

REVAMPING TRADITIONAL INGREDIENTS IN ONE INNOVATIVE PRODUCT WITH HEALTH BENEFITS

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Abstract

Sweet products will always hold a place as indulgent treats, and recent tax hikes of over 10% on sugars will impact consumers' behavior. Modern consumers are increasingly aware of the health benefits of foods, which nutritionists often tout as superfoods. Functional products, in particular, are foods or ingredients that offer health benefits, aiding in disease prevention or treatment. Some market studies in recent times show that consumers are more and more aware of the health benefits of prebiotics at the same time they are sensitive to taste and price. While selecting the ingredients as sources of prebiotics, it has been found that they were often chosen not necessarily for their nutritional value or health benefits, which was often insufficiently researched, but as substitutes for luxury items like coffee, cocoa, and their derivatives such as instant coffee and chocolate. Previous research on selected ingredients highlights their significant nutritional properties that contribute to overall health. This study aims to develop a product based on instant chicory, oatmeal, and a non-sweetened jam of plums (PGI) that combines functional benefits.

Key words: health-conscious sweets; functional products, healthy ingredients, food design

INTRODUCTION

The starting point of this research was the demand for chocolate in the economic environment due to the increasing price of chocolate [1] and the rising awareness of health benefits among consumers [2], especially in fiber content of the intake and gut microbiome

Many chocolate praline producers have chosen to increase the filling ratio and to decrease the chocolate quantity in the shell, in order to remain competitive on the market.

Chocolate praline has been since its official launching on the market, which was in 1912 by a famous Belgian chocolatier Jean Neuhaus II, according to the official records [3]

On the other hand, due to the increasing malnutrition condition due to excessive sugar consumption, in the flow with the World Health Organization, Romania has

adopted laws that taxed the added sugar content in processed food with increased VAT from 9% to 19% for products with more than 10% added sugars and with excised duties for any product with more than 5% sugars [4].

To proceed with the paper, the official definition of a chocolate praline is „a chocolate shell with a softer filling” and since that time the filling has been reinvented by the most prestigious chocolatiers but also replicated in the industrial process.

This paper aims to propose a healthier option for the filling, by using the functional properties of Chicory, oat flakes, dried plumps and plump jam (PGI Magiun de Topoloveni).

The reason for choosing these ingredients is related to revamping these ingredients in the new light of discoveries in the field of nutrition and also to comfort food.

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We gathered some important functional characteristics and properties from the above-mentioned ingredients to encourage the consumer to choose a complex praline with the following characteristics:

- Low sugar content
- Fiber content, including inulin but also beta-glucans, antioxidants
- Texture resembling the old-fashioned praline (soft) with a new touch (crispy)
- Affordable ingredients
- Affordable price

The recipe was developed based on the characteristics of the ingredients as well as the final desired composition.

Chicory

The genus *Cichorium*, which is part of the dandelion family Asteraceae, consists of six species: *C. intybus*, *C. frisee*, *C. endive*, *C. grouse*, *C. Chuckle*, *C. Pumulum*. The origin of these species is the Mediterranean region, but they can also be cultivated worldwide in temperate and semi-arid areas. *C. intybus L.*, commonly known as chicory, is a perennial herbaceous plant that most often bears bright blue flowers and has been cultivated since ancient times. Apart from the medicinal applications of this plant, there are several other uses of *C. intybus L.*, including

the industrial extraction of inulin, as a coffee substitute or as animal feed. In addition, it can be noted that the leaves of the plant can be eaten raw or cooked.

In addition to the benefits mentioned above, *C. intybus L.* possesses numerous beneficial biological properties, including antioxidant, hepatoprotective, anti-inflammatory, antidiabetic, antimicrobial and tumor inhibitory activity. Inulin and specialized metabolites such as hydroxycinnamic acids, coumarins, flavonoids and sesquiterpene lactones that are located in different parts of *C. intybus L.* could be responsible for these biological properties.

