



EVALUATION OF SODIUM CONCENTRATION IN DIFFERENT BREAD TYPES IN SULAIMANYAH PROVINCE, IRAQI KURDISTAN

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Abstract

Sodium content in bread is increasing the attention of public health. This study was conducted to evaluate the concentration of Na in different types of bread consumed by Kurdistan society. Fifty bread samples demonstrating consumed types were collected at seven different locations in Sulaimanyah province, Iraqi Kurdistan. Their Na concentration was determined using ICP-MS. Sodium content differed from 698.8 ± 138.37 to 1129.3 ± 198.41 mg $100g^{-1}$ with an average of 964.41 ± 273.74 mg $100g^{-1}$ of white bread. The results of current work, unfortunately, indicated that content of Na in white wheat bread in the market in five bread types of seven selected locations is much higher associated with contents in other parts of the world. As we do not have the estimation of daily sodium intake and on basis of result from this study and standard level of 300g per-capita, we could achieve that sodium intake in Sulaimanyah province is more than that recommended by the World Health Organization (WHO). This means that the population of the studied province, which consumes white wheat bread daily, might be at risk of cardiovascular and hypertension diseases.

Keywords: Sodium, Concentration, Bread, Intake,

Introduction

Bread is the oldest staple food globally, which its annual consumption is about nine billion kilograms nowadays (Lopes *et al.*, 2017). It is used as the major daily food in several countries (Riyanto and Caraka, 2018). In the world, it has an important role in human nutrition which provides the major daily protein, energy, vitamins and nutrients for the human body (Hafshajani *et al.*, 2019). However, salt is a vital component in bread. It's typically added into bread in low amount but it plays an important role that influences the quality of bread, limiting fermentation, providers in the taste and also has a valuable effect of gluten properties (Ambrosewicz-Walacik *et al.*, 2016; Ploegaerts *et al.*, 2016). Ploegaerts *et al.* (2016) reported that bread is one of the major sources of daily intake of Na. Approximately, about 15% of daily Na intake globally and 30% in the Western countries is due to the consumption of bread (Hafshajani *et al.*, 2019; Riyanto and Caraka, 2018).

The human physiological processes need about 130-230 mg of Na per day (Carcea *et al.*, 2018). While the World Health Organization (WHO) recommended about 2000 mg of Na (5 g salt) as the daily intake in dietary needs (Al Jawaldeh and Al-Khamaiseh, 2018). It is a vital element for the preservation of cell function, transport in the nervous system, acid-base balance and help maintain the fluid in our body (Ploegaerts *et al.*, 2016). However, in most countries salt is causing a series of health issue due to excessive daily intake of salt in more than recommendation level which causes many diseases including renal disease, blood pressure, intestinal cancer, fatness and osteoporosis (Thaisa *et al.*, 2015). And also, Carcea *et al.* (2018) reported that heart diseases including strokes and heart attack are the main factor causing one-third deaths globally because of hypertension due to overload intake of Na from the diet. A high correlation was found between the cardiovascular and

high hypertension diseases and the high intake of Na (Gyori and Sipos, 2016).

Hafshajani *et al.* (2019) reported that about 90% of the daily Na intake is derived from the salt that used to formulate food tasty and inhibit food decay. But, respecting its health result, it is assumed that its use should be decreased. Some countries planned the reduction of salt in produced foods this is to reduce Na intake by population (Riyanto and Caraka, 2018). Thaisa *et al.* (2015) reported that the added salt can be replaced with potassium chloride but use a large amount of potassium chloride makes bread bitter taste so that using this type of salt is restricted. However, the lower dose of salt may not be accepted by people due to change in the bread taste (Ambrosewicz-Walacik *et al.*, 2016). In Kurdistan region there is no data about Na intake in the bread consumed by population. Thus, the aim of this study is to evaluate the sodium concentration in different types of bread and intake of sodium through bread and daily intake of sodium through bread consumption.

Materials and Methods

Bread survey

In the current study five different types of bread including Lawasha, Mashini, Samoon, Hawrami and Tiry at seven different locations in Sulaimanyah province were used. In the list of all bakeries, bread samples for testing consisted of fifty samples were randomly collected as shown in (Table 1) (47 samples in markets and 3 homemade). All samples were made from refined wheat flour (white flour). Sampling was conducted in May-June 2017. The bread samples completely dried at room temperature for three days and then ground using stainless steel electrical grinder to form the same composition. About 5g of bread samples were stored in the plastic bag labelled and transported to the University of Nottingham, the UK for further analysis.

