

Evaluation of the Yin or Yang Character of Some Medicinal Mineral Waters with Biocrystallization

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Abstract

The classification of substances in terms of yin or yang predominance has a major importance in TCM therapy and is often carried out according to the effect produced after their use, i.e., heating or cooling of the body, but there is still no specific method of analysis. Biocrystallization is a method of qualitative informational analysis of food that we propose it through this work as a possible tool for highlighting the predominance of yin / yang. This is the first work to find a method of analysis for determining yin/ yang. We started from the results obtained in the period 2017-2020 in which a series of 55 sources of medicinal mineral waters from Romania were analyzed by biocrystallization, harvesting 93 samples and performing 991 biocrystallization plates. These data were correlated with the information in the literature concerning physico-chemical parameters and pharmacodynamic properties, on the basis of which the waters were framed in mineral waters predominantly yin or yang. It is known that biocrystallization was developed primarily as a method of analyzing the morphogenetic forces associated with the analyzed substrate, which from the point of view of the TCM specific terminology includes the yin/ yang concept. The visual sensory analysis of biocrystallization tests for food, according to ISO 17025, 11035 and 8587 allows an evaluation of their overall quality, translatable also in terms of vitality, movement, dynamism. Starting from these indicators, we identify those specific to the predominance of yin or yang. In our study biocrystallisation allowed a statistically significant differentiation (t-test 1: p-value (one tailed)=2.98501E-10= 0.0000000000299; t-test 2. p-value (two tailed)=5.97002E-10=0.000000000597) of mineral waters predominantly yang from those predominantly yin.

Keywords: Yin; Yang; TCM; Biocrystallization; Medicinal mineral waters

Abbreviation: AC: Acid-Carbonic Mineral Waters; BSP: Branched Specific Pattern; CCD: Copper Chloride Dihydrate; CS: Chloride-Sodium Waters; CST: Thermal Chloride-Sodium Waters; DSP: Dendritic Specific Pattern; MSP: Multicenter Specific Pattern; NS: Nervous System; PCSP: Poorly Coordinated Specific Pattern; TCM: Traditional Chinese Medicine

Introduction

The classification of substances in terms of yin or yang predominance has a major importance in Traditional Chinese Medicine (TCM) therapy and is often carried out according to the effect produced after their use, i.e., heating or cooling of the body. Generally speaking, the yin/ yang pattern identification is the key concept of TCM [1,2], but there is still no specific method of analysis the predominance of yin or yang for a living being, for a food or for a remedy. In terms of Nei Jing, The yellow emperor says about yin and yang: "Yin corresponds to the lack of movement and its energy symbolizes the earth , while Yang corresponds to movement and its energy symbolizes Heaven, so Yin and Yang are the ways of Heaven and Earth, Dao." And also: "Nothing is absolutely Yin nothing is absolutely Yang [3]. In TCM is known that Yang provides growth while Yin ensures development. "Yang is associated with

childbirth (like Spring) yin is associated with growth (like summer), yang is associated with development (like Autumn), and Yin is associated with refuge (like winter) [3]. The yin predominance is associated with Earth, negative, shadow, static, attraction, internal, low, cold, development, horizontally. The yang predominance is associated with Sky, heaven, positive, light, dynamic, rejection, external, up, warm, increase, vertical [4]. The concept of yin/yang have a central role in recognizing and clarifying not only the nature, but also the human health level and even the society [5]. Every disease is regarded as a loss of balance between yin and yang [6]. When we aim to evaluate the yin/yang character for a substance with therapeutic effect, as in our study mineral waters are, we can assess simple parameters such as: 1. the thermal effect which may refer to cooling (yin) or heating (yang); 2. effect on circulation: vasoconstriction (yin), vasodilation (yang); 3. effect on Nervous System (NS): calming, sedative, antispasmodic (yin), dynamizing (yang).

Biocrystallization is a method of qualitative informational analysis of food that we propose through this work as a possible tool for highlighting the predominance of yin/yang. It is known that biocrystallization was developed primarily as a method of analyzing the morphogenetic forces associated with the analyzed substrate, which from the point of view of the specific terminology from TCM includes the yin/yang concept.