Hydroxycinnamic acid derivatives, especially hydroxycinnamoyl esters, are widely distributed in the plant kingdom. These are phenolic compounds that are well known for their antioxidant properties and could play a role in preventing various diseases associated with oxidative stress. Since sucrose and fructophans are known for their radical scavenging ability in plant cells, it has been suggested that the in vitro antioxidant activity of chicory can be attributed not only to phenolic derivatives. Some pharmacological properties of *C. intybus L.* are summarized in Table 1.

Table 1 – Pharmacological properties of *C. intybus L.*

Properties	Substance	References
Gut health microbiota	Inulin	[5]
Antibacterial properties	Phytochemicals	[6]
Health fortification	Sesquiterpene lactones Vitamines (α-tocopherol, γ-tocopherol, β-carotene, zeaxanthin)	[7]
Antioxidant properties	caffeic acid derivatives (chiroric acid, chlorogenic acid, isochlorogenic acid, dicaffeoyl tartaric acid)	

Oat

Analysis of the nutritional, chemical and physical properties of oat grains, with an emphasis on β-glucans, has led to its appreciation in human nutrition, mainly due to its health-promoting properties, including cholesterol-lowering, glycemic-stabilizing, anti-cancer, and anti-inflammatory effects.

Oats (*Avena sativa L.*) are represented by 25 annual plant species, including field crops, wild species and weeds. *Avena sativa* is the main cultivated oat species, comprising about 90% of world oat production. Other cultivated oat species of minor importance include black oat (*Avena strigosa*) and red oat (*Avena byzantina*). At



the same time, common oat (*Avena fatua*) is a weed of cereal crops, especially oats.

Oat grains are a prized raw material in cereal processing due to their nutritional and health-promoting qualities. Oat grain processing products can be divided into three major categories, including (I) milled products: flakes (instant, mountain, regular), pearl barley, bran, flour, and groats; (II) products with the addition of oat grains or substances derived from oat grains: confectionery, special breads (wheat-oat bread, fine bakery products), cereal/fruit mixes (muesli), oat preparations; and (III) products derived from oat grains (eg, β -

glucan) used in the pharmacology, cosmetics, brewing, and chemical industries.

Oat grains, apart from very valuable nutritional compounds, contain substances with anti-nutritional and toxic effects, i.e. saponins (avenacosides), which can irreversibly connect to the cell membrane, thus increasing its permeability. The phytic acid present in oat grains can also have a negative impact on health, as it has, among other things, the ability to block the bioavailability of some micronutrients such as iron, copper, zinc or magnesium. In addition, due to the high fiber content of oat products, their digestion can lead to flatulence, bloating, and diarrhea.

Table 2. Chemical composition of oats and other cereals [8]

Cereal species and products	Protein	Lipids	Carbohydrates	Dietary fiber
Hulled Whole Oats (Range)	7,4 - 16,2	2,2 - 9,2	53 - 66	20 - 38
Hulled Whole Oats (Range)	10,5 - 24,5	3,1 - 15	62 - 75	7,8 - 12,2
Empty oats (range)	14 - 19,5	8,3 - 11,4	69 - 72	8,6 - 12,1
Wheat (medium)	13,5	2,3	67,7	12,1
Rye (medium)	10,2	2,0	63,9	16,1
Whole wheat without husk (medium)	12,0	2,4	65,9	15,4
Corn (medium)	10,5	4,3	71,9	9,4

Oat grains are popularly used in various branches of the food industry (Table 3). One of the most popular oat products is oatmeal, often eaten as a breakfast cereal. Oat flakes are obtained from cleaned oat grains, in which the lipolytic enzymes have been inactivated. Typically, two types of oatmeal are produced: ordinary oatmeal (flakes obtained directly after the process of cleaning the grains and inactivating lipases) and instant oatmeal (subject to an additional hydrothermal treatment, so that it does not require processing/boiling before consumption).

Oatmeal is also used as one of the components of cereal/fruit/nut mixes (muesli) or is processed into granola (oatmeal with sugar, oil and nuts or fruit, subjected to the baking process). Oatmeal wheat flour is another popular oat product. Although it is characterized by weaker technological parameters compared to wheat flour, it is often used as an additive in the production of bread due to the large

amount of substances beneficial to health discussed previously in its composition. In addition, oat flour has a very low glycemic index, unlike popular wheat or rye flours, so it can be used in the production of bread for diabetics. Certified gluten-free oat wheat is also commonly used to make bread suitable for people with celiac disease.

