



Characteristics, Availability, and Cost of Lactose-free Labelled Products in Moroccan Supermarkets

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Abstract: Food products for dietary use is increasing over time including lactose-free products. These are used during the follow-up of lactose-free diets by patients suffering from lactose intolerance. The implementation of a quality control system by the manufacturers, has allowed to respect the safety of these foods by producing lactose-free products by respecting the maximum dose of lactose allowed (10mg/kg). Five categories (LF Milk, LF Yagourt, LF Cheese, Other LF dairy, and Other LF non-dairy) of lactose-free products were available in the different sales sites. The present research identified 70 different lactose-free products, 23 of which were dairy products and its derivatives and 47 non-dairy lactose-free products. The majority of products were available on online sales sites. Moroccan supermarkets do not yet have an area reserved for lactose-free products but for gluten-free products. The price of lactose-free products was two to three times more expensive than their equivalents lactose containing. Hence, the need to encourage Moroccan companies to develop lactose-free products and enrich them with nutrients such as vitamins and calcium.

1 INTRODUCTION

Food safety plays an important role in the prevention of foodborne diseases, including diseases caused by allergens (Fung et al., 2018; Scott, 2003). Hence, great importance has been given to the production of agri-food products for dietetic use and the control of their quality. Among them are "lactose-free" foods. Their production has increased enormously in recent years in developed countries (Dekker et al., 2019). These are products with a lactose content of less than 10mg/kg. Several methods have been used, mainly citing pre-hydrolysis and post-hydrolysis during the production process of these products (Dekker et al., 2019). This process transforms lactose into glucose and galactose. These lactose-free foods are used as part of a lactose-free diet (Suarez et al., 1995; Ugidos-Rodríguez). This remains the most effective tool for the treatment of lactose intolerance. According to a review and meta-analysis conducted by and Storhaug al. (2017), the global prevalence

estimate of lactose malabsorption was 68% (95% CI 64–72), ranging from 28% (19–37) in western, southern, and northern Europe to 70% (57–83) in the Middle East. Galactose intolerance is caused by difficulty or inability to digest lactose due to the absence or decreased production of the enzyme β -galactosidase. It is manifested by bloating, gas, abdominal pain, diarrhea or constipation and vomiting [7]. Hypolactasia can be congenital as well as acquired over time. As well, it can be secondary to an infection with a small bowel disease (celiac disease, gastroenteritis or Crohn's disease). Its diagnosis is based primarily on the lactose tolerance test. This involves measuring blood glucose levels 30 minutes after consumption of lactose diluted in water (Jansson-Knodell et al., 2020). Following a lactose-free diet is hindered by several factors. These are mainly factors related to labelled lactose-free products. First, patients suffering from lactose intolerance find it difficult to identify lactose-free labelled products. Second, their availability is limited.

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Third, their price is exorbitant, and finally their nutritional quality is unbalanced (Świąder et al., 2020). This, dairy products play an important role in human nutrition. They are an important source of minerals, vitamins and proteins. However, their consumption should be moderate or even contraindicated for people suffering from lactose intolerance.

In Morocco, the legislation requires manufacturers to indicate the allergenic substances on food labels such as gluten, penault, soya, and milk. The objective of this law is to avoid the consumption of substances that can cause effects in people predisposed such as lactose intolerance. The

2 METHODS

This was a cross-sectional study whose objective was to determine the lactose-free labelled products. The study was carried out in large Moroccan supermarkets in the city of Marrakech in Morocco. These supermarkets are available everywhere in Morocco, which gives this study a national overview. Other products have been identified through online sales sites. A visit was made to each supermarket to identify the lactose-free products available and highlight their characteristics. The availability of products was studied on the one hand by location of study, and on the other hand by category. The price of each product was compared to its lactose-containing equivalent. The price was recorded by the Moroccan currency (Dirhams) per 1000g/1000ml. Then it was converted into Euro. Knowing that 1 DMA=0.092 Euro.

The analysis of the results is carried out using the software SPSS version 25.0 "Statistical Program of Social Science". The results obtained are expressed as means and standard deviations or as median and interquartile range

3 RESULTS AND DISCUSSION

The present research allowed the identification of five categories lactose-free (LF). These are the category of LF Milk, LF Yagourt, LF Cheese, Other LF dairy, and Other LF non-dairy. The various supermarkets make all these categories available to their customers suffering from lactose intolerance. On the other hand, two online sales sites have only one lactose-free category (figure 1). This is Other LF non-dairy. Only one online store has three categories. However, the

production and consumption of dairy products is increasing considerably (FAO, 2011). At the same time, gluten intolerance is also on the rise and is estimated at 73% (Lebiad & Bour, 2016). The use of the lactose-free diet is also limited by these factors. It is therefore important to know whether lactose-free products are available in Morocco?.Also, do patients suffering from this disease have access to these products at reasonable prices?.