It is for the first time when a laboratory method is used for evaluating the yin/yang ratio. In the specialized literature we find the following methods of informational analysis: electrophotonic imaging analyzes performed by prof. Konstantin Korotkov [7-9]; electronography, a method of analysis developed by acad. Cornelia Guja [10-12] in Romania; Pfeiffer circular chromatography which is a method used for the analysis of organic food in some laboratories, such as Bonn Institute of Organic Agriculture [13-15]. capillary dinamolysis [16,17] and biocrystallisation. Of all these, the best known and used is biocrystallization, because it can highlight the informational quality of the analyzed substrate, named the quality of the information matrix. It is currently considered that all living beings on the planet, including man are complex information-energy-substantial entities that interact with the environment in which they live on all these levels [18].

The biocrystallization method is an informational analysis method used in the field of organic and biodynamic food quality by prof. Johannes Kahl [19-23] (Copenhagen University), Nicolaas Busscher [24,25] (Kassel University), researcher Paul Doesburg [26] (Louis Bolk Institut, Crystal Lab Holland), Jurgen Fritz [27] (Bonn Institute of Organic Agriculture) together with their teams, along with others. It also has applications in the evaluation of the informational quality of bee products [28-30] and medicinal herbs [31]. The method has also been used in the medical field to assess oxidative stress [32], mental stress [33] and for early diagnosis of malignancy [34]. The method was also recently proposed for the evaluation of food quality at the highest level of integration of the concept of quality, in the context of nutritional claims (food claims)

from Europe [35,36]. Due to its importance in the field of food quality, it has been standardized according to ISO 17025, 11035 and 8587 by a consortium of three European laboratories: the Department of Food Quality and Food Culture of the University of Kassel in Germany, the Louis Bolk Institute in the Netherlands and BRAD (Byodinamic Research Associaton) in Danemark [37].

Biocrystallisation patterns can be evaluated by visual sensory analysis or by computerized tools of image evaluation [38,39]. Computer-based assessment is based on the criteria used for visual sensory assessment. Due to the complexity of crystallization patterns, visual evaluation is considered superior for discriminating differences between images. Biocrystallization test is based on the crystallization of a pure copper chloride solution, wich usually crystallizes orthorhombically in form of fine needles agglomerated in deposits, towards the periphery of a Petri dish, without giving rise at all to curved or dendritic shapes [40,41]. When we add a very small quantity of organic additive to this solution, on the crystallization plate appears an inhibition of clumps of fine needles; it amplifies several thousand times the volume of crystals and formed radial dendritic, centered, coordinated growths forming three concentric circles [42]. In this way, during crystallization, reproducible crystallograms, also called specific fingerprints of sensitive crystallization appear [43,44]. Biocrystallization combining two processes: transporting and attaching solubilized molecules to the crystal lattice. The resulting pattern is due to molecular interactions with the additive that influence or even direct the growth of crystals [45]. The remarkable variability of the morphological forms of copper chloride crystals forms the basis of its potential applications. An experiment that analyzed by X-ray photoelectric spectroscopy the crystallized copper chloride network show that the specific elements of the analyzed substrate (nitrogen, carbon and oxygen) influence only the morphology of copper chloride crystallization [46]. Another study conducted in France showed that electric and magnetic fields do not influence biocrystallization either [47].

Materials and Methods

We started from the results obtained in the period 2017-2020 in which a series of 55 sources of medicinal mineral waters from Romania were analyzed by biocrystallization, harvesting 93 samples and performing 991 (including witnesses) biocrystallization plates. These data were correlated with the information in the literature concerning physico-chemical parameters and pharmacodynamic properties, on the basis of which the waters were framed in mineral waters predominantly yin or yang.

The studied samples

Of the 55 sources of mineral waters from Romania, 53 are natural springs and 2 bottled medicinal waters, 36 carbonated sources (of volcanic origin from the Eastern Carpathians (Călimani-Gurghiu-Hargita) and 19 chloride - sodium sources, some of which are also sulphurous or sulphated from the areas of Căciulata-Călimănești and Băile Herculane.

