Mathematical Biosciences and Engineering

MBE, 18(4): 3423–3434.
DOI: 10.3934/mbe.2021171
Received: 15 February 2021
Accepted: 12 April 2021
Published: 19 April 2021

http://www.aimspress.com/journal/MBE

Research article

Research on the influence of attention and emotion of tea drinkers based on artificial neural network

Biyun Hong[1] and Yang Zhang[2,*]

[1] Anxi College of Tea Science, Fujian Agriculture and Forestry University, China
[2] Fine Art and Design College, Quanzhou Normal University, China

*** Correspondence:** Email: 490274603@qq.com.

Abstract: Tea can help to regulate the mood of human. Based on the influence of tea on people's mood and attention, this study explored the tea concentration when the mood and attention of drinkers are in the best state, and established the best concentration model of tea. Using sampling experiment method to collect objective data, which are then combined with questionnaire survey method to collect subjective data, using the results to establish a neural network algorithm model to test the accuracy of the neural network algorithm model. Experiments show that the correlation coefficient of the output value of the BP neural network model constructed in this study is basically consistent with the actual prediction result. After obtaining data such as age, gender, frequency of tea drinking, and tea drinking concentration of tea drinkers, the constructed back propagation (BP) neural network model can accurately predict the mental state score of tea drinkers. The research will provide certain data support and theoretical basis for the follow-up development of the tea industry. Follow-up work needs to be performed in order to further adjust the scope and accuracy of the control model. Then, a more complete and accurate advanced BP neural network model can be established for different types of tea and other parameters.

Keywords: health informatics; mood and attention; BP neural network; α brain wave; tea concentration

1. Introduction

Tea is one of the three largest plant-based beverages in the world. People have been drinking tea made from tea leaves for hundreds of years. Tea is popular worldwide for its various health benefits. Tea water is rich in tea polyphenols, catechins, caffeine and other substances that contribute to health. Although tea has been defined as a healthy beverage since the history of drinking tea, the analysis and research on the composition of tea beverages and tea products have only been conducted for less than 50 years. The nutritional effects of nutrients in tea beverages and tea products and the pharmacological effects of related ingredients in tea are the main reasons why tea is beneficial to human health. A large number of studies have confirmed that tea is beneficial to human health and has certain medical effects on modern diseases such as cardiovascular and cerebrovascular diseases, cerebrovascular diseases and cancer. Dietz et al. believe that tea can affect mood [1]. Spittler et al. According to research, a meta-analysis of clinical trials and observational epidemiological studies proves that tea can effectively relieve ischemic stroke [2]. Scott et al. found that drinking tea has a positive effect on mood [3]. Khan et al. believe that tea and tea products have been shown to inhibit tumorigenesis in a variety of carcinogenic animal models [4]. Mihelj et al. believe that tea polyphenols in tea have high antioxidant, anti-cancer and anti-allergic activities, so they are beneficial to health [5]. Djoko research found that standardized green tea water extracts can prevent and inhibit cancer development by enhancing the expression of IFN-γ and other immune monitoring components [6]. Rizon et al. believe that electroencephalography (EEG) is one of the most reliable physiological signals to detect the emotional state of the brain [7]. Kobayashi et al. conducted experiments on the influence of theanine on brain waves and found that theanine can be used as a new functional food ingredient in soothing foods and beverages [8]. It can be seen that tea has so many pharmacological effects and extensive effects that it cannot be replaced by other beverages. A three-layer neural network algorithm is used to model and optimize the extraction of tea polyphenols in green tea. They combined neural network and genetic algorithm to study the best extraction conditions for the highest yield of tea polyphenols in green tea [9]. Ning et al. established a near-infrared spectroscopy method combined with artificial neural network (ANN) to quickly predict the degree of fermentation of Pu' tea during processing [10]. Das et al. have verified the withering process of tea through research, using artificial neural network to predict machine learning to predict water loss (ML) [11]. Zhou et al. used fuzzy neural networks to study taste signal recognition [12].

