Sensory evaluation of different levels of roasting of New Zealand grown hazelnuts

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ABSTRACT

Hazelnuts (*Corylus aveIIana* L.) are a very recent addition to commercial horticulture in New Zealand and Whiteheart has been selected as the primary commercial cultivar. No published information is available on the optimum temperatures needed to roast the dried nuts. An experiment was designed to investigate three different roasting treatments, blanching, light roast and full roast using a conveyer type roasting oven set at 200°C. The roasted samples were then analysed for proximate contents and evaluated using a taste panel. The appearance, texture, flavour and overall appearance was evaluated by 63 tasters at one time. The blanched nut was appreciated for its colour but it was considered too chewy and bland in taste compared to the roasted nuts. Each one of the heat treatments gave an improved rating for all of the attributes measured. Roasting in the oven set at 200°C for 6 minutes (full roast) was the treatment appreciated most by all tasters. Analysis of the correlation coefficients showed that the overriding impression about the hazelnuts comes from the flavour of the nut followed by its texture. The overall appearance of the nut was not highly rated by the tasters once the hazelnuts had been heat treated.

INTRODUCTION

Hazelnuts (*Corylus aveIIana* L.) are widely used as a luxury food especially when incorporated into chocolate confectionary and muesli products. The taste and flavour of hazelnuts is due to the occurrence of several compounds whose presence affects both quality and nutritional value. However, the beneficial characteristics of hazelnuts and hazelnut oil should not be overlooked.

Hazelnuts are a very recent addition to commercial horticulture in New Zealand. Many blocks of trees have been planted in the last 10 years and crops and more than 40 tonnes/annum have been projected for the Canterbury region when the planted crop reaches full production. The aim of this work is to discover the form in which hazelnuts are most preferred to be eaten. This research is concerned with evaluating various levels of roasting of hazels from no roasting to well roasted.

There appears to be no published papers on the sensory evaluation of the different levels of roasting of hazelnuts. In the paper "New hazelnuts selections for direct consumption" Valentini *et al.,* (2001), different hybrids were compared to find the most favoured raw nuts and the most favoured roasted nuts. They were rated on degree of liking alone. In another study McNeil *et al.,* (1994), compared consumer preferences of 22 walnut cultivars. These were compared for taste, aftertaste, flavour strength and sweetness. In a study by Zeppa *et al.,* (2000) Italian and foreign cultivars of hazelnuts were compared by morphological and sensory analysis. Using a taste panel the Lansing 35 selection gave the best results for the fresh hazelnut but Tonda Geentil delle Langhe gave the best overall result for the roasted kernel. The intensity of its sweetness and overall intensity of aroma was the best features of Tonda Geentil identified in the taste test. Sinesio and Moneta (1997) carried out a sensory evaluation of walnuts by geographical region. The seven trained and experience panellists assessed the nuts for external appearance, taste and flavour and oral texture. Only one study involved roasted hazelnuts and this did not compare levels of roasting. There is also a need to evaluate the New Zealand variety Whiteheart as it is a recent selection.

METHODS

Treatments

Twenty kg of hazelnuts (*Corylus aveIIana* L. cv Whiteheart) were harvested from a Canterbury orchard in June 2001. The nuts were dried and stored in their shell at ambient temperatures until the experiment commenced. The kernels were removed from their shells in April 2002 using a Kempe Cracker and the kernels were stored in a sealed plastic bag in a fridge at 4°C until roasting commenced in June 2002.

Some initial experiments took place to identify the temperature/time characteristics of an electric high-intensity infrared conveyer oven (Lincoln Impinger 1300, Fort Wayne, Indiana, USA). In the final experiment the oven was set at 200°C and the degree of roasting was determined by the speed

of the conveyer. 200°C was chosen because temperatures in excess of this scorched the outside of the nuts. Three speed settings were chosen to correspond to the three levels of required roasting:

Blanched – conveyer set to 1.75 min setting
Light roast – conveyer set to 5 min setting
Full roast – conveyer set to 6 min setting

The nuts were roasted the day before the sensory evaluation took place and the roasted nuts were put in sealed containers and stored overnight at 4°C. The kernels were placed in an oven for 16 hours at 105°C to determine their dry matter content (AOAC, 2002).

Taste tests

A sensory evaluation environment was set up with white booths and four small plastic containers to hold each of the four test samples (raw hazelnuts compared with the three levels of roasting) and a glass of water. The containers contained five nuts per cup. The samples were evaluated from left to right and the order was randomised in each booth. The tasters were invited to eat as many nuts as they wished from each treatment then to fill in the evaluation of that nut before moving to the next sample.

The first part of the questionnaire contained questions on factors, which were identified as potentially having an effect on each tasters decision-taking. The factors collected were gender, age, smoker/non-smoker, coffee and tea intake, nationality and previous hazelnut eating experience. For the tasting section a response on a 9-point Hedonic scale was requested (ranging from like extremely, like very much, like moderately, like slightly, neither like nor dislike, dislike slightly, dislike moderately, dislike very much, dislike extremely). This scale was applied to the four nut attributes, namely appearance, texture, flavour and overall impression. The tasters were simply required to tick the appropriate box. The nuts were sampled in a random order and the volunteers were given no information about the samples. The tasters were also encouraged to record their written comments about attribute for each of the treatments. A summary of these comments is shown in Table 2.

