

# Sensory Evaluation of Meatballs with Jerusalem Artichoke (*Helianthus tuberosus* L.)

I. Gedrovica, and D. Karklina

**Abstract**—Meat and meat products for human consumption are one of main sources of protein, amino acids, fatty acids, vitamins, and minerals. Popular variety of meat product is meatballs, which can be enriched with valuable product – Jerusalem artichoke powder, made from dried and grinded Jerusalem artichoke tubers, it is raw material with low-calorie, low fat, rich in dietary fibres, minerals, and vitamins. The results of this study indicate that that people could accept the new product - meatballs with Jerusalem artichoke powder and Jerusalem artichoke powder is suitable for meatballs preparation, in result them is possible to improve meatballs sensory and physical properties.

**Keywords**—Meatballs, Jerusalem artichoke powder, sensory evaluation.

## I. INTRODUCTION

MEAT and meat products are important part of people diet. Meat was considered a highly nutritious food, highly valued and associated with good health and prosperity. Meat for human consumption is one of main sources of protein, amino acids, fatty acids, vitamins, and minerals. The quality of meat is characterised by its chemical composition. Meat protein has a higher biological value than plant protein as some of the amino acids are limiting in plant protein. The use of meat stimulates appetite and creates feeling of satiety [1].

Meat can be prepared in numerous ways, as steaks, in stews, fondue, as dried meat, salami, and used for sausages forming [2]. Popular variety of meat use is mincemeat preparing. Mincemeat is typical base for making meatballs. Classical recipe of meatballs preparing in Latvia include white bread, which is not so high- quality product and its function in meatballs is increasing of mass of finished product and moisture content maintenance. White bread could be replaces by other, with higher value, product, which carry out the same function in meatballs, for example, Jerusalem artichoke powder.

Jerusalem artichoke (*Helianthus tuberosus* L.) is part of the sunflower family and isn't related to globe artichokes. It looks similar to ginger, has a rich nutty flavour and can be eaten either raw or cooked [3].

In the world widely known product is Jerusalem artichoke powder obtained by drying and grinding of Jerusalem

artichoke tubers. Jerusalem artichoke powder containing high amount of dietary fibre - non-starch dietary fibre - 14 %, and inulin – 59 % [4], also minerals, and vitamins, it does not contain bitter taste and has pleasant, slightly sweet taste [5]–[7]. Jerusalem artichoke powder is raw material with low-calorie diet and low fat [6], used in various dishes and food preparation.

Experiments made in Russia showed that Jerusalem artichoke powder can be successfully used in production of sausages, increasing their nutritional value and physical properties [8]. Replacing 5% of mechanically separated meat with 5% of Jerusalem artichoke powder, improves fat – protein ratio, increasing the water content maintenance by 2.9%, also increase mass of finished product by 4.9%. Jerusalem artichoke powder increase minerals and amino acids content in sausages, as well as preventing the development of pathogens microorganisms, in resulting them is extended storage time of doctor sausages up to six days.

Information of the other studies in which Jerusalem artichoke powder is used for meat products preparation and what is the sensory evaluation of those products is missing. The sensory analysis of foods plays an important role in the food industry, especially for new products. Meatballs, in which white bread was replaced with Jerusalem artichoke powder nutrition value increased, also sensory evaluation was changed.

The objective of this work was to investigate sensory qualities of newly formulated meatballs in which the Jerusalem artichoke powder was used as the replacement of white bread.

## II. MATERIALS AND METHODS

Experiments were carried out in the Sensory Laboratory of Food Evaluation and Laboratory of Food Analysis at the Department of Food Technology at the Latvia University of Agriculture in 2012.

For experiments were used three kinds of samples: control sample and two kinds of samples with Jerusalem artichoke powder. Meatballs prepared using classical recipe (beef, pork, white bread, onion, water, salt, and spices) and technology, were used as a control sample. In samples with Jerusalem artichoke white bread was substituted with Jerusalem artichoke powder in concentrations – ½ of planned amount of white bread (T2) and ¼ planned amount of white bread (T1).

Acceptability test and product profiling is used for sensory evaluation of new formulated meatballs.

The acceptability on overall liking of the meatballs with Jerusalem artichoke powder was evaluated by 50 male (n = 10) and female (n = 40) panellists of age between 23 and 64.

I. Gedrovica is with the Faculty of Food Technology, Latvia University of Agriculture, Jelgava, Latvia, LV-3001 (e-mail: Ilga.Gedrovica@llu.lv).

D. Karklina is with the Faculty of Food Technology, Latvia University of Agriculture, Jelgava, Latvia, LV-3001 (e-mail: Daina.Karklina@llu.lv).

Publication and dissemination of research results has been made due to the funding of the ERAF Project „Promotion of scientific activities of LLU”, Contract Nr. 2010/0198/2DP/2.1.1.2.0/10/APIA/VIAA/020.

