

Meat patty characteristics vary, depending on the types of raw ingredients, processing methods and storage used. This Bulletin describes various types of patties and discusses how the raw materials and patty formulation affect patty quality.

MEAT PATTY TECHNOLOGY 1:

Raw materials and formulation

Because of its size, the meat patty market is of significant interest to the meat industry. For example, the United Kingdom burgers and grill steaks market was worth more than an estimated £1 billion in 1990. More than 80% of this came from sales at fast food outlets. The United States market uses about 3 million tonnes of beef annually for grinding and processing. Japan is also now an emerging market.

WHAT IS A 'TYPICAL' PATTY?

Patties typical for one country may be quite different from patties typical for another. Each country sets its own legal standards for a "patty". As well, customer tastes and expectations often differ significantly from country to country.

- **New Zealand** - New Zealand patties may contain cereal, carbohydrate sweeteners, salt, vinegar, sodium caseinate, flavourings, specified antioxidants, phosphates and other foodstuffs. However, they must contain at least 90% meat and not less than 15% protein derived from meat.

- **United States** - The traditional American 'hamburger' patty is made from beef, and can contain up to 30% beef fat, and/or seasonings. These patties are often processed using a least-cost formulation, and patties are often made from a combination of domestic fresh and imported frozen beef, such that the fat level and temperature of the final blend can be controlled.

- **United Kingdom** - In the United Kingdom, the meat content must be at least 80%, of which 65% must be lean. British regulations also allow an alternative 'economy burger' with a minimum meat content of only 60%. Chilled 100% beef burgers, which are perceived as having high quality, are becoming more popular and are aimed at a small niche market. The catering trade often prefers 4 - 6 oz. (113 - 170 g) patties over 2 oz. (57 g) patties. The smaller patties are commonly used in fast food outlets.

- **Japan** - Two generic hamburger products are available in Japan. The first is an all-beef American-style hamburger patty, sold at fast-food outlets.

Occasionally pork is used and seasoning may be added. The second is called a 'hamburg'. It is a large, thick patty, which is substituted for steaks

in restaurants and catering operations. It usually contains a variety of ingredients such as sautéed or rehydrated onion, bread crumb, whole egg or egg powder, milk, salt, spices and flavourings. A coarse-grind bread crumb gives patties a loose, open texture, suitable for eating with chopsticks.

MEAT

Both animal-related factors and initial meat-processing factors can affect patty quality.

Animal factors

Animal factors affecting patty quality include breed, sex, country of origin and diet (for example, grass-fed vs. grain-fed).

Beef is the main meat source for patties, but other meats such as mutton, lamb, veal, pork, venison, turkey and chicken can be used. Horse meat is widely used for burgers in Belgium and France.

Using sheepmeat in patties would be of benefit to New Zealand meat producers. However, many consumers dislike sheepmeat odour and flavour, and this limits the use of sheepmeat in such products.

For sheepmeat patties to gain acceptance in these markets, methods are needed to either remove or mask the meat's undesirable mutton odour and flavour. For example, fat is largely responsible for meat flavour, and



the fat of other species such as beef could be used in the formulation. Also, spices and other flavour-enhancing ingredients could be added to sheepmeat patties during their formulation. In fact, heavy spicing is a feature of most lamb burger formulations.

Processing factors

Processing factors include the grade and type of cut used, which relate to the lean, fat and connective tissue content of the meat; whether the meat was hot boned or cold boned; the storage temperature (chilled vs. frozen); and the use of whole-tissue or mechanically separated meat.

Hot-boned (pre-rigor) beef

The main advantage of using hot-boned beef for patty processing is that the meat binds better. If hot-boned meat is ground and fast frozen immediately after boning, when its pH is still high, it can retain some of its good binding ability. Adding salt to hot-boned meat that is sufficiently pre-rigor (pH value about 6 or higher) also helps retain this property.