Research on tea shows that the caffeine and other substances in tea can affect the mood and attention of tea drinkers and have a positive effect. At the same time, artificial neural network algorithms have also been applied to tea classification, element extraction, storage and fermentation and other fields, and breakthroughs have been made [13]. However, there is no research to verify the degree of influence of tea on tea drinkers, such as tea concentration, age and sex of drinkers, and tea drinking frequency. These factors will have an emotional impact on tea drinkers and make them reach their best state [14,15]. Based on the influence of tea on people’s mood and attention, this article collects objective data through sampling experiments, and collects subjective data through questionnaire surveys. Finally, the relationship between tea concentration and mood and attention is discussed. When the mood and concentration of tea drinkers are at their best, please explore the concentration of tea. Through a combination of subjective evaluation and objective measurement, the optimal tea concentration was tested and analyzed, and a tea concentration prediction algorithm

model based on BP (back propagation) neural network was established. This research will provide certain data support and theoretical basis for the follow-up tea beverage research.

2. Methodology

2.1. Test subjects

We recruited 112 tea drinkers. To ensure the validity of the experiment, 1 patient with cognitive impairment and 3 subjects who could not complete the experiment were excluded. In the end, a total of 108 effective experiments were carried out, including 66 men and 42 women. The age of tea drinkers is 16 to 70 years old, with an average age of 36.67 years. 108 experimental subjects completed all the contents of this experiment in accordance with the experimental rules, so these 108 experiments are valid and have research significance. 108 tea drinkers were distinguished based on age, gender and frequency of tea drinking. These data are shown in Table 1.

Table 1. The age, frequency and gender distribution of drinkers.

Drinking Frequency	Age: ≤ 20 Years Old	Age: 21–40 Years Old	Age: 41–60 Years Old	Age: 60 + Years Old
≥ 3 Times a Week	2（Male 2, Female 1）	11（Male 5, Female 6）	16（Male 10, Female 6）	5（Male 4, Female 1）
3 > x ≥ 1 Time per Week	5（Male 4, Female 1）	19（Male 12, Female 7）	15（Male 9, Female 6）	4（Male 3, Female 1）
< 1 Time per Week	5（Male 3, Female 2）	12（Male 6, Female 6）	10（Male 7, Female 3）	4（Male 2, Female 2）

2.2. Subjective evaluation

A total of 108 subjects completed the experiment, and the questionnaire filled out is complete and valid. We use the online and offline methods to complete the questionnaire [16,17]. Combined with experimental comparison, the questionnaire survey collected 108 valid questionnaires, 94 online questionnaires and 14 offline questionnaires. Finally, manually input the offline questionnaire into the online questionnaire system. The data variables of tea concentration are the time of making tea [18] and the content of tea. The tea content is 3, 5, 10, 15 g. There are five types of tea brewing time: "5 seconds", "10 seconds", "20 seconds", "30 seconds" and "60 seconds". According to different combinations of tea content and tea brewing time, there are 20 combinations, 20 kinds of tea water combinations are shown in Table 2.

Table 2. Combination table of tea concentration parameters.

	Brewing Time 5 Seconds	Brewing Time 10 Seconds	Brewing Time 20 Seconds	Brewing Time 30 Seconds	Brewing Time 60 Seconds
Tea Content 3 g	3 g5″	3 g10″	3 g20″	3 g30″	3 g60″
Tea Content 5 g	5 g5″	5 g10″	5 g20″	5 g30″	5 g60″
Tea Content 10 g	10 g5″	10 g10″	10 g20″	10 g30″	10 g60″
Tea Content 15 g	15 g5″	15 g10″	15 g20″	15 g30″	15 g60″

2.3. Objective comment

We use the eego™mylab fully mobile EEG recording and analysis system as the device for this comparison test to record the EEG data of tea drinkers. eego™mylab is an innovative brain science product of ANT Neuro. It is a fatigue monitoring system for underground coal mine workers. It includes a wearable part, a personnel operating equipment part, a personnel terminal part and a signal terminal processing part. Waveguard™ EEG caps can be effectively used to study emotions, learning, attention, perception and other cognitive processes. Ladin Wakidvin (Ladin Wakidvin) Alexander Potor Potolak (Alexander Potor Potolak); Valeria (Valeria), Potolac (Potolac); Bikson, Marom used in article 11: inside Replay of the primary sleep rhythm may cause drowsiness. Alpha brain waves are the most intuitive and objective reflection of emotions. Combined with subjective questionnaires, the psychological and emotional changes of tea drinkers can be accurately measured. We collect the brainwave data of the drinker when filling in the questionnaire and record it with the eego™mylab all-mobile EEG recording and analysis system. Next, we change the emotional attention of tea drinkers when drinking tea, and use the software to classify the collected EEG data as the target of the experimental data source. Emotional changes can be expressed in the form of alpha brain waves. The shape of alpha brain waves is shown in Figure 1.