Oat grains, obtained from oat grains in the processes of hulling and polishing, can be a substitute for products such as rice, pasta or potatoes. Another application of oat grains in the food industry is the production of sprouts. Sprouts are obtained as a result of the germination process of grains and are intended to be eaten whole - like a sprouted grain. Germination is characterized by high enzymatic activity and contains a set of nutritionally important ingredients such as vitamins (A, B, C and E) and minerals (fluorine, iron, zinc, copper, calcium and iodine).

Oat grains are suitable for making oat drinks, but can also be used to make fermented products from plant-based drinks, such as oat "yoghurts". It is also popular to use oat bran (a byproduct of grinding hulled oats) as an addition to desserts, milk, yogurt, or other foods to increase their fiber content.

Table 3. Examples of possible uses of oat grains and its products in the food industry

	Products	Processing/application methods	Characteristics	Source
Whole products	Whole grain oats	Hydrothermal treatment Germination treatment Fermentation treatment	It has reduced phytic acid content It strengthened the antidiabetic activity	[9]
	Flakes (also called oats)	Degreasing treatment	Improved stability Used for the production of the following: - Pasta (hardness reduction), - Biscuits (change in taste and texture), - As an additive in meat products (reducing hardness, elasticity and viscosity, increasing capacity), - Bread, - Drinks (water retention)	[10]
	Flour, bran	Hydrothermal treatment		
Fermented drinks	Milk replacers Probiotic microorganisms Dairy-free yogurt	Fermentation treatment	Intended for people suffering from the following: - Lactose intolerance, - Allergy to milk protein, - Irritable bowel syndrome, - Low immunity, - high cholesterol, - Diarrhea, - Colorectal cancer	[11]
Oat concentrates	β -glucan, starch and protein	Fermentation treatment Hydration treatment Direct mixing	Isolates used in the production of the following: - Bread, - Pasta (oat β -glucans significantly increased the viscosity of pasta; the addition of 10-15% β -glucans resulted in functional pasta containing 3.3-5.5 g β -glucans/100 g, with a quality high of cooking and sensory attributes), - Skimmed fermented milk (reduction of blood serum cholesterol), - Meat products: chicken breast meat (increasing soluble protein content and gel strength), lean beef meatballs (replacing fat, improving moisture retention).	[12]



Oatmeal is a valuable and cheap raw material that can be used extensively in food technology. It is worth taking an interest in oats in the sphere of research, processing and use in nutrition. The wider use of oat wheat in the food industry can create excellent opportunities for rational nutrition and thus contribute to improving the health of the population.

Plums

Plums are an important source of compounds that influence human health and the prevention of many diseases. Plums have an abundance of bioactive compounds such as phenolic acids, anthocyanins, carotenoids, flavanols, organic acids, (eg citric and malic acids), fiber (pectin), tannins, aromatic substances, enzymes, minerals (eg potassium, phosphorus, calcium and magnesium, organic) and vitamin A, B, C and K.

The phenolic compounds in plums are particularly important for health. Among the most prevalent are caffeic acid, 3-O-caffeicquinic acid (neochlorogenic acid), 5-O-caffeicquinic acid (chlorogenic acid), and 4-O-caffeicquinic acid (cryptochlorogenic acid). These compounds are known for their antioxidant properties and ability to help protect cells against oxidative stress, thus having health benefits.

In Romania, the first PGI product was „Magiun de Topoloveni” a type of jam made out over 100 year old recipe with fresh plumps harvested from Topoloveni area, a famous region for plum trees and plum-derivates products, including brandy [13].

MATERIAL AND METHOD

The praline was created based on an idea of the lecturer as part of the Masterfood student competition held at USAMV Bucharest, within the Faculty of Animal Production Management and Engineering, between December 4, 2023, and March 15, 2024, where it was awarded with the 2nd prize.