Patties made from pre-rigor meat have shown the following characteristics, compared to patties made from cold-boned meat:

- Lower cook losses and less change in dimensions during cooking.
- Higher moisture content and juiciness.
- Similar or better tenderness.
- Higher consumer preference for stored patties in terms of flavour, tenderness, juiciness and overall acceptability.
- Similar microbiological quality.

Chilled or frozen meat

During patty manufacture, processors may use chilled, frozen or a combination of chilled and frozen meat.

With frozen meat, microbial spoilage is not a problem during storage, and that meat's cold temperature helps to control the grind temperature. However, frozen meat requires a

tempering or thawing step, which requires energy.

Chilled meat has a high quality image. The main advantages of using chilled meat are that thawing is unnecessary and chilled meat is easier to handle during processing,



but the meat can spoil during storage.

Mechanically separated meat

Mechanically separated beef (MSB) (also called mechanically deboned beef) has been tested in meat patties and can be used where regulations allow. Compared with minced whole-tissue meat, MSB has a finer texture, reduced connective tissue, and fine bone particles.

Very fine mincing makes MSB susceptible to bacterial growth, so for microbiological acceptability, the MSB must be hygienically produced, stored and handled. Low levels of MSB (about 10%) can be used in patties without detrimentally affecting their quality.

If patties contain too much MSB, the following problems could arise:

- Oxidation - Ascorbic acid from bone marrow and fine mincing enhance oxidation.
- Residues - Residues (such as heavy metals) can accumulate in bone and be present in MSB.
- Lower flavour scores - Spicy flavours or flavours distinctive of bone marrow or iron have been noted.
- Inappropriate texture - MSB usually gives processed meats a finer, more uniform texture than hand deboned meat.

FAT

Fat is largely responsible for meat flavour.

The fat content of patties is controlled by controlling the proportions of the lean meat, trimmings and/or fat used in the formulation. Rapid fat tests are often done and, if necessary, the mince is reblended to give the desired fat content.

Sensory ratings and cooking losses are not affected by the source of the fat within an animal (such as from flanks, plates, trimmings, brisket and kidney fat), but can vary if the fat is from different species.

Beef fat is the most preferred fat source for various patties in many countries. Pork fat is less preferable and can be more easily oxidized. Properly emulsified vegetable oil can be used without detrimentally affecting sensory properties.

Fat content has a major effect on patty acceptability. Generally, the overall acceptability of patties increases as the fat content increases from 5 to 20%, then declines for patties containing 25% fat (see figure). Patties containing about 15-20% fat have enough fat for lubrication (acceptable mouthfeel) and flavour without being too greasy.

Increasing the fat level has the following effects on patty quality:

- Decreased cook yield - The proportion of fat retained during cooking decreases as the fat content of the raw patty increases. Thus, yield also tends to decrease.
- Increased tenderness and juiciness.
- Product is less crumbly and easier to swallow - The fat acts as a lubricant.
- More air pockets - Air pockets form due to translocation of fat during cooking.

NON-MEAT INGREDIENTS

Non-meat ingredients are used because they:

- Improve sensory traits, including flavour, texture, juiciness and appearance.
- Increase binding and yields.
- Reduce costs.
- Improve nutritional value.
- Have antioxidant properties.
- Inhibit microbial growth.
- Replace fat or meat protein.

The type and amount of non-meat ingredients in patties vary considerably, depending on local custom and company recipes. Consumers tend to be open-minded about the use of many ingredients if the flavour and price are right.

Salt

Salt is used in patties to provide flavour and for its functional properties. Salt, however, promotes the oxidation of fat and pigments.

Salt causes meat proteins to dissolve and this reaction absorbs heat (is endothermic). As a result, the water holding capacity increases and the mix temperature decreases, which can be beneficial during processing. For full functionality, salt should be added at the start of mixing.

Phosphates

Phosphates improve emulsification, yield, binding, moisture retention, and sensory attributes. They also have an antioxidant effect. When oil is used instead of fat, phosphates cause the oil to disperse in fine droplets, stabilizing the emulsion.