Each panellist was served with 3 samples. Meatballs were offered to consumer for sensory evaluation using 9-point hedonic scale to determine consumer degree of liking each kind of samples. That is, 9 – extremely like, 5 – neither like nor do dislike, and 1 – extremely dislike [9, 10].

The sensory profiles of meatballs with Jerusalem artichoke powder was evaluated by experts ( $n = 20$ ). Descriptors, description and references were constructed by panel. The descriptors included appearance, aroma, taste, texture, colour, juiciness. The structured 5 point scale (0 - insufficient quality, 5 - very good quality) was used in scoring the quality of each attribute [10].

The results were processed by mathematical and statistical methods. Data were subjected using one way analysis of variance (ANOVA) and Two-Factor without Replication analysis of variance (ANOVA) using the statistical analysis software SPSS 17.0 for Windows, significance was defined at  $p < 0.05$ .

### III. RESULTS AND DISCUSSION

The acceptance test for experimental samples has been done by a hedonic scale and results ranged from 7 till 8, it means, “average like” – “like very much”, and overall sensory quality of meatballs was 7.3. The results of sensory evaluation with acceptability test show that there is no significant difference between experimental samples ( $p < 0.05$ ), but there can observe some tendency.

The result of control was 7.3, but meatballs, where half of planned amount of white bread was substituted with Jerusalem artichoke powder (T2) get assessment 7.2. The highest sensory evaluation was for meatballs, which contain Jerusalem artichoke powder in concentration one fourth of planned amount of white bread (T1). The results of sensory evaluation with acceptability test for all samples are demonstrated in Fig. 1.

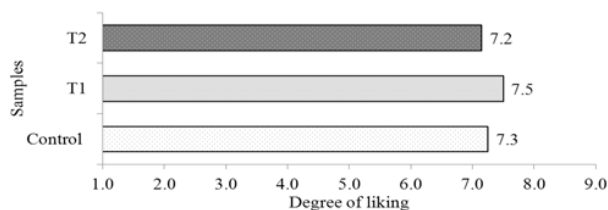


Fig. 1 The results of consumer evaluation of meatballs with Jerusalem artichoke powder using a structured 9-point hedonic scale

Mean age of panellists was 39.9 years. General Linear Model tests showed that gender and age has no significant influence on the sensory evaluation of meatballs ( $p < 0.05$ ).

Results of acceptance test show that consumers like almost all samples equally; it means that the Jerusalem artichoke powder can be used in the preparation of meatballs.

Experts was defined the product profile in sensory evaluation of experimental meatballs. The results of experts' evaluation are shown in the star diagram (Fig. 2).

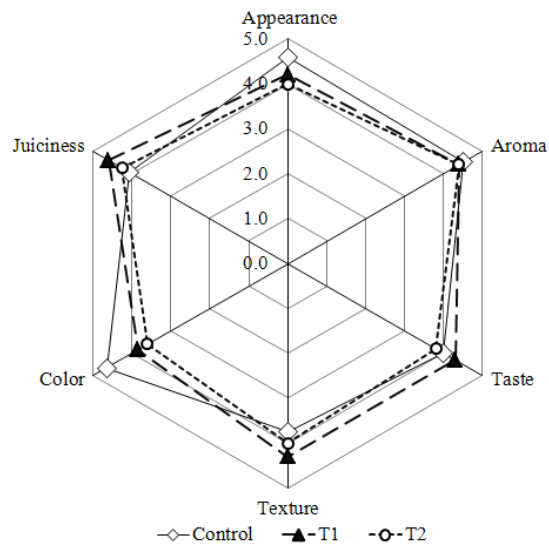


Fig. 2 The results of experts' evaluation of meatballs with Jerusalem artichoke powder using a structured 5 - point scale

The obtained results showed that the addition of Jerusalem artichoke powder to meatballs have significant impact on appearance, taste, texture, colour, and juiciness of meatballs ( $p < 0.05$ ). Aroma is only sensory property of meatballs that did not have significant effect of Jerusalem artichoke powder.

Appearance of control sample gets the highest evaluation in comparison with others samples (Fig. 2); it is related with changes of colour of meatballs. Addition of Jerusalem artichoke powder makes the colour of meatballs darker, their colour obtained livid nuance, which did not seem appealing for many evaluators.

Aroma of samples with Jerusalem artichoke powder was pleasant and was evaluated the same as control sample (Fig. 2).

As the experts' evaluation showed that addition of Jerusalem artichoke powder at low concentration to meatballs was resulted in the taste improving (Fig. 2). The high concentration of Jerusalem artichoke powder is not acceptable, because the taste of meatballs become noticeable sweet and nutty, and for many people dislike it.

According to previous studies [8] addition of Jerusalem artichoke powder improves physical properties that was also confirmed in this experiment. Texture becomes more flexible, if Jerusalem artichoke powder is added to the meatballs in small quantities. If the amount of Jerusalem artichoke powder is high, then texture of meatballs get grainy and a little bit tougher than a control sample.

