Study to investigate the concentration of sodium in bread for some Baghdad bakeries

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Abstract:

Background: Cardiovascular disease is the leading cause of premature death due to dietary factors such as high salt intake. Bread is one of the most important sources, as it causes high blood pressure.

Objective: The aim of this study is to establish the approved controls and standards for adding sodium to three types of bread.

Materials and methods: The sodium concentration in the samples mentioned in this study was calculated; using a dedicated sodium concentration kit, produced by Agappe Diagnostics Switzerland Sodium is estimated by colorimetric method based on modified Maruna and Trinders method. Sodium and proteins are precipitated together by Magnesium Uranyl acetate as Uranyl Magnesium Sodium acetate salt. Excess of Uranyl salt reacts with potassium ferrocynide to produce a brownish color. The intensity of the color is inversely proportional to the sodium concentration in the specimen and is measured photometrically at 530 nm.

Results: The maximum value of Sodium Concentration for white bread was in AlShaeb Region (3.546gm), while the maximum value of the Sodium Concentration for the Barley Bread type was in the Alghazalia region (3.516gm) and Mahmudiyah region (3.494gm) .The maximum value for the Sodium Concentration was for the third type, which is the local Bread in the Hittin district (3.630gm) and Alssadr City region (3.603gm).and the a minimum value of the Sodium Concentration for white bread was in Abu Ghareeb region (3.097gm) and Alsaydia region (3.136gm), while the a minimum value of the Sodium Concentration for the Barley Bread type was in the Abu Ghareeb region (3.091gm) , Palestine Str. (3.132gm), Dura region (3.182gm) And Karrada region (3.187gm) and the a minimum value of the Sodium Concentration for Local Bread was in Dura region (3.182gm) , Palestine Str. (3.185gm) and Abu Ghareeb region (3.206gm).

Conclusion: The results of this study showed a more than doubled concentration of sodium in bread the reason is due to the lack of clear controls and standards that define and obligate bakeries to add sodium in specific quantities according to these standards. When Baghdad governorate was divided into north, south, and east and west, as well as when it was divided into two parts, Karkh and Rusafa, it was found that there was no significant difference between Baghdad districts due to the varying levels of sodium concentration in these areas.

Keywords: bakeries, white bread, Barley bread, local bread, Sodium Concentration.

Introduction

The correlation between salt intake, high level of dietary sodium intake and raised blood pressure is well established (1). This is lead to increasing risk opportunity of cardiovascular disease, harmful effect on health like risk opportunity of Stomach cancer (2, 3) and indirect link to obesity (4). According to WHO recommendation daily salt intake is 5g/day for adults and its reduction strategy is one of the top three priority actions to handle the non- communicable disease crisis (5,6). The Noncommunicable diseases (NCDs) data report (Iraqi Ministry of health, 2019), was estimated that 30% of Iraqis have High blood pressure and 10g/day of salt/sodium intake for adults (7). Bread is the main food stuff and is the highly consumed food globally, which is about nine billion kilograms nowadays(8,9), also Iraqi people consumed Bread (Samoon) as the major daily food , accordingly salt play as vital component in bread in spite of its qualitative roles in the texture, flavour, controlling fermentation and extension shelf life of bread prosperities(10). Bread represent the average of 30% daily salt intake (11) and COSQC estimated that salt should not be exceeded 1.5% of the weight of bread. Nowadays many countries planned a strategies to reduce salt in foodstuff including bread but they have challenges of reduction salt in the bread will change qualitative characteristics of this products (12) according to last report of ministry of health, 2019. The government decided to take action and planning for reducing salt daily intake by Iraqi population, so the aim of our study to evaluate the sodium concentration in the deferent type of Iraqi bread product in Baghdad region and this study It is considered the first for Baghdad Governorate where help our government to evaluate the risk opportunity of daily salt intake through bread consumption. So the aim of our study to evaluate the sodium concentration in the deferent type of Iraqi bread product in Baghdad region and this survey assist our government to assay the risk opportunity of daily salt intake through bread consumption.