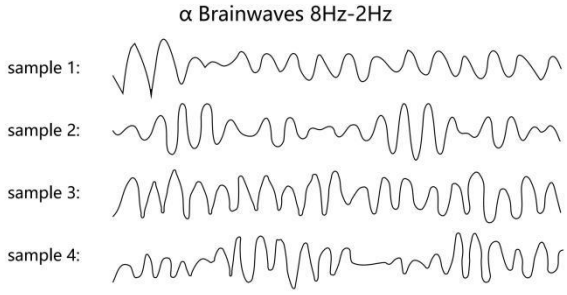

Figure 1. Alpha brain wave shape.

2.4. Experiment process

First, according to the combination of experimental parameters, 20 different concentrations of tea are brewed in sequence, the tea leaves are separated from the tea leaves, and the 20 different concentrations of tea are kept at a constant temperature. Use at 60°C. Taking 3 grams for 5 seconds as an example, the content of tea is 3 grams of tea per 150 milliliters of water, and so on. The tea drinker drinks a cup of 10 ml of tea at a time. During the experiment, subjects were prohibited from ingesting beverages and food containing caffeine and alcohol. The tea drinker rinsed his mouth with water three minutes before drinking, and stopped eating before the rinsing experiment. To ensure that the quality of the tea remains the same, it is updated at least every three hours. The experimental steps are as follows: Step 1: The staff introduces the whole experiment process to the tea drinkers and distributes the questionnaire; Step 2: Put the tea drinker on the Waveguard™ EEG cover, and the staff opens the eego™ mylab system to detect when the tea drinker drinks different combinations of EEG Fluctuations; Step 3: According to the questionnaire, tea drinkers try different combinations of tea and beverages. The staff will monitor and record the EEG data of the tea drinkers; Step 4: The

staff collect and organize the data according to the questionnaire data collected in the experiment, and use the eego™mylab software to organize the data; Step 5: Detect the emotional influence of each tea combination The content of the substance; Step 6: Establish and verify the tea concentration model that has the greatest impact on drinking fountains based on BP neural network. The questionnaire was adjusted based on the combination of the five-level scoring scale of the NASA TLX scale and the Richter scale [19,20] to make it suitable for the research situation. Conduct subjective experiments in the form of questionnaires. In this experiment, Tieguanyin tea was used as the experimental tea, and 20 tea reagents of different concentrations were brewed according to the experimental rules, as shown in Figure 2.

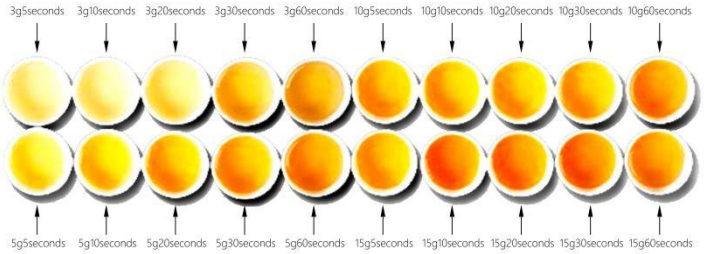

Figure 2. 20 Combinations of tea water.

2.5. BP neural network

BP neural network model is widely used in system modeling because of its powerful nonlinear adaptive processing ability. In this study, a new mathematical model was established based on the BP neural network, which is suitable for the influence of tea concentration on tea drinkers of different ages, genders and tea drinking frequencies. BP neural network is a commonly used multilayer feedforward neural network. Its main function is to forward the signal, propagate the error back, and adjust the threshold and network weight according to the prediction error, so that the prediction output is always close to the expected value. The structural framework includes input layer, hidden layer and output layer. Figure 3 shows the single hidden layer BP neural network structure selected in this paper.