Table 1: Bread types collected at seven difference locations in Sulaimanyah province

	No. of samples	Lawasha	Mashini	Samoon	Hawrami	Tiry
Halabja	10	2	2	2	2	2
Khormal	5	3	-	2	-	-
Said Sadiq	8	2	2	2	1	1
Sulaimanyah	7	2	2	2	-	1
Piramagrun	6	2	2	2	-	-
Chamchamal	5	2	1	2	-	-
Kalar	6	4	-	2	-	-
Home made	3	1	-	-	1	1

Determination of sodium concentration

Sodium concentration in bread samples were determined after digestion under microwave heating (Anton Parr, Multiwave, 3000) for about 45 mins at 2MP in 4.0 mL HNO₃ and 2.0 mL H₂O₂. Digested samples were diluted to 20 mL with Milli-Q water and stored at room temperature. In the solution iron was measured by ICP-MS (Thermo Fisher scientific ICAP Q, Germany). The results were used to approximate the population sodium consumption resulting from bread consumption in the selected locations and bread types.

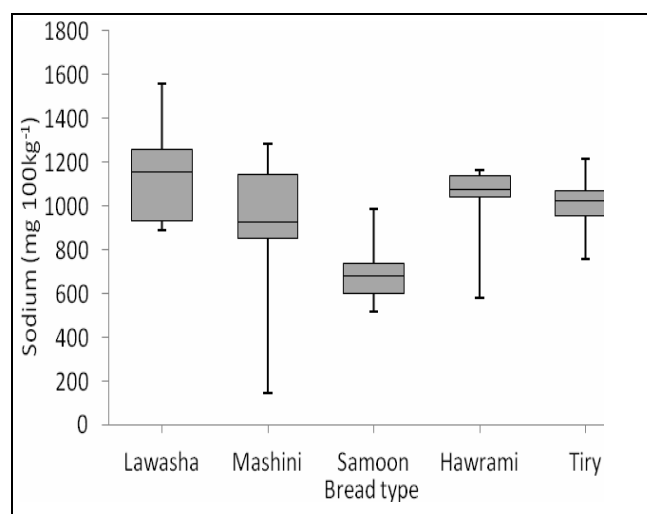
Statistical analysis

Data were statistically analyzed by analysis of variance (ANOVA) and LSD test was applied to check the significant differences between the averages with a significance level of 0.05, using SPSS software (version 17).

Results and Discussion

Bread has no essential sodium content, it is added during the bread-making process for physical aims including reduction of spoilage, limit fermentation and yeast development rate and product texture (Georgios *et al.*, 2016). And also, it's used to improve primarily flavour which formulates it difficult to eliminate from formula or sufficiently replace (Vukic *et al.*, 2013). Furthermore, all the bread forms are one of the extremely commonly consumed staples; it is one of the main sodium sources due to salt in its formulation. Because of the large flexibility in the types of the flour used for bread making, flour and bread classification was hard according to flour extraction rate. Thus, bread samples classified according to thier name including Lawasha, Mashini, Samoon, Hawrami and Tiry.

Therefore, this part gives the results of analyzed of Na content in common bread types consumed in Sulaymaniyah province. The average Na concentration in bread samples in (mg 100g⁻¹) ranged from 698.8±138.37 to 1129.3±198.41 mg 100g⁻¹ for Samoon and Lawasha respectively as shown (Fig. 1). Sodium concentration in bread samples varied between bread types and bread-making procedure. Statistical analysis of variance showed that there is a significant difference in the content of Na when Samoon compared to Lawasha, Mashini, Hawrami and Tiry. However, bread samples of Lawasha, Mashini, Hawrami and Tiry had no significant difference in sodium content (p<0.05).


Fig. 1: The distribution of sodium in studied bread types (n=50) collected from bakeries in Sulaimanyah province

The average Na concentration in the whole white bread was 248.149 mg 100g⁻¹ in a study of 120 samples for 6 different bread types in Duhok city Iraqi Kurdistan (Abdulrahman, 2016). Al Jawaldeh and Al-Khamaiseh (2018) reported lower Na levels of < 300 mg 100g⁻¹ for bread consumed in Tunisia but they also reported Na level of 763 mg 100g⁻¹ for bread consumed in Jordan. Grafenauer and Curtain (2018) reported the Na range from 237 to 710 mg 100g⁻¹ for 80 of white bread consumed in Australia. Hafshajani *et al.* (2019) analyzed 451 bread samples of five different types in Iran and observed the average Na concentration of 769±248 mg 100g⁻¹. Compared to these wide reports, the average Na concentration among whole samples was 964.41±273.74 mg 100g⁻¹, which is higher than that obtained globally. This indicates that Na concentration in bread consumed by Sulaimanyah society is in the higher range of Na concentrations worldwide. From the comparison of the current study with the worldwide, it also can be appreciated that consumption of 300 g which was set as standard level per capita of daily intake higher than recommendation level suggested by (FAO, 2011). Thus, Kurdistan society can clearly meet more than the daily requirement of Na intake, which is 2g suggested by WHO as daily intake as shown in (Table 2). This may be due to lack of integrated standard, and it causes increase in the Na daily intake in bread.