Methodology

In this study, samples to be studied for the three types, white bread, barley bread and local bread, were collected from 16 bakeries in Baghdad from all sides, north, south, east and west, that is, in two parts: Karkh and Rusafa district. To calculate the sodium concentration in the samples mentioned in the study. Note the weight of the bread dough before being put into the oven is about 90-100 grams, and the amount of sodium after taking it out of the oven should be around 1.5 grams, according to the Iraqi standard. A kit was used to measure the concentration of sodium, it produced Agappe Diagnostics Switzerland company, below are the details of the concentration account as per the mentioned company.

Principle

Sodium is estimated by colorimetric method based on modified Maruna and Trinders method. Sodium and proteins are precipitated together by Magnesium Uranyl acetate as Uranyl Magnesium Sodium acetate salt. Excess of Uranyl salt reacts with potassium ferrocynide to produce a brownish color. The intensity of the color is inversely proportional to the sodium concentration in the specimen and is measured photometrically at 530 nm (500-546 nm).

Procedure Notes

Step 1- Precipitation	Laboratory Procedure for Semi Auto Analyzer	
	Standard	**Sample**
Sodium R1(Precipitating Reagent)	**1000µL**	**1000µL**
Sodium Standard	**10 µL**	**-**
Sample	**-**	**10 µL**
Shake vigorously and incubate at room temperature for 5 minutes. Then centrifuge at 2000-3000 RPM for 2 minutes to obtain a clear supernatant and Transfer the supernatant immediately after centrifugation for standard and test.		

Step 2- Sodium Estimation			
	Blank	**Standard**	**Sample**
Sodium R2(colour Reagent)	**1000µL**	**1000µL**	**1000µL**
Supernatant from Step1	**-**	**20 µL**	**20 µL**
Sodium R1	**20 µL**		**-**
Mix well and allow it to stand at room temperature for 5 minutes. Measure the absorbance of standard and sample against reagent blank.			

Calculation

Sodium concentration mmol/L =

$$\frac{\text{Absorbance of Blank} - \text{Absorbance of Sample}}{\text{Absorbance of Blank} - \text{Absorbance of Standard}} \times 150$$

Pipetting of Sodium R1 (Precipitating Reagent) (in step 1) and transfer of supernatant (in step 2) should be done quickly to avoid error to low density of liquid.

Note: The kit that was used in this study measures the sodium concentration in mmol/l only, and for the purpose of calculating the concentration of sodium chloride completely for the three types of bread that were used in this study, the concentration of mmol/l was converted to grams The Sodium chloride consists of combining two elements, sodium and chlorine, in the same proportions.

Note: Sodium Assay is an inverse reaction hence blank absorbance is higher than that of standard and test, and the factor may come in negative in some instruments.

From this equation, we can calculate the mass (gm):

Mass (gm) = Concentration (mmol) × 1000ml × molecular weight of sodium

Results

The data obtained from this Study, as shown in Tables (1, 2 and 3) included the Measurements of the Concentrations of Sodium in three types (White Bread, Barley Bread and Local Bread).

Table (1): shows the values of Sodium Concentrations that were obtained for the three types of bread and for 16 regions in Baghdad.

City	White Bread (Mean± SD)	Barley Bread (Mean± SD)	Local Bread (Mean± SD)
Aljhad	B, a 150.89±3.54	D, b 146.95±1.061	EF, c 140.86±1.061
Alsaydia	E, b 136.51±3.18	E, a 144.52±1.061	E, a 142.23±1.768
Albataween	B, a 150.327±2.151	D, b 147.98±1.061	C, a b 150±1.061
Alghazalia	B, a 150.91±2.83	A, a 153.02±1.061	B, a 152.01±1.768
Mahmoudia	C, b 145.53±3.89	AB, a 152.08±1.061	D, b 145.04±1.061
Kadhimiya	B, a 150.63±2.86	D, a 148±1.061	C, a 150±1.768
Adhamiya	D, a 142.14±2.127	G, a 140.2±1.768	FG, a 140.3±1.061
Alssadr city	B, a 150.5±1.061	C, a 150.22±0.106	A, b 156.79±1.768
Palestine str.	D, a 140±2.121	H, b 136.3±1.061	G, a 138.6±1.061
Hittin district	B, a 150.64±1.774	D, c 147.7±1.768	A, a 158±1.061
Karrada	D, b 140.953±2.122	G, b 138.7±1.061	D, a 145.43±1.768
AlSadoon	AB, b 151.547±1.062	F, c 142.8±1.061	B, a 153.04±1.061
ALshaeb	A, a 154.332±1.777	BC, b 150.6±1.768	B, b 152.09±1.061
Alhusaynia	AB, a 151.635±1.774	C, a 150.2±1.061	B, a 151.79±1.768
Abu Ghareeb	E, b 134.79±2.133	I,b 134.55±1.061	FG, a 139.55±1.061
Dura	D, a 142.1±2.51	G, a 138.5±3.42	G, a 138.5±3.42
P-value	**0.0004**	**0.0022**	**0.0003**
LSD	**3.069853**	**1.788854**	**1.754993**

