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Original Article

Investigation of cost and availability of gluten-free food in Jeddah, KSA

Lamya Qashqari, BSc [a], Dana Shakweer, BSc [a], Abeer S. Alzaben, PhD [b] and Mahitab A. Hanbazaza, PhD [a,*]

[a] *Department of Food and Nutrition, Faculty of Human Sciences and Design, King Abdulaziz University, Jeddah, KSA*
[b] *Department of Health Sciences, College of Health and Rehabilitation Sciences, Princess Nourah bint Abdulrahman University, Riyadh, KSA*

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الملخص

أهداف البحث: يتزايد انتشار مرض الداء البطني في المملكة العربية السعودية بشكل تدريجي. إن الالتزام المستمر بنظام غذائي خال من الغلوتين هو الطريقة الفعالة الوحيدة لعلاج مرض الداء البطني. يلعب توفر وتكلفة طعام خال من الغلوتين دورا مهما في الالتزام بنظام خال من الغلوتين الغذائي. كان الهدف من هذه الدراسة هو دراسة تكلفة وتوافر الغذاء الخالي من الغلوتين في عينة من المتاجر المحلية ومحلات السوبر ماركت في جميع أنحاء محافظة جدة في المملكة العربية السعودية.

طرق البحث: تمت زيارة أحد عشر متجرا سوبر ماركت في جدة، المملكة العربية السعودية، تتراوح ما بين محلات السوبر ماركت ذات الميزانية العالية/الجودة إلى المتاجر ذات الميزانية المنخفضة. تم تقييم ثماني فئات غذائية بما في ذلك الدقيق وحبوب الإفطار والخبز والمعكرونة والوجبات الخفيفة (مثل البسكويت والكعك وألواح الوجبات الخفيفة ورقائق البطاطس). تم تسجيل مدى توافر وتكلفة العناصر التي تحتوي على خال من الغلوتين و المحتوي على الغلوتين ضمن هذه المجموعات الغذائية. تم حساب كل عنصر مدرج في هذه الفئات الغذائية، ثم تم حساب متوسط السعر الإجمالي.

النتائج: تم العثور على إجمالي 233 منتج خال من الغلوتين مقارنة بـ 24 منتج محتوي على الغلوتين. كان لدى السوبر ماركت 1 أعلى نسبة توافر للأغذية التي تحتوي على خال من الغلوتين (العدد = 90)، يليه السوبر ماركت 2 (العدد = 34)، السوبر ماركت 3 (العدد = 30)، السوبر ماركت 4 (العدد = 23)، السوبر ماركت 5 (العدد = 21)، السوبر ماركت 6 (ن=18)، سوبرماركت 7 (ن=9)، سوبرماركت 8 (ن=8). كان متوسط السعر لكل 100 جرام من أغذية خالية من الغلوتين أعلى تكلفة بكثير من منتجات محتوية على الغلوتين. تكلفة منتجات خالية من الغلوتين، والتي كانت أعلى بكثير من منتجات محتوية على الغلوتين، أدت إلى أن تكون الأغذية الخالية من الغلوتين أغلى بمرتين من نظيراتها من المحتوية على الغلوتين.

الاستنتاجات: كان توافر منتجات خالية من الغلوتين محدودا، وكانت منتجات خالية من الغلوتين أكثر تكلفة من منتجات محتوية على الغلوتين القياسية. تمثل التكلفة العالية والتوافر المحدود حواجز رئيسية أمام الأشخاص الذين يعانون من الداء البطني لاتباع نظام غذائي خال من الغلوتين. يجب أن تتعاون المنظمات الحكومية مع مقدمي الرعاية الصحية والصناعات الغذائية للتأكد من أن الأغذية الخالية من الغلوتين متاحة على نطاق واسع وبأسعار معقولة لمرضى الداء البطني، لتقليل الضغط المالي وتحسين جودة الصحة.

