

# THE ROMANIAN MOUNTAIN PRODUCT, PROBIOTIC IN THE CONTEXT OF COVID-19. CASE STUDY ON MOUNTAIN PRODUCERS IN ROMANIA

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## Abstract

In the context of COVID-19, consumers need to be aware of the importance of healthy nutrition and a balanced lifestyle. Providing the necessary with healthy food, but especially as a probiotic, is an imperative of life in the pandemic. The paper proposes as probiotics, for the prevention and control of COVID-19, three types of mountain product groups known as natural medicine, namely *Allium sativum* – garlic (vegetable products category), honey (bee products category), fermented dairy products (sana, yogurt, kefir, whipped milk, skimmed milk, sour milk, thick milk). The mentioned probiotics were chosen from the Register of mountain products in Romania, which have low percentages to number of producers and products compared to other mountain products. The methods used in the paper are of qualitative type, by studying the official documents with mountain character from Romania, respectively of quantitative type by creating a general statistical table regarding the probiotics proposed in the article. The research results show that mountain producers focus on certain mountain products used as probiotics, namely honey, partially neglecting the marketing of other mountain products proposed in the article. Knowing this information, the decision makers in ensuring the nutritional education in Romania can support information campaigns, in the context of COVID-19, in order to accentuate the consumption of certain mountain products with probiotic character. The paper proposes to the Romanian mountain producers the development of the production and trade with the probiotics mentioned in the article, as well as the education of the population in the sense of a balanced way of life and healthy nutrition.

**Keywords:** *COVID-19, probiotic, mountain product, mountain producers.*

## INTRODUCTION

Probiotics are important in the context of COVID-19 and the sustainability of mountain products because they hold significant percentages in the global drug market and because are widely used by consumers. Probiotics are defined by the World Health Organization (WHO) and the Food and Agriculture Organization of the United Nations (FAO) (2006) as living microorganisms that when administered in appropriate amounts confer a health benefit to the host.

According to an international group of probiotic specialists (Drugs, 2021), the forms of probiotics can be *Bifidobacterium bifidum*, *Bifidobacterium breve*, *Bifidobacterium infantis*, *Bifidobacterium longum*, *Enterococcus faecium*, *Lactobacillus acidophilus*, *Lactobacillus helgaracus*, *Lactobacillus bulgaricus*, *Lactobacillus bulgaricus*, *Lactobacillus bulgaricus*, *Lactobacillus bulgaricus*, *Saccharomyces boulardii*, *Streptococcus salivarius*, *Streptococcus thermophilus*. The same scientists postulate that probiotics support health against diabetes, acute infectious diarrhea, antibiotic-associated diarrhea, *Clostridium difficile*-associated diarrhea, persistent diarrhea, radiation-associated diarrhea, dyslipidemia, eczema, Crohn's disease, gastrointestinal colon syndrome ulcerative colitis, infantile colic, dysbiosis, lactose intolerance, hepatic

encephalopathy, bacterial vaginosis, Candida infections, *Helicobacter pylori* infections, neonatal necrotizing enterocolitis, otitis media infection, pneumonia, upper respiratory tract infection, upper respiratory tract infection pancreatitis, allergies, asthma, cancer, cardiovascular diseases, late-onset sepsis, liver disease, rheumatoid arthritis, and sustain the general immunity of the body, etc.

The global retail market for all probiotic products was estimated in 2017 at US \$ 45.6 billion, with a projected annual growth rate for 2022 of 7% (2017–2022) (MarketsandMarkets, 2017). A market analysis predicts that the global market for probiotics, including as ingredients, will grow from \$ 1.71 billion to \$ 3.56 billion in 2016–2025 (Grand View Research Inc, 2017b). The probiotic food supplement sector, which ranked second after probiotic foods and beverages, will grow from \$ 3.3 billion to \$ 7.0 billion (compound annual growth rate will be 7.5%) (Grand View Research Inc., 2017a). (Jackson et al., 2019)

Romania, a country in Central and Eastern Europe, similar to the others in this group is known as promoter of mountain products high in fat, which are harmful to the body's immunity in general and COVID-19 disease in particular. In this context, Romania and the other countries of Central and Eastern Europe should focus on the development of mountain products as probiotics, so as to prevent the adverse effects of excessive use of fats in the diet.

