

Mineral Composition of Acorn Coffees

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ABSTRACT

Background and Purpose: Wild plant nuts have been important food resources, mainly staple substitute in food crisis periods, during the human history. Acorns which are fruits of *Quercus* trees growing in Mediterranean climate are also important wild food and feed source with high nutritive value. Besides its folkloric food uses for human diets and important feed source especially in poultry, processed acorns have been used as herbal coffee in some regions. Nutritional values and mineral compositions of wild edible plants have been studied and many publications were released up to now. **Material and Methods:** Acorns used in the present study were harvested from wild *Quercus coccifera* L. tree and shrubs in Kilis, located in Eastern Mediterranean Region in November 2016. Acorns were dried, peeled and prepared for laboratory analysis. Acorn coffees were processed by two ways; boiled-roasted-ground and roasted-ground. In raw peeled acorns and acorn coffees prepared by two different processes were analyzed their mineral compositions by ICP-AES. Macronutrients (P, Ca, K, Mg and S), micronutrients (Fe, Cu, Mn and Zn) and heavy metals (Cd, Co, Cr, Ni and Pb) were determined in the samples. **Results:** According to analysis results, raw peeled acorns and acorn coffees prepared by different ways had different mineral compositions. Processing affected mineral composition, difference among the processing changed by minerals. Compared by other herbal coffees and their raw materials, raw peeled acorn and two acorn coffee product had lower mineral composition. Heavy metal concentrations in analyzed acorn and acorn coffee samples were much lower than that the acceptable limits for herbs and spices by WHO. **Conclusion:** Our results showed that acorn coffee, as a novel healthy drink, had useful minerals and lower composition by hazardous heavy metals. Having useful minerals and lower heavy metal concentrations both acorn coffee types could be consumed in safe and probable health benefits can be obtained these traditional herbal coffees according to consumer preferences. Further studies should be done their health benefits and toxicological effects for human health as safe food.

KEY WORDS: Acorn Coffee, Functional Food, Herbal Coffee, Minerals, *Quercus Coccifera* L.

INTRODUCTION

The term of herbal coffee can easily defined as hot drinks, which are prepared by roasting different parts of various plant parts, other than coffee beans, till brown color, grinding and cooking like Turkish coffee.¹ Various plant parts as kernel (date coffee), seed (black cumin coffee), and fruits (Gundelia, terebinth and carob coffees) obtained local plant sources could have been used for herbal coffee production in different parts of the world.² Wild plant nuts have been important food resources, mainly staple substitute in food crisis periods, during the

human history. Acorns which are fruits of *Quercus* trees growing in Mediterranean climate are also important wild food and feed source with high nutritive value.³ besides its folkloric food uses for human diets and important feed source especially in poultry, processed acorns have been used as herbal coffee in some regions. Because of negative side effects and health risks of true coffee (*Coffea arabica*, *C. robusta* and other species) products and fluctuations in world coffee production by the years, herbal coffees with high nutritive values, useful

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mineral content, lower health risks and health benefits have recently been substitute by true coffee products. Interest in herbal natural products such as wild vegetables, herbal teas, herbs, spices and herbal mixtures for healthy life has been gradually rising in recent times. Because of their probable side effects on human health, some ordinary foods and drinks are also substituted by healthier or less harmful ones. Because of the distinguished aroma and stimulant effects, different coffee products are of the most used drinks all over the world.² Besides their taste and health benefits, mineral compositions of such novel products are important for food safety. Thus, mineral compositions of acorn coffees were determined in the present study. Macronutrients (P, Ca, K, Mg and S), micronutrients (Fe, Cu, Mn and Zn) and heavy metals (Cd, Co, Cr, Ni and Pb) were determined in the samples by ICP-AES. Processed herbal coffees were also compared to their raw material in terms of mineral compositions.

MATERIAL AND METHODS

Plant Material: Acorns used in the present study were harvested from wild *Quercus coccifera* L. tree and shrubs in Kilis,⁴ located in Eastern Mediterranean Region in November 2016. Acorns were dried, peeled and prepared for laboratory analysis. Acorn coffees were processed by two ways; boiled (boiling water removed)- then roasted and ground; and sole roasted and ground. In raw peeled acorns and acorn coffees prepared by two different processes were analyzed their mineral compositions by ICP-AES. B, Ca, Cd, Co, Cr, Cu, Fe, K, Mg, Mn, Ni, P, Pb, S and Zn were determined in the samples.

