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EVALUATING THE QUALITY OF IMPORTED AND LOCAL FLOUR IN TERMS OF QUALITY WITH IRON AND FOLIC ACID AND ITS COMPLIANCE WITH IRAQI STANDARD

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ABSTRACT

Food fortification has an important and necessary role in compensating for the shortage of nutritional micronutrients, especially in developing and least developed countries. So, 12 samples of flour available in the local market, whether imported or locally produced flour, were obtained during 2019. The amount of base metal of the necessary iron element in the flour models studied which are available in local markets, measured by spot testing and was compared with the values that should be added according to the specification Iraqi standard. Results revealed the qualitative evaluation of iron in locally produced flour does not conform to the Iraqi standard and is almost free of any reinforcement. While the percentage of imported flour samples with iron-fortification was 75 relative to the studied species available in the local markets, and the ratio decreased to 40 % in relation to the flour imported from foreign countries. The average iron concentration in flour imported from Arab countries was 30-60 ppm, while imported from foreign countries ranged between 10-15 ppm. As for the Turkish flour, the highest fortification rate was 60 ppm, but the iron ratio was 25% relative to other Turkish types available in the local markets.

Keywords: Flour samples, fortification, iron

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تقييم جودة أنواع الطحين المستورد والمحلي من حيث النوعية بعنصر الحديد وحامض الفوليك ومدى مطابقته للمواصفة القياسية العراقية

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الخلاصة

تدعيم الاغذية له دور هام وضروري في تعويض النقص من المغذيات الدقيقة الغذائية وخاصة في الدول النامية والاقل نمواَ، لذا تم الحصول على 12عينة من الطحين المتوافر في الاسواق المحلية سواء المستورد او المنتج محليا خلال عام 2019، وتم قياس مقدار التدعييم لعنصر الحديد الضروري في نماذج الطحين المدروسة والمتوافرة في الاسواق المحلية بواسطة اختبار البقع وتمت مقارنة مع القيم الواجب إضافتها طبقا للمواصفة العراقية القياسية، وكشفت النتائج ان التقييم النوعي للحديد في الدقيق المنتج محليا لا يطابق المواصفة القياسية العراقية ويكاد يكون خاليا من أي تدعيم، بينما كانت نسبة الطحين المستورد والمدعم بالحديد 75% نسبة الى الانواع المدروسة والمتوافرة في الاسواق المحلية، وانخفضت النسبة الى 40% بالنسبة للدقيق المستورد من الدول الاجنبية، وكان متوسط تركيز الحديد في الدقيق المستورد من الدول العربية 30-60 ppm بينما المستورد من الدول الاجنبية يتراوح بين 10-15ppm، اما الدقيق التركي كانت اعلى نسبة تدعيم وهي 60 ppm، لكن نسبة التدعيم هي 25% نسبة الى الانواع التركية الاخرى المتوافرة في الاسواق المحلية.

الكلمات المفتاحية: نماذج الطحين، التدعيم، الحديد

INTRODUCTION

Statistics of the food and agriculture organization show that about 868 million people worldwide suffer from food shortages, especially iron. About two billion people suffer from anemia or iron deficiency, which is one of the most prevalent food disorders in the world **(Muthayya *et al.*, 2012)** and some vitamins, and 26 % of children suffer from stunting for malnutrition.Also, there is a great shortage in the nutritional components of microelements in the food of many poor families such as zinc and folic acid, and the categories of infants, children, pregnant women and the elderly are the most vulnerable to the risk of food shortages for these low-income families **(Adel *et al.*, 2017)**.The consolidation of food was common in the aftermath of the second world war in America and some European countries, and it was a major cause in eliminating the rickets of children and the thyroid gland and the swelling or what is called corn disease **(FAO 2012)** by strengthening various types of grains with nicotine or folic acid. That intensive studies in the USA and Canada **(EFSA 2009)** demonstrated the importance of fortifying foods made with this acid and its effect on a significant reduction in the incidence of neural tube defects **(Nguyen *et al.*, 2013)**. Congenital anomalies of modern births **(Magali *et al.*, 2015; Castillo *et al.*, 2013)**, as well as a close relationship between increased folic acid in the blood and a direct decrease in the risk of heart disease **(Scorsatto *et al.*, 2011)** and the vascular system, cancer **(Lobo *et al.*, 2011; Black *et al.*, 2013)**, and in improving cognitive function in adults **(Arsenault *et al.*, 2013)**, as well as its role in reducing iron deficiency cases as well as fortifying food with iron is one of the best solutions for solving iron deficiency anemia **(Hamed 2017)**, and anemia is reduced **(Abtahi *et al.*, 2014)** and wheat flour is an appropriate food for iron fortification.The apparent benefits of nutritional fortification with macronutrients (micronutrients) on consumer health **(World Health**