Consumer behavior in these countries has a disorganized system of food and associated services, mainly because during communism the population, having no other options, consumed what the government introduced in stores. In these countries, operational decisions at the government level should include both information and education campaigns for the population on the harmful effects of this way of consuming services or food (action from the range of changing agri-food and service models). Funding for mountain entrepreneurs by public and private governance should be done so that they can grow their own business by supporting the gradual transition from products based on fats considered unhealthy to healthy products rich in protein, fiber, and vegetable fats. Consequently, the population of these countries needs to be educated towards eating healthier and less prepared foods, with the emphasis on eating as naturally as possible, with the aim of ensuring better immunity to various diseases, especially for COVID-19. Mountain products have a higher nutritional potential and a stronger probiotic role as, in general, the mountain ecosystem is less polluted.

Food education involves the application of the theory of planned behavior. This theory presupposes the knowledge of foods and the differentiation between harmful and non-harmful or beneficial; expanding the understanding of what we should eat, as well as changing eating behavior can be ensured by analyzing and integrating established patterns and some similar to the population for which the model applies. The choice of food and associated services is given by the possibility of selection, the right to proceed in a certain way (the possibility to choose from a food point of view), the multiplication of actions of food and associated services, the abundance or variety of a thing, the person or thing chosen, alternatives between the above statements (Johnson, 2015; Covaci, 2019).

Consumer preferences for healthy products need to focus on the transition from harmful behaviors acquired through childhood learning to the adoption of positive eating patterns. Food and associated services involve learned, not innate, behaviors. The operational decisions underlying ensuring a favorable climate for the application of positive agri-food models also emphasize the incorporation of theoretical statements into the practice of a certain eating

behavior and the transition from individual to general in addressing this issue (Hanušovský et al., 2020; Covaci, 2019).

Food choice and quality behavior must be developed so that the individual or group focuses on healthy products and not on satisfying altered tastes or services. Food producers and distributors must take all these coordinates into account and respond to consumers' wishes, without compromising the nutritional quality of the food supplied. (Soltani et al., 2020; Garrido-Castro, 2019; Schermer, 2015)

The memory of food and associated services is constantly active since birth and is a complex of behaviors, freedoms, and food constraints. Sociologists believe that daily diet or entertainment in developed countries is more the result of public or group norms and constraints than of personal behaviors and decisions (Wilk, 2015).

Central and Eastern European countries are growing rapidly in the food and associated services sectors, especially those that support the mountain food sector considerably. The positive dynamics of Eurostat's mountain entrepreneurship indicators show that entrepreneurs in Central and Eastern European countries emphasize the desire for rapid enrichment without taking into account the context of healthy eating behaviors and services (often mountain entrepreneurs make reductions to quality in favor of fast and unsustainable gains). Former European communist countries are still willing to give up quality in favor of gains for lack of a long-term food vision. For the countries of Central and Eastern Europe, the closest and most sustainable model, paradigmatic and applicable, should be Austria. (Covaci, 2021)

## METHODOLOGY AND CONCEPTUALIZATION

The paper presents several Romanian mountain products with a probiotic role, the aim being to create a more accurate picture of the potential to ensure the health of the population. The most used Romanian mountain products with probiotic character belong to animal products – fermented dairy products, vegetable products, and bee products, being studied from the corresponding range within the National Register of Mountain Producers (RNPM, 2021).

*Fermented dairy products (lactic acid bacteria)* are defined by the FAO (2003) as a dairy product obtained by fermenting milk, which can be made from milk products with or without compositional changes, by the action of appropriate microorganisms and resulting in reduced pH- with or without coagulation (isoelectric precipitation). These initial microorganisms must be viable, active, and abundant in the product until the date of minimum durability. If the product is heat-treated after fermentation, the requirement for viable microorganisms does not apply.

*Allium sativum – garlic* (from the group of plant products) is defined by FAO (2017) depending on the degree of drying, respectively: a. Fresh garlic: product with fresh stem, soft and flexible skin of the bulb; b. semi-dried garlic: fresh product with incompletely dry stem and outer skin; c. dried garlic: fresh product in which the stem, the outer skin of the bulb, and the surrounding skin, but also each space is completely dry; d. solo garlic: garlic bulbs consisting of a single puppy.