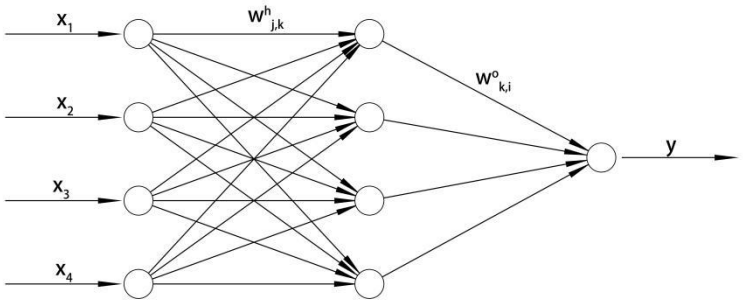

Figure 3. Single hidden layer BP neural network structure.

In Figure 3, the BP neural network structure is a three-layer BP neural network with 4 inputs and 1 output. In the figure, x is the network input value, y is the network output value, wh j, k are the connection weight values of the j-th neuron in the input layer and the k-th neuron in the hidden layer, wo k, i are the values in the hidden layer Value is the connection weight value between the elements in the output layer of the k-th neuron and the i-th neuron.

The number of hidden layer nodes is as follows:

$$h = \sqrt{m+n} + a \tag{1}$$

Among them, h is the number of hidden layer nodes, m is the number of input layer nodes, n is the number of output layer nodes, and a is an adjustment constant between 1 and 10.

Assuming that all the results of the output layer are dj, the error function is as follows:

$$E(w,b) = \frac{1}{2}\sum_{j=0}^{n-1}\left(d_j - y_j\right)^2 \tag{2}$$

3. Results

3.1. Comparison of experimental results

According to the tea-water combination data, Cronbach's α coefficient is 0.891 [21,22]. Therefore, the derivation of the combined frame system constructed in this study is reasonable and has research value. The questionnaire in this study was improved based on the Richter scale 5 scale, using tea content and brewing time as scoring variables. Finally, different concentrations were obtained to obtain the tea score rate, as shown in Table 3.

Table 3. Water score rate of different concentrations of tea.

Average Score Rate of 20 Reagent Combinations							
Reagent Name	Scoring Rate	Reagent Name	Scoring Rate	Reagent Name	Scoring Rate	Reagent Name	Scoring Rate
3 g5″	40.1%	5 g5″	45.6%	10 g5″	73.3%	15 g5″	85.5%
3 g10″	51.2%	5 g10″	67.5%	10 g10″	86.5%	15 g10″	76.9%
3 g20″	55.5%	5 g20″	75.2%	10 g20″	77.9%	15 g20″	68.6%
3 g30″	63.1%	5 g30″	83.3%	10 g30″	53.9%	15 g30″	45.1%
3 g60″	70.9%	5 g60″	43.3%	10 g60″	36.6%	15 g60″	32.2%

In this study, subjective assessment and objective measurement were combined to study the subjective assessment and objective measurement of different combinations of emotional attention of tea drinkers under the above test conditions. The evaluation level can be divided into 5 levels. The subjective scoring standards designed according to requirements are shown in Table 4.

Table 4. Grading standards.

Level Description of the Physiological State of the Drinker	Grade	Score
Emotional attention is good, alpha brain waves are highly active	1	81–100
Better emotional attention, more active alpha brain waves	2	61–80
Emotional attention status is average, alpha brain waves are more active	3	41–60
Poor emotional attention, alpha brain waves are less active	4	21–40
Poor emotional attention and low alpha brain wave activity	5	1–20

Table 5. Alpha brain wave probability of tea water drinkers with different combinations.