Table (2): shows the average Sodium Concentration for the three types of bread for the city of Baghdad from its four directions, North, South, East and West.

City	White Bread (Mean± SD)	Barley Bread (Mean± SD)	Local Bread (Mean± SD)	p-value
North	A, a 149.61±5.13	A, a 147.25±4.84	A, a 148.54±5.57	**0.817**
South	A, a 141.27±3.73	A, a 143.45±6.39	A, a 142.97±2.89	**0.784**
West	A, a 146.73±8.12	A, a 145.56±7.82	A, a 147.61±8.9	**0.941**
East	A, a 148.2±5.49	A, a 144.32±6.19	A, a 149.61±7.85	**0.526**
P-value	**0.25**	**0.849**	**0.539**	

Table (3): Shows Sodium Concentration for the three types of bread in Baghdad for Karkh and Rusafa District

City	White Bread (Mean± SD)	Barley Bread (Mean± SD)	Local Bread (Mean± SD)	p-value
Karkh District	A, a 145.16±6.73	A, a 145.66±6.35	A, a 145.86±6.82	**0.977**
Rusafa District	A, a 147.74±5.67	A, a 144.63±5.81	A, a 148.5±6.44	**0.405**
P-value	**0.421**	**0.738**	**0.438**	

Discussion

Table (1) Shows the values of Sodium Concentrations that were obtained for the three types of bread and for 16 regions in Baghdad the maximum value of Sodium Concentration for white bread was in AlShaeb Region (3.546gm), while the maximum value of the Sodium Concentration for the Barley Bread type was in the Alghazalia Region (3.516gm) and Mahmudiyah (3.494gm) .The maximum value for the Sodium Concentration was for the third type, which is the local Bread in the Hittin district (3.630gm) and Alssadr City region (3.603gm).and the a minimum value of the Sodium Concentration for white bread was in Abu Ghareeb Region (3.097gm) and Alsaydia Region (3.136gm) while the a minimum value of the Sodium Concentration for the Barley Bread type was in the Abu Ghareeb region (3.091gm) , Palestine Str. (3.132gm), Dura region (3.182gm) and Karrada region (3.187gm) and the a minimum value of the Sodium Concentration for Local Bread was in Dura region (3.182gm) , Palestine Str. (3.185gm) and Abu Ghareeb region (3.206gm).

Table (2) shows the average concentration of sodium for the three types of bread for the city of Baghdad from its four sides, north, south, east and west. Through the use of the statistical program SPSS version 23, we find that there is no significant difference in the level of sodium concentration for these four directions, and the reason for this is the uneven areas or the average level of sodium concentration changes from region to another region. However, we find that there is a region in which the concentration of sodium is high, while there is another region in which this concentration is low, and when we take the average of these values for the concentrations of sodium, they become equal, and we also conclude from this that there are no significant differences in the level of The sodium concentration for the three types of bread, and this issue did not appear in Table (1) because the sodium concentration was taken for each region separately when using the statistics program that gave the differences. In the sodium concentration of the three types of bread, by which it is inferred on the region in which the level of sodium concentration is the maximum value and the region in which it is the lowest value.

