

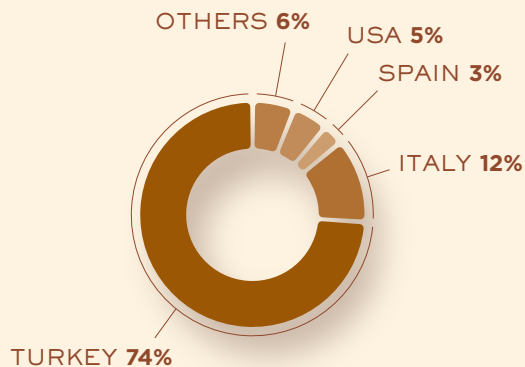


# Hazelnut Applications and Usage

A GUIDE FOR FOOD PROFESSIONALS

# A World Crop

World production of hazelnuts averages nearly one million tons each year, ensuring ample supply to meet food industry needs. Hazelnuts (*Corylus avellana*), also called Filberts, are grown in many countries including Turkey, Italy, Spain, and the United States. The size of the crop varies slightly each year by country. Generally, Turkey supplies 74% and the United States 5% of the world's hazelnuts. Here is a summary of the 2003 hazelnut crop.





*round or oblong shape*



*brown skin, tan interior*



*mild, sophisticated flavor*



*crisp, crunchy texture*

## SHAPE

All shapes provide high quality monounsaturated fats. Uses of the nuts vary with the shape, but the predominant varieties used by the baking, dairy and confections industries are round, which have less loss of kernel during shelling.

Hazelnuts can be round and spherical or oblong and pointed in shape depending on the variety. Round hazelnuts have high fat levels and their skins are easy to remove with blanching. The Turkish varieties include Giresun, Tombul, Palaz, Mincane, Fosa, Cakildak and Kara Findik. The most common variety used for kernels in Oregon is the Barcelona, which does not lose its skins as readily as others, and Ennis, which is predominately used inshell. Several newer varieties blanch well.

Oblong and pointed hazelnuts are longer in shape and have lower oil content, which makes their skins harder to remove. The lower oil nuts work well in confections as they bind better with chocolate coatings. These varieties include Sivri and Incekara and they are grown in Giresun and Trabzon in Turkey. The Badem variety is not suitable for cracking or processing and is sold to consumers inshell. Its varieties include Yuvarlak, Badem and Yassi Badem. Fosa is a larger, round hazelnut primarily used inshell.

## COLOR

Natural hazelnut kernels have red brown to dark brown skin with a cream to tan colored interior. If they are blanched, the dark skin is removed and the nuts are cream to tan colored.

## FLAVOR

Hazelnut's flavor is mild, deep and sophisticated. Its flavor notes are described by trained tasting panels as sweet, fruity, chocolate-like, coffee, floral, rich, nutty, woody, green grassy, smoky and rose-like. The mild flavor of hazelnuts is found in the carbohydrate fraction, rather than in the fat. As a result, the flavor is more easily extracted and concentrated. Hazelnut flavor is created by a combination of pyrazines, aldehydes, ketones, pyrroles and terpenes. Roasting, chopping and grinding increases the volatile flavors, including aldehydes, alcohols, aromatic hydrocarbons, terpenes, furans, ketones, pyrazines and pyrroles.

Consumers describe hazelnut flavor as exotic, deep, old world, and smooth. Because of their slightly sweet, rich flavor, hazelnuts are compatible with a wide variety of foods and can be substituted for any other nut in a recipe.

## TEXTURE









The moisture content of natural, unroasted hazelnuts is typically 5-6% and their texture is soft and slightly crunchy. After roasting, moisture is reduced to about 2% and the texture is crisp and crunchy, making the nuts compatible with confection, ice cream and bakery products as well as main dishes, salads and side dishes. Hazelnut's crisp texture can be maintained by coating with sugar, chocolate, fat or edible shellacs and waxes. With their low moisture content, hazelnuts are an ideal addition to chocolate and other fat-based confections and baked items. Hazelnut butter and paste have a smooth, silky texture.