الكلمات المفتاحية: التوفر؛ التكلفة؛ الداء البطني؛ خال من الغلوتين؛ نظام غذائي خال من الغلوتين؛ المملكة العربية السعودية

Abstract

Objective: The prevalence of celiac disease (CD) in KSA is progressively increasing. Consistent adherence to a gluten-free (GF) diet is the only effective CD treatment. The availability and cost of GF food are important factors in adherence to a GFD. The objective of this study was to investigate the cost and availability of GF food in a sample of local stores and supermarkets across Jeddah province in KSA.

Method: Eleven supermarkets in Jeddah, KSA, ranging from high budget/quality supermarkets to low-budget stores, were visited. Eight food categories were evaluated, including flour, breakfast cereals, breads, pastas, and snacks (e.g., biscuits, cookies, snack bars, and chips). The availability and cost of GF and gluten containing (GC) items within these food categories were recorded. Each

* Corresponding address: Kingdom of Saudi Arabia University, P.O. Box 80200, Jeddah, 21589, KSA.
E-mail: mhanbazaza@kau.edu.sa (M.A. Hanbazaza)
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item included in these food categories was counted, and the overall average price was calculated.

Results: A total of 233 GF and 24 GC products were found. Supermarket 1 had the highest availability of GF foods (n = 90), followed by supermarket 2 (n = 34), supermarket 3 (n = 30), supermarket 4 (n = 23), supermarket 5 (n = 21), supermarket 6 (n = 18), supermarket 7 (n = 9), and supermarket 8 (n = 8). The median price per 100 g was significantly greater for GF than GC products ($p < 0.05$). The cost of GF products was significantly higher than that of GC products ($p < 0.05$); consequently, GF foods were twice as expensive as their GC counterparts.

Conclusion: The availability of GF products was limited, and GF products were more expensive than standard GC products. High cost and limited availability are major roadblocks to GFD adherence among people with CD. Governmental organizations must cooperate with healthcare providers and food industries to ensure that GF foods are widely available and affordable for people with CD, to minimize financial pressure and improve health quality.

Keywords: Availability; Celiac disease; Cost; Gluten-free; Gluten-free diet; KSA

Introduction

Celiac disease (CD) is a chronic, autoimmune disorder that is characterized by an abnormal immune reaction after gluten ingestion, and causes inflammation and flattening of the small intestine. This damage further decreases the ability of the small intestine to absorb almost all nutrients.[1] Gluten is a protein found in wheat and related grains (barley and rye), which are abundantly consumed in the Western diet, through products including bread and pasta. The Arab diet is heavy in gluten-containing bulgur wheat, thus leading to high exposure to gluten-containing food.[2] CD has no cure or treatment; the only therapy is lifelong strict adherence to a gluten-free diet (GFD).

Approximately 1.4% of the world's population is diagnosed with CD[3]; the reported prevalence in KSA (SA) is increasing, primarily because of better understanding of the pathology of CD. Rates of both biopsy-demonstrated CD and CD seroprevalence in SA are higher in the at-risk population (10.6% and 15.6%, respectively) than among the general population (1.4% and 2.7%, respectively).[4,5] Several variables have been identified as risk factors that predispose individuals to CD; these risk factors include genetics and having a family member with CD. Furthermore, individuals with other autoimmune diseases, such as type 1 diabetes and thyroid disease, are more likely to develop CD.[6] People with CD experience symptoms such as chronic diarrhea, recurrent abdominal pain, bloating, steatorrhea, vomiting, and hindered growth.[7] Consistent adherence to a GFD is the only known effective management of CD.

A GFD serves as a nutritional therapy for patients with not only CD but also other diseases, such as irritable bowel syndrome and non-celiac disease gluten sensitivity.[8] The availability and cost of GF food are key factors in the adherence to a GFD and in ameliorating CD symptoms. Numerous studies in developed countries have assessed GFD availability, cost, and adherence.[8–11] Higher cost and limited availability of GF products have been shown to prevent people with CD from effectively adhering to GFDs.[11–13] In addition, high costs deterring low-income individuals from adhering to GFDs can increase the risks of complications including malnutrition, osteoporosis, lactose intolerance, depression, and intestinal lymphoma.[14] However, limited studies in KSA that have investigated both the availability and cost of GF food.[11] The objective of this research was to descriptively assess the cost and availability of GF food across a range of stores in SA. In particular, we compared the cost and availability of GF products versus gluten containing (GC) products in a variety of local stores and supermarkets across Jeddah city in KSA.

