

Comparative Studies of Mineral Contents of Hulled Sesame Paste (Tahin), Unhulled Sesame Paste (Bozkir Tahin) and Their Blends

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Tahin is generally produced by using hulled roasted sesame seeds, however Bozkir tahin is produced by using unhulled roasted sesame (natural) seeds. Concentration of thirteen minerals (Al, Ca, B, Cu, Fe, K, Mg, Mn, Mo, Na, Ni, P and Zn) of tahin produced from hulled roasted sesame, Bozkir tahin produced from unhulled roasted sesame (with hulls) and their blends (25, 50 and 75 %) were determined by inductively coupled plasma optic emission spectrometry (ICP-OES). All samples contained high amounts of Ca, K, Fe, Mg, Na, P and Zn. The highest mineral concentration for tahin samples and sesame seeds were measured between 0.16-3.74 mg/kg Al, 2005.92-8794.09 mg/kg Ca, 14.04-21.19 mg/kg B, 15.39-33.67 mg/kg Cu, 165.7-437.66 mg/kg Fe, 4096.55-6876.06 mg/kg K, 2020.97-2482.87 mg/kg Mg, 12.56-21.31 mg/kg Mn, 0.74-1.55 mg/kg Mo, 605.81-2436.5 mg/kg Na, 4.78-8.66 mg/kg Ni, 5019.89-7627.85 mg/kg P and 41.28-52.85 mg/kg Zn. The concentration of minerals such as Al, Ca, B, Cu, Fe, K, Mg, Mn, Mo, Na, Ni, P and Zn in tahin increased with increasing of unhulled roasted sesame seeds levels, except for magnesium. The magnesium contents decreased with increasing of levels of unhulled roasted sesame seeds. As a result, minerals such as Al, Ca, B, Cu, Fe, K, Mn, Mo, Na, Ni, P and Zn increased with increasing hulls content, but Mg content decreased. The increased in minerals with increasing levels of unhulled roasted sesame seeds in tahin can be explained by the increasing of peel (hulls) contents. Tahin, especially Bozkir tahin contain nutrient elements of vital importance in man's metabolism.

Key Words: Tahin, Bozkir tahin, Sesame paste, Hulled sesame paste, Unhulled sesame paste, Minerals.

INTRODUCTION

The hulled sesame seed has extensive used in the food industry, including the production of sesame paste and upscale cakes. Roasted sesame seeds are also important condiments in Turkey, Japan and Korea for improving the colour and aroma of dishes.

Sesame paste, known as Tahin in Turkey, is a traditional food in the Middle East, which is produced by grounding the dehulled roasted sesame seeds. Tahin is used in preparation of some local dishes such as java beans, chickpeas, salad and in desserts such as honey and pekmez (fruit molasses). Helva (sweetened tahin) is also a local food in Turkey, which is made from blending the sesame paste with a proper sweetener such as honey, crystal sugar, glucose syrup and grape and mulberry pekmez (molasses).

Sesame paste have a high nutritive value; for it is rich in lipids (50-65 wt. %); protein (23-27 wt. %); carbohydrates (6.4-9 wt. %); dietary fiber (9.3 wt %); niacin (4.5 mg/100 g); thiamin (1.08 mg/100 g); and some minerals such as: calcium (100 mg/100 g); iron (9 mg/100 g); phosphorus (807-840 mg/100 g). These values were adapted from different sources¹⁻⁵.

Hulled sesame seeds (without hull) are commonly used for tahin production. But also, it is produced by using roasted unhulled sesame seeds (with hull) in order to produce sesame paste and this product is known as Bozkir Tahin in Turkey. Bozkir Tahin is different in terms of some properties such as colour, oil, protein content for containing hulls according to tahin which produced using dehulled sesame seeds.

EXPERIMENTAL

The conventional roasting process was carried out in a local factory in Konya, Turkey. The hulled and unhulled sesame seeds were separately roasted using a temperature-controlled rotary roasting machine (Karabay Co., Turkey) at roasting temperature of 130 °C, which is used commercially for sesame paste and confectionary productions. During roasting process samples were taken different time (150 min. for natural sesame and 210 min for hulled sesame) (Table-1). These roasted sesame seed samples (hulled and unhulled) were mixed with each other at 25, 50 and 75 % ratio (w/w) and milled by a grinder.