Method

The crystallization chamber used was a model inspired by Andersen and Barth [48], constantly monitored for temperature and humidity. For the copper chloride solution, we used ACS Dihydrated Copper Chloride (CCD), Reag. Ph. Eur. from Merck and commercially available double-distilled water for medical use. To determine specific crystallization fingerprints, concentration series were performed according to Andersen 2003 [49]. After the crystallization process was completed, each plate was photographed with a Canon 550D camera, using a Canon 18-55mm IS-STM lens, and a Canon Macro Lens EF 100mm f/2.8USM lens with Kenko circular polarizing filters. All plates were photographed on an LED panel for product photography, modified and equipped with a vertical polarization filter. The interpretation of the biocrystallization fingerprints obtained in our experiments was performed according to ISO 17025, 11035 and 8587 by a working group of 10 experienced and inexperienced members, who made the panel of necessary criteria, built a scale of interpretation and after that was involved in its use carried out the evaluation in two stages at a distance of one month between them [37].

Results and Discussion

The yin/yang characteristics of mineral waters in Romania from literature

Territory of Romania it has a complex geological composition and have a particularly wide range of mineral waters. Several thousand springs have been studied, which include almost all types of mineral waters. Taking into account the chemical composition, the mineral waters of Romania can be grouped into three predominant types, closely related to the geological composition of the soils from which they spring: 1. salt water, 2. sulphated sulphurous waters, 3. acid-carbonic waters [50].

The yin/yang origin of mineral waters: Pliny the Elder tells: "Talles sunt aquae quales sunt terrae (Such are the waters as are the lands through which they flow)." so, the origin of mineral waters it allows us to first fit into yin or yang waters because we have 1. Groundwater also called veteric waters or fossil waters=yin, because they come from water webs trapped in very old geological layers and which are often present near oil deposits; 2. Depth waters also called juvenile waters=yang from yin includes the waters coming from the condensing water of volcanic magma; 3. Surface waters = yang, also called vadous waters come from atmospheric water penetrated into the soil and mineralized during the process of crossing geochemical formations.

The yin/yang dynamic of mineral waters: Another important characteristics is the dynamics of mineral waters, the speed of circulation through rocks. From this point of view we have: 1. Waters with low dynamics=yin, and highly mineralized, containing rare minerals such as bromine and iodine that need a longer contact time with water to dissolve; 2. Mineral waters with high dynamics=yang, which have a low content of minerals (bicarbonated and salty waters); 3. Waters with medium dynamics, comprising sulphated, calcium and magnesium waters.

The yin/yang temperature of mineral waters: The temperature of mineral waters can be also an yin/yang indicator because we have cold (yin) waters having at source below 20 °C and hot (yang) waters (thermal) having at source over 20 °C. The thermal waters can be hypothermal (with temperature between 20-31 °C), isothermal if they have a temperature between 34-37 °C or hyperthermal if their natural temperature exceeds 37 °C.

The yin/yang effects of mineral water baths: Another useful parameter is the effects of mineral water baths. In the case of chloride-sodium, sulphurous water baths the effects are due to mineral salts contained in the soil overflowing by waters, and we know that the earth is yin in relation to the sky. The major indication of these waters are chronic inflammatory diseases, because they have an anti-inflammatory, regenerating (because of sulfur), calming, antispasmodic action. All these effects have a yin in nature. In the case of carbonated water baths, the effects are due to carbon dioxide dissolved in water and less the mineral composition of water. We know that carbon dioxide is a gas, so it has a relation with the Sky, which is Yang in his nature. The major indication of carbonated water bath is cardiovascular disease because they have a vasodilator effect. Although the water is below 34 °C, the baths give a feeling of warmth: at the level of the skin there is an excitation resulting from the simultaneous and constantly moving contrast between the aqueous or gas phase in the mineral bath as well as a mechanical impact effect (mechanical excitation) because the surface of the skin is covered with small gas bubbles (extremely fine in the case of baths with carbonated natural water), which reaching a certain size detach, in their place taking the birth of other vesicles. All these effects have a yang nature.