Table 2: Average sodium in (mg d⁻¹) and salt in (g d⁻¹) for consumption of 300 g bread per-capita in studied bread types were collected in Sulaimanyah province

Type of bread	Number of sample	percentage of sample	Sodium content of bread (300g) Salt content (300 g)	
			Average ± SD	
Lawasha	18	36	3387.9±602.27	8.62±1.53
Mashini	9	18	2726.4±1003.5	6.93±2.55
Samoon	14	28	2096.3±419.71	5.33±1.07
Hawrami	4	8	3003.8±716.66	7.64±1.82
Tiry	5	10	3018.9±563.95	7.68±1.43

The average Na concentration in the samples of Halabja location was highest 1036.7±181.64 mg 100g⁻¹, but in Sulaimanyah samples was the lowest 794.73±400.40 mg 100g⁻¹. On the other hand, the lowest and highest Na concentration of 500 and 1380 mg 100g⁻¹ observed for Lawasha and Mashini bread samples respectively at Sulaimanyah locations (Table 2), which shows a significant difference between bread types. This is because bakeries add a high amount of salt and soda together during the bread-making process which increases the Na concentration in

the bread. Carcea *et al.* (2018) conducted a survey of sodium chloride content in Italian Artisanal (n=135) and Industrial (n=19) bread. They found that all Na in bread is increased through salt added during the bread-making process because naturally the flour has not Na content. This is the same for our results because during the study we analyzed some of flour samples and Na has not been detected. There is also difference in Na concentration between bakeries in the same location.

Table 3: Average sodium concentration in (mg 100g⁻¹) in bread types

Location	Bread type				
	Lawasha	Mashini	Samoon	Hawrami	Tiry
Halabja	1219	1013	739.9	1090	1121
Khormal	1345	-	588.2	-	-
Sid sadiq	1084	1217	733.7	1075	758.1
Sulaimanyah	1380	500.0	715.1	-	583.3
Piramagrun	1061	927.1	687.5	-	-
Chamchamal	996.1	865.7	584.9	-	-
Kalar	974.7	-	842.1	-	-
Home made	913.4	-	-	1167	1026

There is no data on which to evaluate the Na intake of the population in Iraqi include Kurdistan region and also assess the amount of daily bread intake. Furthermore, there is no recommendation for Na concentration in Iraqi bread. Therefore, The Nutrition Research Institute of Iraq is depending on the Kuwaiti standard specification of the bread which describes the 262.640 mg 100g⁻¹ as the highest acceptable concentration of sodium in the bread. This is due to the absence of Iraqi standard specification of the bread No (677) for the Na concentration in the bread (Abdulrahman, 2016). Thus, all the surveyed bread samples contain more than permissible Na concentration. Again this is because, in Kurdistan region, bakeries add salt and soda during the bread-making process. The latter observation is presented based on bakeries interviews undertaken during the bread survey.

Furthermore, our results indicate that consuming about 200 g bread by sulaimanyah population exceeds the recommended daily intake of Na set by WHO and the Institute of Medicine in the United States of American (Jafri *et al.*, 2017). They confirmed the adequate daily intake at 2 and 1.5 g of Na (3.75-5 g of salt) for people between 9-50 years ages. Some countries have applied plans to decrease Na intake (WHO, 2018) by urging produces to decrease added salt or implementing identifying scheme. Jafri *et al.* (2017) reported that a 25% reduction of salt can be done to bread during the bread-making process without affecting customer receipt in a short time. (Miller and Hodeney (2008)) reported

that about 50% of salt content in the white bread can be decreased without a change in the taste. These methods provided to reduction in total hypertension and in heart attacks and strokes in the affected people.

Sodium concentration in the surveyed bread samples is comparatively high. This indicates the lack of control of salt and soda addition by bakeries. Moreover, it indicates that bakeries do not have enough knowledge and there is a requirement to educate them by the associated agencies. And also, consumption of the high salty foods by Kurdistan population should be changed within the education technique and enough information about the risk of the high amount Na daily intake.

Conclusion

The paper shows the high sodium concentration in white wheat bread consumed in Sulaimanyah province. Assumed that bread is a staple food in the county, its consumption supplies a daily intake of sodium above all suggestions and could be reliable for a high sodium intake in Iraqi Kurdistan, which might guide to enhanced cardiovascular risk. In the lack of information about the accurate sodium intake in Iraqi Kurdistan, we can individually suggest using these data to increase knowledge about sodium over-intake which could raise the prevalence of blood pressure.

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