Organization 2015) appear without the need to change consumption patterns, as well as the low cost of fortification and the abundance of various techniques for applying fortification to achieve nutritional diversity, whether natural or chemical nutrients **(Penelope & Ritu 2000; Naveen *et al.*, 2019)**. This is confirmed by the world organization and the organization of agriculture and the world health organization, as well as what was confirmed by the **(International Conference on Nutrition in 1992)** and giving it the highest priority and for all countries, especially developing and least developed, to implement fortification and give them help and assistance to achieve fortification through the improvement of improving the food diet, fortifying food and supporting public health with a fundamental goal to improve Setting the basic nutritional components of the entire population and the necessity of sustaining these improvements to ensure community improvement and long-term sustainability **(WHO, FAO, UNICEF 2010)**.In Iraq, many families still suffer from chronic problems of poverty, hunger and malnutrition, so we must look forward and benefit from the experiences of the past and neighboring Arab countries in developing solutions and visions that are independent, sustainable and implementable within an institutional framework and a time that everyone agrees to advance healthy and fortified food as one of the most important Human rights, basic public health, human well-being, societal peace, political stability and sustainable development in developing countries Wheat flour is consumed in many countries of the world, especially the eastern Mediterranean countries and Arab countries in very large quantities, so flour is an essential factor in the iron fortification program and macaronic components in these countries as an effective strategy to reduce cases of anemia and anemia caused by iron deficiency **(WHO 2001; WHO 2009)**. Therefore, the aim of the current research to investigate the proportions of iron and folic acid in all types of flour available in the local markets, whether imported or locally manufactured, which was approved by the world health organization and supported by wheat flour with iron and folic acid since the nineties of the last century, but so far it has not been applied **(Hurrell *et al.*, 2010; Sadighi *et al.*, 2010)**.

MATERIALS AND METHODS

Samples Collection

It was brought 12 samples of wheat flour that are available in the imported and locally manufactured local markets on 1/5/2019, Al-Jadiriya area (Al-Rusafa side, and Al-Bayaa markets (Al-Karkh side) as shown in (Table 1).

Table (1): Collection of wheat samples available in local and imported markets.

The sequence	Sample type (flour or barley)	Trade mark	Country of Origin
The ratio of local flour = 25			
1	Wheat flour Wheat flour (ration)	General Establishment for Grain Industry / Ministry of Trade	Iraq
2	Barley Flour	Al-Taji Mill	Iraq
3	Wheat flour (Not bagged)	Sofia	Arbil/ Iraq
The percentage of flour imported from Arab countries = 33.33			
4	Wheat Flour (1Kg)	Jihan	United Arab Emirates
5	Wheat flour (Not bagged	Buchler	United Arab Emirates
6	Wheat Flour (1Kg)	Medal	United Arab Emirates
7	Wheat Flour (1Kg)	deluxe	Kuwait

The percentage of flour imported from foreign countries = 41,66			
8	Wheat Flour (1Kg)	Buchler	Turkey
9	Wheat Flour (Not bagged)	Buchler	Turkey
10	Wheat Flour	Jihan	Turkey
11	Barley Flour	Doyan	Turkey
12	Wheat Flour	The red mill	American

Chemical estimates of wheat and barley flour

Moisture, ash, protein, fat, fibercontent analyzed by the methods of AACC (2000). The carbohydrate was measured by the difference: 100-(moisture+protein+ash+fat+fiber).