Informational quality of mineral waters

After the publishing of the preliminary results about the informational quality of mineral waters in *Revista de chimie* nr. 2/2020 on determination of biocrystallization patterns specific to mineral waters, we continued to study them by observing the formation of other patterns [51]. Correlating those patterns with the yin/yang characteristics of mineral waters presented earlier in this paper, we observed a significant relationship between the biocrystallization pattern, and the yin or yang character of the mineral waters included in the study. Based on this relationship, we were able to classify mineral water samples into four categories of patterns as you see in Table 1: 1. Carbonated acid waters=YANG, having a Dendritic Specific Pattern (DSP): Borsec, Harghita, Chirui, Corund, Balványos, Tuşnad, Covasna, Vâlcele, Homorod, Băile Jigodin, Micfalău, Malnaş Chloride-sodium springs; 2. Sulphurous and sulphated mineral waters of deposit=YIN, having a Multicenter Specific Pattern (MSP): Călimăneşti springs 5,6,8; 3. bicarbonated carbonated waters=YIN of YANG having a Branched Specific Pattern (BSP): Borsec springs, Malnaş Maria spring; 4. sulphurous waters, chlorinated-sodium, juvenile, +/-thermal=YANG of YIN having a Poorly Coordinated Specific Pattern (PCSP): Herculane (sources Neptun, Diana, Traian, Vicol, Scorillo, Apollo, Venera, 7 hot springs), Căciulata 1,2, Călimăneşti 4,14,7 springs.

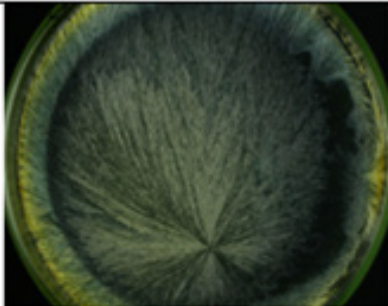

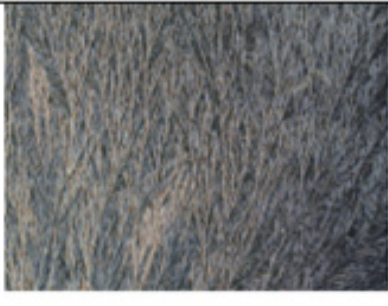
Table 1: Yin/yang pattern of studied mineral waters.

A	Biocrystallization Pattern	Type of Mineral Waters	Source with this Pattern
Yang	dendritic specific pattern	carbonated acid waters	Borsec, Harghita, Chirui, Corund, Balványos, Tuşnad, Covasna, Vâlcele, Homorod, Băile Jigodin, Micfalău, Malnaş Chloride-sodium springs
Yin	multicenter specific pattern	sulphurous and sulphated mineral waters of deposit	Călimăneşti springs 5,6,8
Yin from Yang	branched specific pattern	bicarbonated carbonated waters	Borsec springs, Malnaş Maria spring
Yang from Yin	poorly coordinated specific pattern	sulphurous waters, chlorinated-sodium, juvenile, +/-thermal	Herculane (sources Neptun, Diana, Traian, Vicol, Scorrillo, Apollo, Venera, 7 hot springs), Căciulata 1, 2, Călimăneşti 4, 14, 7 springs

The dendrite Specific Pattern (DSP): The Dendritic Specific Pattern (DSP) observed on biocrystallization test for acid-carbonic waters (acidified and bicarbonated)=YANG has the features:

centering, coordinating, integrating the image="sun", long and dense dendritic branches, curved, suggesting mobility see Images 1, 2 & 3 in Table 2 – Examples for dendrite specific pattern.


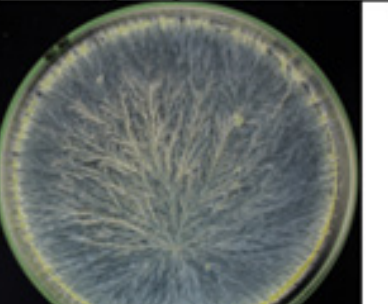

Table 2: Examples for Dendrite Specific Pattern (DSP).