Good quality meatballs should be a juicy. The experts note that meatballs with Jerusalem artichoke powder are juicier than control (Fig. 2). This could be explained with increase in the amount of dietary fibres that holds moisture in meatballs. Sample with lowest amount of Jerusalem artichoke powder showed better result than samples with high concentration of

Jerusalem artichoke powder, which indicates the importance of ingredients optimal concentration.

The sensory evaluation of the meatballs with Jerusalem artichoke powder suggests that people could accept the new product and Jerusalem artichoke powder is suitable for meatballs preparation, in result them is possible to improve meatballs juiciness, to make an interesting texture, and to acquire new taste nuances of meatballs.

#### IV. CONCLUSION

The results of this study indicate that there is no significant difference between meatball samples in the degree of liking. That means that the consumers liked all samples similarly. The result of hedonic evaluation of meatballs was 7.3.

Jerusalem artichoke powder quantity is significant influence on appearance, taste, texture, colour, and juiciness of meatballs ( $p < 0.05$ ). Aroma is only sensory property of meatballs that did not have significant effect of Jerusalem artichoke powder.

Experts determined that Jerusalem artichoke powder is suitable for meatballs preparation, in result them is possible to improve meatballs juiciness, to make an interesting texture, and to acquire new taste nuances of meatballs.

#### ACKNOWLEDGMENT

Publication and dissemination of the research results has been made due the funding of the ERAF Project „Promotion of scientific activities of LLU”, Contract Nr. 2010/0198/2DP/

2.1.1.2.0/10/APIA/VIAA/020



IEGULDĪJUMS TAVĀ NĀKOTNĒ

#### REFERENCES

- [1] Kerry Joseph, Kerry John and Ledward D. (2007) Meat processing. Improving quality. Woodhead publishing limited, Cambridge, England, p. 64 – 92.
- [2] Feiner G. (2006) Meat products handbook. Practical science and technology. Woodhead publishing limited, Cambridge, England, 648 p.
- [3] Kays S. J., Nottingham S. F. (2008) Biology and Chemistry of Jerusalem Artichoke *Helianthus tuberosus* L. Boca Raton: CRC Taylor & Francis Group. 459 p.
- [4] Gedrovica I. (2012) Pastry products enriched with dried Jerusalem artichoke (*Helianthus tuberosus* L.) powder: Promotion work. Jelgava: LLU, 156 p.
- [5] Beķers M., Grube M., Upīte D., Kaminska E., Linde R., Ščerbaka R., Danilevičs A. (2007) Carbohydrates in Jerusalem artichoke powder suspension. *Nutrition and Food Science*, Vol.37, No.1, p. 42–49.
- [6] Daniļevičs A., Beķers M., Linde R. (2006) Wasteless technology for topinambour concentrate production. No: Starptautiskā konference "EcoBalt' 2006", 11.-12. maijs, 2006.g., Rīga, 98.–99. lpp.
- [7] Snider H. K. (1986) Production of Jerusalem artichoke flour. United States Patent. Patent Number 4,565,705, Date of Patent: Jan. 21, 1986.
- [8] Куликов Ю. И., Прокопенко В. И. (2004) Современные аспекты биотехнологии варенных колбас функционального назначения. В кн: Сборник материалов международной конференции Пробиотические, пребиотические, синбиотические и функциональные продукты питания. Состояние и перспективы. Москва, 2–4 июня [tiešsaiste] [skatīts 2011.g. 23. dec.]. Pieejams: [www.topinambur.net](http://www.topinambur.net)
- [9] Meilgard M., Civille G. V., Carr B. T. (1999) Sensory Evaluation Techniques. 2nd Edition. Boca Raton, Florida: CRC Press. 344 p.
- [10] Strautniece E. (2004) Pārtikas produktu sensorā novērtēšana. Jelgava: LLU. 88 lpp.

**Iga Gedrovica**, Dr.sc.ing. Assistant professor in Latvia University of Agriculture was born in Latvia, Balvi at 1978. In 2012 she defended PhD thesis and obtained doctoral degree in food science. Her field of the research is Jerusalem artichoke, vegetables, fruits and its use for different food products enrichment as well as analyses of the physico-chemical parameters of the food. She has 8 scientific publications and participated in 2 different projects.

**Daina Karklina**, Dr.sc.ing. Professor in Latvia University of Agriculture was born in Latvia, Riga at 1950. She has received her Dr., degree in Food science and technology at 1986, and elected in professor's post in Latvia University of Agriculture at 2001. Scientific interests – Functional properties of food products, production of healthy qualitative and safety food products, also studies of the fruits and vegetables processing, as well as alcoholic beverages. She has about 150 published scientific articles, and participated in numerous different projects both in national and European level.