*Natural honey* is defined in the Codex Alimentarius (FAO, 1981, revisions in 1987, 2001, 2019) as the sweet natural substance produced by bees in plant nectar, secretions of

living parts of certain plants or excretions from insects on different plants, which bees collect and transform by combining with their specific substances in honey. Codex Alimentarius defines two types of natural honey, namely flower honey or nectar honey (honey that comes from plant nectars) and manna honey is honey that comes mainly from the excretions of insects that deposit on plants (*Hemiptera*) live parts of secretions own or from the secretions of the living parts of certain plants.

The research conducted in the paper was qualitative-exploratory (investigation of official documents on mountain products with probiotic role), quantitative-statistical (extraction and processing of related statistical data), and experimental (performing laboratory tests for mountain bee honey – Table 1). The data were processed and statistically simulated in Excel, performing a percentage analysis.

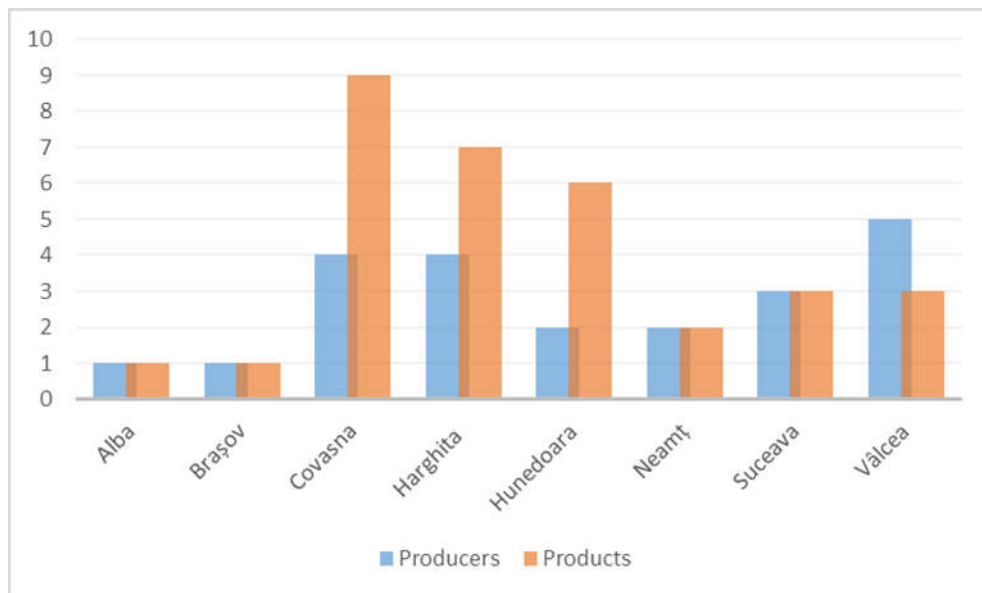
## RESULTS AND DISCUSSION

Research shows that mountain producers in Romania sell mountain products with major potential for the body's immunity.

*Fermented dairy products*, according to numerous studies, have indisputable therapeutic and preventive effects for diseases such as cancer, infection, gastrointestinal disorders, and asthma, respectively COVID-19. Consumption of yogurt, especially in immunocompromised populations, such as the elderly, can enhance the immune response, which in turn would increase resistance to immune-related diseases (Meydani and Ha, 2000).