Materials and Methods

This cross-sectional study evaluated the availability and cost of GF food in SA. The selection criteria for stores considered their geographical locations and popularity, and were designed to include both local/budget and more expensive supermarkets. To compare GF products with their GC counterparts, we visited eight major supermarkets and three local/budget stores across Jeddah city in February 2021.

Data collection

Food categories

Eight essential categories encompassing everyday foods and snack items were chosen for analysis: flour, breakfast cereals, breads, pastas, snack bars, chips, cookies, and biscuits. GF products from these categories were carefully selected and compared with GC counterparts, in a thorough evaluation. This comparison considered the approximate weight per gram and food type, when applicable. For instance, GF bread (sandwich rolls) weighing 200 g was compared with GC bread (sandwich rolls) also weighing 200 g. In another example, GF pasta (spaghetti) weighing 400 g was compared with GC pasta (spaghetti) with a weight of 450 g.

Procedures

The availability and cost of GF products in each store were assessed. GF products collected from each supermarket were found in stores' GF, organic, and imported sections, as well as in each product's specified section (bakery, pasta, biscuits, and cereal sections). The selection criteria included only products from the eight chosen food categories in this study, in addition to items with an explicit GF statement on the packaging. The availability, price, weight per gram, weight per serving, brand name, type, flavor, GF statement, and GF store section were documented for each product.

The same criteria were also recorded for counterpart GC products, for comparison.

Statistical analysis

Data were analyzed in PSPP software 1.4.1. Continuous variables are presented as median and interquartile range (25th percentile to 75th percentile), and categorical variables are presented as numbers and percentages. The Wilcoxon rank sum test was conducted to compare the cost of GF and GC products.

Results

Availability of gluten-free products

After comprehensive evaluation of products from 11 supermarkets across Jeddah city, we found GF products in eight stores, except for the local/budget stores which did not supply any GF products. A total of 233 GF products and 24 GC products were found. Some products were found in multiple stores, and were included to compare their cost and availability.

As demonstrated in Table 1, the most recorded food category with GF products was breakfast cereals, with 46 GF products found. The least recorded food category with GF products was cookies, with 15 GF products found. Moreover, bread, which is considered an essential component of the Saudi diet, had GF options available in only three supermarkets.

The availability of GF foods differed among supermarkets. Supermarket 1 had the most GF products (n = 90), followed by supermarket 2 (n = 34), and supermarket 3 (n = 30) (Table 1). These three supermarkets supplied most of the products found in each category of GF products from all food categories (breads, pasta, flour, cereals, snack bars, chips, biscuits, and cookies).

Most GF food was found in the organic section. Other GF food was located in the imported and health food sections. Four of the eight supermarkets (supermarkets 1, 3, 4, and 5) had a special GF section.

Cost of gluten-free products

To conduct a direct comparison of the cost differences between GF and GC products, we calculated the median price per 100 g in each food category, taking into account each product described in the food category.

Table 2 presents the medians and interquartile ranges for the eight supermarkets selling GF food. A significant difference in cost between GC and GF products was observed. However, the cost of GF products differed among supermarkets. In a comparison of supermarkets, the only three stores supplying all eight food categories were supermarket 3, which had the most expensive GF products, with a median price of 3.27 (2.17−5.05) USD/100 g, followed by supermarket 2, with a median price of 3.04 (1.91−3.49) USD/100 g, and supermarket 4, with a median price of 2.80 (2.13−3.97) USD/100 g. The median price per 100 g was significantly greater for GF foods than GC products ($p < 0.05$) (Figure 1). Snack bars had the highest median price (19.6 USD/100 g), and flour had the lowest median price (5.0 USD/100 g) among the categories of GF products. The greatest median price differences between GF and GC products were found for bread and flour.