TABLE-1
TYPES OF SESAME SEED PASTES USED IN STUDY

Ratio of hulls (%)	Roasting		Types	Product
	Temp. (°C)	Time (min)		
0	130	150	Hulled Sesame	Tahin
100	130	210	Unhulled Sesame (whole)	Bozkir Tahin

Tahin produced from 100 % roasted whole (hulled) sesame seeds is known as Bozkir Tahin in Turkey. In order to determine mineral contents, tahin, Bozkir tahin samples and their blends were used in experiment.

Determination of mineral content: Varian inductively coupled plasma-optical emission spectrophotometer (ICP-OES) was used for determination of mineral contents. The instrument was operated in the following conditions. RI frequency 27 MHz; operating power, 1200 W; pump rate, 20 rpm; plasma argon flow rate, 2 L min⁻¹; carrier argon flow rate, 2 L min⁻¹; burner type Minitorch; ultrasonic nebuliser type Cetae; sample flow rate, 0.02 mL min⁻¹ and nebulization pressure, 1 bar.

5 mL of 0.1 N HNO₃ were added to the resultant ash and the mixture was stirred on a heating plate to almost complete dryness. Then, 10 mL of the same acid were added and brought up to 25 mL with distilled water. The minerals were determined by ICP-OES⁶. The emission wavelength (nm) for the determination each mineral, together with its linear working range and correlation of determination (R²) from the calibration graph, were as follows;

K (766.491; 6.771-3467 mg/L, 0.9997), Mg (279.553; 1.957-250.5 mg/L; 0.9998), Ca (317.933; 2.936-375.75 mg/L; 0.9993), P (213.618; 0.976-499.8 mg/L; 0.9992), Na (589.592; 0.2342-119.9 mg/L; 0.9996), Fe (238.204; 0.0782-40.03 mg/L; 0.9993), Cu (327.395; 0.0078-3.98 mg/L; 0.9999), Zn (213.857; 0.0195-9.98 mg/L; 0.9998), Mn (257.610; 0.0393-20.13 mg/L; 1.0).

RESULTS AND DISCUSSION

Mineral contents of hulled, unhulled sesame paste and their blends are given in Table-2. As can be shown Table-2, all samples contained high amounts of Ca, K, Fe, Mg, Na, P and Zn. The highest mineral concentration for tahin samples and sesame seeds were measured between 0.16-3.74 mg/kg Al, 2005.92-8794.09 mg/kg Ca, 14.04-21.19 mg/kg B, 15.39-33.67 mg/kg Cu, 165.7-437.66 mg/kg Fe, 4096.55-6876.06 mg/kg K, 2020.97-2482.87 mg/kg Mg, 12.56-21.31 mg/kg Mn, 0.74-1.55 mg/kg Mo, 605.81-2436.5 mg/kg Na, 4.78-8.66 mg/kg Ni, 5019.89-7627.85 mg/kg P and 41.28-52.85 mg/kg Zn. The concentration of minerals such as Al, Ca, B, Cu, Fe, K, Mg, Mn, Mo, Na, Ni, P and Zn in tahin increased with increasing of unhulled roasted sesame seeds levels, except for magnesium. The magnesium contents decreased with increasing of levels of unhulled roasted sesame seeds. Changes in contents of major elements such as Ca, Fe, K, Mg, Na and P and of minor elements such as Al, B, Cu, Mn, Mo, Ni, Pb and Zn are shown in Figs. 1 and 2, respectively. Sawaya *et al.*¹ reported that sesame paste (tahinah) contains 1000 mg/kg calcium, 90 mg/kg iron, 8070-8400 mg/kg phosphorus.