The research and practical creation were carried out by a team of master's students (second-year Food Safety and first-year EPA) in the bakery and pastry research and development laboratory of the faculty.

The recipe was developed based on material balance calculations, and the ingredients were provided by Dulcelle Factory from Bănești, Prahova County, where the industrial-scale testing was also conducted.

The final recipe, as well as the preparation technology, is presented in Table 4 and the designed final product is shown in Fig. 2:

Table 4. List of ingredients used in the recipe of Chocolate praline with plum jam PGI Magiun de Topoloveni, chicory ganache and crisp of dried plum and oat flakes

Ingredients	%	Value
(2) Chicory ganache		
Whipped cream 35%	%	8
Stevia rebaudiana	%	1
Invert sugar	%	2
Instant chicory	%	8
Cocoa butter	%	2
Butter 82%	%	2
(1) Plum jelly		
Topoloveni PGI plum jam	%	6
Glucose syrup	%	1
White pectin	%	1
Stevia rebaudiana	%	1
Lemon juice	%	10
(3) Crispy Oatmeal		
Crispy oat muesli	%	1
Gianduia hazelnut and chocolate sweetened with dates	%	2
Cocoa butter	%	30
Maxim Peanut Butter	%	8
Chocolate Shell		
Dark origine Guatemala chocolate	%	2

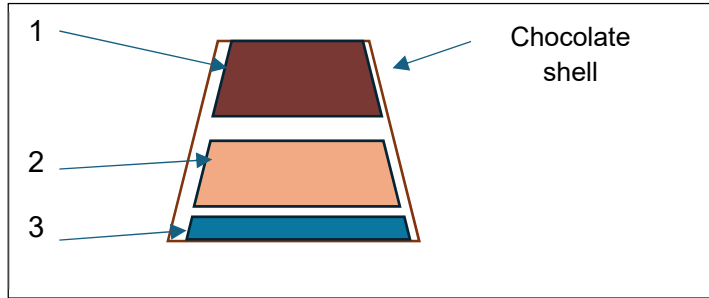


Fig. 2 Designed chocolate praline

The process contains the following steps:

1 – melt the inverted sugar, chicory, cocoa butter, and butter into the whipped cream, stirring continuously. Leave to cool in the fridge then whipe in a food processor. Set it in the bag so that it can be easily dosed.

2 - Heat the plum jam, glucose syrup and lemon juice to the boiling point, add the pectin mixed with the sugar and pour it into the frame on the silicone. Cool in the refrigerator and cut out shapes 2 mm smaller than the candy shape. (it can be put in a disposable bag and then poured into the chocolate shell - check that the temperature is lower than 27 C)

3 – Hot mix the crunchy oats with cocoa butter, giandua, and peanut butter. Pour onto a silicone sheet and let cool. It is cut with the dui, the size of the plum jelly. (You can also load the mold with a spatula, leveling it well)

4 – the chocolate for the shell is melted and tempered (dark chocolate is heated to 45 –

50°C and cooled to 27 – 29°C) until it becomes glossy.

5 – the polycarbonate forms are washed well and wiped with ethyl alcohol 960, they are left to air at room temperature

Assembly:

Polycarbonate praline molds are filled with tempered chocolate using a piping bag. Shake well to remove air bubbles and then invert the mold to collect the chocolate in the bowl. Let it crystallize on the table, standing, on the edge. If the layer is too thin, a new layer can be applied, proceeding identically to the previous step.

After it has cooled, pour with a spoon 1- the jelly, then 2- the ganache and finally load it with 3- the crisp. Pour chocolate to the edge of the mold, apply the transfer sheet and then spread it well over the entire surface with the spatula.

By labeling requirements, the nutritional declaration was calculated, both for 100 g and for one piece (Table 5):

Table 5. Nutritional declaration (average per 100 g)

Nutritional declaration	per 100 g		per 1 piece (12 g)	% RCV
Energy	kJ	1905	253	23
	kcal	454	60	
Fats, from which:	g	26,1	3,2	37
saturated fatty acids	g	13,9	1,7	39
Carbohydrates, from which:	g	44,8	5,4	17
sugars	g	25,5	3,1	28
Fibres	g	3,8	0,5	/
Proteins	g	6,2	0,7	12
Salt	g	0,1	0,0	2

*RCV – reference consumption value for 8400 kJ/2000kcal

The product was analyzed from the sensory characteristics point of view (appearance, texture, taste, flavor) and also an online survey of the health-conscious knowledge about the ingredients was performed in September 2024. The results and the conclusions are in the following chapter.