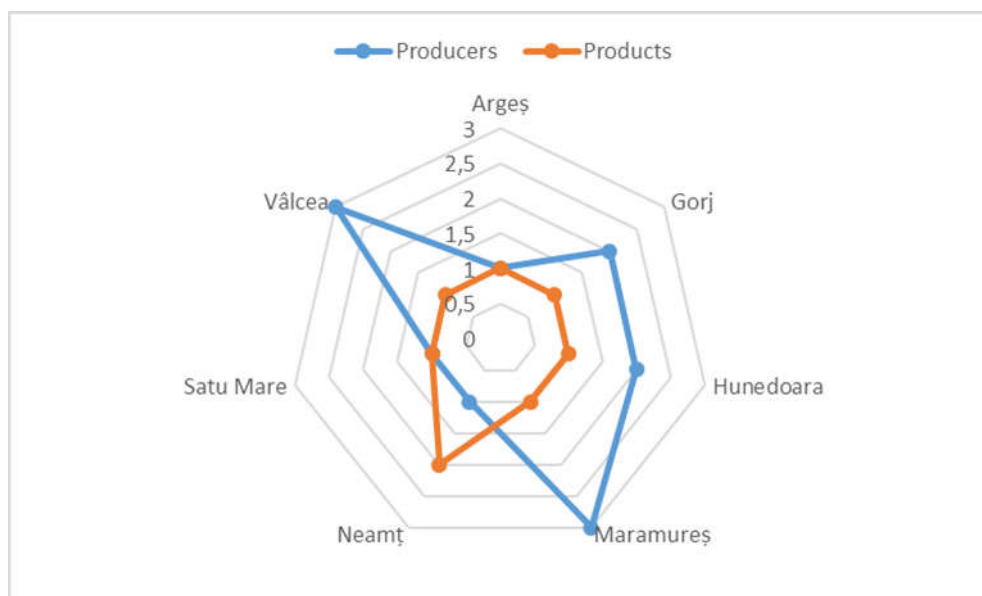
In the research related to the work, the fermented dairy products considered come from certain horned animals (sheep or cow), falling into the assortments of yogurt, creamy natural yogurt, fruit yogurt, thick milk, sour milk, skimmed milk, sana, kefir various fats (not specified in the register). In RNPM (2021) there are also products with specific characteristics or fats, such as sana 3.6%, yogurt 2.8%, kefir 3.5%, yogurt 2.8%, kefir 3.3%, sana 1.8%, yogurt 10%, whipped milk 2%. As can be seen in Figure 1, out of a number of 22 mountain producers, in Alba and Braşov there are one for each county, Covasna and Harghita four, Hunedoara and Neamţ two, Suceava three and Vâlcea five. The distribution of the assortments of mountain products in each county presents one in Alba and Braşov, nine in Covasna, seven in Harghita, six in Hunedoara, two in Neamţ, and three in Suceava and Vâlcea.

From the research carried out on the mountain producers and the assortments related to the fermented dairy products, it is observed that both studied coordinates are in small numbers. Mountain producers of animal products in Romania focus more on meat and other types of animal products, such as sweet and savory cheese, curd, cheese, and others. The partial lack of interest in fermented dairy products, which naturally have a probiotic role, shows that both supply and demand for such products are low in Romania. As mentioned in the introduction, Romania, like other Central and Eastern European countries, partially neglects the importance of diet and health based on the prevention of medical problems by natural methods. At the level of public governance, the proposed solutions are related to educating the population to increase the consumption of food products with a probiotic role, but also to finance the mountain producers who sell such products. At the level of private governance, mountain entrepreneurs should make efforts to promote the benefits of probiotic mountain products and the additional production of these products.



**Fig. 1. Mountain producers and related assortments of fermented dairy products in Romania**

Source: National Agency for Mountain Areas (2021), National Register of Mountain Products



**Fig. 2. Mountain producers and related assortments of *Allium sativum* (garlic) in Romania**

Source: National Agency for Mountain Areas (2021), National Register of Mountain Products

The present study develops aspects related to *Allium sativum* – green or dried garlic, being the most common types of garlic in Romania and RNPM (2021). Other forms such as

power garlic and garlic tables are less commercialized in Romania. The preferences of Romanian consumers are clear for garlic in natural green or dry form, the other forms of garlic presented in the Codex Alimentarius not being too often found in Romanian consumption. Mountain producers of plant products do not know very well the benefits of enrolling in the RNPM (2021), which is why only 13 are registered (Figure 2). Of these, one is located in Argeş, Neamţ and Satu Mare, two in Gorj and Hunedoara, three in Maramureş and Vâlcea. The assortments of products commercialized are one in Argeş, Gorj, Hunedoara, Maramureş, Satu Mare and Vâlcea and two in Neamţ.