Discussion

This study is one of the few investigating the availability and cost of GF products in Jeddah, KSA.[15] Overall, our key findings indicated that GF product availability remains limited, and GF products are substantially more expensive than GC foods. Most GF products were found in high budget supermarkets and were not available in local/budget stores, thus potentially discouraging low-income Saudi individuals with CD from following a GFD.[16]

The average price for GF food was twice that of GC products. A study conducted in KSA by Eid et al.[15] found a total of 179 GF products—fewer than the 233 products found in our study. This difference might reflect the growing demand for GF food as a result of the increasing prevalence of CD. Moreover, this demand is expected to rise further.[6] Eid et al. observed a clear variation in GF

Table 1: Availability of GF products in each supermarket.

Food category	Supermarket 1	Supermarket 2	Supermarket 3	Supermarket 4	Supermarket 5	Supermarket 6	Supermarket 7	Supermarket 8	*Total number*
Flour	14	3	4	6	3	2	0	0	**32**
Bread	17	7	5	0	0	0	0	0	**29**
Pasta	11	3	4	3	4	4	2	3	**34**
Breakfast cereals	12	8	5	6	5	4	4	2	**46**
Biscuits	9	5	4	4	2	2	0	1	**27**
Snack bars	6	3	2	3	3	2	0	2	**21**
Cookies	9	1	3	0	1	1	0	0	**15**
Chips	12	4	3	1	3	3	3	0	**29**
	n = 90	n = 34	n = 30	n = 23	n = 21	n = 18	n = 9	n = 8	***233***

n = number of GF products found in each supermarket.

Table 2: Median and interquartile range of GF products in each supermarket[a].

Food category	Supermarket 1	Supermarket 2	Supermarket 3	Supermarket 4	Supermarket 5	Supermarket 6	Supermarket 7	Supermarket 8	Total
Flour	1.96 (0.54 −1.79)	0.90 (0.88 −0.98)	2.14 (1.70 −2.89)	1.97 (1.34 −4.30)	1.06 (0.93 −1.99)	2.34 (1.90 −2.79)	NA	NA	1.34 (0.76−2.14)
Bread	4.30 (3.16 −4.97)	3.06 (2.83 −3.30)	3.17 (2.76 −3.80)	NA	NA	NA	NA	NA	3.55 (3.06 −4.66)
Pasta	0.91 (1.59 −1.47)	1.91 (1.91 −1.91)	2.09 (1.82 −2.90)	2.79 (2.02 −2.79)	1.21 (1.02 −1.54)	1.26 (0.75 −1.76)	1.23 (1.23 −1.23)	0.69 (0.69 −0.69)	1.35 (0.83 −1.91)
Breakfast cereals	2.40 (1.89 −3.06)	2.23 (1.72 −2.57)	2.28 (2.07 −2.49)	2.23 (2.11 −2.44)	1.88 (1.77 −2.33)	2.28 (2.07 −2.49)	2.13 (1.89 −2.56)	1.66 (1.59 −1.74)	2.22 (1.89 −2.64)
Biscuits	7.63 (5.23 −7.79)	3.19 (3.01 −3.83)	3.96 (3.43 −4.57)	4.93 (3.25 −4.83)	2.43 (2.07 −2.80)	4.18 (3.53 −4.84)	NA	1.86 (1.86 −1.86)	4.61 (3.18 −5.37)
Snack bars	5.44 (4.96 −5.89)	5.97 (4.31 −5.97)	10.70 (9.00 −12.40)	3.72 (3.49 −3.97)	10.92 (10.90 −11.57)	3.65 (3.58 −3.73)	NA	4.93 (4.93 −4.93)	5.23 (4.22 −5.97)
Cookies	2.22 (1.95 −2.22)	3.19 (3.19 −3.19)	3.20 (2.33 −4.36)	NA	1.70 (1.70 −1.70)	2.80 (2.80 −2.80)	NA	NA	2.22 (1.83 −2.52)
Chips	2.83 (2.45 −3.03)	3.60 (3.53 −3.69)	13.96 (13.96 −13.96)	7.15 (7.15 −7.15)	2.83 (2.69 −3.00)	3.53 (3.41 −8.75)	3.47 (3.16 −5.54)	NA	3.30 (2.83 −3.98)
Total/ 100 g	2.66 (1.71 −4.54)	3.04 (1.91 −3.49)	3.27 (2.17 −5.05)	2.80 (2.13 −3.97)	2.02 (1.53 −2.93)	2.72 (1.81 −3.45)	2.29 (1.62 −3.37)	1.66 (0.69 −2.63)	