Detection of iron in flour samples:

Preparing chemical solutions

A- The first detector:

1. KSCN potassium thiocyanate 10%

10 gm of KSCN are dissolved in 100 mL of distilled water with good shaking.

2. Hydrochloric acid (2M) HCl

17 mL of 37% HCl concentrated in a 100 mL volumetric flask are added and supplemented with the distilled water mark. When used, mix equal quantities of KSCN with HCl in Baker.

B- The second detector

Hydrogen peroxide H_2O_2 3%

It is prepared by adding 9 mL of 3% H_2O_2 to a 100 mL volumetric flask and supplementing 81 mL with distilled water.

Preparation of standard solutions

Standard forms of flour containing premix are prepared in the proportions of 0.1, 0.2, 0.4, 0.6 and 0,8 gm of premix to 1 kg of flour to form the following concentrations 15, 30, 60 and 90 ppm of iron respectively.

The method

It was taken a 100 gm of each sample and placed on the filter paper and a circular hole is created in the center of the flour by 4×4 cm with pressure on the flour surface and 5 drops of the first detector are added and we wait for a period of 15-30 sec. and then add 5 drops of the second detector on the same area covered with the first detector and wait for a while 1-2 min., and this oxidizes ferrous to ferric, so we notice the appearance of red spots on the surface of the flour indicating the presence of iron in the flour and it can be compared with several standard models known as concentration and specified in ratios 15, 30, 60 and 90 ppm and returned in the same previous way as repeaters. The number of points visible and the darkness of the red color indicates The amount of iron concentration in the fortified flour while the absence of color indicates no support for flour according to **(AACC 2000)** no. 40-40.01.

Statistical analysis

The statistical analysis system **(SAS 2012)** was used in data analysis to study the effect of different factors on the characteristics studied according to a complete randomized design (CRD).

RESULTS AND DISCUSSION

Samples Collection

(Table 1) shows most of the samples available in the current Iraqi markets, as it was found that the local meal flour is prevalent in the markets and there is no other returning to the private sector except for barley flour in small quantities and difficult to provide to the consumer, despite the awareness of many people of its importance for health, especially diabetics, obesity and weight loss, most of which are consumed by fake (barley) barley bread by manufacturers, that is, bakers, knowing that the source of flour made from it is puffed barley bread, which is available in most bakeries and automatic ovens is wheat flour imported from Turkey **(Hamdia *et al.*, 2017)**. There is also wheat flour of the Sofia mark, which is a local product in the Kurdistan Region of Iraq as well. After that, there are 4 types imported from the neighboring Arab countries, at a rate of 33.33 including three types from the United Arab Emirates and only one type from the State of Kuwait. While the predominant is the foreign importer with a percentage of 41.66 and the majority is from Turkey, where there are 7 types and a percentage of 58.33 for the importer from outside the country, and only one type is from America, the twelfth model, as shown in (Table 1).

Table (1): Collection of wheat samples available in local and imported markets.

The sequence	Sample type (flour or barley)	Trade mark	Country of Origin
The ratio of local flour = 25			
1	Wheat flour Wheat flour (ration)	General Establishment for Grain Industry / Ministry of Trade	Iraq
2	Barley Flour	Al-Taji Mill	Iraq
3	Wheat flour (Not bagged)	Sofia	Erbil/ Iraq
The percentage of flour imported from Arab countries = 33.33			
4	Wheat Flour (1Kg)	Jinan	The United Arab Emirates
5	Wheat flour (Not bagged	Buchler	The United Arab Emirates
6	Wheat Flour (1Kg)	Medal	The United Arab Emirates
7	Wheat Flour (1Kg)	deluxe	Kuwait
The percentage of flour imported from foreign countries = 41,66			
8	Wheat Flour (1Kg)	Buchler	Turkey
9	Wheat Flour (Not bagged)	Buchler	Turkey
10	Wheat Flour	Jihan	Turkey
11	Barley Flour	Doyan	Turkey
12	Wheat Flour	The red mill	American