Statistical analysis

Demographic information of each of the 63 tasters and their responses for each attribute on the raw and three roasting treatments were recorded and the data from the taste tests were analysed using the GLM procedure (analysis of variance) in SAS V8.2 to determine differences between each treatment. The taster was included as a blocking factor. The factor was not significant for all but the texture result. The Bonferroni (Dunn) t-test at α = 0.05 was used to calculate the LSD.

RESULTS AND DISCUSSION

The 1.75 min conveyer setting supplied just enough heat to allow the pellicle to be removed from the raw hazelnuts. A 5 minute conveyer setting changed the nuts to a light brown colour and produced a crisper texture in the nuts. Six minutes of cooking caused the nuts to brown further; cooking beyond 6 minutes caused the hazelnuts to begin to burn. The moisture level of the raw nuts was 4.5% and after roasting for 6 minutes the level dropped to 1.5%.

Table 1: Taste test values for each attribute at each level of roasting, (mean ± S.E.),

Treatment	Appearance	Texture	Flavour	Overall impression
Raw	6.0 b ± 0.21	5.4 c ± 0.22	5.8 c ± 0.26	5.7 c ± 0.24
Blanch	6.1 b ± 0.19	6.4 b ± 0.18	6.2 bc ± 0.22	6.3 bc ± 0.18
Roast 5 minutes	6.5 ab ± 0.18	7.0 ab ± 0.15	6.7 ab ± 0.18	6.6 ab ± 0.18
Roast 6 minutes	6.9 a ± 0.20	7.5 a ± 0.14	7.1 a ± 0.23	7.2 a ± 0.20
p =	0.005	<0.001	0.001	<0.0001

Different letters within each attribute indicate significant differences between treatments (Bonferroni t-test at α = 0.05)..

The results in this table show a remarkably consistent pattern. Without exception, as the treatment level increased so did the score for each of the four attributes. All but five of the 63 tasters made some comments about the nuts on their evaluation sheets and these are summarised in Table 2.

The numbers in the table relate to the number of tasters who made that comment. Again, the comments give a clear picture. They also give a rationale for the consumer preferences. A raw hazelnut is generally not liked as much as a roasted hazelnut. This is in spite of a majority of the tasters liking the appearance of the skin. A common comment was the bitterness of the skin and the difficulty in chewing it.

The blanched nut was appreciated for its white colour but was considered too chewy and bland. These factors led to a low overall impression of the blanched nuts. The light roast and the full roast nuts received similar comments. The full 6-minute roasted nuts were more appreciated for each attribute except for its overall impression. It is unclear why more tasters commented positively on the light roast than the full roast in this category, though many of those who did comment on the full roast said they were the best tasting nuts. Both treatments of the nuts were considered to have a good appearance, a number of tasters commenting that this was how a hazelnut should look. A few tasters felt the nuts looked burnt. Many tasters commented on how they liked the crunchy texture. Comments supported the tasters liking for the flavour of the roasted nuts. There was a particularly strong response for the flavour of the full roast nuts. Though the majority wrote comments on just a few categories, more than 50% felt strongly enough to comment on the good flavour of the full roast nuts. An unavoidable complication of the tasting session was that some individual nuts were rancid and these could not be identified before the tasting session commenced. The negative feedback from a few of the tasters regarding flavour of some of the nuts was almost certainly due to this occurrence. It should be noted that the occurrence of individual rancid nuts would be expected to occur in equal numbers across the raw and three roasting methods.

Table 2: Summary of the main comments made by the tasters.

Appearance	Raw	Blanched	Light roast	Full roast
Liked the colour	12	10	11	13
Don't like the colour	9	6	4	4
Texture				
Crunchy and crisp	0	4	22	25
Chewy/stuck in teeth	29	8	0	0
Dry	0	2	2	0
Oily	0	1	1	1
Smooth	0	3	4	0
Flavour				
Nice strong flavour	5	10	17	32
No flavour	9	9	1	1
Bad flavour/bitter	11	3	6	4
Raw	0	3	0	0
Overall				
Best	0	1	4	6
Good	1	0	13	8
OK	0	5	0	2
Bad	15	6	2	3
Taste resembled:	peanuts	peanuts	almonds	hazelnuts
		walnuts	eggs	cashews (2)
				peanuts

CONCLUSIONS

The Whiteheart cultivar of hazelnuts has been selected to be the main commercial cultivar in New Zealand. This experiment showed that the blanched nut was appreciated for its colour but it was considered too be chewy and bland in taste compared to the roasted nuts. Each heat treatment received an improved rating for all of the attributes measured. Roasting in the oven set at 200°C for 6 minutes (full roast) was the most appreciated treatment by all of the tasters. Analysis of the correlation coefficients showed that the overriding impression of the hazelnuts comes from the flavour of the nut followed by its texture. The overall appearance of the nut was not highly rated by the tasters once the hazelnuts had been heat treated.

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