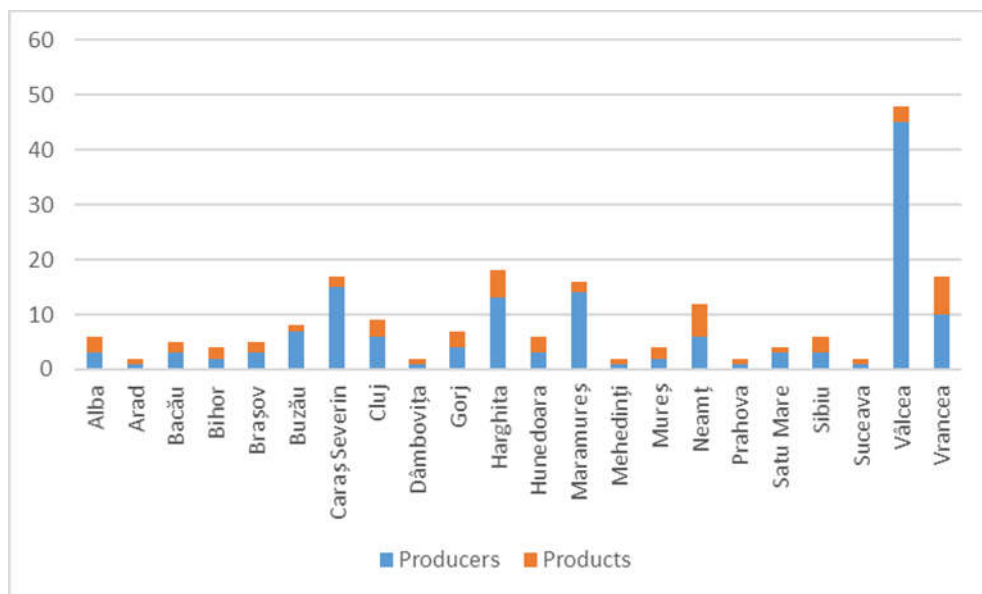
As can be seen, the mountain producers and the related varieties of garlic (*Allium sativum*) in Romania are small in number. Out of 329 mountain producers of vegetable products, only 13 are garlic producers (3.80% of the total) and out of 74 varieties of plant products with a probiotic role, only two are garlic (2.70% of the total). The distribution of *Allium sativum* (garlic) in the total producers and assortments of mountain products in Romania is low, other European countries outside Central and Eastern Europe, but also other countries in the world have a much higher share of garlic production/consumption. Both public and private governance in Romania should implement necessary measures for the development of the plant sector, especially one of the most powerful natural probiotics, *Allium sativum* (garlic).

Natural honey commercialized in Romania is found in RNPM (2021) in the form of natural honey or bee cream honey. The types of honey in RNPM (2021) are mountain raspberry honey, acacia honey, polyfloral honey, manna honey, linden honey, mountain honey (manna mixed with polyfloral), cherry honey, black grass honey (black), acacia and apple honey, berries honey, chestnut honey, fir and raspberry honey, mountain polyfloral honey, forest polyfloral honey, hay honey, cranberry honey, sea buckthorn cream, cream honey with blackcurrants, cream honey with raspberries, acacia and hawthorn honey, raspberry and blackberry honey, polyfloral honey with pollen, polyfloral honey with propolis, polyfloral honey with sea buckthorn, polyfloral honey with nuts, raspberry honey and blackberries, honey polyflora with walnut kernels, polyfloral honey with prunes, honey with pollen, pasture and propolis, honey with spices and propolis, cream honey with propolis, cream honey with pollen, cream honey with royal jelly, cream honey with saffron, cream honey with pasture, cream honey with bee venom. Regarding the numerical distribution (Figure 3), natural honey is commercialized by three producers in Alba, Bacău, Hunedoara, Satu Mare and Sibiu, one each in Arad, Dâmboviţa, Mehedinţi, Prahova and Suceava, two each in Bihor and Mureş, six in Cluj and Neamţ, four in Gorj, ten in Vrancea, 15 in Caraş-Severin, 13 in Harghita, 14 in Maramureş and 45 in Vâlcea. The assortments of products commercialized by mountain producers are three in Alba, Cluj, Hunedoara, Sibiu and Vâlcea, one each in Arad, Buzău, Dâmboviţa, Mehedinţi, Prahova, Satu Mare and Suceava, two each in Bacău, Braşov, Caraş Severin, Maramureş and Mureş, five in Harghita, six in Neamţ and seven in Vrancea.

Natural honey is the most commercialized bee product in Romania, being found in a proportion of 98.65% in the total range of mountain products and the second, after milk and dairy products, in the total mountain products (author according to ANZM, 2021). Some researchers postulate that natural honey can sustain a person's life on its own, having most of the vitamins and minerals necessary for life (Miller, 1955).

According to the analyzes carried out by numerous researchers and by the author, manna honey-like any other mountain product – is nutritionally more complex than other

types of honey (Table 1) (Rey, 2014). Important nutritional values for human health has been found in mountain honey more than in hilly honey, such as sucrose of 2.41 % – g/g (hilly honey only of 2.19), reducing sugar of 76.18 % – g/g (hilly honey of 75.67), fructose of 41.06 % – g/g (hilly honey only of 40.10). Also, the pH level is higher for manna honey (3 milliliters Sodium hydroxide solutions 1N/100 g of honey) than for polyfloral honey (2.80 milliliters Sodium hydroxide solutions 1N/100 g of honey), having a majority composition of linden with willow, manna, grasses, Umbelliferae inserts (hilly product). Through mentioned properties, mountain honey act as real antioxidant (sucrose and fructose in normal quantity, and reducing sugar which are good agents of immunity assurance and sugar reducers from organism) and anti-inflammatory (a high level of pH assures a good protection for the body immunity).