		
Image 1: DSP -Vâlcele: 0,07 g/4,6ml/0,4 ml (CCD/distilled water/mineral water on plate)	Image 2: DSP - Borsec no 6: 0,07 g/4,6ml/0,4 ml (CCD/distilled water/mineral water on plate)	Image 3: DSP branches detail

The Branched Specific Pattern (BSP): The Branched Specific Pattern (BSP) was observed on biocrystallization test for acid-carbonic waters (alkaline and bicarbonated)=yin from yang, has

the features: centering, coordinating, integrating the image="sun", dendritic branches with secondary branches of grade 2 and 3. These features can be observed in images 4 & 5 and 6 in Table 3.

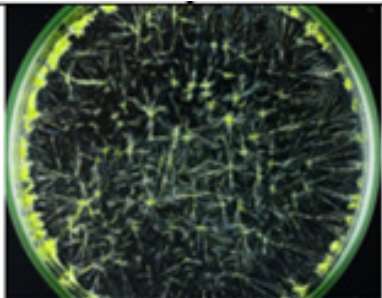
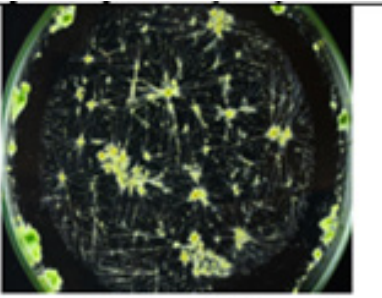
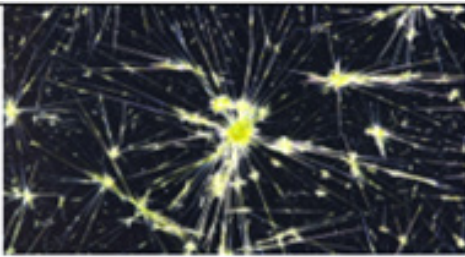
Table 3: Examples of Branched Specific Pattern (BSP).

		
Image 4: BSP for Borsec 11spring: 0,07 g/4,6ml/0,4 ml (CCD/mineral water/bidistilled water on plate)	Image 5: BSP Borsec 10 spring: 0,07 g/4,6ml/0,4 ml (CCD/mineral water/bidistilled water on plate)	Image 6: BSP branches detail

The Multicenter Specific Pattern (MSP): The Multicenter Specific Pattern (MSP) was observed for sulphurous waters, chloride-sodium=yin and has the features: rigid and straight

branches – immobility, formations in "star"="starry sky" as we see in images 7 & 8 and 9 in Table 4.

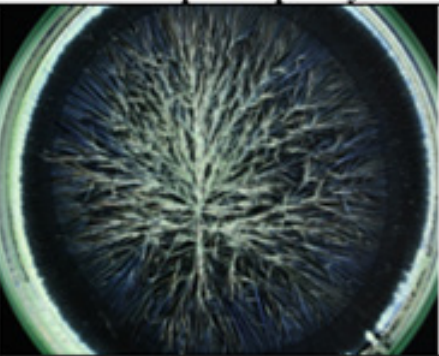
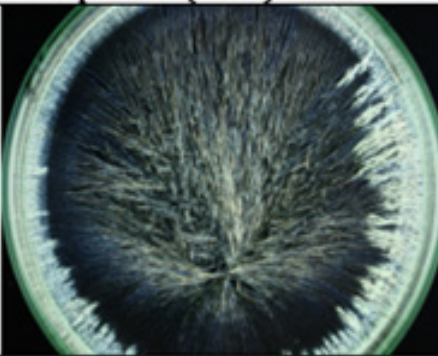

Table 4: Examples of Multicenter Specific Pattern (MSP).