Nutrition Facts

The results indicated in (Table 2) showed that examination of the trademark showed that 75% of the samples mentioned the trademark in both Arabic and English. While 25% of the samples did not mention the trademark in the English language, including: wheat flour and barley produced locally, as less From 10% of the study samples in which the trademark was mentioned in the Arabic language only the Sofia mark, while all imported samples were observed, whether from Arab or foreign countries, in which the type of product and the name and address of the product were mentioned, while an examination of the package shape shows that 50% of the samples were in a rectangle , and 50% were cylindrical. It was noted that 50% of the packages in the study sample were a nylon bag and 50% paper, which is the fourth, seventh, eighth, tenth and twelfth models. The weight of the samples ranged between 1-25 kg, while it was noted that all samples contained a mention of the country of origin, while it was noted that 33.3% of the study samples did not mention the date of production and entry, while 33.3% of the models did not mention the validity date of production. And the fortification was absent in the first, second, third and ninth model of wheat flour or barley. As for fortification with the element iron and folic acid it was found that 25 % of the samples were mentioned, while all local species did not mentioned anything about fortification.

Table (2): Indication data for the types of flour available in the local markets for the years from 2018-2019.

Seq.	Trade Mark		Product Type	Product Name	Packaging shape	Packaging type	Net weight (kg)	Country of Origin	Nut. Fact	Expiration date	
	Arabic	Eng.								Prod. date	Exp. date
1	–	–	Wheat Flour	General Establishment for Grain Industry / Ministry of Trade	Not Pagged	Nylon	20	Iraq	–	–	–
2			Barley	Al-Taji Mill	Not Pagged	Nylon	20	Iraq	–	–	–
3	صوفيا	–	Wheat Flour	–	Not Pagged	Nylon	20	Iraq/Erbil	–	–	–
4	جنهان مدعم بالحديد	Jenan	Wheat	Al Ghurair Company	Bag	Foliar	1	UAE	Mentioned	–	–
5	بشلر	Bushler	Wheat	Buchler	Bag	Foliar	20	UAE	–	1/2018	12/2018
6	ميدال	Medal	Wheat	–	Bag	Foliar	1	UAE	Mentioned	1/2018	12/2018
7	فاخر دقيق قمح مدعم بالحديد والفوليك	Patent	Luxurious flour for all uses	Kuwait Flour Mills and Bakeries Company	Rectangular bag Rectangular bag	Foliar	1	Kuwait	Mentioned	21/2/2019	Shelf life: 6 months from the date of packing

	اسد										
8	طحين بشلر	BESLER UN	Buchler flour	Gaziantep	Big Bag (20kg)	Foliar	1	Turkey	Mentioned and illustrated	15/1/2019	15/1/2020
9	تركي–فل-	Sofia	Flour with a condition of baking	Bread Table General Trading Company - Erbil (20kg)	Rectangular bag	Big Bag (20kg)	20	Turkey	––	-	-
10	جيهان	Cihan Flour	–	Cihan Group	Rectangular	Rectangular	1	Turkey	Mentioned and illustrated	–	–
11	طحين الشعير دويان	DUYAN	Barley Flour	Turkey	Big Bag (25kg)	Big Bag (25kg)	25	Turkey	Not Mentioned and illustrated	Not Menshoned	Not Menshoned
12	طحين قمح مدعم بالحديد والفوليك	Red Mill	Wheat Flour	American	Rectangular	Rectangular	1.36	American	1/1/2018	1/1/2018	30/12/2019