**Fig.3. Mountain producers and related assortments of natural honey in Romania**

*Source:* National Agency for Mountain Areas (2021), National Register of Mountain Products

Specialists believe that the antagonistic activity of probiotic bacteria in natural honey (especially manna, which is found mostly in the mountains) against a broad spectrum of pathogenic microorganisms allows their application for the prophylaxis and treatment of many diseases. The benefits of natural honey, especially manna honey, are multiple for both human and veterinary medicine (Gaifullina et al., 2016).

The Romanian mountain natural honey producers, but also the other actors involved in the value chain of this complex food must support more the beekeeping sector both at the level of internal production and distribution, as well as at the level of external distribution. Romania currently ranks 14th in the world's top of natural honey exports, but applying a well-developed strategy can return to higher positions in this ranking (International Trade Center, 2021).

**Table 1. Physico-chemical analysis of the quality of some types of natural mountain and hill honey**

	<b>Honeydew – manna honey (Maramureş, Romania)</b>	<b>Polyflora honey (linden – preponderent, willow, manna, grasses, umbelliferae) (Neamţ, Romania)</b>
<b>Appearance</b>	Dark amber	Light yellow
<b>Methylglyoxal (MGO)</b>	-	-
<b>Diastase index</b>	29.4±0.18; unities on Goethe	29.4±0.18; unities on Goethe
<b>Sucrose (β-D-Fructofuranosyl α-D-glucopyranoside)</b>	2.41±0.43; %, g/g	2.19±0.39; %, g/g
<b>Reducing sugar</b>	76.18±3.40; %, g/g	75.67±3.37; %, g/g
<b>5-Hydroxymethylfurfural</b>	0.10±0.01; mg/100g of honey	0.19±0.03; mg/100g of honey
<b>PH</b>	3.00±0.46; milliliters Sodium hydroxide solutions 1N/100 g of honey	2.80±0.43; milliliters Sodium hydroxide solutions 1N/100 g of honey
<b>Moisture contents</b>	17.20±0.24; %, g/g	16.80±0.24; %, g/g
<b>Pollen analysis</b>	manna – 98%, mountain polyflora – 2%	linden – 95%, manna – 5%
<b>Electrical conductivity</b>	0.55 mS/cm	-
<b>Ashes</b>	0.21±0.02; %, g/g	0.44±0.03; %, g/g
<b>Fructose (3S,4R,5R)-1,3,4,5,6- Pentahydroxyhexan-2-one)</b>	41.06; %, g/g	40.10; %, g/g
<b>Glucose (2R,3S,4R,5R)-2,3,4,5,6- Pentahydroxyhexanal)</b>	35.12; %, g/g	35.57; %, g/g

Source: Author processing in accordance with the National Research-Development Institute for Beekeeping (2021), Analysis Bulletin 39 / 29.01.2021 and with Covaci B., Brejea R., Covaci M. Sweeteners World Trade and Behaviour in the Pandemic. Evidence from Honey Remedies Nexus Mountain Apis Mellifera Product

## CONCLUSION

Probiotics are gaining ground in the face of antibiotics and anti-inflammatory drugs. The world's population, especially in the context of COVID-19, understands the importance of using probiotics and prebiotics in preventing and combating imbalances in human health. Entrepreneurs involved in the value chain of probiotics, partisans of homeopathic and natural medicine, are gaining ground over those in allopathic medicine. Romania, as well as the other countries in Central and Eastern Europe that belonged to the communist bloc, must adhere to the upward trend of entrepreneurship and consumption of probiotic products. The paper demonstrates that the mountain area is well developed at entrepreneurial chapter and consumption of honey (honey having more producers than other mountain products). The existing data in the RNPM shows that fermented dairy products and vegetable products (especially *Allium sativum* – garlic) must be supported at least for local production and



distribution. Public governance must be made aware of the value chain of natural honey, the mountain potential in this respect being almost unlimited.

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