Patties containing phosphate bloom bright red during processing and freezing. However, phosphates also cause the colour to deteriorate during frozen storage. The surface colour changes from red to brown. This effect is most pronounced with trimetaphosphate and increases with increasing phosphate concentration. Surface redness changes during thawing, so that thawed patties become similar in

colour, regardless of phosphate treatment.

A variety of phosphates can be used in patties. Each form of phosphate has its own advantages and disadvantages, so processors need to select the phosphate appropriate to their production process.

Salt and phosphate can have the following synergistic effects, which can improve several aspects of patty quality:

- They cause actomyosin to dissociate and the meat 'swells', thereby improving yields and binding of the meat particles.
- They improve sensory properties, cohesiveness and cooked colour.
- They lower cook losses.
- Diphosphate and triphosphate have been shown to counteract the pro-oxidative effect of salt.

Seasonings and flavourings

A wide variety of ingredients can be added to improve flavour.

These include:

- Herbs and spices.
- Some spices and herb extracts (for example rosemary) are effective natural antioxidants. The flavour of rosemary

oleoresin may also mask other undesirable flavours in patties.

- Commercial flavourings.
 - Sauces (tomato sauce, soy sauce).
 - Sweeteners.
 - Onions.
- Onion may be added raw, fried or partially fried, or as dry or rehydrated onion flakes. Onion is added for flavour purposes, but onion juice has also been shown to reduce lipid oxidation in lamb patties.
- Other foodstuffs.

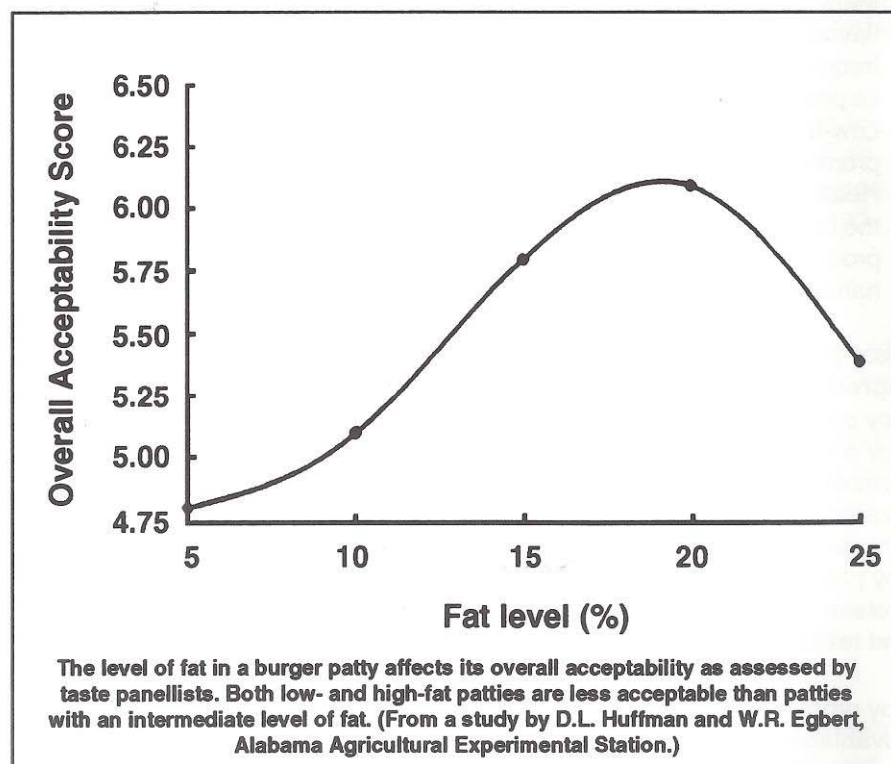
Water

Water may be used, usually at about 5-10%. It can be added as a liquid or it may be added as ice, which helps keep the mixing temperature down.

Water can be a source of contaminants. For example, water can contain metal ions that promote oxidation. Using ion exchangers or plastic piping can help stop such metal contamination. Iron grinding blades are another source of metal ions.