		
Image 7: MSP- Herculane – Neptun 2; 0.07 g/4.6 ml/0.4 ml (CCD/mineral water/bidistilled water on plate)	Image 8: MSP -Căciulata – 1; 0.07 g/4.6ml/0.4 ml (CCD/mineral water/bidistilled water on plate)	Image 9: MSP detail

The Poorly Coordinated Pattern (PCSP): The Poorly Coordinated Pattern (PCSP) was observed for calcium sodium chloride waters = yang from yin, and has the features: centering,

medium coordination, and medium image integration medium density secondary branches rigid branches suggesting no movement (a yin feature) as we can see in images 10 & 11 and 12 in Table 5.

Table 5: Examples of Poorly Coordinated Pattern (PCSP).

		
Image 10: PCSP for Călimănești 7 spring; 0.07 g/ 4.6ml/ 0.4 ml (CCD/mineral water/bidistilled water on plate)	Image 11: PCSP for Căciulata 2; 0.07 g/4.6ml/ 0.4 ml (CCD/mineral water/bidistilled water on plate)	Image 12: PCSP detail

Statistical analysis

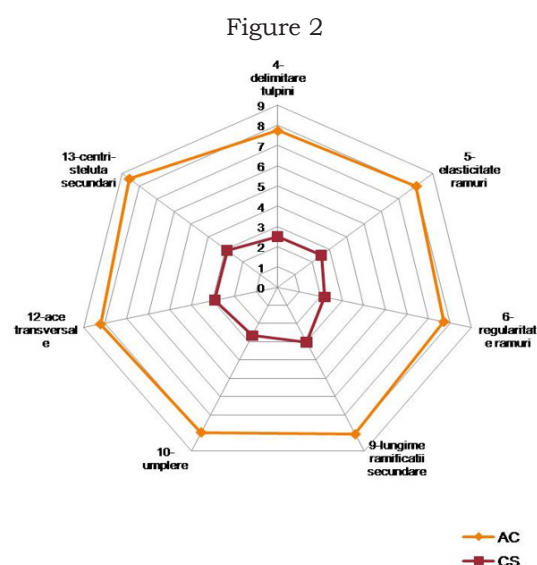
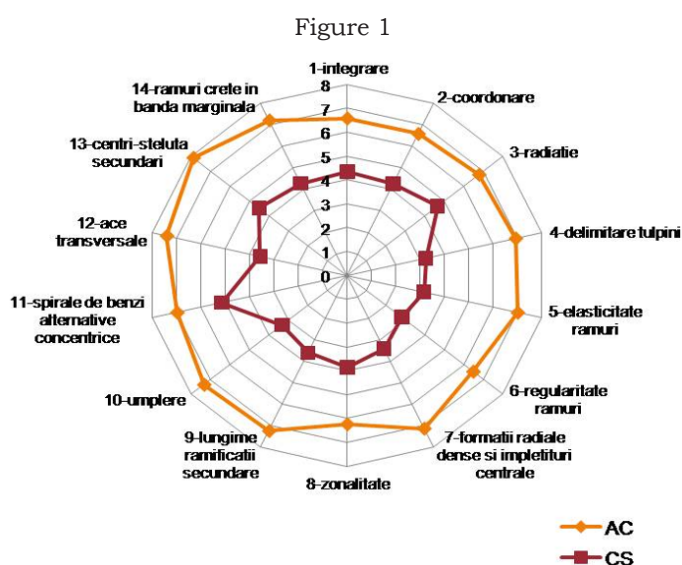
The centralization of the visual sensory evaluation notes of the specific fingerprints of biocrystallization was performed with the help of excel software. The data were processed in excel to obtain the arithmetic means for each analysis criterion and for each sample studied. Graphs were made using Excel to render the ability of biocrystallization to differentiate morphological patterns corresponding to the main and secondary chemical types of

mineral waters studied and the TTEST function in excel was used to calculate the p value.

Differentiating of yin and yang pattern: In the Figure 1 & 2 we can observe the significant capacity of biocrystallization test to differentiate the mineral waters with a yang predominance, and the chloride-sodium waters wich has a yin predominance. Parameters of differentiation of acid-carbonic waters (YANG) from chloride-sodium waters (YIN) are shown in Table 6.

