

## A STUDY OF SODIUM CONCENTRATION IN DIFFERENT BREAD CONSUMED IN DUHOK CITY –KURDISTAN REGION –IRAQ

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### ABSTRACT

**Background:** Cardiovascular disease is the main cause of death and disability worldwide. Hypertension is among the highly important major risk factors and up to 62% of cerebrovascular accidents and 49% of coronary heart disease are credited to raised Blood Pressure. There are strong evidences that present human consumption of salt is the major factor increasing Blood Pressure and thereby Cardiovascular diseases. Since bread is the main part in people diet, particularly in our country, the determination of sodium content of bread is of highest priority and needs further researches.

**Methods:** (120) samples of six types of bread were collected from (120) different bakeries in Duhok city and thereafter assessed for sodium content in the laboratories of the Institute of Nutrition Researches in Baghdad

**Results:** This study showed that 35% of bread's samples has sodium concentration overrides the standard level and the residual 65% is within the usual range. Average proportion of bread's sodium concentration was as 248.149 mg / 100g.

**Conclusions:** The sodium contents of one third of studied bread samples are higher than is acceptable limit and may be contributing to adverse health outcomes. Therefore, an urgent public health intervention is highly advisable

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**Keywords:** Sodium, bread, Duhok city.

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The daily salt consumption of human ancestors was less than 0.25g. But this rate increased when the Chinese discovered that salt could be used to preserve food (about 5000 years ago).<sup>1</sup> After World War II, refrigeration and deep freezing began to displace salt from being the main food preservative. In spite of that, salt consumption has increased in the past decades due to consumption of highly salted processed foods. About 75% of salt intake is estimated to come from processed food.<sup>2</sup>

The sodium content of processed foods is higher if compared with their natural counterparts. For example, chick peas, sweet corn and peas naturally have a very low sodium content, while processing them increases the sodium content by 10–100-fold; and foods such as corned beef, bran flakes or smoked salmon, have sodium intakes of 1–2%, equivalent to, or more than, the sodium concentration of Atlantic seawater.<sup>3</sup> Sodium content is high in processed foods, such as bread (approximately 250

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mg/100g), processed meats (approximately 1500mg/100g), snack foods such as pretzels, cheese puffs and popcorn (approximately 1500 mg/100g), as well as in condiments such as soy sauce (approximately 7000mg/100g), and bouillon or stock cubes (approximately 20000mg/100g).<sup>4</sup>

Current data on sodium intake reveal that people all over the world are consuming much more sodium than their physiological needs (184-230mg/day).<sup>5</sup> Most individuals consume an excessive amount of salt-on average 9–12 grams per day,<sup>6</sup> or around double the advised upper limit of sodium intake by World Health Organization (WHO) for adults, which is less than two grams' sodium/day (equal to five grams' salt/day).<sup>7</sup>

Cardiovascular diseases (CVD) is the leading cause of mortality and morbidity globally. Elevated blood pressure is among the most significant major risk factors, and up to 62% of strokes and 49% of coronary heart disease are attributed to raised BP. There are strong evidences that existing human intake of salt is the major factor increasing BP and thereby CVD.<sup>1,8,9</sup> Hypertension is responsible for at least 45% of deaths due to heart disease and 51% of deaths due to stroke.<sup>4</sup> According to the Iraqi national survey for non-communicable diseases risk factors in

2006, 40.4% of Iraqi population are hypertensive.<sup>10</sup>

Bread, in its various forms, is the most widely consumed food in the world. It is the staple food and essential diet in many countries including Iraq and, because it is consumed so frequently, it is also the single biggest contributor of salt to our diet.<sup>11</sup> Recent findings from multiple studies conducted in several countries suggest that bread in Ireland provides 25.9% of total salt intake, with corresponding values of 25.5% for Turkey, 24.8% for Belgium, 24.2% for France, 19.1% for Spain, 19% for the UK, 26% for Lebanon, and 28.5% for Kuwait.<sup>12-14</sup>

Over the different eras the salt content of bread has grown gradually. The greatest increase occurred with the industrialization of bread making in the 20<sup>th</sup> century, when quick bulk manufacture techniques required salt to regulate the process and the resulting product, thereby lessening bread's lack of flavor and reaching values as high as 2%.<sup>15</sup>

This study assesses the concentration of sodium in samples of bread produced and consumed in Duhok city, Kurdistan Region, Iraq; the probable contributions of bread in population level exposure to salt; and draws attention to the need to develop effective strategies to ensure that reduction in salt consumption is achieved as the

bread provides up to one quarter of daily sodium intake.