Fat replacement ingredients

Several ingredients can be used as fat replacers, to produce low-fat burgers. The main functions of these ingredients are to improve water



retention and patty texture. Some of these ingredients are:

- Carrageenan.
- Starches (for example, cassava starch).
- Plant fibres (isolated vegetable protein, oats).

Because fat is largely responsible for the meaty flavour, the flavour of low-fat patties needs to be enhanced. Possible flavour enhancers include salt (standard or encapsulated), hydrolysed vegetable protein (HVP), autolysed yeast, and commercial beef flavour enhancers.



Fat replacement is a topical issue for health concerns, but low-fat patties containing fat replacers have not yet been accepted by consumers for several reasons:

- Low-fat patties can have a poor flavour, texture and mouthfeel and tend to be more expensive.
- Many customers dislike the flavour of carrageenan, a frequently used substitute, and its price tends to fluctuate.
- Low-fat patties have not been promoted effectively.
- Health-conscious consumers, the target market for low-fat products, do not tend to eat at hamburger outlets.

Meat protein replacement ingredients

Soy protein

Soy protein can be used in patty formulations as a meat extender. Available forms of soy protein include soy flakes, soy flour (50% soy protein), soy concentrate (70% protein), soy isolate (90% protein), and textured soy protein.

Soy protein has several advantages in patty manufacture. For example, patties containing soy

protein have less cook loss and shrinkage and therefore a higher yield. This is due to the hydrophilic nature of soy protein, which allows water absorption and retention.

Another advantage is the nutritional properties of soy protein — it contains more calcium, magnesium, copper, and manganese than meat. Soy protein also has an antioxidant action and has been beneficial in slowing the rate of quality deterioration of patties stored frozen for long periods.

Using soy protein also has disadvantages. Patties made with high levels of rehydrated soy protein (about 20% or more) often have poor sensory acceptability. This is due to such factors as undesirable patty appearance, a less acceptable texture and, most notably, the presence of soy flavours with reduced beef flavour intensity.

Other plant proteins and cereal products

Ingredients such as defatted peanut, field pea meals, glandless cottonseed and corn germ protein flour have been used for patty formulation and have similar effects to soy protein.

Dairy ingredients

Liquid whole milk, caseinates, milk co-precipitates and whey powders can also be used for patty formulation. Caseinates and milk co-precipitates can increase water binding and improve juiciness, appearance and structure in coarsely comminuted products, and whey powders, which are high in lactose, enhance flavour and increase the browning effect during frying.

The following factors should be considered when choosing meat replacers:

- Cook yield.
- Moisture retention.
- Patty appearance.
- Flavours and aromas.
- Juiciness.
- Mouthfeel.
- Texture.

GENERAL PATTY PROCESSING STEPS

Patty processing methods can vary, but general steps common to most processes are as follows:

- Meat preparation.
- Desired fat content formulation.
- Meat comminution.
- Blending in of non-meat ingredients.
- Regrinding of the mix through a finer plate (about 2.5-6 mm).
- Patty forming.
- Patty packaging.
- Patty storage.

The next Bulletin in this series discusses these processing steps.

FURTHER READING

Hamburger Patty Technology: A Literature Review by V.L. Mikkelsen, MIRINZ Publ. No. 932, Dec. 1993.

Meat Patty Technology 2: Processing variables, storage, and final product quality. MIRINZ Bulletin No. 31, September 1995.

This bulletin was prepared by the Information Centre of MIRINZ for use by the New Zealand meat industry. It may not be reproduced without prior permission.

Production of this bulletin was funded by the New Zealand Meat Research and Development Council.

Disclaimer: Every effort has been made to ensure that information in this bulletin was correct at the time of publication. MIRINZ (now AgResearch) accepts no liability for any loss or damage that may result from any advice, opinion, statement or omission in this publication

For more information please contact:
AgResearch MIRINZ
Private Bag 3123
Hamilton 3240
New Zealand

Phone: +64 7 838 5576
MIRINZ@agresearch.co.nz