

**XXVI INTERNATIONAL
ECO-CONFERENCE® 2022
21–23th SEPTEMBER**

XII SAFE FOOD



PROCEEDINGS

NOVI SAD, SERBIA

XXVI INTERNATIONAL ECO-CONFERENCE® 2022

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XII SAFE FOOD**
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2022

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Original Scientific paper

NEW TYPE OF COOKIE PRODUCT WITH DEHYDRATED PEACH

Abstract

Osmodehydrated and lyophilized peach is characterized by upgraded dehydration effectiveness and enriched chemical and mineral matter content, and as such, is an interesting material to be added to the cookies' formulation. Produced cookie samples with different levels of peach dehydrated by two different methods, were subjected to the nutritive and technology quality parameters testing. Obtained results showed that the addition of higher levels of dehydrated peach enhanced all nutritive, while simultaneously decreased most of the technological quality parameters. The optimal addition of osmodehydrated and lyophilized peach to the cookie formulation was determined to be 15%. Testing consumers' attitude showed high appreciation of cookies with dehydrated peach sensory characteristics and high positive attitude towards presented new product thus pointing at its' high potential for market acceptability.

Key words: *osmotic dehydration, lyophilization, sugar beet molasses, peach, cookies*

INTRODUCTION

Combinations of different material dehydration methods have provided numerous beneficial results. Combination methods of osmotic dehydration with lyophilization, for example, has several advantages. This combined method has the possibility to lower the application volume of a high energy-demanding process that gives excellent product quality (lyophilization) via application of a low energy requirements pre-treatment of osmotic dehydration (Ciurzynska et al., 2016; Igual et al., 2019; Filipović et al., 2022a).

Sugar beet molasses is characterized by high dry matter content and rich nutritive composition, and due to high driving force for the water removal during osmotic dehydration has the potential to be a good osmotic solution. Its specific chemical composition, sensory properties, low cost and reuse of by-products of different industry, presents molasses as a better choice than some other, usually used osmotic mediums (Lončar et al., 2021).

Cookies are very popular wheat-based product consumed in the whole world, due to their different flavours, affordable price, long shelf life and readiness to eat. In effort of health improvement and increase of conscience regarding diet and health interaction, cookies' formulation adjustment is needed (Blanco Canalis et al., 2020).

Cookies are a complex system where every ingredient has an essential purpose, and every change in standard formulation usually leads to cookies' dough changes that affect final product quality, hence every addition of new raw material to the cookies' formulation, requires precise testing and quality optimization (Blanco Canalis et al., 2017; Filipović et al. 2022b).

In this research, most of the results produced in scientific project titled: "Production and implementation of innovative product from domestic peach with improved sensory and nutritive properties" are systemized and elaborated in effort of presenting new type of cookie product supplemented with combinedly dehydrated peach.

PEACH COMBINED OSMOTIC DEHYDRATION AND LYOPHILIZATION PROCESS

In published papers: Filipović et al., 2022a; Filipović et al., in press, osmotic dehydration process performed under atmospheric pressure, at constant temperature of 20, 35 or 50 °C, during 1, 3 or 5 hours in molasses of 60, 70 or 80% concentration and successive lyophilization process of following parameters: pressure of the 1.6 Pa, condenser temperature of -57 °C and duration of the lyophilization of 2, 4, 5 or 6 hours, were described.

The obtained results from the research showed that all three osmotic dehydration parameters (process temperature and duration and molasses concentration) statistically significantly affected dry matter content and a_w values of combinedly dehydrated peach. Osmotic dehydration process, in combination with lyophilization, contributed to enhancing overall dehydration effectiveness, by increasing obtained dry matter content values of successive dehydration process, reducing time and energy consumption of high energy demanding single-stage lyophilization process. Exceptional peaches samples' a_w values reduction in lyophilization stage contributed to the synergetic dehydration method with samples' microbiological stability, obtaining dehydrated product of only 0.433 of a_w value. Dehydrated peach chemical content was preserved, while mineral matter content was highly enriched, due to molasses, as an osmotic solution, application. As the optimal parameters of combined osmotic dehydration and lyophilization process were determined: osmodehydration process temperature of 20 °C, during 5 hours in 80 % molasses concentration and 5-hour successive lyophilization process (Filipović et al., 2022a; Filipović et al., in press).