Chemical composition of flour and barley types

The results of the study show the chemical composition of the different types of wheat and barley flour available in the local market as in (Table 3). In general, by comparing these special proportions in the chemical composition of foodstuffs, we find an approach to what he found **(Magali *et al.*, 2015)**. With regard to the percentage of moisture, which is the determining factor for the quality of flour and its storage conditions, it is preferable not to exceed 13-14%. The results showed a significant difference ($P < 0.05$) between wheat flour and barley flour. The reason is due to the increase in starchy compounds in wheat flour, which have a high ability to store and drink water more than barley flour. There was no significant difference ($P > 0.05$) between the different types of flour Wheat, both domestic and imported. As for the ash content in barley flour is higher than in wheat flour and with a high moral difference ($P < 0.05$) and this is supported by **(Aziz &Mohammed 2013)**, while the protein percentage there is a high moral difference ($P < 0.05$), then its percentage in barley flour is higher than Wheat flour, in addition, studies have shown (**COSQC 1988)** that the protein content of wheat flour more than 11.95 may meet the need for baker to give the bread material desired by the consumer in terms of the excellent sensory properties of baking. As for the percentage of fats, it was statistically high ($P < 0.05$) in barley flour in relation to wheat flour. Also, there is a significant difference ($P < 0.05$) between the different types of wheat flour studied and the reason is attributed to the same reasons mentioned above. It is noted from the

same table that there is a high significant difference (P<0.05) in the percentage of fibers in wheat flour types, as well as a high moral difference for barley flour (P<0.05) and these ratios are close to what he found **(Muthayya *et al.*, 2012)**, and as it is It is known that more extraction leads to more ash and fiber.

Table (3): Shows the chemical content of different types of flour.

Seq.	Flour samples	Chemical content (%)					
		Moisture	Ash	Protein	Fat	Fiber	Carbohydrates
1	General Establishment for Grain Industry / Ministry of Trade/Iraq	12.20	0.50	10.87	2.50	0.72	73.21
2	Iraqi Barley Flour	10.9	1.5	12.6	17.20	2.8	55. 00
3	Wheat Flour (not bagged)/Erbil	12.50	0.55	11.56	2.60	0.80	71. 99
4	Wheat Flour	12.10	0.60	12.50	2.60	0.70	71. 50
5	Wheat Flour (not bagged)	12.00	0.61	12.52	2.58	0.68	71. 61
6	Wheat Flour/Medal	11.86	0.59	12.50	2.61	0.65	71. 88
7	Wheat Flour/Kuwait (1 kg)	11.9	0.55	12.90	2.56	0.62	71. 47
8	Bushler Wheat Flour/Turkey	12.2	0.56	12.55	2.80	0.55	71. 34
9	Bushler Wheat Flour/Turkey (Not bagged)	12.50	0.60	12.50	2.65	0.60	71. 15
10	Jihan Flour	12.60	0.58	12.0	2.62	0.62	71.08
11	Turkish Barley Flour/ Doian	11.20	1.25	12.52	14.5	0.90	59.63
12	American Wheat Flour	12.00	0.49	11.90	2.50	0.63	72.48
LSD Value		2.37 NS	0.629 *	1.522 *	2.83 *	0.568 *	6.407 *

* (P≤0.05)=significant, NS: Non-Significant.

Iron content in different types of wheat flour available in the local market

The method of semi-quantitative or macular testing was used in this study because it is simple, inexpensive and fast to determine the presence of iron in the flour models under study. In this method, by comparing the color intensity and number of colored points, approximate iron levels in the flour can be estimated according to **(Adel *et al.*, 2017; Naveen *et al.*, 2019)**. The results of the current study showed that there are no samples of locally produced flour that are distributed within the ration for low and middle income people by the Ministry of Trade/ Public Establishment for the manufacture of grains from iron, with the two types of wheat flour and barley flour, as shown in (Table 4) and (Figures 1 and 2) respectively. The results also showed that the flour produced in Iraqi Kurdistan, the Sophia / Erbil type, is also devoid of iron, as shown in (Table, 4 and Figure, 3). While the samples of flour imported from neighboring Arab countries contain the element of iron in a high proportion and as recommended by international standards, as the samples of the United Arab Emirates 4 and 6 contain a high quantity of 60 and 30-60 ppm respectively, while sample no. 5 is devoid of iron element, as is evident in (Table 4 and Figures 4, 5 and 6). The results also showed that the flour imported from Kuwait contains the required percentage of iron, 60 parts per million, as shown in (Table 4 and Figure 7),which fall within the standard range of the Iraqi standard **(COSQC 1988; WHO, FAO 2006)**.As for the flour imported from Turkey, for the four samples no. 8, 9,