# Forms of Hazelnuts



*inshell whole diced sliced meal paste pieces*

FORMS	DESCRIPTION	FUNCTION	APPLICATIONS
 <b>Inshell</b>	<ul style="list-style-type: none"> <li>•Hazelnut with shell intact surrounding the kernel.</li> </ul>	<ul style="list-style-type: none"> <li>•Longer shelf life</li> </ul>	Snacks—partially cracked, salted and roasted
 <b>Whole Kernel</b>	<ul style="list-style-type: none"> <li>•Natural: Kernel with brown skin attached</li> <li>•Blanched: Kernel with skin removed</li> <li>•Dry roasted: Natural or blanched and roasted</li> <li>•Oil roasted: Blanched, roasted and salted</li> </ul>	<ul style="list-style-type: none"> <li>•Nut recognition</li> <li>•Garnish for baked goods and confections</li> <li>•Crisps texture</li> <li>•Lower oil varieties bind best with chocolate coatings</li> </ul>	Bakery, Confections, Snacks
 <b>Diced</b>	<ul style="list-style-type: none"> <li>•Produced to manufacturer's specifications</li> <li>•Small 1/8"</li> <li>•Medium 3/16"</li> <li>•Large 5/16"</li> <li>•Diced 1mm-12 mm</li> </ul>	<ul style="list-style-type: none"> <li>•Even nut distribution</li> <li>•Uniform flavor, texture, appearance</li> <li>•Stronger flavor</li> <li>•Darker color</li> <li>•Visual appeal</li> <li>•Crunchy texture</li> </ul>	Bakery, Cereals, Confections, Snacks, Ice Cream
 <b>Sliced</b>	Whole nut thinly sliced lengthwise	<ul style="list-style-type: none"> <li>•Nut recognition</li> <li>•Contrast for flavor</li> <li>•Crunchy texture</li> <li>•Garnishing</li> </ul>	Low-calorie entrees, Bakery & Toppings, Cereals, Snacks, Confections
 <b>Meal / Flour</b>	Finely ground to 0.08 inches or 2 mm; free flowing	<ul style="list-style-type: none"> <li>•Flour replacer</li> <li>•Binding agent</li> <li>•Flavoring agent</li> </ul>	Bakery, Fillings & Sauces, Snacks, Low Carb Foods, Health Foods, Confections, Ice Cream
 <b>Hazelnut Praline*</b> (with sugar)	<ul style="list-style-type: none"> <li>•Sweetened mixture of ground roasted hazelnuts and sugar</li> <li>•Spreadable but grainy</li> <li>•Light, medium, dark roast</li> </ul>	<ul style="list-style-type: none"> <li>•Adds body, sweetness, flavor and moisture</li> <li>•Lowers melting point of chocolate for a creamier mouthfeel</li> </ul>	Bakery Fillings, Toppings, Confections, Ice Cream
 <b>Hazelnut Paste**</b> (without sugar)	<ul style="list-style-type: none"> <li>•Finely ground roasted hazelnuts to 25 +/- 5 microns</li> <li>•Consistency like natural peanut butter</li> <li>•Must contain at least 90% nut content (CFR 164.150)</li> </ul>	<ul style="list-style-type: none"> <li>•Adds flavor, richness and protein content</li> <li>•Lowers melting point of chocolate for a creamier mouthfeel</li> <li>•Replaces carbohydrates</li> </ul>	Confections, Bakery & Icings, Entrees, Sauces, Fillings, Ice Cream
 <b>Broken or Bits and Pieces</b>	Whole nuts, halves and smaller pieces	Same as diced	Same as diced

\*May also be called "paste" depending on country of origin.

\*\*May also be called "butter" depending on country of origin. The term "butter" is only used in the U.S. due to familiarity with peanut butter.



