

YEAST-RAISED DOUGHNUTS

INFORMATION SHEET



BAKING INDUSTRY
RESEARCH TRUST

DEFINITION

Doughnuts are a snack food made with deep-fried sweet dough. They are usually circular with a hole in the middle, but are also made in the shape of balls, fingers and stars. Hot doughnuts may be dusted with sugar and spice; cold doughnuts may be glazed with icing or filled with jam, custard or similar. Yeast-raised doughnuts have a light open texture.

HISTORY

It is feasible that ancient Egyptians ate doughnuts, as a panel dating to 1000 BC depicts a court bakery where small cakes or dough were being fried. In Germany there is a tradition of Pfankuchen, yeast-raised dough pieces which are deep fried. Known as Berliners, these products were enjoyed at carnival times. This product became known throughout Europe and was introduced to the USA by immigrants in early 1900s. During WWII they were brought into the UK by American military personnel.

INGREDIENTS

Ingredient	Function & Specifications (*Based on flour content.)
Flour	Strong flour with protein content of 12.5–14%. Flour must exhibit good baking qualities to withstand the air pressure it is subjected to in an extrusion system. The protein should be sufficiently mellow to produce good machining.
Soy flour	Both full fat and defatted soy flours can be used. Provides structure and improves the tolerance of the dough, darkens crust colour and increases water absorption. Excessive amounts can weaken the action of gluten.
Sugar	Added at 6–12%*, either as sucrose or dextrose, or a combination of the two. Sugar is a fermentation substrate for the yeast, and plays a role in crust colour.
Shortening	A good quality shortening should be used primarily to improve eating quality by tenderising the finished product. Also important for machining and expansion.
Yeast	Melting point = 49°C. FFA = 0.1% maximum. Addition 8–15%*
Non-fat dry milk	Added at 4–6%* depending on how much fat and sugar is added to the formulation.
Egg yolk	High heat-treated bakery-grade non-fat dry milk. Poor quality non-fat dry milk may produce yields that have poor gas retention, which results in insufficient proofing tolerance, poor volume, excessive spread and high fat absorption.
Salt	Doughnuts can be produced with a minimum amount of egg added (0–5%*). Egg yolk contributes to greater volume and more desirable skin characteristics for glazing and, most importantly, performance tolerance which is important for product symmetry.
Emulsifiers	Added at 1–2%* to control fermentation and affect flavour.
Chemical leavening	Lecithin conditions the crust for better glaze retention. Mono- and di-glycerides, and sodium stearoyl-2-lactylate improve dough machinability and crumb texture.
Water	Offers a burst of carbon dioxide in the fryer, as adequate expansion of the doughnut may not occur if only carbon dioxide from yeast fermentation is relied on.
	Major ingredient in the preparation of the batter as it controls the viscosity. Makes up 54–62% of mix.

PROCESSING

There are two different methods that can be used.

1. Sponge dough method

This system offers greater flexibility than straight dough in that fermentation is a slow process, allowing desirable mellowing of protein and better gluten development. Sponges are set at 24–26°C with 5–6% yeast for approximately 2 hours of fermentation. Once the sponge has reached maturity it is added to the remaining ingredients. The full dough is mixed until developed and extensible with a dough temperature of 29°C + 1°C.

2. Starter dough system

A complete dough is mixed approximately 2 hours before the first regular doughnut dough is required. Then to each subsequent fresh dough a predetermined quantity of started dough is added, about 25–35% of the total dough. This system lets the fresh dough perform with many advantages of the sponge dough, and the end product is improved by healthier fermentation than that obtained using a regular straight dough system.

Doughnuts can be made either by sheeting and cutting or alternatively by a pressure extruding process which is outlined in the steps below:

PROCESSING

Process	Details
Mixing	For extruded processing the dough must be well developed and extensible. The dough needs very little floor time so dough temperatures and mixing time must be tightly controlled. Dough temperature is between 27–29°C.
Cutting	After 0–10 min floor time the mixed dough is dropped into the cutting hopper, sealed and put under controlled pressure for extrusion through cutters. To obtain good cutting characteristics, dough must have been mixed properly with sufficient water to allow good flow. The dough ages quickly under air pressure so it is essential not to give dough too much floor time, add too much scrap, let temperature rise or make dough too stiff.
Proofing	During this stage cut doughnuts are conditioned for transfer to the fryer. The quality of yeast leavened doughnuts can be affected by improper proofing conditions. Proofing is essential for controlling symmetry, volume, fat absorption. The key is an accurately controlled proofer, usually 35–41°C and 30–45 minutes.
Frying	Very important step as the fat becomes the 'pan', heat transfer medium and a major product ingredient. During frying moisture is being driven from the batter and fry fat is being absorbed. Frying fat temperature ranges from 188–193°C and affects doughnut volume, crust colour, doughnut spread and fat absorption. Doughnuts are fried in two stages with first stage (before turning) being slightly hotter and longer than the second stage.
Cooling	After frying doughnuts are cooled to an internal temperature of 32–35°C. During cooling more moisture loss occurs and doughnuts firm to allow handling for coating and packaging. If doughnuts are not properly cooled then the product will be too tender and moist, allowing breakage, breakdown of coating and weeping in the packaging.
Coating & glazing	Doughnuts can be coated with a glaze or powdered sugar which, apart from making the doughnut more attractive, also improve the eating quality of the doughnut by providing sweetness. A typical coating sugar may be made up of 76–87% dextrose, 5–8% shortening and 8–16% starch.

TROUBLE SHOOTING

Problem	Probable cause
Balling	Excessive handling during make up. Too much dusting flour.
Blistered doughnuts	Dough too warm. Under mixed. Too little floor time. Frying temperatures too high. Excessive handling.
Collapsed doughnuts	Under-mixed. Excessive floor time and handling. Too much dusting flour and scrap in dough.
Dark crust	Too little floor time. Frying temperatures too high – fat broken down.
Excessive spread	Too much water. Frying temperature too low. Fat broken down. Low fat level. Too much moisture in proofer.
Excessive sweating (glazed)	Too much water. Under mixed. Frying temperatures too high. Fat broken down. Fat too new.
High fat absorption	Dough too warm. Too much water. Under mixed. Excessive floor time. Frying temperature too low. Fat melting point too low. Fat broken down.
Light crust	Dough too warm. Excessive floor time. Frying temperature too low. Fat too new. Too much scrap in dough. Dough too old or young.
Low volume	Dough too warm. Too little water. Over or under mixed. Frying temperature too high. Excessive handling. Too much dusting flour. Too much scrap in dough.
Poor keeping quality	Dough too warm. Too little water. Frying temperature too high. Too much cooling. Fat absorption too low. Excessive handling during makeup. Too much dusting flour. Too much scrap in dough.
Too tough	Dough too cold. Not enough water. Over mixed. Too much cooling. Excessive handling. Too much dusting flour. Too much scrap in dough.

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