NA = no products found.

Note: median prices with no interquartile (25th percentile to 75th percentile); had either one product or different products with the same price.

[a] Data are presented as median and interquartile range (25th percentile to 75th percentile).

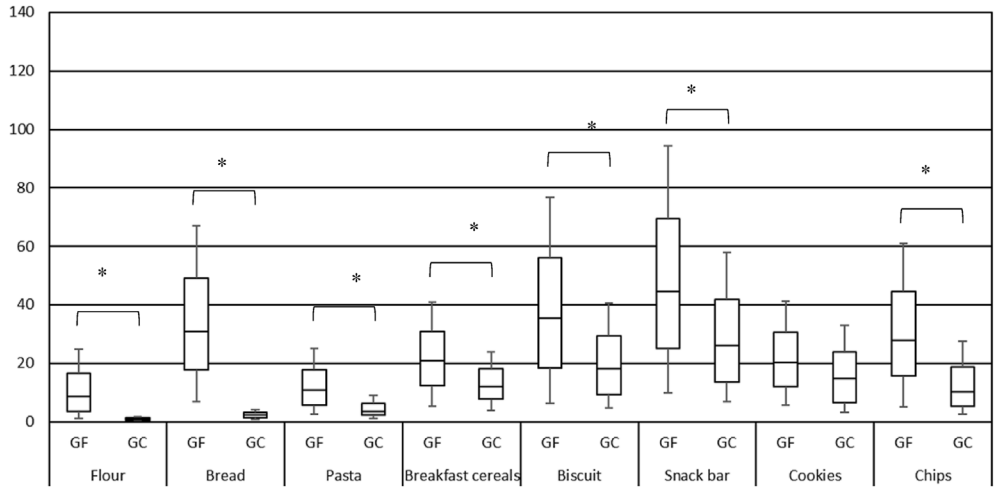

Figure 1: Median price/100 g of GF and GC products. * Represents significant difference between GF and GC products ($p < 0.05$).

food availability and price among supermarkets,[15] as supported by our findings. However, the previous study assessed six supermarkets considered high in quality and budget, whereas we investigated 11 supermarkets ranging from high to low budget.

Our results revealed that only 3 of the 11 supermarkets (supermarkets 1, 2, and 3) sold GF products in all eight food categories. The rest of the supermarkets offered GF products for only several food categories (supermarkets 4, 5, 6, 7, and 8) or no GF products (local/budget stores). Breakfast cereals were the only GF product consistently available in all stores that sold GF items. In contrast, bread was available in only three stores (supermarkets 1, 2, and 3) and was significantly more expensive than GC bread. GF bread was therefore considered the least available essential food. Similar findings have been reported in the UAE, where staple foods such as GF bread, pasta, and flour products are more expensive and limited than GC products.[12] The greater cost might be due to the complex industrial process required to make palatable and nutritive GF breads.[9]

Burden et al.[8] analyzed supermarkets in the UK and online shops to assess the cost and availability of GF products, and found that the mean price of GF food was four times higher than that of GC foods; moreover, although online retailers offered a wider selection, their prices were more expensive. Our findings indicated that GF foods cost twice as much as their GC counterparts. However, we visited only physical supermarkets and did not include online shops. One strength of our study in this regard was that all data were acquired from well-known supermarkets; therefore, their prices are consistent across the Kingdom.