	Probability of α Brain Wave for Tea Drinkers with Different Combinations				
Reagent Name	3 g5″	3 g10″	3 g20″	3 g30″	3 g60″
α Brainwaves	45%	59%	61%	63%	74%
Reagent Name	5 g5″	5 g10″	5 g20″	5 g30″	5 g60″
α Brainwaves	53%	65%	80%	87%	39%
Reagent Name	10 g5″	10 g10″	10 g20″	10 g30″	10 g60″
α Brainwaves	76%	91%	80%	60%	35%
Reagent Name	15 g5″	15 g10″	15 g20″	15 g30″	15 g60″
α Brainwaves	88%	82%	70%	45%	30%

According to Table 5, the score rate of the tea combination can be obtained. Taking 10 grams of tea for 10 seconds as an example, the average score of 108 tea drinkers after tasting is 7.783, so the calculated score rate is 86.5%, and so on. According to Table 5, the alpha brainwave probabilities of tea drinkers with different combinations are obtained. The score rate and brainwave probability are shown in Figure 4.

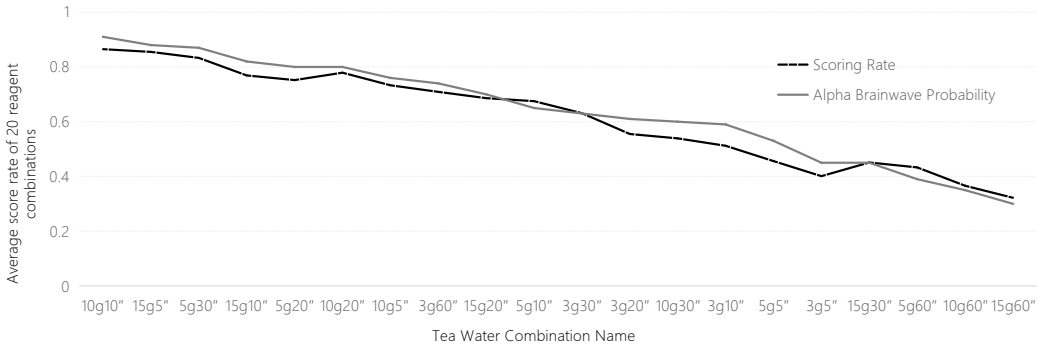

Figure 4. Comparison of subjective evaluation and brainwave detection.

According to Figure 4, it can be concluded that the probability of drinking Alpha brain waves with different tea combinations is basically the same as the scoring rate obtained by the questionnaire, which indicates that the subjective data is the same as the objective data. Therefore, this research is reasonable, effective and highly accurate. During the experiment, analyze and compare the scoring rates of 3 g10 seconds, 5 g10 seconds, 10 g10 seconds and 15 g10 seconds of tea drinkers of

different ages, genders and tea drinking frequency. As shown in Figure 5, the results show that there is a large gap between the average scores of elderly tea drinkers and young drinkers, male and female drinkers, and drinkers with different tea frequencies ($P > 0.05$)). It is statistically significant. Meaning, so it can be the object of discussion in this study.

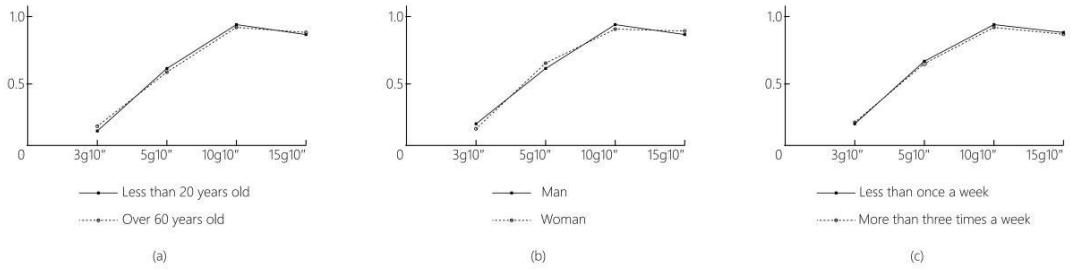

Figure 5. Comparison of average scores of age, gender, and different drinking frequencies.

4. Discussion

When the tea content is 10 grams for 10 seconds, 15 grams for 5 seconds, and 5 grams for 30 seconds, tea drinkers score the highest in these three cases, and tea drinkers have the best mood and attention state when drinking. At this time, the tea concentration has the best effect on the emotional attention of tea drinkers. When the tea concentration is 10 g for 60 seconds; When the tea concentration is 15 g for 60 seconds, the tea concentration has the worst effect on the mood and attention of tea drinkers. Too high tea concentration will not have a higher positive effect on tea drinkers, because too high concentration will make the tea bitter and difficult to drink, and affect the mood of tea drinkers. Too low a concentration will result in insufficient caffeine and theanine in the tea, and will not effectively affect the drinker.