# Grades and Standards

As the largest producer of hazelnuts, Turkey has its own standards for in shell (TSE 3074), shelled (TSE 3075) and processed (TSE 1917). All exported goods must conform to the Turkish standards as well as USDA standards. Additionally, Turkish exporters have been producing products according to the regulations of the importing country and the importer's special specifications.

The U.S. also has standards for both inshell and shelled hazelnuts. The USDA inspects all imported hazelnuts prior to entering into the United States.

## INSHELL GRADE AND SIZE REQUIREMENTS

Grades are determined primarily by size, degree of kernel fill, color and freedom from defects and foreign material. U.S. No. 1 must contain: U.S. No. 1 or better, at least medium size, <20% hazelnuts of a different type (round vs. long type), <10% defective nuts, provided that <5% are poorly filled and <5% are rancid, decayed, moldy or insect injured; and <3% insect injured. Additionally, <15% can be off size with <10% undersized.

## SHELLED GRADE AND SIZE REQUIREMENTS

U.S. No. 1 shelled hazelnuts must be well dried and clean, free from foreign material, mold, rancidity, decay or insect injury and free from serious damage caused by shriveling and other means. Tolerances for shelled hazelnuts include not more than 0.02 of one percent (0.0002%) foreign material, not more than 5% kernels below grade, including not more than 2% for mold, rancidity, decay or insect injury, and no more than 1% with rancidity or insect injury. (See 7 CFR 999.400 or Agricultural Marketing Agreement Act, as amended (7 U.S. C. 601-674).

## KERNEL SIZE STANDARDS

TURKISH		DOMESTIC	
Standard 1	13-15mm	Giant	16mm
Standard 2	11-13mm	Jumbo	15-17mm
Standard 3	9-11mm	Extra Large	14-16mm
F.A.Q.	9-16mm	Large	13-15mm
Piccolo, small	<9mm	Medium	12-14mm
		Small	11-13mm
		Whole & Broken	NA



## FORMULATION CONVERSIONS

1 lb. inshell hazelnuts = 1½ cups kernels

1 lb. hazelnut kernels = 3¼ cups

1 cup hazelnut kernels = 1⅛ cups coarsely chopped  
or  
1¼ cups finely chopped  
or  
1⅓ cups meal

# Hazelnut Processing



## SPECIFICATIONS

### PHYSICAL

Color	Reddish brown
Flavor	Free from musty or off odors
Moisture	6% maximum (7% max. TSE 3075)
Raw nuts	4% - 6% (Blanched 5%)
Roasted nuts	1.5% - 3%
Water Activity (aw)	0.46 to 0.49 at sale point*

### MICROBIOLOGICAL

TBAC	≤ 100/g (20000 gr/Max)
E-coli	≤ 10/g (Negative)
Yeast & Mold	≤ 100/g
Salmonella	Negative
Coliform	≤ 100/g
Aflatoxin	10 ppb

## HARVESTING

Hazelnuts are harvested from late August through October. Harvesting methods vary with the country of origin. Once collected, the nuts are delivered to a processing facility where they are cleaned and dried.

## DRYING

Processors focus on air-drying with ambient or mild warming immediately after harvest to bring nuts to uniform 4% to 6% moisture. This is important as prolonged exposure to higher moistures can reduce the storage life by initiating enzymatic hydrolysis of fat, which leads to the development of off-flavors. To dry, nuts are held several layers deep for 2 to 4 weeks in a warm dry place, stirring daily, or the nuts are placed in food dryers at 90°F to 105°F for 2-3 days. After drying, the nutmeat becomes firm with a cream colored center. No chemicals are used in processing.

## SHELL REMOVAL

In the sheller, shells are cracked and the kernels separated from the shells and sorted by size and grade. The nuts are packaged using oxygen barrier packaging material, nitrogen flushing or vacuum packing, and stored in cool dry storage.