The lack of GF products in low-budget supermarkets is extremely important to people from low socioeconomic backgrounds and those with low incomes, who are likely to rely on such supermarkets as food sources.[9] Furthermore, most supermarkets that provided a variety of GF foods were not located near their districts, thus limiting accessibility among older or disabled people. As previously described, this scenario poses challenges for people with CD following a GFD, and may increase related morbidities and healthcare expenditures.[17] However, Saudi patients with CD are finically supported by the government of KSA, which provides monthly financial support for each patient with CD, and monthly GF products including flour, bread, and pasta,[18] thus resulting in immense implications regarding food security.[19]

A study providing an online questionnaire to a support group for Saudi patients with CD has found that two-thirds of the participating families spent an average of 500–2000 SAR (133–533 USD) per month on GF foods, and 61.9% of the participants indicated that the GFD substantially affected their family budgets.[19] That study had demonstrated the extent to which Saudi individuals with CD struggle to find convenient and affordable GF foods. A wider range of GF products would provide people with CD with more options, thus allowing them to select foods according to their particular preferences, and helping them adhere to GFDs.[11] People with CD can safely consume oats that are specifically labeled as "gluten-free," if they have been produced in a GF environment and are free from cross-contamination.[20]

Recommendations

The Saudi Ministry of Health provides GF products to patients with CD through hospital prescriptions, which are extremely beneficial. However, these products are distributed by only 31 hospitals throughout the Kingdom, and the product options are limited. We recommend that the Ministry of Health improve the process by supporting food industry participation in the production of local GF foods, beginning with the development of different types of GF products at reasonable prices, to support people with CD adhering to GFDs. In addition, health professionals (dietitians and nutritionists) must continue to play a role in raising governmental awareness regarding this issue.

Strengths and limitations

One strength of our study is that it considered GF products from the most essential food categories. Another

strength is that the findings offer valuable information regarding the financial burden faced by people with CD, which must be brought to the authorities' attention.

However, our work has several limitations. This study was limited to one city; nonetheless, by visiting different supermarkets throughout the area, we were able to collect diverse data on available products. Because the included supermarkets are popular throughout the Kingdom, we are confident that our results will reflect prices across various large cities. Second, the global COVID-19 pandemic substantially affected the number of stores that we were able to visit and the time spent in each store, because of fear of a sudden lockdown. Despite this challenge, we were able to cover all stores within a timeframe of 1 month, although concerns persist regarding whether the pandemic might have contributed to the high cost of GF foods. The third limitation is that we selected only some essential food categories for the GF products. Other foods such as oats and sauces were not included. Desserts (cakes, chocolates, and sweets) were considered unhealthful food choices and thus were also excluded. Fourth, several food products are GF, either naturally or because of their ingredient lists; however, we included only products bearing clear GF statements on the packaging. Finally, we investigated availability and cost at only supermarkets, whereas health food shops and online stores were not included.

Conclusion

This study is one of the few assessing the cost and availability of GF food in Jeddah, KSA. The key outcomes highlight that GF products have highly limited availability and are more costly than GC foods. Thus, the ability of Saudi individuals with CD to find convenient, nutritious, and affordable GF foods is a matter of major concern, as indicated by the limited high-cost GF products found in this study. Most investigated stores import and sell GF options for essential foods such as bread, flour, and pasta at very high prices, thus potentially resulting in detrimental effects on quality of life among Saudi individuals with CD. This research suggests that governmental organizations must cooperate with healthcare providers and the food industry to ensure that GF foods are widely available, accessible, and affordable for Saudi individuals with CD, to minimize their financial burden and health outlook.

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Conflict of interest

The authors have no conflict of interest to declare.

Ethical approval

IRB approval was not necessary, given that these data were collected from supermarkets.

Authors contributions

A.A. and MH. conceived and designed the study. L.Q. and D.S. contributed to data collection, data analysis, and interpretation. L.Q., D.S., A.A., and M.H. contributed to writing the manuscript, and the final revision and approval of the manuscript. A.A. and M.H. supervised this project, and provided logistic support and critical review of the study. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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