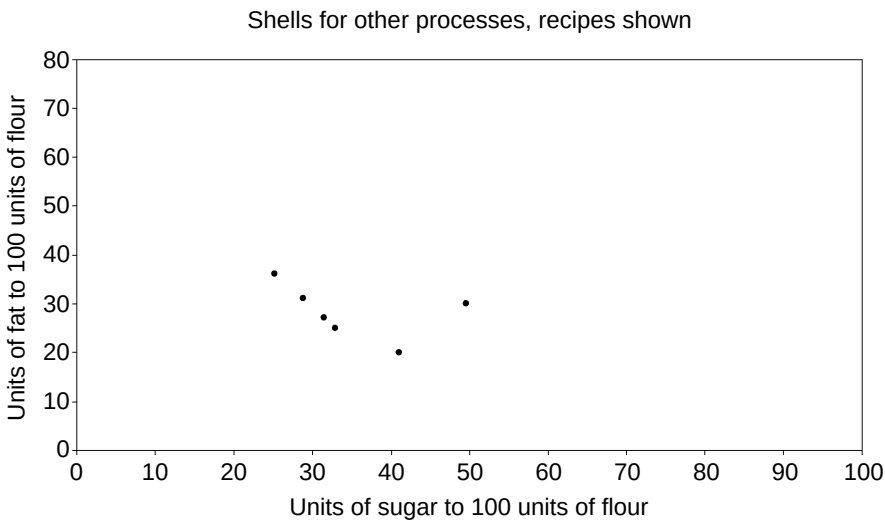
6.5 Enrichment of recipes for biscuit shells shown.

6.3 Biscuits for cream sandwiching

Recipe no. Type product	76 Bourbon cream	77 Swiss cream	78 custard cream	79 orange cream	80 enrobed cream	81 coffee cream
flour, weak	100.00	100.00	100.00	100.00	100.00	100.00
powdered sugar	37.50	28.60	29.29	35.00	31.30	28.00
cane syrup 80%	3.57		3.57	3.57	4.70	
invert syrup 70%					0.45	
dough fat	22.05	25.19	36.43	33.21	22.40	23.52
lecithin	0.45	0.51				0.48
whey powder		1.79				1.00
amm. bic.		0.71	0.27	0.31	0.15	0.72
soda	0.45	0.18	0.31	0.31	0.30	0.44
ACP	0.45					
salt	0.45	0.45	0.54	0.54		1.00
vanilla/in*	0.10					
liquid flavour*				0.10		
cocoa	4.50					
colour*		0.10	0.10	0.10		
caramel colour					2.20	0.60
total added water	14	18	9	8	8	12

* These ingredients are not represented by accurate quantities.

Enrichment of recipes for shells for cream sandwiching is shown in Fig. 6.5.



6.6 Enrichment of recipes for shells, etc. shown.

6.4 Biscuits for other secondary processing

Recipe no. Type product	82 icing base	83 icing base	84 jam sandwich	85 marshmallow base	86 marshmallow sandwich	87 chocolate crunch
flour, weak	100.00	100.00	100.00	100.00	94.48	100.00
cornflour					5.52	
granulated sugar					21.76	38.10
powdered sugar	27.90	21.43	28.57	30.00		
cane syrup 80%	1.10	14.29	3.57			14.30
invert syrup 70%				10.00		
malt extract 80%					1.06	
glucose syrup 80%				5.00	3.18	
dough fat	29.80	25.00	27.14	20.00	25.48	29.40
oil					10.62	
lecithin	1.31				0.01	0.60
SMP	1.79				2.12	
amm. bic.			0.85	0.27	0.19	0.89
soda	0.27	0.27		0.36	1.38	
ACP	0.36			0.09	0.80	
salt	0.80	0.71	0.71	1.26	0.87	1.43
SMS			0.022		0.003	
vanilla/in*	0.16					0.10
spice*		0.22				
liquid flavour*				0.10	0.10	
des. coconut						4.64
colour*	0.10		0.10	0.10	0.10	
total added water	14	9	13	15	11	14

* These ingredients are not represented by accurate quantities.

Enrichment of recipes for shells for other secondary processing is shown in Fig. 6.6.

6.5 Chemicals present in the recipes of this group

Ammonium bicarbonate is found in 93% of the recipes and where used the average level is 0.47 units and the range is 0.04 to 1.77 units.

An acid salt such as SAPP or an acid, for instance, tartaric or citric is present in 41% of the recipes. Sodium bicarbonate (soda) is found in 96% of the recipes and where used the average level is 0.73 units and the range is 0.18 to 1.92 units. However, the quantity of soda does not seem to be greater to compensate for the reaction which takes place with soda in the dough. Soda is used both as a source of chemical aeration and as a means of adjusting the biscuit pH. This latter significantly affects the flavour and it seems that insufficient attention is given to this aspect of the recipes.

Almost all the recipes use salt as a flavour enhancer and the average level is 0.90 units. Where used the range is 0.19 to 2.00 units. In some cases the salt is provided in butter.

A very few recipes contain sodium metabisulphite, SMS, but this is regarded as unnecessary in short doughs because there should be little or no gluten development if the mixing is done correctly.

6.6 Secondary processes used for products of this group

As can be seen from the names of the recipes given a full range of secondary processing is common.

Chocolate Half coating with chocolate (or chocolate flavoured coating) by enrobing is very popular. Less frequently biscuits are fully coated. There is a problem of fat migration from the biscuit into the chocolate which, in time, makes the chocolate soft and 'cheesy'. This becomes worse where the fat level in the biscuit is high and the storage temperature of the biscuits is above 18 °C. Cream sandwiched biscuits which are fully enrobed with chocolate are common as 'count lines', that is, individually wrapped biscuits.

Many of these biscuits also form the centres for moulded chocolate bars, either plain, cream sandwiched or with an addition of caramel toffee.

Cream sandwiching After chocolate coating this is the most common form of secondary processing. All the creams are sweet and may be of vanilla, fruit or chocolate flavour.

Marshmallow The use of marshmallow provides a useful second texture to the product. The principal applications are either as:

- A marshmallow sandwich which is then fully coated with chocolate flavoured coating.
- A top deposit of marshmallow and a small deposit of jam which is then fully coated with chocolate flavoured coating (these are called Teacakes).
- A top deposit of marshmallow which is then dusted with desiccated coconut.

Icing A half coating with an icing mixture which is then dried to give a hard shiny surface. The icing may be coloured in various ways and patterned. This product is particularly popular with children.

Jam and/or cream sandwiching As the name implies, the centre is jam and often one of the sandwich shells has holes to expose the jam filling. These holes may be in the form of some design which appeals to children such as the shape of eyes, nose or mouth.

For more details of recipes for secondary processing see chapter 10.

Reference

[1] MANLEY, D J R (1998) *Biscuit, Cookie and Cracker Manufacturing Manuals, 4. Baking and cooling of biscuits.* Woodhead Publishing, Cambridge.