Chemical analysis pathway: After cleaning and washing by deionized water the samples were air dried. They were demoustrized at 70 °C for 48 h in an oven and ground for chemical analysis. And then 0.2 g samples were put into burning cup and 5 mL HNO₃ 65 % (Merck, Darmstadt, Germany) and 2 mL H₂O₂ 30 % (Merck, Darmstadt, Germany) were added. Incinerated in a HP-500 CEM MARS 5 microwave (crop. Mathews NC, USA) at 200 °C, the solution was cooled at room temperature for 45 min. Filtrated by Wattman 42 filter paper, the extracts were cooled by high-deionized water in a 20 mL-polyethylene bottles and kept at 4 °C in laboratory for ICP-AES analyses. All the analyses were made in triplicate. R1 and R2 groups of Merck standards were used as analytical reagent grade chemicals. Corn bran (standard reference material, 8433) and Peach leaves (standard reference material, 1547) were used as reference materials. In the present study, determining of the minerals ICP-AES (Varian Vista-Pro, Australia) was used.

RESULTS AND DISCUSSION

According to analysis results, raw peeled acorns and acorn coffees prepared by different ways had different mineral compositions. Processing methods also affected mineral composition of the coffees. Compared by other herbal coffees and their raw materials, raw peeled acorn and two acorn coffee product had lower mineral composition.² Heavy metal concentrations in the analyzed acorn and acorn coffee samples were much lower than that the acceptable limits for herbs and spices by WHO.⁵ When compared P, Ca, Mg and S concentrations of the raw material and the coffee samples, boiling process gave the highest levels of determined minerals. Apart from these macronutrients, the highest potassium concentration in the samples was obtained from sole roasted coffee samples (Table 1). Among the determined macronutrients, raw peeled acorns has the lowest P, Mg and S. Interestingly, these samples had higher calcium concentration than sole roasted and potassium than boiled-roasted coffee samples. These results showed that processing had considerable effect on the macronutrient concentrations of the acorn coffees.

Similar results were determined in the micronutrient concentrations of the analyzed samples (Table 2). Although the highest Fe, Cu, Mn and Zn concentrations were obtained from the boiled acorn coffees, the lowest values were in the raw peeled acorns.

Different processing methods for acorn coffee interestingly affected mineral compositions of the analyzed coffee samples. Boiled-roasted type coffee had higher mineral concentrations than roasted coffee and raw materials. It could be explained that volatile matters in the samples could be more removed by boiling than sole roasting process. Thus, inorganic matters in boiling-roasted method removed by water thus minerals were relatively more available than sole roasting method. Long processing period may also affect availability of the minerals. Acorn coffee prepared by boiled-roasted method could serve more available useful minerals for human health.

Heavy metals have negative effects on human health; thus high concentrations in the foods could be resulted some crucial health problems. World Health Organization determined and released limits acceptable limits of heavy metals for herbs and spices.⁵ Heavy metal concentrations of acorn coffee and raw material are given in Table 3.

As the boiled-roasted coffees had higher cadmium and chromium concentrations, sole roasted coffee sampled had higher cobalt and lead levels. Nickel concentration was determined in the higher levels among the analyzed

Table 1: Macronutrient concentration values with SD of acorn coffee and raw material

Samples	Minerals (mg/kg)														
	P			Ca			K			Mg			S		
Boiled-roasted	880	±	7	1265	±	13	6851	±	58	603	±	9	479	±	9
Roasted	661	±	18	742	±	3	9165	±	50	603	±	14	356	±	17
Raw	587	±	19	811	±	15	7732	±	160	490	±	2	313	±	5

Table 2: Micronutrient concentration values with SD of acorn coffee and raw material