COOKIES WITH DEHYDRATED PEACH PRODUCTION

Cookies samples were produced with and without the addition of lyophilized and osmodehydrated and lyophilized peach at different levels of addition. In the effort of obtaining the same moisture content and comparability of different cookie dough while applying material of different moisture content, the quantity of distilled water addition was adjusted to every cookie sample with dehydrated peach formulation, providing the same level of dough moisture content through the investigated cookie samples.

On produced cookie samples chemical, mineral, total carotenoid and polyphenol content, antioxidative activity, technological quality, instrumental texture and colour and descriptive sensory analysis were performed (Filipović et al., 2022b).

QUALITY OF COOKIES WITH DEHYDRATED PEACH

The results of cookies with dehydrated peach addition quality testing and optimization showed that different dehydration methods had statistically significantly different impacts on the nutritive characteristics of cookies, where molasses application in the osmotic treatment stage of the combined dehydration method had a positive effect on cookies with dehydrated peaches' overall nutritive composition. Cookies with 10% of combinedly dehydrated peach addition nutritive quality indicates a significant increase in chemical, mineral, and phenol content, and antioxidative activity. Peaches' combined dehydration method positively influenced certain cookies' technological quality parameters in comparison to cookies with the same amount of lyophilization peaches addition. The results of the descriptive sensory analysis showed that with the addition of up to 10% of dehydrated peaches to the cookie formulation, there was a positive effect on all sensory responses, providing a favorable peach note to overall taste and flavor (Filipović et al., 2022b).

In table 1 results of the Z-score analysis of cookies, with and without the addition of lyophilized and osmodehydrated and lyophilized peach, are shown. Presented results show segment Z-score S1 - S6, which corresponds to Z-score results of chemical, mineral matter and phenolic compounds content, technological quality parameters, instrumental colour and descriptive sensory analysis responses, respectively. The addition of peach dehydrated by combined method led to the increase of segment Z-score values for all nutritive cookie characteristics, while segment Z-score values for technological cookie characteristics declined with the addition of dehydrated peach to the cookies' formulation, especially with the addition of peach dehydrated by the combined method. Total Z-score values, mathematically combine all segment Z-scores and point at the optimal combination of all tested cookies' nutritive and technological responses. The addition of dehydrated peach by combined method to the cookies formulation, produced an optimal combination of tested quality characteristics. The optimal addition of osmodehydrated and lyophilized peach to the cookies formulation was determined to be in the quantity of 15% (Filipović et al., 2022b).

Table 1. Z-score analysis of cookies with and without the addition of lyophilized and osmodehydrated and lyophilized peach (Filipović et al., 2022b)

| Sample description and (number) | Segment Z-score | | | | | | Total Z-score |
|------------------------------------------------------------|-----------------|----------------|----------------|----------------|----------------|----------------|---------------|
| | S ₁ | S ₂ | S ₃ | S ₄ | S ₅ | S ₆ | S |
| Control (1) | 0.00 | 0.09 | 0.00 | 0.98 | 0.75 | 0.81 | 0.54 |
| 2.5% of lyophilized peach addition (2) | 0.16 | 0.03 | 0.05 | 0.43 | 0.64 | 0.79 | 0.38 |
| 5% of lyophilized peach addition (3) | 0.27 | 0.00 | 0.10 | 0.18 | 0.58 | 0.78 | 0.31 |
| 2.5% of lyophilized and osmo-dehydrated peach addition (4) | 0.16 | 0.16 | 0.08 | 0.75 | 0.57 | 0.77 | 0.48 |
| 5% of lyophilized and osmo-dehydrated peach addition (5) | 0.28 | 0.28 | 0.14 | 0.60 | 0.53 | 0.60 | 0.45 |
| 10% of lyophilized and osmo-dehydrated peach addition (6) | 0.49 | 0.49 | 0.22 | 0.52 | 0.47 | 0.49 | 0.47 |
| 15% of lyophilized and osmo-dehydrated peach addition (7) | 0.71 | 0.65 | 0.45 | 0.44 | 0.39 | 0.31 | 0.49 |
| 20% of lyophilized and osmo-dehydrated peach addition (8) | 0.84 | 0.83 | 0.63 | 0.27 | 0.34 | 0.13 | 0.46 |
| 25% of lyophilized and osmo-dehydrated peach addition (9) | 1.00 | 1.00 | 1.00 | 0.04 | 0.25 | 0.00 | 0.45 |