10 and 11, most of them do not contain the element iron, except for sample no. 8, it was found to contain a small percentage of iron, approximately 10-15 ppm only. While the only sample of flour imported from the United States of America is the type of American flour, marked Red Mill no. 12 as it contains the high and internationally defined percentage of the iron element in the amount of 60 ppm as in (Table 4 and Figure 12). All of this indicated the lack of health control and the lack of implementation of international programs to support the micronutrient components needed for the health of the Iraqi consumer of the Iraqi product and imported from neighboring foreign countries such as Turkey. The wheat flour fortification process includes adding, distributing a specified amount of iron and folic and monitoring it for a specific amount of flour **(Magali *et al.*, 2015)**. Among the main reasons that may lead to a significant increase or decrease in the size of the supported the following:1-Imbalance in premix injection rate. The injection rate and the addition of the initial mixture must be calculated immediately based on the actual rate of flour production, as the micron feed unit should be organized in such a way as to inject a precise weight of the mixture per minute. 2- Lack of calibration of the small feeding apparatus and regular control of premix weight. 3- Maintaining the continuous flow of flour production. 4- In addition, there must be skilled and experienced workers in accurate weights and loyalty. So that the constant flour production rate across the production line is very important. 5- Despite the low cost compared to the health of the consumer, Iraq's critical economic conditions and mismanagement, so Iraq has been unable to implement the much-needed consolidation system today. The results of this study came in much less than study (**Adel *et al.*, 2017).**

Table (4): Shows the premix iron content for different types of flour.

Sequences	Sample type (flour)	Brand and country of origin	Iron content (ppm)
1	Flour from General Establishment for Grain Industry / Ministry of Trade/Iraq	General Establishment for Grain Industry / Ministry of Trade/Iraq	–
2	Iraqi Barley Flour	Iraq	–
3	Wheat Flour (not bagged)/Erbil	Sofia/ Erbil	–
4	Wheat Flour	UAE	60
5	Wheat Flour (not bagged)	UAE	–
6	Wheat Flour/Medal	UAE (1 kg)	30-60
7	Wheat Flour/Kuwait (1 kg)	Kuwait	60
8	Bushler Wheat Flour/Turkey	Turkey	10-15
9	Bushler Wheat Flour/Turkey (Not bagged)	Turkey	–
10	Jihan Flour	Turkey	–
11	Turkish Barley Flour/ Doian	Turkey	–
12	American Wheat Flour	American	30-60
LSD Value	–		* 12.584

* (P≤0.05)=significant, NS: Non-Significant.

CONCLUSION

The results of the evaluation of the iron element showed most of the types of flour available in the local markets of the city of Baghdad, which are the same available in most Iraqi governorates, whether the product is locally and most of it is within the production of the

General Establishment for Grain Manufacturing (the ration supply) is free of iron element and is not supported by the iron and folic acid, while Imported from neighboring Arab and foreign countries, the percentage of countries actually supporting iron and sour was 41.66. While the actual ratio of consolidation relative to the importer from abroad was 55,55 in the city of Baghdad and most of the Iraqi provinces. Therefore, it is very necessary to pay attention and refer to the governmental and regulatory authorities to the necessity to follow the Iraqi standard **(OSQC, 1988)** to follow the conditions of fortification of wheat flour and to follow the program of mandatory consolidation of the necessary macaroni components, including iron and folic acid for wheat flour and its products by governmental and non-governmental bakeries, which we set the food and health organization is a global organization for many developing and least developed countries and Iraq is among the countries, due to its fundamental importance for many low and middle income families for the health of the Iraqi consumer and ensuring the health of sensitive segments such as pregnant women, infants and the elderly.

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