We calculated the alpha wave changes of 12 tea drinkers who drank tea once a week and 33 tea drinkers who drank tea more than 3 times a week to explore the effects of different tea drinking frequencies on the mood and attention of tea drinkers. Test the influence of tea drinkers with different tea drinking frequencies. In this study, 10 grams for 10 seconds, 3 grams for 5 seconds and 15 grams for 60 seconds were used as reference objects. The result is shown in Figure 6. People with low tea drinking frequency (10 grams) for 10 seconds have significantly lower mood changes than those with high tea drinking frequency and average tea drinking frequency. In the case of 5 g/5 seconds, the emotional experience of people who often drink tea is significantly lower than that of people who do not drink tea often. People with low tea frequency have much lower emotional response at 15 g/60 seconds than those with high tea frequency. The result may be that people who drink less tea have less experience in drinking tea, have no deep understanding of changes in tea concentration, and are not clear about the taste of tea. When 15 grams lasts for 60 seconds, the concentration of the tea will be higher and the taste will be very bitter. People who drink less tea react more strongly. People who drink tea frequently drink tea for a long time, so they have a clear self-perception of the concentration and taste of tea. Therefore, when the tea concentration is the highest, the emotional experience is the best, and when the tea concentration is too low, the emotional experience is the worst. Due to the high frequency of drinking tea for a long time, a certain

degree of taste fatigue may occur. Therefore, when the tea concentration is 15 g for 60 seconds, the emotional response is weak.

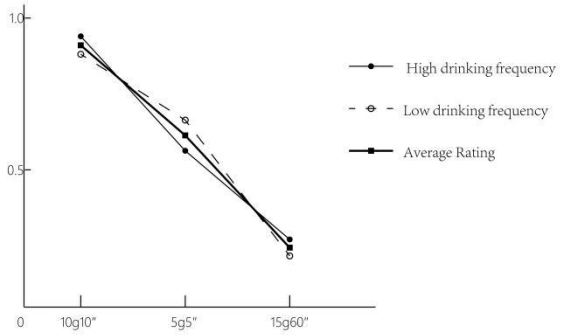

Figure 6. Comparison of the effects of three tea water combinations with different drinking frequencies.

According to the above experimental test results, 105 tea drinkers of different gender, age, drinking frequency and drinking score were selected, and the optimal tea drinking concentration level model was established. Use the data of the remaining 3 drinkers as test samples to study the accuracy of the network model. The model takes age, gender, frequency of drinking tea, and scoring rate of different concentrations of tea as input, and takes emotional attention score as output. The correlation coefficient between the training output of the model and the target reaches 99.83%, as shown in Figure 7.

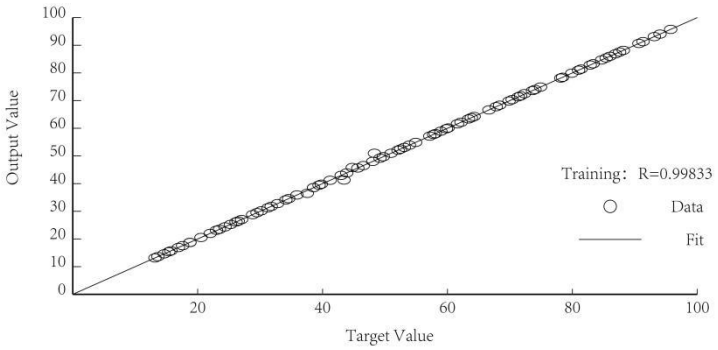

Figure 7. Comparison of output value and target value.

Table 6 shows the results of neural network prediction, which lists gender, age, frequency of tea drinking, tea concentration, scoring rate, tea drinkers' predicted value and error. Table 6 shows that in the 3 sets of test data, the maximum error is 1.73% and the minimum error is 0.11%. Combined with Figure 7, the correlation coefficient after training the BP neural network is close to the accuracy of the actual prediction result. After obtaining the age, gender, frequency and concentration of tea drinkers, the BP neural network model can accurately predict the level of tea drinkers.