CONSUMERS' TEST OF NEW COOKIE PRODUCT WITH DEHYDRATED PEACH

Cookie product with lyophilized and osmodehydrated peach, of experimentally determinated optimal formulation (quantity of dehydrated peach addition of 15%), was produced in higher quantities, in effort of conducting consumers' test and evaluating acceptability of new type of cookie product on large scale of unspecified consumers (576 randomly selected consumers of different sociodemographic characteristics).

Table 2 shows 3 general and 5 specific questions (Filipović et al., 2016), that consumers were asked on the conducted survey.

Table 2. Consumers' survey questions

| Question type | Question no. | Question |
|--------------------|--------------|----------------------------------------------------------------------------------------------------------------------------------------|
| General questions | Q1 | Do you read declarations on cookies' packaging? (Answer: YES/NO) |
| | Q2 | Does your health condition require special diet? (Answer: YES/NO) |
| | Q3 | Based on your opinion, does the food affect health condition? (Answer: YES/NO) |
| Specific questions | Q4 | Is the cookies' with dehydrated peach colour acceptable? (Score from 1 to 9, where 9 is the highest score) |
| | Q5 | Is the cookies' with dehydrated peach taste acceptable? (Score from 1 to 9, where 9 is the highest score) |
| | Q6 | Is the cookies' with dehydrated peach smell acceptable? (Score from 1 to 9, where 9 is the highest score) |
| | Q7 | Is the price of cookies' with dehydrated peach significant issue in buying decision? (Score from 1 to 9, where 9 is the highest score) |
| | Q8 | Would you buy cookie with dehydrated peach and implement it in your diet? (Score from 1 to 9, where 9 is the highest score) |

Table 3 shows results of the consumers' answers to the conducted survey, from which it can be seen that with the age, level of education and income increase, percent of the positive answers to the reading of the declarations, increased also. Younger consumers were not exposed to the health issues that would require special diet, which changed with the age increase. In general population, there is a low percent of consumers whose health condition requires special diet – 18.90%. Large share of consumers in all groups positively answered the question regarding effect of the food on health condition.

Answers to the specific questions regarding acceptability of colour, taste and smell of the cookies with dehydrated peach were very high (close to maximal value of 9). Cookies colour was highly evaluated by all consumers, while some lower scores were marked at middleaged consumers, with high level of education and with the highest income level. Taste and smell were better scored at older and higher educated and population with the highest income. Consumers' answers to the questions from Q4 to Q6 indicate to highly appreciated sensory characteristics of cookies with dehydrated peach.

Cookie price was marked with significantly high scores and evaluated as important buying parameter, especially at younger population.

Answers to the last question, would consumers buy cookies with dehydrated peach and implement it in their diet, showed high level of positive attitude towards presented new product and indicated on high potential for marked acceptability of newly developed cookie type with dehydrated peach.

