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REGULAR ARTICLE

TEXTURE OF COOKED SPELT WHEAT NOODLES

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ABSTRACT

At present, there are limited and incomplete data on the ability of spelt to produce alimentary pasta of suitable quality. Noodles are traditional cereal-based food that is becoming increasingly popular worldwide because of its convenience, nutritional qualities, and palatability. It is generally accepted that texture is the main criterion for assessing overall quality of cooked noodles. We present selected indicators of noodle texture of three spelt cultivars – Oberkulmer Rotkorn, Rubiota and Franckenkorn grown in an ecological system at the locality of Dolna Malanta near Nitra. A texture analyzer TA.XT PLUS was used to determine cooked spelt wheat noodle firmness (N) (AACC 66-50). The texture of cooked spelt wheat noodles was expressed also as elasticity (N) and extensibility (mm). Statistical analysis showed significant influence of the variety and year of growing on the firmness, elasticity and extensibility of cooked noodles. The wholemeal spelt wheat noodles were characterized with lower cutting firmness than the flour noodles. Flour noodles were more tensile than wholemeal noodles. The best elasticity and extensibility of flour noodles was found in noodles prepared from Rubiota however from wholemeal noodles it was Oberkulmer Rotkorn. Spelt wheat is suitable for noodle production, however also here it is necessary to differentiate between varieties. According to achieved results, wholemeal noodles prepared from Oberkulmer Rotkorn can be recommended for noodle industry due to their consistent structure and better texture quality after cooking.

Keywords: noodles, spelt, texture, firmness, elasticity, extensibility

INTRODUCTION

Noodles are traditional cereal-based food that is becoming increasingly popular worldwide because of its convenience, nutritional qualities, and palatability. At present, there are limited and incomplete data on the ability of spelt to produce alimentary pasta of suitable quality (**Marconi *et al*., 2002; Cole, 1995**). It is generally accepted that texture is the main criterion for assessing overall quality of cooked noodles (**Dziki and Laskowski, 2005; Manthey and Dick, 2012**). Proper evaluation of noodle cooking quality requires consideration a number of factors including elasticity, firmness, surface stickiness and cooking tolerance. Taste panels can be used to estimate pasta cooking quality, but they are time-consuming and impractical when sample size is limited or large numbers of samples are to be evaluated (**Borneo and Aguirre, 2008; Wood, 2009; Smewing, 1997**). In response to these constraints, a number of instrumental methods have been developed that successfully estimate cooked noodle texture parameters (**Petitot *et al*., 2010; Brennan *et al*., 2003; Oh *et al*., 1983**). The objective of this study was to determine the texture of cooked spelt wheat noodles.

MATERIAL AND METHODS

Selected indicators of noodle texture of three spelt cultivars – Oberkulmer Rotkorn, Rubiota and Franckenkorn grown in an ecological system at the locality of Dolna Malanta near Nitra are presented. A TA.XT PLUS (texture analyzer equipped with a 5-kg load cell) was used to determine cooked spelt wheat noodle firmness (N) (AACC 66-50). The strain of 100% ensured that the blade would pass through the core of strip. This destructive method use a knife blade to measure the force required to cut noodle strip. Noodle firmness was defined as the height of the force peak (N), which is analogous to maximum cutting force. The texture of cooked spelt wheat noodles was expressed also as elasticity (N) – the maximum tension force and extensibility (mm) – the distance at which was noodle strip ruptured. They were evaluated in ten replicates and the results presented are means of the ten realized measurements. Obtained data were statistically evaluated by analysis of variance (ANOVA), LSD test was used to determine the significance of differences between the means. Significance level was $P<0.05$.

RESULTS AND DISCUSSION

It is generally accepted that texture is the main criterion for assessing overall quality of cooked noodles. The consumer preferences differ according to their cultural mostly individual habits (**Edwards *et al.*, 1993**). Texture measurement is based on subjective (sensorial) as well as objective (instrumental) methods (**Martinez *et al.*, 2007; Epstein *et al.*, 2002**). The quality of cooked noodles was in our study determined by three different instrumental methods, where the firmness, elasticity and extensibility were analysed.