Table 6. Comparison table of test cases.

	No 1: Male, 19 Years Old, Twice a Week			No. 2: Female, 26 Years Old, Once a Week			No. 3: Male, 42 Years Old, 3 Times a Week		
Tea concentration	Score	Predictive Value	Error	Score	Predictive Value	Error	Score	Predictive Value	Error
3 g5″	25	25.2	0.79%	26	25.7	1.16%	25	25.3	0.25%
3 g10″	58	58.6	1.02%	59	59.4	1.01%	59	59.2	0.34%
3 g20″	62	62.1	0.16%	61	60.7	0.49%	61	60.8	0.33%
3 g30″	64	64.3	0.47%	62	62..6	0.96%	63	63.3	0.47%
3 g60″	74	74.3	0.4%	75	75.4	0.53%	73	73.1	0.14%
5 g5″	55	54.2	1.47%	52	52.4	0.76%	52	51.9	0.19%
5 g10″	65	64.5	0.78%	64	63.8	0.31%	66	66.1	0.15%
5 g20″	81	80.4	0.75%	81	81.3	0.37%	83	83.1	0.12%
5 g30″	87	87.4	0.46%	88	87.1	1.03%	86	86.4	0.46%
5 g60″	39	38.9	0.26%	38	38.3	0.78%	39	38.6	1.04%
10 g5″	76	75.6	0.53%	77	76.7	0.39%	74	73.9	0.14%
10 g10″	92	91.7	0.33%	92	92.1	0.11%	92	91.9	0.12%
10 g20″	81	80.8	0.25%	81	80.7	0.37%	82	81.6	0.49%
10 g30″	61	61.2	0.33%	60	60.5	0.83%	63	63.1	0.16%
10 g60″	36	35.5	1.41%	34	34.6	1.73%	36	35.6	1.12%
15 g5″	88	88.8	0.9%	89	88.4	0.68%	89	89.2	0.22%
15 g10″	81	81.2	0.25%	81	81.6	0.74%	82	81.8	0.24%
15 g20″	71	70.4	0.85%	71	70.7	0.42%	73	73.1	0.14%
15 g30″	45	46.5	1.08%	46	45.7	0.66%	46	46.1	0.22%
15 g60″	30	30.1	0.33%	31	30.6	1.31%	31	31.2	0.64%

5. Conclusions

According to this research, the conclusion is that the use of BP neural network algorithm can accurately calculate the emotional attention changes of tea drinkers of different ages, genders and tea drinking frequency when drinking different concentrations of tea combinations, and give an accurate result score. Therefore, when you are depressed, you can use the neural network model to calculate the optimal tea concentration for your drinking water to regulate your mood. The caffeine and theanine in tea can cause the strongest arousal. Drink proper concentration of tea during work and study. Water can improve concentration and alertness. In this study, only Tieguanyin was used as the research sample of the reagent sample. Since the brands and varieties of tea are not uniform, it is not clear whether the results are equally applicable to other types of tea, and further discussion is needed. This research will provide certain data support and theoretical basis for follow-up research. Future work needs to increase the number of training samples, increase the research data and individual difference data analysis of subjects of different ages, and improve the scope and accuracy of the control model to establish a more complete and accurate neural network model.

Acknowledgments

The research was supported by data from Anxi Tea Science College of Fujian Agriculture and Forestry University and Art and Design College of Quanzhou Normal University.

Conflict of interest

The authors declare that there are no conflicts of interest.