## MATERIALS AND METHODS

This is a cross sectional study designed to determine the sodium (salt) content of bread samples taken from 120 bakeries in different districts of Duhok city. For administrative purposes, Duhok city was divided into four districts and there are (268) bakeries at time of the study in Duhok city. Thirty samples from each district were collected in one day by 8 trained teams; each team was composed of two staff. The amount of bread that was collected from each bakery was more than 150grams and each sample of bread or Samoon saved in labelled air free plastic bag. Considering the numbers of bakeries in every district, samples were collected from six different types of bread. These are called flat bread (Naan) (Figure. 1a), Saj bread (Figure. 1b), Turkish flat bread (Figure. 1c), Samoon (Figure. 1d), Samoon hajari (Iraqi bread made on stone) (Figure. 1e) and Turkish pita samoon (Figure. 1f). Samples were sent to the Nutrition Research Institute laboratories in Baghdad for assessment of their sodium content. The technique utilized for measuring breads' sodium is Dry Ashing. The main objective of Dry Ashing procedure is to combust all of the organic material and to prepare the sample for subsequent treatment using fusion techniques.<sup>16</sup>

As to the a lot of pastry shops, gathered examples of every sort of bread was different. By using proportionate stratified sampling procedure, the largest samples were flat bread (Naan) and Samoon, while the smallest were Turkish pita Samoon (Table 1).

Due to the lack of any limitation of the highest permissible level of sodium in bread within the Iraqi standard specifications of the Bread No. (677), So Nutrition Researches Institution are relying on the Kuwaiti standard specifications of the Bread, which defines the 262.640mg/100g as a maximum permitted level of sodium in the bread.



a



b



c



d



e



f

Figure 1. Different kinds of bread. flat bread (Naan) (Fig. 1a), Saj bread (Fig. 1b), Turkish flat bread (Fig. 1c), Samoon (Fig. 1d), Samoon hajari (Iraqi bread made on stone) (Fig.1e) and Turkish pita samoon (Fig. 1f).

Table 1: Bread Samples by Type

Type of bread	No. of available bakeries	No. of selected samples	%
Flat bread (Naan)	120	54	45.0
Saj bread	9	4	3.3
Turkish flat bread	9	4	3.3
Samoon	109	49	40.8
Samoon Hajari	16	7	5.8
Turkish pita samoon	5	2	1.7
Total	268	120	100.0

#### Statistical analysis

Chi square test was done for statistical analysis of the data by practicing SPSS soft- ware version 23. P value  $\leq 0.05$  was considered significant.

#### RESULTS

This study showed that 35% (42) of the samples has sodium content higher than 262.640 mg /100g and the rest 65% (78) of the samples has sodium content less than 262.640 mg /100 g.

Up to 50% (28) of samples of flat bread (Naan) type and Turkish pita samoon showed higher sodium contents than standard level, in reducing order was found in Sammon, Saj bread, Turkish flat bread, Samoon and Samoon hajari Table 2. ( $p < 0.05$ )

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**Table 2: Bread Samples by Type and Sodium contents**

Type of Bread	Sodium Content No. (%)		Total
	>262.64 mg / 100 g.	< 262.64 mg / 100 g.	
Flat bread (Naan)	28 (51.9)	26 (48.1)	54 (100)
Saj bread	1 (25)	3 (75)	4 (100)
Turkish flat bread	1 (25)	3 (75)	4 (100)
Samoon	10 (20.4)	39 (79.6)	49 (100)
Samoon hajari	1 (14.2)	6 (85.8)	7 (100)
Turkish pita samoon	1 (50)	1 (50)	2 (100)
<b>Total</b>	<b>42 (35)</b>	<b>78 (65)</b>	<b>120 (100)</b>

The mean sodium content of whole samples was 248.149g. The average mean sodium content in the samples of district IV was the highest (282.7mg/100g) while in the district I, samples were the lowest in sodium (216.5mg/ 100g). Table 3