The objective of the present research is part of this framework. On the one hand, to identify lactose-free products in Morocco, and on the other hand, to evaluate their availability and price in Moroccan supermarkets and online sales websites.

two categories (LF milk, Other LF dairy) are represented by only one product each. While 7/9 of the products belong to the category of Other LF non-dairy.

Other LF non-dairy are the most represented in the different points of sale whether it is online sales sites or in supermarkets. In total, 120 Other LF non-dairy products are available. Most of the Others LF non-dairy exists in online sales sites (84/120). However, the majority of these products are the same and exists at the in several sites.

Then, LF Yagourt, LF Cheese, and Other LF dairy are represented by 25, 24 and 19 respectively in the different points of sale. The category of LF milk was only by 16 products (figure 2).

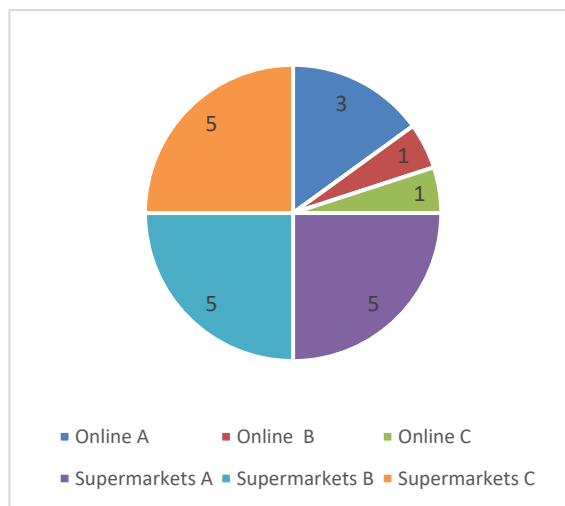


Figure 1: Number of category per online site and Moroccan supermarket

Supermarkets offer a wide range of categories. However, the number of products remains limited compared to online sales sites (figure 2).

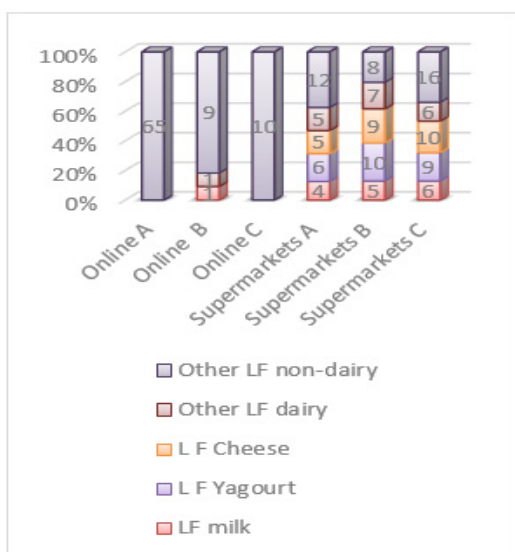


Figure 2: The distribution of number of the lactose-free products by category and sales site.

Some products can be found in the 6 sales sites. The exclusion of some products existing in duplicate has identified 84 different products that exist in Morocco. It was remarkable that LF Milk was represented by only 6 products. It includes pasteurized products and UHT (Ultra Heat Treated) products. 4 of these products are manufactured by local companies and two are imported from outside. The category of LF other dairy was represented by 9 products. These are milk products made mainly from soy and rice. LF Yagourt and LF Cheese constitute 14.29% and 12% respectively of the total products identified. While more than half (56%) of the identified products belong to the Others LF non-dairy category (figure 3).

The majority of Moroccan supermarkets have made available to celiac patients areas reserved for gluten-free products. So, during this research, no supermarket has reserved an area for lactose-free products. The latter are dispatched by everything in the supermarket. The patient suffering from lactose intolerance has to search all over the supermarket to collect these products and sometimes he has to travel from one supermarket to another to collect all the desired categories.

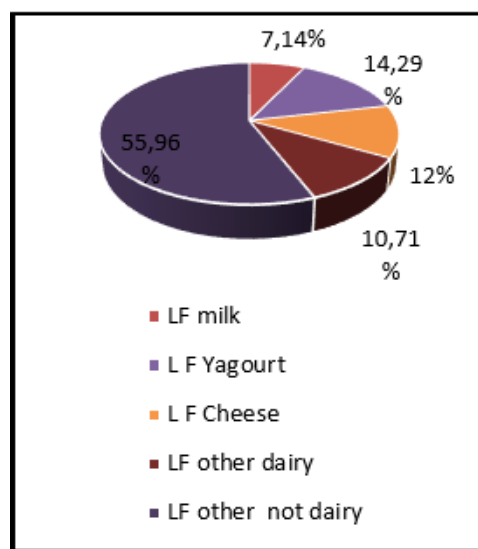


Figure 3: prevalence of lactose-free products by category identified

It is remarkable that other dairy and other non-dairy were 2.9 and 2.5 times more expensive than their lactose-containing equivalents. This difference was less in the Yagourt and Cheese categories.

