



# Research Progress of Bioactive Components in Baijiu: A Minireview



Anjun Li<sup>1</sup>, Hongjiao Li<sup>2</sup>, Cuifang Wu<sup>1</sup>, Jiejie Qin<sup>1</sup>, Xinglin Han<sup>2</sup>, Deliang Wang<sup>2</sup> and Feike Hao<sup>2\*</sup>

<sup>1</sup>China National Research Institute of Food and Fermentation Industries, China

<sup>2</sup>Anhui Gujing Gongjiu Co. Ltd., Bozhou 236820, China

**Submission:** August 27, 2020; **Published:** October 19, 2020

**\*Corresponding author:** Dr. Feike Hao, China National Research Institute of Food and Fermentation Industries, No. 24, Jiuxianqiao Middle Road, Chaoyang District, Beijing, China

## Abstract

Baijiu, also known as a traditional liquor in China, has more than thousand years of production history. Baijiu is a fermented alcoholic beverage which contains phenols, organic acids, terpenes, esters and other components. Recent studies have suggested that some polyphenols or peptides in Baijiu play a positive role in anti-inflammatory or antioxidant. In this context, we summarize the reported bioactive components in Baijiu and their potential benefits to health. Furthermore, the direction of future research is discussed.

**Keywords:** Baijiu; Traditional chinese liquor; Bioactive components

## Introduction

Baijiu, a traditional Chinese liquor, has been drunk as a national alcohol beverage over thousands of years [1]. It is one of the six major distilled spirits in the world. Different from other famous distilled spirits in the world, raw materials of Baijiu include sorghum, corn, rice, wheat, peas, and millet. In addition, the fermentation and distilling process of Baijiu are also unique [2]. During those processes, Jiuqu which is pre-made and contains rich active microorganism, mix with raw materials first and then ferment and distill under condition of solid-state. Due to this ancient and unique production method, Baijiu contains rich flavor components and potential bioactive components. Among flavor components of Baijiu, some of which have been identified to play a role to prevent cell from inflammatory injury [3,4]. Furthermore, a tetrapeptide (Ala-Lys-Arg-Ala) in Baijiu show a significant positive effect of antioxidative [5]. Meanwhile, Baijiu is recognized as a partner of Traditional Chinese Medicine (herbs) with good synergistic effect from ancient China. Therefore, to understand possible link between the application of Baijiu in Traditional Chinese Medicine and functional components, this paper reviews properties of bioactive compounds found in Baijiu, including their concentrations, functions and possible synergy effects.

## Phenolic Compounds

Phenolic compounds are recognized as main cause for health-promotion of wine. Resveratrol, a most famous phenolic

compounds in wine, have been described many health-promoting properties, such as antioxidative effect, cardiovascular diseases, and prolong the lifespan of various organisms. Similar with wine, phenolic compounds are an important component in Baijiu, which play a role in the aroma, taste and stability of liquor. 4-ethylguaiacol, a common aroma compound in Gujinggong Chinese Baijiu, has been shown to play an anti-inflammatory effect in THP-1 human monocytic cells through activation of pro-inflammatory signaling pathway and decreasing the production of inflammatory cytokines [4].

Furthermore, another study found that 4-methylguaiacol, 4-ethylguaiacol and vanillin detected in Gujinggong Chinese Baijiu has significant antioxidative effect in vivo [6]. 4-ethylguaiacol, which is produced by the spoilage yeast *Brettanomyces*, can contribute bacon, spice, clove, or smoky aromas in alcoholic or nonalcoholic beverages [7]. It may play a similar role in Baijiu as well as resveratrol in wine. Duo to its multiple biological functions, more studies need to be performed to investigate other benefit effects of 4-ethylphenol and illustrate its related mechanisms.

## Organic acid

Baijiu contains a variety of organic acids, including acetic acid, lactic acid and butyric acid. Although the population is small, it produces various flavors of Baijiu [8]. It is reported that butyric acid can maintain intestinal homeostasis to improve intestinal

immunity and prevent the occurrence of enteritis [9]. In addition, recent studies have found that butyric acid can also inhibit the proliferation of tumor cells to achieve the effect of suppressing tumors [10].

## Terpenes

Terpenes generally have high antibacterial activity and anticoagulant properties [11]. Recent work showed that geranyl acetone (GAT), which is first detected in Baijiu, and  $\beta$ -caryophyllene (BCP) play a significant antioxidative effect in Hep-G2 cells. Both of GAT and BCP can eliminate intracellular ROS, increase the concentration of non-enzymatic antioxidant GSH to increase the antioxidant capacity [12].