Samples	Minerals (mg/kg)											
	Fe			Cu			Mn			Zn		
Boiled-roasted	11,7	±	0,4	2,80	±	0,20	3,98	±	0,66	9,0	±	0,7
Roasted	5,7	±	0,3	2,08	±	0,10	3,86	±	0,11	5,6	±	0,3
Raw	5,4	±	0,2	2,03	±	0,04	3,61	±	0,07	5,3	±	0,3

Table 3: Heavy metal concentration values with SD of acorn coffee and raw material

Samples	Minerals (mg/kg)														
	Cd		Co			Cr			Ni		Pb				
Boiled-roasted	0,0249	±	0,0025	0,01572	±	0,00014	0,1897	±	0,0079	1,53	±	0,06	0,09	±	0,13
Roasted	0,0023	±	0,0003	0,04055	±	0,00163	0,0633	±	0,0015	1,65	±	0,04	0,01	±	0,01
Raw	0,0008	±	0,0003	0,07191	±	0,00974	0,0888	±	0,0024	1,55	±	0,03	0,16	±	0,05

acorn samples. When compared to other herbal coffees and reports released by WHO for spices and herbs, raw peeled acorn and acorn coffee samples had much lower heavy metal concentrations and in acceptable limits for herbs, spices and wild edible plants by WHO and former scientific reports.^{5,6,7,8} Regarding both processing methods had different levels of minerals, these coffee types had useful minerals and lower heavy metal concentrations. According to consumer preferences both coffee types could be consumed in safe and probable health benefits can be obtained these traditional herbal coffees.

CONCLUSION

As a traditional and staple food source in Mediterranean, acorns have recently been rediscovered as a novel herbal product and functional food. Although acorn coffee is traditional hot drink in rural areas by substitution true coffee, it has a great potential as industrial product soon. Having useful minerals and lower heavy metal concentrations both acorn coffee types could be consumed in safe and probable health benefits can be obtained these traditional herbal coffees according to consumer preferences. Determining its useful and hazardous minerals for human health was the first step of its usefulness in food industry. Further studies are needed to prove biological

activity, safety, toxicity and nutritive values of acorn coffee. This is the first scientific report for acorn coffee and presents novel information for science world.

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CONFLICT OF INTERESTS

The authors have declared that no conflict of interest exists.

ABBREVIATIONS USED

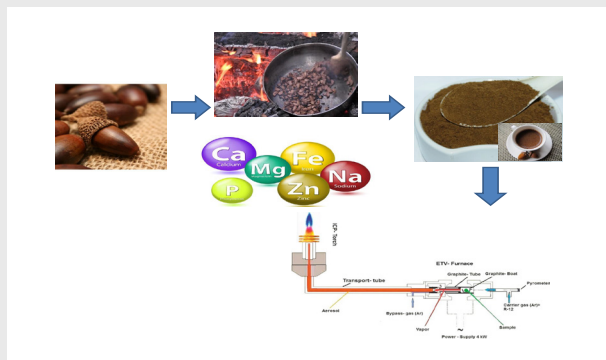
Al: Aluminum; **B:** Boron; **Ca:** Calcium; **Cd:** Cadmium; **Co:** Cobalt; **Cr:** Chromium; **Cu:** Copper; **Fe:** Iron; **K:** Potassium; **Mg:** Magnesium; **Mg/kg:** Milligram/kilogram; **Mn:** Manganese; **Ni:** Nickel; **P:** Phosphorus; **Pb:** Lead; **S:** Sulphur; **Zn:** Zinc; **SD:** Standard deviation

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PICTORIAL ABSTRACT



SUMMARY

- Herbal Coffees prepared by different parts of some plants apart from Coffee spp. are traditional herbal drinks.
- They have been consumed as healthy drinks in local people around the world.
- Phytochemical properties, mineral compositions and biological activities of some herbal coffees were investigated and reports were released up to now.
- Acorn Coffee has been used some parts of the world and local products have also produced in small scale.
- This paper is overall the first scientific report, especially on mineral composition, of Acorn Coffee.
- According to laboratory analysis, Acorn Coffee is healthy drink with useful minerals and safe for hazardous heavy metals.

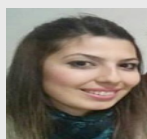
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