Table (3) shows the sodium concentrations for the Baghdad governorate, when it was divided into two District, Karkh and Rusafa. It is clear from the results that there is no significant difference in measuring the sodium level for the three types of bread, and the reason is the same as mentioned in the analysis of Table (2) for the unequal regions or the average sodium level in the regions changes due to extract rate.

Conclusion

The results of this study showed a more than doubled concentration of sodium in bread the reason is due to the lack of clear controls and standards that define and obligate bakeries to add sodium in specific quantities according to these standards. When Baghdad governorate was divided into north, south, east and west, as well as when it was divided into two parts, Karkh and Rusafa, it was found that there was no significant difference between Baghdad districts due to the varying levels of sodium concentration in these areas.

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دراسة للتحقق من تركيز الصوديوم في الخبز لبعض مخابز بغداد

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الخلاصة:

خلفية عن الموضوع : أمراض القلب والأوعية الدموية هي السبب الرئيسي للوفاة المبكرة بسبب عوامل غذائية مثل تناول الملح بكميات كبيرة ويعتبر الخبز من أهم هذه المصادر لاحتوائه على الملح والذي يسبب ارتفاع ضغط الدم .

الهدف من الدراسة : هو وضع الضوابط والمعايير المعتمدة لإضافة الصوديوم لثلاثة أنواع من الخبز.

المواد وطرق العمل : تم حساب تركيز الصوديوم في العينات المذكورة في هذه الدراسة باستخدام مجموعة مخصصة لتركيز الصوديوم ، تم إنتاجها من قبل شركة Agappe Diagnostics Switzerland ، يتم تقدير الصوديوم بطريقة القياس اللوني بناءً على طريقة Maruna و Trinders المعدلة. يتم ترسيب الصوديوم والبروتينات معًا بواسطة أسيتات المغنيسيوم يورانيل كملح أسيتات الصوديوم المغنيسيوم يورانيل حيث يتفاعل فائض ملح اليورانيل مع فيروسينيد البوتاسيوم لإنتاج لون بني. تتناسب شدة اللون عكسًا مع تركيز الصوديوم في العينة ويتم قياسها ضوئيًا عند 530 نانومتر.

النتائج: كانت أقصى قيمة لتركيز الصوديوم للخبز الأبيض في منطقة الشعب (3.546 جرام) ، بينما كانت أعلى قيمة لتركيز الصوديوم لنوع خبز الشعير في منطقة الغزالية (3.516 جرام) ومنطقة المحمودية (3.494 جرام). كانت أقصى قيمة لتركيز الصوديوم للنوع الثالث وهو الخبز المحلي في منطقة حي حطين (3.630 جم) ومنطقة مدينة الصدر(3.603 جم) وأقل قيمة لتركيز الصوديوم للخبز الأبيض كانت في منطقة ابو غريب (3.097 جم) ومنطقة السيدية (3.136 جم) ، بينما كانت أقل قيمة لتركيز الصوديوم لنوع خبز الشعير في منطقة أبو غريب (3.091 جم) ، شارع فلسطين. (3.132 جم) ومنطقة الدورة (3.182 جم) ومنطقة الكرادة (3.187 جم) والحد الأدنى لتركيز الصوديوم للخبز المحلي كان في منطقة الدورة (3.182 جم) ، شارع فلسطين. (3.185 جم) ومنطقة أبو غريب (3.206 جم).

الاستنتاج: أظهرت نتائج هذه الدراسة زيادة تركيز الصوديوم في الخبز بأكثر من الضعف ، والسبب يعود إلى عدم وجود ضوابط ومعايير واضحة تحدد وتلزم المخابز بإضافة الصوديوم بكميات محددة. عندما تم تقسيم محافظة بغداد إلى شمال وجنوب وشرق وغرب ، وكذلك عندما تم تقسيمها إلى قسمين ، الكرخ والرصافة ، تبين أنه لا يوجد فرق معنوي بين مناطق بغداد بسبب اختلاف مستويات تركيز الصوديوم في هذه المناطق.

الكلمات المفتاحية: مخابز/ خبز أبيض / خبز شعير / خبز محلي / تركيز الصوديوم.