It can be understood from the explanations, tahin, Bozkir tahin and their blends are rich in several macro and microelements. Trace element concentrations in sesame paste (tahin) are considerably higher than those

TABLE-2
EFFECT OF LEVELS OF NATURAL SESAME SEED ON
MINERALS IN TAHIN

Minerals (mg/kg)	Sesame seed		Unhulled roasted sesame levels (%)				
	Hulled- roasted	Raw	0	25	50	75	100
Al	0.66	3.74	0.16	0.38	0.56	1.01	2.12
Ca	2005.92	8408.87	2436.54	3776.64	5084.35	7514.02	8794.09
B	14.04	16.23	14.22	14.8	19.69	18.1	21.19
Cu	15.39	23.67	17.78	19.99	18.52	20.53	23.41
Fe	186.01	437.66	165.7	214.53	225.77	229.97	250.74
K	4096.55	4428.94	5636.2	6037.48	6117.77	6655.5	6876.06
Mg	2040.83	1928.94	2482.87	2491.18	2267.42	2230.82	2020.97
Mn	12.69	15.21	12.56	12.88	13.98	14.01	21.31
Mo	0.90	1.55	0.74	1.11	1.28	1.26	1.37
Na	1412.62	2436.5	605.81	1228.07	1431.21	1468.52	1899.09
Ni	5.14	6.13	4.78	6.33	6.79	7.17	8.66
P	5019.89	5778.28	5116.95	6340.15	6925	7056.52	7627.85
Pb	0.01	0.39	0.01	0.28	0.49	0.59	0.7
Zn	41.28	47.55	46.97	49.28	51.89	52.08	52.84

of agricultural crop plants, vegetables and fruit. This would suggest that sesame paste possess a very effective mechanism that enables them to take up some trace elements from the substrate more readily. Tahin, Bozkir tahin and their blends contain high amounts of Ca which is an essential element for the growth of bones and muscles. Iron is necessary for the formation of hemoglobin. Iron was also found in all samples. Iron is an important element for human body and plays a role in oxygen and electron transfer. These minerals are especially used in the treatment of constipation and is beneficial for pregnant women^{7,8}. Also, Zn develops immune system and its highest concentration (52.84 mg/kg) in Bozkir tahin containing 100 % peel.

High amounts of K are important because of its role in function of intra cellular enzymes Copper and Zinc are required in our diet because they exhibit a wide range of biological functions such as components of enzymatic and redox systems⁹. Also, decreasing of these toxic element contents is an advantage.

As a result, minerals such as Al, Ca, B, Cu, Fe, K, Mn, Mo, Na, Ni, P and Zn increased with increasing hulls content, but Mg content decreased. The increased in minerals with increasing levels of unhulled roasted sesame seeds in tahin can be explained by the increasing of peel (hulls) contents. Tahin, especially Bozkir tahin contain nutrient elements of vital importance in man's metabolism.

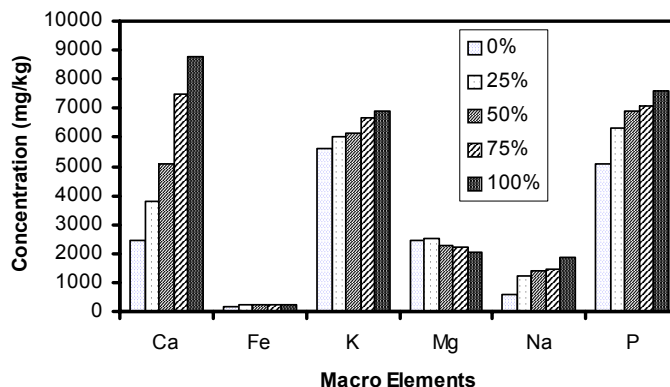


Fig. 1. Changes of macro elements with increasing unhusled roasted sesame levels

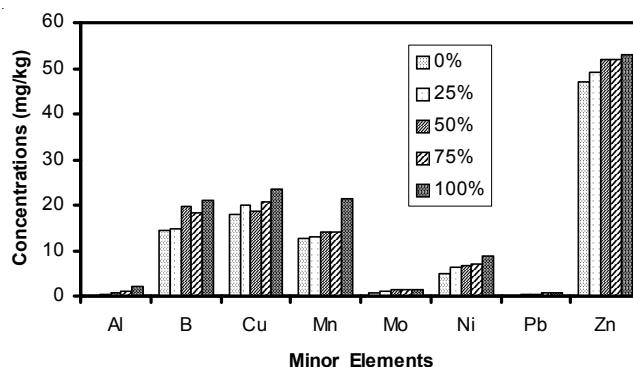


Fig. 2. Changes of minor elements with increasing unhusled roasted sesame levels

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