Figure 4 shows the comparison between the prices of lactose-free products and their gluten-containing equivalents. In total, lactose-free products are twice as expensive as regular products with a significant difference ($p < 0.001$).

Thus, dairy products labeled "lactose-free" available in Morocco are rare. Recently, some Moroccan food companies have recently launched the 1st lactose-free milk in Morocco. However, the number of companies that have launched this type of product has not exceeded 2 out of more than 7 companies active in the dairy sector. It is important to note that even the legislation does not yet require manufacturers to fortify them, most products have been enriched with vitamins A and D. The aim is to develop fresh milk, pasteurized, and UHT milk. However, lactose-free yagurt, lactose-free cheese is still predominantly imported from abroad. It will be enough to choose products with low lactose or lactose-free or replace it with fortified soy or rice beverages. According to a study conducted by et al (Euromonitor Database, 2020), the LF Milk category is the most responded to.

This research showed the opposite. This category is the least identified.

Lactose content in cheese products is generally low. This is due to the production process which includes a step of washing the curd to lower the

lactose or actin content of the lactic acid bacteria during ripening (Walstra et al., 1999).

The factors listed below show that patients with intolerance find it very difficult to follow their lactose-free diet by accessing lactose-free products. On the one hand, many patients resort to practices such as manually adding the industrial lactase enzyme to dairy products. The effectiveness of this practice is so difficult as they consume lactase capsules. On the other hand, many people resort to the replacement of lactose-free dairy products with other non-dairy lactose-free products. Les lactases neutres et les lactases acides sont le type de lactase utilisé. La première est utilisée par les industriels et est parfois proposée aux consommateurs pour le traitement du lait à domicile. The second is used as a nutritional supplement (Dekker, 2016).

The industry of "gluten-free" products is growing considerably. There are reserved and indicated symbols on the labels of these products to identify these foods, or even foods that are certified as such. However, there is not yet an international symbol that allows to know lactose-free foods from their symbol on their labelling.

Patients suffering from lactose intolerance are obliged to follow a lactose-free diet. This diet must include foods that are naturally lactose-free and products that are labeled lactose-free. Among the latter, lactose-free dairy products remain essential. They are an important source of vitamins, calcium, etc. Therefore, substituting them with other foods can cause nutritional imbalances. However, it is essential to take preventive measures especially at the levels of glucose and galactose since lactose transforms them (Dekker et al., 2019). Lactose intolerance also influences the quality of life with a poor score compared to controls. These patients are faced with a different food culture from that of society. Access to food is limited and integration with society becomes difficult. However, monitoring a lactose-free diet improves the scores of this quality of life (Zheng et al., 2015).

In Morocco, the National Food Safety Office (ONSSA) requires manufacturers to indicate the allergenic substances on food labels (ONSSA, 2018). This law requires manufacturers to indicate whether food allergens such as milk exist in the product. However, it does not yet require manufacturers to manufacture enough food for dietary use such as gluten-free or lactose-free. Hence the need for Symbol Labelling to encourage manufacturers to do so. Also, it is important to encourage studies concerning the determination of exact levels in naturally lactose-free products and / or foods labeled

lactose-free (Gille et al., 2018; Mangan et al., 16). This will allow a regular control of these products and push them to adopt a powerful quality control system based on the regular application of HACCP (Hazard Analysis Critical Control Point).

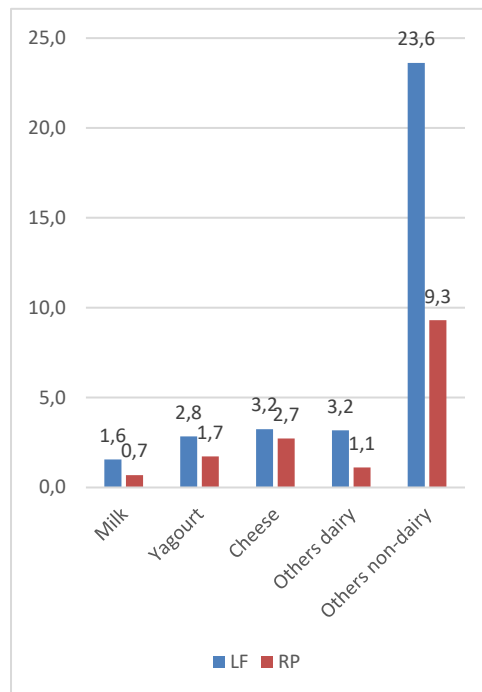


Figure 4: Average price (euro) for lactose-free products and theirs equivalents products (1000g/1000ml).

4 CONCLUSIONS

Lactose-free products are rare in Morocco. Their diversification is limited, dominated by the presence of non-dairy lactose-free products. The price is expansive and sometimes two to three times more expensive than regular products. Patients suffering from gluten intolerance find it very difficult to identify these products. Hence, the need to encourage and sensitize food companies, especially those active in the dairy field, to develop products labeled lactose-free. At the same time, enrichment with nutrients remains a necessity in order to avoid any nutritional deficiency secondary to lactose intoxication.

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