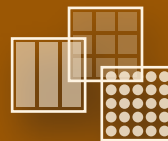
## ROASTING

**Dry Roasting:** Most processors dry (oven) roast. Hazelnuts may be roasted in small batches, on continuous belt roasters, or in roasting drums. Typically, processors utilize high capacity equipment capable of 1,000-3,000 pounds per hour. In general, longer roasting residence times and moderate roasting temperatures, 275°F to 295°F, are preferred for optimum shelf life. The length of roast time is determined by the thickness of the nut bed. Most hazelnut applications use a light to medium roast to provide subtle flavor. The ice cream industry, however, uses a dark roast to add a rich, roasted flavor.

Studies show the higher the roast temperature, the shorter the shelf life of hazelnuts. The amount the shelf life decreases varies with the roasting temperature and oven dwell time. A light roast has a longer shelf life than a



*roasting*



*milling*



*packaging*



dark roast and can last up to one year, depending on the storage environment. The darkest roasts, used in ice creams, have a shelf life of about 6 months. (However, ice cream's frozen environment helps extend the shelf life longer than ambient temperatures.) Care must be taken to balance these effects and optimize the flavor properties while maintaining conditions for a good shelf life.

Establishing the optimal roasting temperature and moisture is critical to efficient roasting and long shelf life. Work at the Swiss Federal Institute of Technology in Zurich on BARTH equipment found a two-step roasting process yielded desirable roasted flavor while maintaining a higher quality for longer shelf life. Roasting was shown to increase the size of intracellular pores thereby increasing oxygen transfer. The two-step roasting process kept the cell's pore size increase minimal for an optimal roasted quality. The best results were obtained using mild temperature in the first step followed by longer and higher temperatures. (R. Perren, "Investigations on the hot air roasting of nuts" 51st PMCA, 1997).

Several changes occur in the nuts during roasting. The hazelnut flavor intensifies, color develops (browning reaction), and moisture decreases to 1.5% to 3%. The time and heat conditions in the blancher/roaster determine the amount of color development or "degree of roast." During roasting, fat within the hazelnut cells is exposed to oxygen, which can lead to oxidative rancidity over time. Thus, roasted nuts have a shorter shelf life than natural nuts and require protection from oxygen. Cooling and packaging should be done as fast as possible, within 2-3 days of roasting, using oxygen barrier packaging techniques for the longest shelf life. It is best to roast hazelnuts just before using in the product. Never reroast the nuts, rather, order them roasted in the form needed. If you prefer to roast yourself, order natural kernels and roast them just before use. The nutritional values are not appreciably different between natural and roasted hazelnuts.



**Blanching:** Blanching removes the skin by using a heat application. Heating loosens the nut's skin and continuous movement of one nut against another along with the action of rubber brushes/rollers causes the skins to slough off when removed by vacuum. Blanching starts the oxidative process, as skins are a natural barrier to oxygen. No chemicals are used in blanching.

**Oil Roasting:** Hazelnuts, a soft nut, take on the flavor of the roasting oil. It is important to use light, clean tasting vegetable oils such as soybean or Canola to produce high quality products. Different oils destabilize and break down at different rates. Hydrogenated oils are more stable and salt adheres better to nuts roasted in these oils compared to liquid vegetable oils.

As the skins may loosen and come off in the oil, blanched hazelnuts are more commonly used in oil roasters. Typically, hazelnuts are roasted at 280°F-300°F. The desired color is determined by the residence time in the oil. Oil roasting is faster than dry roasting due to the oil's heat capacity. Roasting times vary with the nut's size, type of roaster and oil temperature. Cooling and salting immediately follow roasting.

### COOLING

It is important to cool hazelnuts to ambient temperature (70° F) as quickly as possible after roasting, ideally within one hour. The nut's high fat content retains heat from roasting. Cooling is the critical last step in the roasting process. There are different methods of cooling, including high velocity air or refrigerated cooling. Failure to adequately cool the nuts results in continued moisture loss, color darkening and off flavor development.