The average firmness of cooked flour spelt wheat noodles measured as maximum cutting force was 1.55 N (Tab 1) and ranged from 1.46 N (Oberkulmer Rotkorn) to 1.69 N (Rubiota). Statistical analysis showed significant influence of the variety and year of growing on the firmness of cooked noodles. More firm were cooked noodles prepared from flour than from wholemeal (Tab 2). The average firmness of wholemeal noodles was 1.45 N. The highest firmness was found in Rubiota, in both flours.

Table 1 Texture analysis of spelt wheat flour noodles, average values for 2008-2009

VARIETY	Firmness (N)	Elasticity (N)	Extensibility (mm)
Oberkulmer Rotkorn	1.46 a	0.51 b	33.79 b
Rubiota	1.69 b	0.59 c	38.41 c
Franckernkorn	1.50 a	0.39 a	28.05 a
YEAR			
2008	1.67 b	0.60 b	35.11 b
2009	1.43 a	0.39 a	31.72 a
AVERAGE	**1.55**	**0.50**	**33.42**
standard error	±0.21	±0.15	±5.44

Tension is defined as a force normal to surface on which it acts, and directed outwards from the body. The maximum force is the tensile strength of the material. Fracture begins with a small crack that slowly spreads across the sample over a comparatively long period of time and the crack may not be perpendicular to the plane of the applied tension. Tensile test measure the adhesion of a food to a surface. Tensile tests are not widely used with foods, which is understandable because the process of mastication involves compression, not tension, of the food between the molars. The advantage of tensile testing over compression is

that the start of fracture can be observed easily because is nearly always at the outside of the sample, while with uniaxial compression the start of fracture is often inside the test-piece (**Manthey and Dick, 2012**). When the elastic limit was exceeded the noodle snapped (observed as the maximum tension force). The distance at which the noodle snaps is measure of noodle extensibility. The average elasticity of cooked flour noodles was 0.50 N and ranged from 0.39 – 0.59 N (Tab 1). Maximum 0.59 N was found in Rubiota. The elasticity of flour cooked noodles was higher than in wholemeal noodles (Tab 2). Most elastic wholemeal noodles was prepared from Oberkulmer Rotkorn. The less elastic wholemeal noodles were prepared from Franckernkorn.

Table 2 Texture analysis of spelt wheat wholemeal noodles, average values for 2008-2009

VARIETY	Firmness (N)	Elasticity (N)	Extensibility (mm)
Oberkulmer Rotkorn	1.46 b	0.49 c	32.76 c
Rubiota	1.63 c	0.46 b	31.32 b
Franckernkorn	1.27 a	0.35 a	28.44 a
YEAR			
2008	1.38 a	0.41 a	27.84 a
2009	1.53 b	0.44 b	33.83 b
AVERAGE	**1.45**	**0.43**	**30.84**
standard error	±0.19	±0.07	±3.99

The average flour extensibility was 33.42 mm and ranged from 28.05 mm (Franckernkorn) – 38.41 mm (Rubiota). The noodle extensibility was influenced by variety and year of growing. Lower noodle extensibility was measured in wholemeal noodles due to not so compact noodle structure, as particle size distribution of the wholemeal was not so homogenous than in flour noodles **(Ross, 2006; Edwards *et al*., 1995**). The extensibility of wholemeal noodles of Franckernkorn was low; it did not reach 30 mm.

CONCLUSIONS

Statistical analysis showed significant influence of the variety and year of growing on the firmness, elasticity and extensibility of cooked noodles. The wholemeal spelt wheat

noodles were characterized with lower cutting firmness than the flour noodles. Flour noodles were more tensile than wholemeal noodles.

The best elasticity and extensibility of flour noodles was found in noodles prepared from Rubiota however from wholemeal noodles it was Oberkulmer Rotkorn. Spelt wheat is suitable for noodle production, however also here there is a choice differentiate between varieties. According to achieved results, wholemeal noodles prepared from Oberkulmer Rotkorn can be recommended for noodle industry due to their consistent structure and better texture quality after cooking.

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