Table 3. Consumers' answers to the survey questions

| | | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 |
|---------------------|------------|------------------------------|-------|--------|------|-------------------------|------|------|------|
| | | Positive answers percent (%) | | | | Consumers average score | | | |
| Consumers age | <18 | 15.34 | 0.00 | 84.61 | 8.89 | 7.72 | 8.86 | 6.43 | 3.86 |
| | 18-30 | 63.76 | 21.80 | 100.00 | 8.91 | 7.70 | 8.74 | 4.63 | 5.40 |
| | 31-50 | 74.70 | 17.96 | 100.00 | 8.20 | 8.50 | 8.52 | 4.82 | 6.91 |
| | >50 | 82.32 | 16.07 | 96.82 | 8.74 | 8.49 | 7.50 | 5.75 | 5.50 |
| Education level | Elementary | 41.99 | 15.00 | 100.00 | 8.83 | 7.71 | 8.91 | 6.42 | 5.14 |
| | Medium | 65.11 | 18.05 | 100.00 | 8.97 | 7.85 | 8.31 | 5.31 | 5.77 |
| | Higher | 87.17 | 20.09 | 85.57 | 8.91 | 8.39 | 7.20 | 6.60 | 4.80 |
| | High | 74.43 | 18.91 | 100.00 | 8.38 | 8.63 | 8.51 | 4.30 | 6.66 |
| Income level | Low | 48.00 | 10.10 | 100.00 | 8.79 | 7.49 | 8.39 | 5.10 | 4.50 |
| | Medium | 79.53 | 29.49 | 97.02 | 8.65 | 8.29 | 8.12 | 5.83 | 6.88 |
| | Higher | 80.10 | 10.50 | 88.51 | 8.55 | 8.77 | 7.62 | 4.50 | 6.30 |
| | High | 77.20 | 14.39 | 100.00 | 8.31 | 8.97 | 8.37 | 4.16 | 6.23 |
| Sex | Male | 68.14 | 17.08 | 96.71 | 8.37 | 8.37 | 8.30 | 4.60 | 5.86 |
| | Female | 62.55 | 19.60 | 99.01 | 8.80 | 8.30 | 8.29 | 5.24 | 6.23 |
| Total in all groups | | 64.53 | 18.90 | 98.15 | 8.61 | 8.33 | 8.32 | 5.04 | 6.04 |

CONCLUSION

From presented results it can be concluded that:

- Osmotic dehydration process, as pretreatment to lyophilization, increased total dehydration efficiency, reducing duration and energy consumption in high energy demanding lyophilization process.
- Due to molasses, as an osmotic solution application, antioxidative activity, chemical and mineral matter content of combinedly dehydrated peach was increased.
- Cookies with 10% addition of dehydrated peach were nutritively enriched, with significant increase chemical, mineral and polyphenol content and antioxidative activity.
- Some technological quality parameters were enhanced by using combinedly dehydrated peach in comparison to lyophilized peach.
- The optimal addition of osmodehydrated and lyophilized peach to the cookies formulation was determined to be in the quantity of 15%.
- Results of consumers' test showed high appreciation of cookies with dehydrated peach sensory characteristics by large group (576) of randomly selected consumers.
- Consumers showed high positive attitude towards presented new product and indicated on its' high potential for market acceptability.

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НОВА ВРСТА КЕКС ПРОИЗВОДА СА ДЕХИДИРАНОМ БРЕСКВОМ

Резиме

Осмотски дехидрирану и лиофилизовану брескву карактерише унапређена ефикасност дехидратације и обогаћен хемијски и минерални садржај, и као таква, интересантан је додатак у сировинском саставу кекса. Испитани су нутритивни и технолошки параметри квалитета произведених узорака кекса са различитим нивоима брескве дехидриране помоћу два метода. Добијени резултати су показали да је додатак виших нивоа дехидриране брескве унапредио све нутритивне, док је истовремено смањио већину технолошких параметара. За оптималну количину додатка осмотски дехидриране и лиофилизоване брескве у сировински састав кекса одређена је количина од 15%. Испитивање ставова потрошача је показало високу прихватљивост сензорних карактеристика кекса са дехидрираном бресквом и високу прихватљивост нове врсте кекс производа и указало је на његов висок тржишни потенцијал.

Кључне речи: *осмотска дехидратација, лиофилизација, меласа шећерне рене, бресква, кекс*

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