### BENCH TOP ROASTING

Preheat a conventional oven to 275°. Place shelled, natural hazelnuts in a single layer on a non-greased baking sheet. Bake for 20 to 30 minutes until the skins crack and nutmeats turn a light golden color. Remove nuts from the oven, pour into a bowl, cover and steam for 4 to 5 minutes. Place hazelnuts in a clean terry-cloth towel and rub vigorously for 1 to 3 minutes or until most of the skin is removed.



## SLICING, DICING, AND GRINDING

Hazelnuts can be sliced, diced or ground to a flour/meal to a manufacturer's specification. A smaller grind is less stable with a shorter shelf life than a larger dice. Processors protect the nut's quality by minimizing the use of high heat steps prior to slicing or dicing. When slicing, dicing or grinding, hazelnuts are heated to a moderate temperature allowing them to become more flexible and minimize breakage. After processing, the nuts are quickly cooled and packaged in protective packaging for storage. Most suppliers package processed kernels into vacuum packed cartons.

## PASTE, BUTTER AND PRALINE

To make a paste or butter, roasted hazelnuts are milled to particle sizes of 25 +/- 5 microns. In the U.S., butters are natural nuts without any added sugar. In Europe, this product is generally called paste. In the United States, pastes are blended with sugar and other ingredients and may have a grainier mouthfeel. In Europe, a hazelnut product with sugar is generally called praline.

## PACKAGING

Hazelnuts are packaged in a variety of case sizes or high-barrier plastic or "foil" bags to protect the kernels from oxidative rancidity and increase the shelf life. Interior oxygen impermeable packaging options include poly-lining. Vacuum packaging, nitrogen flushing or oxygen scavenging packets also help protect the nuts.

## STORAGE CONDITIONS AND SHELF LIFE

Store hazelnuts in a cool, dry place, 50°F or lower, to protect from insect pests and extend shelf life. Keep away from light such as ultraviolet light, which accelerates unsaturated oil rancidity, and store in moderate relative humidity of 60-65RH. Moisture increases sugar levels, accelerates oxidation, increases microbial problems and decreases eating quality. Hazelnuts are high in oil and easily absorb odors from other products such as vegetables, garlic, spices and coffee. Avoid storage locations with strong odors, particularly for nuts packaged in bulk bags without plastic liners. Storing in airtight closed containers helps reduce oxygen availability, insect injury and the possibility of absorption of flavors from other products.

The finished product shelf life depends upon care taken during processing and storage. Shelf life is decreased by rancidity, caused by the presence of free fatty acids or exposure to heat, light and moisture. Rancidity causes unpleasant off-tastes and odors. Fortunately, hazelnuts have low moisture and high vitamin E levels to help resist oxidation and rancidity. Their low water activity and moisture promote bacteriological and texture stability.



## HAZELNUT SHELF LIFE

FORM	VACUUM BAGS, AMBIENT	VACUUM BAGS, REFRIGERATED
Inshell	24 months	24 months
Shelled, natural	12-18 months	18-24 months
Shelled, blanched	12-18 months	18-24 months
Shelled, roasted	12-18 months	18-24 months
Shelled, chopped/diced/sliced	12 months	12 months
Praline* (with sugar)	Store refrigerated	12 months
Paste** (without sugar)	Store refrigerated	12 months

\*May also be called "paste" depending on country of origin    \*\*May also be called "butter" depending on country of origin



## HAZELNUTS AND ALLERGY

One area of concern is the potential, inadvertent introduction of an allergenic ingredient to a food, which can occur when one line is used to produce two food products, one with nuts, one without. Allergens can also be introduced through reworked material. Manufacturers must take all steps necessary to eliminate cross contamination and ensure accurate labeling of all foods. For more information contact The Food Allergy and Anaphylaxis Network (<http://www.foodallergy.org>), the National Food Processor Association ([www.nfpa-food.org](http://www.nfpa-food.org)), or the Grocery Manufacturer's Association at ([www.gmabrands.com](http://www.gmabrands.com)).