RESULTS AND DISCUSSION

The product has been presented to a sensory analysis panel with 7 members.

They have been asked to rate with points from 1 to 5 where: 1 – not good and 5 – excellent and the taste for 4 characteristics, compared with a classic praline:

- 1 – the appearance of the praline
- 2 – texture
- 3 – taste
- 4 - flavor

Summarizing the results, the chart of sensory analysis is shown in Fig. 2.

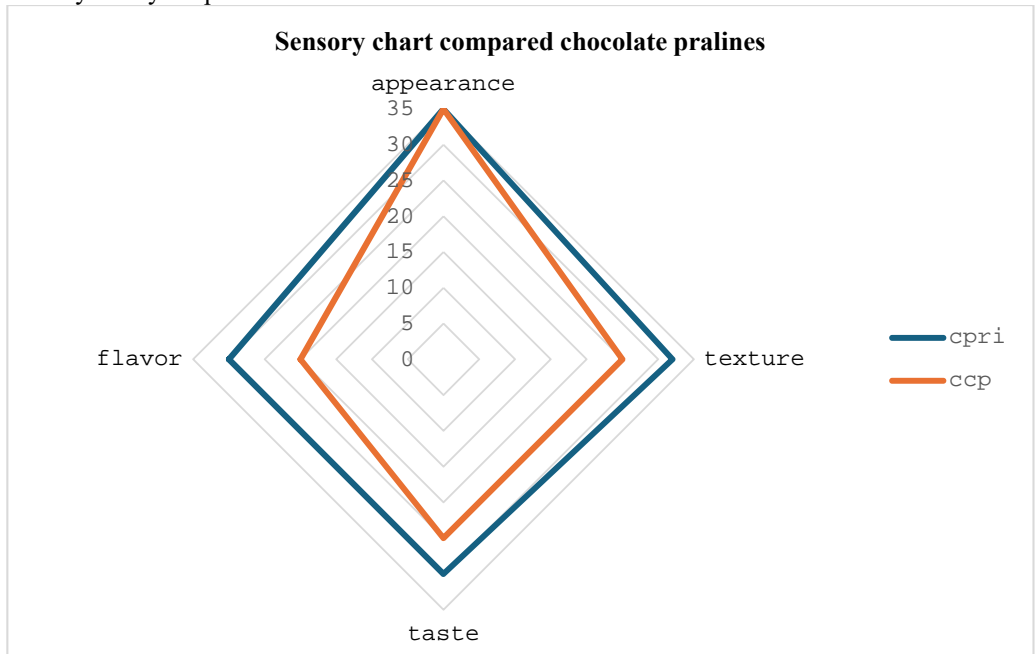


Fig. 2 Sensory analysis of chocolate praline with revamped ingredients

Where: cpri – chocolate praline with revamped ingredients and ccp – classic chocolate praline

It is obvious that the taste of the modern consumer appreciates better the praline with revamped ingredients than the classical one, but we dig to the bottom to find out whether is due to the knowledge or is it because of the recipe. The arguments presented by the specialized literature regarding the health benefits of the ingredients or the consumption of chocolate pralines are

commercially insufficient. Therefore, to investigate consumers' knowledge about ingredients and chocolate pralines, in September 2024, we conducted a survey with 55 respondents.

The respondents were from the following categories: Gen Z: 18-24 years old – 1.8% Millennials: 25-39 years old – 23.6%, Gen X: 40-56 years old – 58.2%, Boomers: 57-75 years old – 16.4%

After their studies, 45.5% of the respondents hold a master's degree, 32.7%

have a bachelor's degree, 7,3% hold a doctorate, and 1,8% did not wish to disclose their education level.