**Table 3: Sodium Contents of Bread by Districts and Number of Bakeries**

Districts	Mean	No. of bakeries with Sodium content > 262.64 mg / 100 g.	No. of bakeries with Sodium content < 262.64 mg / 100 g.	Total
District I	216.5	6 (20)	24 (80)	30 (100)
District II	248.5	12 (40)	18 (60)	30 (100)
District III	241.9	12 (40)	18 (60)	30 (100)
District IV	282.7	12 (40)	18 (60)	30 (100)
	248.14	42 (35)	78 (65)	120 (100)

## DISCUSSION

Non -communicable diseases (NCDs) are the main contributor to mortality and morbidity globally<sup>17,18</sup> and interventions to reduce the burden of NCDs are highly cost-effective.<sup>19</sup> Elevated sodium intake has been associated with a number of NCDs (including hypertension,

cardiovascular diseases and stroke), Hence lowering sodium intake may reduce blood pressure and the risk of developing related NCDs.<sup>20</sup> Recent data on sodium intake show that populations around the world are consuming much more sodium than the physiological requirement. The estimated sodium intake in Jordan is up to 7623



mg/day,<sup>21</sup> while the estimated sodium intake in Turkey is 5905mg/ day<sup>22</sup>, On other hand, there is no available data on estimation of sodium intake in Iraq.

Bread is the unique processed food that is available, and consumed daily by, both low and high income people. Moreover, it is the largest sodium contributor to the Iraqi diet. Due to the fact that excess sodium consumption contributes to premature death and disability, therefore any reduction in the level of salt in bread would have a major impact on public health but unfortunately, there are no regulations or public laws in Iraq that regulate the salt or sodium contents in processed foods specially bread. This study which assumed to be the first of its kind in Kurdistan Region was conducted to determine sodium (salt) content in the bread.

The mean sodium content of whole samples was 248.149mg/100g which is lower than that obtained in a similar study conducted in Bagdad city in 2014 (293.812mg/100g).<sup>16</sup> The present study showed that (35%) or 42 samples out of 120 have sodium contents above permissible level. Meanwhile in Baghdad study, the sodium content exceeded the permissible level in (61%) or 92 out of 150 of bread samples.<sup>22</sup> A similar study done in Nigeria showed that the mean sodium content of two brands of bread was

very high (660-716.7mg/100g) and 70% of the studied samples had considerably more sodium than the recommended limit in Nigeria which is 440mg/100g.<sup>23</sup> Silva and her colleagues did a study in Maputo, Mozambique, and they found that the mean sodium content of bread was 450.3mg/100g, with no significant differences between bakeries and traditional markets.<sup>24</sup> In Montero-Campos Mde study in Costa Rica, 99 samples of bread showed that sodium concentration was between 496 and 744mg/100g, and 80% reported greater amount than found by direct analysis.<sup>25</sup>

The results of similar studies on salt levels of bread in Iran carried out from 1994 to 2009 indicated that the amount of salt in bread was higher than the standard level in Shiraz, Mashhad, Sanandaj and Isfahan<sup>26-28</sup> The current study showed that there is a wide variation in bread sodium content among bakeries from 31,725mg/100g to 948mg/100g. This may be due to the absence of unified standards, and in turn it will lead to disparity in the amount of daily- consumed salt in bread and other foods, As if a person eating four average slices of bread twice daily from two different bakers. First consumer may take 60mg sodium if they bought their bread from the craft baker with the lowest sodium levels compared with other one take 1820mg sodium from the craft baker

with the highest sodium level. There are also differences in bread sodium content among districts inside the same city

The sodium content of bread could be gradually decreased over 4-6 weeks without affecting consumer's palatability or acceptability of sensory characteristics, including overall liking, appearance, aroma, flavor, sweetness, salt level and texture, or purchase intent.<sup>29</sup> Bolhuis et al, found that salt reduction of up to 50% in bread does not decrease bread consumption.<sup>30</sup>

It seems that most bakers either do not have enough knowledge about the standard level of salt used for the production of bread, or they have some other reasons for using salt below or above the standard (e.g. type of flour) or some other factors which are needed to be investigated in further studies.

Finally, there should be a strict supervision and effective measures by relevant local authorities for bakeries to control the amount of salt in bread.