Table 6: Yin/Yang pattern differentiation indicators.

Yin	Yang
	Density of branches of order 1
Short main stems	Long main stems
Rigid branches, impression of immobility	Elastic branches, impression of mobility
Multiply centers="stars"	Single center="sun"
Disorder	Ordering coordinated by the center
	Stem delimitation
Irregular pattern	Regular pattern



Figures 1 & 2: The significant capacity of biocrystallization test to differentiate the mineral waters with a yang predominance, and the chloride-sodium waters which has yin predominance.

Differentiating cold Chloride-Sodium waters (CS)=YIN from thermal ones (CST)=YANG from YIN: Parameters differentiating chloride-sodium waters (yin) from thermal chloride-sodium

waters (yang from yin) are shown in Table 7 and their ability to differentiate patterns in Figure 3.

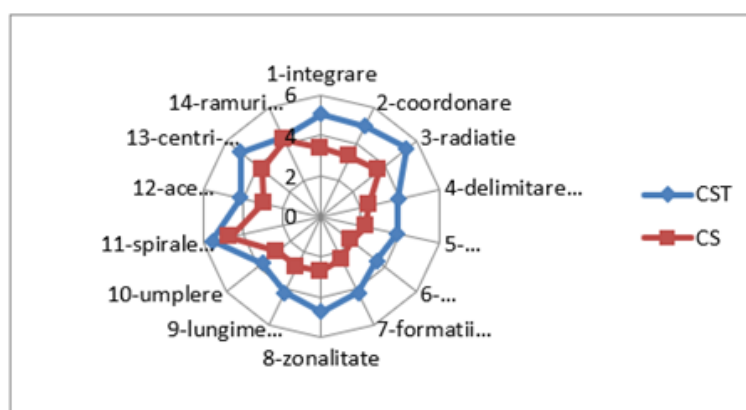


Figure 3: Differentiating cold Chloride-Sodium waters (CS)=YIN from thermal ones (CST)=YANG from YIN.

Table 7: yin/yang from yin pattern differentiation indicators.

Yin	Yang from Yin
Stems short, just around the centers	Long main stems
Rigid branches, impression of immobility	Stiff, intertwined branches, impression of reduced mobility
Multiple Centers="stars"	Single center="sun" but secondary "stars" centers persist attached to the branches
Disorder	Minimum order, zoning
	Dense radial formations, amorphous
Irregular pattern	Irregular pattern

Differentiating acidic-carbonic acid waters (YANG) from alkaline-carbonic acid waters (YIN from YANG): Parameters differentiating acidic-carbonic acid waters (YANG) from alkaline-carbonic acid waters (YIN from YANG) is shown in Table 8.

Table 8: Parameters differentiating acidic-carbonic acid waters (YANG) from alkaline-carbonic acid waters (YIN from YANG).

YIN from YANG	YANG
Filling with branches of order 2,3	Density of order 1 branches

Conclusion

Visual sensory analysis of biocrystallization tests for those mineral waters, according to ISO 17025, 11035 and 8587 allows an evaluation of their overall quality, translatable also in terms of vitality, movement, dynamism. Starting from these indicators, we identify the predominance of yin or yang of mineral waters studied in this work, using the features presented in this paper. The method allows in this study a significant differentiation of pattern for carbonic acid waters (more yang) than chloride-sodium ones (more yin), for cold chloride-sodium waters (yin) from thermal ones (yang from yin) and for acidified carbonic acid waters (yang) from alkaline ones (yin from yang). The specific yang and yin morphological parameters correspond to TCM description of Yin and Yang. For yang we observed a centering aspect, like a "sun", image coordination, orderly pattern, growth in length of crystallization branches, from center to periphery. For yin we observed multicentric aspect like "starry sky", non-coordination and a pronounced development of secondary branching. Studies on other food or medicinal substances with a known yin or yang predominance are needed to validate and even extend parameters identified in this mineral water study.

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Conflict of Interest

We declare there is no financial interest or any conflict of interest.

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