## Lipopeptides and Peptide

A lipopeptide is a molecule consisting of a lipid connected to a peptide. Some of lipopeptides have antibacterial and antifungal activities. Xu et al. discovered lipopeptide compounds in Baijiu for the first time, such as subtilisin and lichenin. They found that lichenin has strong antibacterial, antiviral and fibrinolytic activities [13]. Peptide is short chains of between two and fifty amino acids. Increasing evidence has suggested that peptides have benefit effects to human health. Wu et al. found that a tetrapeptide in Baijiu have a preventive effect against AAPH-induced oxidative stress in HepG2 cells [5].

## Conclusion and Prospects

With the development of detection technology, more than 1800 components in Baijiu have been identified.

Among these, polyphenols and terpenes are main components of Baijiu with possible benefit effect, their concentrations are quite different in different type of Baijiu. Polyphenols and terpenes have been wide reported with antioxidant, anti-inflammatory and anti-aging properties. However, there are still unknown components and biological activities need to further investigate. For future research, there are several points should be focused on. The first is to determine all kinds of bioactive components in Baijiu and how it produced. The second is to illustrate the possible mechanism of each bioactive component and investigate the potential synergies between each other components. The third is to achieve the ability to regulate the concentrations of bioactive components which has benefit effect.

## References

- McGovern PE, Zhang J, Tang J, Zhang Z, Hall GR, et al. (2004) Fermented beverages of pre- and proto-historic China. *Proc Natl Acad Sci USA* 101(51): 17593-17598.
- Zhu Y, Tramper J (2013) Koji - where East meets West in fermentation. *Biotechnol Adv* 31(8): 1448-1457.
- Zhao DR, Jiang YS, Sun JY, Li HH, Sun XT, et al. (2019) Amelioration of 4-methylguaiacol on LPS-induced inflammation in THP-1 cells through NF- $\kappa$ B/I $\kappa$ B $\alpha$ /AP-1 and Nrf2/HO-1 signaling pathway. *J Funct Foods* 55: 95-103.
- Zhao DR, Jiang YS, Sun JY, Li HH, Luo XL, et al. (2019) Anti-inflammatory Mechanism Involved in 4-Ethylguaiacol-Mediated Inhibition of LPS-Induced Inflammation in THP-1 Cells. *J Agric Food Chem* 67(4): 1230-1243.
- Wu J, Huo J, Huang M, Zhao M, Luo X, et al. (2017) Structural Characterization of a Tetrapeptide from Sesame Flavor-Type Baijiu and Its Preventive Effects against AAPH-Induced Oxidative Stress in HepG2 Cells. *J Agric Food Chem* 65(48): 10495-10504.
- Zhao D, Shi D, Sun J, Li H, Zhao M, et al. (2018) Quantification and cytoprotection by vanillin, 4-methylguaiacol and 4-ethylguaiacol against AAPH-induced abnormal oxidative stress in HepG2 cells. *RSC Adv* 8: 35474-35484.
- Caboni P, Sarais G, Cabras M, Angioni A (2007) Determination of 4-ethylphenol and 4-ethylguaiacol in wines by LC-MS-MS and HPLC-DAD-fluorescence. *J Agric Food Chem* 55(18): 7288-7293.
- Liu H, Sun B (2018) Effect of Fermentation Processing on the Flavor of Baijiu. *J Agric Food Chem* 66(22): 5425-5432.
- Corrêa-Oliveira R, Fachi JL, Vieira A, Sato FT, Vinolo MAR (2016) Regulation of immune cell function by short-chain fatty acids. *Clin Transl Immunol* 5: 1-8.
- Siregar C, Wasito EB, Sudiana IK (2016) Effect of Butyric Acid on p53 Expression and Apoptosis in Colon Epithelial Cells in Mice after Treated with 9,10-dimethyl-1,2-benz(a)anthracene. *Procedia Chem* 18: 141-146.
- Wang CY, Chen YW, Hou CY (2019) Antioxidant and antibacterial activity of seven predominant terpenoids. *Int J Food Prop* 22(1): 230-238.
- Zhang Qian, Zhu Tingting, Huang Mingquan, Wei Jinwang, Wu Jihong HJ, et al. (2020) Intracellular Antioxidant Activity of Two Terpenoids in Baijiu. *Food Sci* 41: 66-73.
- Xu Yan, Zhang Rong WQ and ZY (2014) Identification and Characterization of Lipopeptides in Baijiu (Liquor). *Liquor Sci Technol* 1-4.



This work is licensed under Creative Commons Attribution 4.0 License  
DOI: [10.19080/NFSIJ.2020.10.555790](https://doi.org/10.19080/NFSIJ.2020.10.555790)

**Your next submission with Juniper Publishers  
will reach you the below assets**

- Quality Editorial service
- Swift Peer Review
- Reprints availability
- E-prints Service
- Manuscript Podcast for convenient understanding
- Global attainment for your research
- Manuscript accessibility in different formats

**( Pdf, E-pub, Full Text, Audio)**

- Unceasing customer service

**Track the below URL for one-step submission**

<https://juniperpublishers.com/online-submission.php>