## LABELING

The FDA Food, Drug and Cosmetic Act requires a complete listing of all ingredients in a food product. Although there are two very narrow exemptions to this rule, any substance that may cause an adverse reaction is significant, and therefore, must be reported. Tree nuts must always be reported on the label, without exception. For labels, use the common name, hazelnuts. TSE Labeling: product, variety, size, weight, lot number, origin, crop, producer name.



## FDA QUALIFIED HEALTH CLAIM



Scientific evidence suggests  
but does not prove  
that eating 1.5 ounces per day  
of most nuts, such as  
hazelnuts, as part of a diet  
low in saturated fat and  
cholesterol may reduce the  
risk of heart disease.

(SEE NUTRITION INFORMATION FOR FAT CONTENT)



# Hazelnuts and Health



heart healthy, nutrient rich

## QUALIFIED HEALTH CLAIM FOR NUTS

FDA issued notice for a qualified health claim for nuts and reduced risk of coronary heart disease in 2003. The agency authorized the following qualified health claim and disclosure coronary heart disease statement for certain nuts and nut-containing foods.

“Scientific evidence suggests but does not prove that eating 1.5 ounces per day of most nuts, such as hazelnuts, as part of a diet low in saturated fat and cholesterol may reduce the risk of heart disease.”

FDA proposed definitions to distinguish between products which are essentially only nuts and other food products that contain nuts. U.S. manufacturers with products that qualify can take advantage of this health claim. Contact the Hazelnut Council for more information.

## HAZELNUTS & THE DIETARY GUIDELINES FOR AMERICANS

USDA's food guidance system encourages more frequent consumption of nuts. It suggests incorporating 1.5 ounces of healthy nuts, such as hazelnuts, into the diet four to five times per week. Additionally, hazelnuts are specifically called out as a rich source of vitamin E.

## NUTRITION FACTS

Hazelnuts are a nutrient and energy dense food and an excellent source of monounsaturated fats. They are cholesterol free and a good source of dietary fiber, manganese, potassium, copper, thiamin and vitamin B6, as well as Vitamin E, folate and antioxidants.

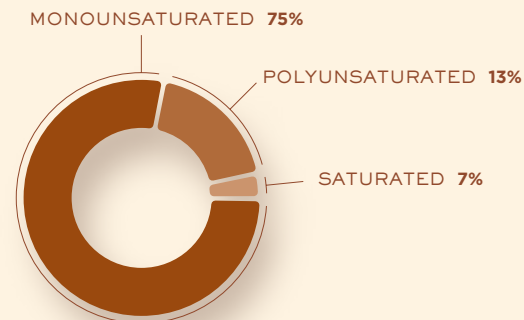
## NUTRITION FACTS FOR ONE OZ. OF HAZELNUTS

NUTRIENT	CONTENT	NUTRIENT	CONTENT
Calories	178	Potassium	193 mg
Protein	4.2 g	Zinc	.69 mg
Total Fat	17.2 g	Copper	.48 mg
Saturated Fat	1.2 g	Manganese	1.7 mg
Monoun-saturated Fat	12.9 g	Thiamin	.18 mg
Polyunsatu-rated Fat	2.2 g	Riboflavin	.03 mg
Cholesterol	0 mg	Niacin	.51 mg
Carbohydrate	4.7 g	Pantothenic acid	.26 mg
Fiber	2.7 g	Vitamin B6	.16 mg
Calcium	35 mg	Folate	32 mcg
Iron	1.2 mg	Arginine	.62 g
Magnesium	46 mg	Vitamin K	4 mcg
Phosphorus	82 mg	Vitamin E	4.26 mg
		Total Phytosterols	27 mg

Source: USDA National Nutrient Database for Standard Reference, Release 17, 2004. Nuts are unsalted and unroasted.

g = gram mg = milligram %DV = percent Daily Value mcg = microgram

## FAT CONTENT OF HAZELNUTS





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