Regarding the respondents' background, 81,8% live in urban areas, with 36,4% living in Romania.

An interesting aspect of the study is the monthly income, with 63,6% of respondents having a monthly income of over 5000 lei, 16,4% earning between 3701–5000 lei, and 10,9% earning less than 3700 lei. 9,1% of respondents did not wish to disclose their monthly income.

To question q1: which ingredient (chicory, oat flakes, plum jam) is most familiar to them – 46% of respondents are very familiar with chicory, 88% are very familiar with oat flakes, and 95% say that plum jam is a very familiar ingredient.

To question q2: what influences the decision to purchase a box of chocolate candies – the price (correlated, in fact, with income level) is important for only 15% of respondents. 55% of respondents believe that the expiration date influences their purchasing decision, and 75% of respondents are highly interested in the list of ingredients, while only 40% are interested in the nutritional declaration. 55% of respondents greatly appreciate health benefits (e.g., high fiber content, sugar-free, salt-free), and TV commercials are irrelevant for 79% of respondents. 31% of respondents consider the packaging not to be an important criterion, while only 39% consider the packaging quantity unimportant.

To question q3: can chocolate candies be a healthy and tasty product – 55% of respondents believe yes, if they contain no added sugar, and 69% believe that if they include ingredients with health benefits, the product can be both tasty and healthy.

However, only 31% of respondents consider chicory to be a source of fiber, as inulin, extracted from chicory, is less promoted as a fiber. Nevertheless, 48% believe it has a high antioxidant content, but

they do not recognize the prebiotic properties of inulin, with 57% of respondents believing that it does not contain prebiotics. Additionally, 48% of respondents chose chicory as being beneficial to health because it contains no sugar.

Regarding oat flakes, 89% of respondents identify this ingredient as a source of fiber, 42% do not associate it with antioxidants, yet paradoxically, 48% do not recognize it as containing prebiotics. 53% of respondents acknowledge that oat flakes contain no sugar.

As for plum jam, 46% identify it as a good source of fiber, 17% do not associate it with antioxidant properties, but 39% recognize the antioxidant properties of plum jam. 49% do not associate plum jam with prebiotic properties, and 46% believe it contains no sugar.

It is surprising that, despite their financial power, higher-than-average education, and demonstrated knowledge of ingredient characteristics, 70.9% of respondents would consume occasionally a chocolate praline containing chicory, oat flakes, and plum jam as ingredients, while 5.5% would never consume such a product. 23.6% admit they would consume one piece daily.

Regarding hedonistic elements, the sensory characteristics of chocolate candy are dominated by taste and texture, with 97%. 66% consider smell important, 53% consider appearance important, and only 19% give importance to shape. 46% of respondents give importance to the nutrient content, while only 44% consider energy value relevant.

To summarize and correlate demographic data with education and income, the final question, q10, aimed to investigate which of the ingredients in the proposed chocolate candy is perceived to most influence its health benefits. 91% of respondents appreciated dark chocolate, followed by oat flakes (37%), chicory

(31%), and plum jam, which only 29% of respondents consider to have a significant influence on the health benefits of chocolate praline.

CONCLUSIONS

There are endless combinations to make a chocolate praline, however, something from the „comfort food” registry can make the difference in a competitive market with producers from abroad.

Despite the level of education or average monthly income, some nutritional benefits of less expensive ingredients like instant chicory powder, oat flakes, and plum jam are seen as inferior compared with chocolate.

Technologists and food designers can optimize the price while using some local ingredients with better biological value and bioavailability due to familiarity with the ingredients.

Even aware of ingredients with health benefits only the name „praline” changes the consumption frequency from „daily” to „occasionally”

This work opens up opportunities for chocolate praline producers, given that the price of chocolate is continuously rising, while its nutritional benefits are recognized regardless of consumers' income levels.

It also provides evidence of the need for nutritional education among consumers, and the nutritional benefits from recent research should be better communicated to them.

Undoubtedly, such an initiative requires the combined efforts of all involved parties, so that consumers can make well-informed choices regarding products that offer both nutritional value and enjoyable taste.

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