References

1. C. Dietz, M. Dekker, B. Piqueras-Fiszman, An intervention study on the effect of matcha tea, in drink and snack bar formats, on mood and cognitive performance, *Food Res. Int.*, **99** (2017), 72–83.
2. K. L. Spittler, Consumption of green and black tea is associated with a lower risk of stroke, *Neurol. Rev.*, 2009.
3. D. Scott, J. A. Rycroft, J. Aspen, C. Chapman, B. Brown, The effect of drinking tea at high altitude on hydration status and mood, *Eur. J. Appl. Physiol.*, **91** (2004),493–498.
4. N. Khan, H. Mukhtar, Tea polyphenols for health promotion. *Life Sci.*, **81** (2007), 519–533.
5. T. Mihelj, A. Belscak-Cvitanovic, D. Komes, D. Horzic, V. Tomasic, Bioactive compounds and antioxidant capacity of yellow Yinzhen tea affected by different extraction conditions, *J. Food Nutrit. Res.*, **53** (2014), 278–290.
6. D. A. Purwanto, Analysis of ifn-γ concentration in wistar rat blood after oral administration of standardized green tea water extract, *Indones. J. Chem.*, **10** (2010), 390–395.
7. M. Rizon, M. Murugappan, R. Nagarajan, S. Yaacob, Asymmetric ratio and FCM based salient channel selection for human emotion detection using EEG, *Wseas Trans. Signal Process.*, **4** (2008), 596–603.
8. K. Kobayashi, Y. Nagato, N. Aoi, Effect of L-theanine on the release of α-brain waves in human volunteers, *Nippon Nogeikagaku Kaishi*, **72** (1998), 153–157.
9. J. Xi, Y. Xue, Y. Xu, Y. Shen, Artificial neural network modeling and optimization of ultrahigh pressure extraction of green tea polyphenols, *Food Chem.*, **141** (2013), 320–326.
10. J. Ning, X. Wan, Z. Zhang, X. Mao, X. Zeng, Discriminating fermentation degree of Puer tea based on NIR spectroscopy and artificial neural network, *Trans. Chinese Soc. Agric. Eng.*, **29** (2013), 255–260.
11. N. Das, K. Kalita, P. K. Boruah, U. Sarma, Prediction of moisture loss in withering process of tea manufacturing using artificial neural network, *Instrum. Meas., IEEE Trans.*, **67** (2018), 175–184.
12. Z. C. Guang, L. Y. Chun, Y. Tian, H. C. Quan, S. Xin, A study of identification of taste signals based on fuzzy neural networks. Journal of computer research and development, *Comput. Res. Dev.*, **36** (1999), 18–26.
13. H. Lin, Z. Li, H. Lu, S. Sun, F. Chen, K. Wei, et al., Robust classification of tea based on multi-channel LED-induced fluorescence and a convolutional neural network, *Sensors (Basel)*, **19** (2019), 4687.
14. L. I. Yang, L. I. Rui-Rong, L. Y. Wang, Studies on the infusing rules of effective constituents in tea with different water temperature, *Beverage Ind.*, **3** (2015), 1–5.

15. X. U. Mei-Ling, Measuring the caffeine concentration in green tea beverage by high performance liquid chromatography, *Beverage Ind.*, **3** (2015), 6–9.
16. M. Jovović, B. Femić-Radosavović, M. Lipovina-Božović, Comparative analysis of results of online and offline customer satisfaction loyalty surveys in banking services in montenegro, *J. Cent. Banking Theory Pract.*, **6** (2017), 65–76.
17. R. Marfil, R. Giménez, O. Martínez, P. R. Bouzas, J. Rufián-Henares, M. Mesías, et al., Determination of polyphenols, tocopherols, and antioxidant capacity in virgin argan oil (Argania spinosa, Skeels), *European J. Lipid Sci. Technol.*, **113** (2011), 886–893.
18. K. Esfahanizadeh, G. Hemati, N. Valaei, Effect of brewing time on the amount of fluoring released from tea, *J. Res. Dentalences*, **6** (2010), 63–68.
19. R. W. Massof, Likert and guttman scaling of visual function rating scale questionnaires, *Ophthalmic Epidem.*, **11** (2004), 381–399.
20. S. E. Harpe, How to analyze likert and other rating scale data, *Curr. Pharm. Teach. Learn.*, **7** (2015), 836–850.
21. E. Cho, S. Kim, Cronbachs coefficient alpha: well known but poorly understood, *Organ. Res. Methods*, **18** (2015), 207–230.
22. L. J. Cronbach, P. Schonemann, D. Mckie, Alpha coefficients for stratified-parallel tests, *Educ. Psychol. Meas.*, **25** (1965), 291–312.

AIMS Press