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## پوخته

فەكولینا ئاستی صودیومی لناف جورین نانی ئەوین دەینه بکارئینان ل باژیری دھوکی

**پێشهکی و ئارمانج:** ئیشین دلی ولولین خوینی ئەگەرین سەرەکیە بۆ مرنی و پەگفتنی ل جەانی. نیزیکی ۶۲٪ ل جەلتین مێشیکی و ۴۹٪ ل ئیشین دەمارین خوینی یا دلی دەینه رویدان ژێگەری زێدەبونا فیشارا خوینی. و بەلگین بەهێز هەنە دیار دکن کو بکارئینانا مروفی بۆ خویی خارنی ب رێژا نوکە، ئەگەرەکی سەرەکیە بۆ زێدەبونا فیشارا خوینی ول ئەنجامدا زێدەبونا ئیشین دلی ولولین خوینی. ژبەر کو نان بەشەکی سەرەکی یە ل خارنی گەئێ مە یا روژانە ، دیارکنا ئاستی صودیومی (خویی) گەلەك گرنگە و پیدفی هەیه بۆ فەكولینین زێدەتر.

**رێککین فەكولینی:** (۱۲۰) نمونین ل شەش جورین نانی ل (۱۲۰) نانپێژا و سەمونخا ل باژیری دھوکی هاتنە وەرگرتن و ئاستی صودیومی هاتنە پشکنین ل تاقیگەهین پەیمانگەها خوراکێ ل بەغدا.

**ئەنجام:** ئە فەكولینا دیارکر کو ئاستی صودیومی ل ۲۵٪ ل نمونین نانی زێدەترە ل ئاستی ستاندرەد و ۶۵٪ نورمال بوون، و رێژا خویی ل هەمی نموونا ۲۴۸.۱۴۹ ملیگرام / ۱۰۰ گرام.

**دەرئەنجام:** وەك دەرئەنجام رێژا صودیومی ل سێ یەکا نموونا نانی بلندترە ل ئاستی ستاندرەد و دی ئەنجامین نەرینی هەبیت ل سەر ساخلەمیا گشتی ژبەر فی ئەگەری، پیدفی پێنگافین بلەز بهینه هافیتن ژلایی دەرگەهین پیوهندیار.

## الخلاصة

دراسة تركيز الصوديوم في عينات من مختلف أنواع الخبز المستهلك في مدينة دهوك - إقليم كردستان العراق

**الخلفية والاهداف:** أمراض القلب والأوعية الدموية هي السبب الرئيسي للوفاة والعجز في جميع أنحاء العالم. ارتفاع ضغط الدم هو من بين أهم عوامل الخطورة الرئيسية والهامة جداً، إن حوالي ٦٢٪ من الجلطات الوعائية الدماغية و ٤٩٪ من أمراض القلب التاجية تعزى إلى ارتفاع ضغط الدم. وهناك أدلة قوية على أن الاستهلاك الحالي للإنسان من الملح هو العامل الرئيسي لزيادة ارتفاع ضغط الدم وبالتالي زيادة الإصابة بأمراض القلب والأوعية الدموية. وحيث أن استهلاك الخبز هو جزء رئيسي في الوجبات الغذائية اليومية للناس ولاسيما في بلادنا، لذا فإن تحديد محتوى الصوديوم وبالتالي (الملح) في الخبز يعتبر من الأولويات القصوى ويحتاج إلى مزيد من الأبحاث.

**طرق البحث:** تم جمع (١٢٠) عينة من ستة أنواع مختلفة من الخبز من (١٢٠) مخبزاً مختلفاً في مدينة دهوك وتم بعد ذلك دراسة تركيز (محتوى) الصوديوم في مختبرات معهد بحوث التغذية في بغداد.

**النتائج:** أظهرت الدراسة أن ٣٥٪ من عينات الخبز تحتوي على تركيز الصوديوم تتجاوز المستوى القياسي المسموح بها في العراق وبينما كانت النسبة المتبقية ٦٥٪ ضمن النسب المسموحة. وكان متوسط نسبة تركيز الصوديوم في جميع عينات الخبز ١٤٩،٢٤٨ ملغ/ ١٠٠ غرام.

**الاستنتاجات:** تركيز الصوديوم في ثلث عينات الخبز المفحوصة كانت أعلى من الحد المقبول ويمكن أن تؤدي إلى نتائج صحية سلبية. ولذا فإن تدخل الجهات المسؤولة عن الصحة العامة يعتبر في غاية الأهمية.