

## Trends in the Use of Symbiotics in Morocco

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### ABSTRACT

The symbiotic have been shown to be effective in prophylaxis and treatment of various diseases. Indeed, one of the main functions of probiotics is to improve microbial homeostasis in the body and to decrease the invasion of pathogens and their colonization. The objective of our study is to assess and then compare the rate of sales and the use of symbiotics by the Moroccan population in order to describe the status of sale of this type of Medicine. The collection of belly data was carried out using a questionnaire which contains information on all Moroccan market products and this study includes fifteen of the most widespread symbiotics products (probiotics and prebiotics). The study suggests that the sale of symbiotic products increased in some strains such as bacterial strain *Bifidobacterium infantis* which reached 96,300 units and *Bifidobacterium lactis* with a sale which reached 35,000 units and also there was also a decrease in sales of other symbiotic products such as *Lactobacillus casei* in 2019 compared to the sale in 2018 and according to the student test there is no significant difference between the average sales during the two successive years of 2018 and 2019 ( $p = 0.496$ ). The results show that the consumption and use of symbiotic in Morocco has undergone significant fluctuations trending towards a regression.

**Keywords:** symbiotic, probiotics, prebiotics, sales, Morocco.

### INTRODUCTION

Symbiotics are a combination of prebiotics and probiotics that positively affects the living organism by stimulating bacter beneficial for health and thus improving production performance and well-being (Laice et al., 2021). Probiotics are living organisms, which when administered in adequate dose leads to a great benefit to the health of the host (Hill et al., 2014). A prebiotic is defined as a substance which is selectively consumed by the microorganisms of the host and which provides an extra value for the organism. Indeed, the prebiotics are substrates that are most often glucidic

not digested by the small intestine and likely to modify the colonic ecosystem. The best studied are the fructooligosaccharids, inulin and galactooligosaccharids (Gibson et al., 2017).

The studies have established the benefits of probiotics on a large number of pathologies including inflammatory bowel disease, irritable bowel syndrome, infectious diseases, vaginal infections and immune enhancements (Boumekah et al., 2013).

This work consists in evaluating the increase of the sales and the use of the symbiotic by the Moroccan population during two successive years in order to describe the status of sale of this type of medicine.

## MATERIAL AND METHOD

### Data collection

The cross-sectional study was based on several types of symbiotic products. The data concerned the increase in sales throughout the Moroccan territory during the two consecutive years 2018 and 2019. Data collection was based on a questionnaire distributed by IMS (information management system) and completed by the marketing authorization holder in Morocco territory (Table 1).

### Statistical analysis

The results are expressed as a percentage of market share and in sales units. The mean comparison between the sales of the symbiotic was evaluated by the Student test t. The test was considered significant if the p value <0.05. The data were entered and analyzed using the Statistical Package for the Social Science (SPSS) (software version 17.5) and SAS (Statistical Analysis System) 9.3 for Duncan test.

## RESULTS

### The evolution of sales of symbiotic products during 2018 and 2019

According to the results obtained in Figure 1, we observed an increase in the sales of products P1(Corn starch, capsule shell...), P5 (*Bifidobacterium lactis*...) and P6 (*Rhubarb; Coriander*...) and a decrease in the sales of products

P2 (*fructoolligosacharides*...), P4 (*Lactobacillus helveticus Rosell-52*...), P7 (*Bifidobacterium longum*...), P8 (*Ocidilactici CECT 7483*...), P9 (*Lactobacillus rhamnosus*...), P10 (*Bifidobacterium longum*...), P11 (*Lactobacillus rhamnosus R00*...), P12 (*Bulking agent: cellulose*...), P13 (*Bulking agent (isomalt)*...) and P15 (*1 g of active substance contains: Enterococcus faecium – 300 mg*...) during the year 2019 compared to the sales of these products in 2018.

According to the Student test t, we noticed that there is no significant difference between averages of sales during the two successive years of 2018 and 2019 with p = 0.496 (Table 2).

The Duncan test (Fig. 2) revealed five statistical groups: a, ab, abc, bc and c and allowed us to see that the symbiotic product P3 falls into group (ab) with an average of 41.1 followed by the P2 and P5 which are located in group (abc) with a maximum average 32.5 and then the products P4, P6, P7, P8, P9, P10, P11, P13, P14 and P15 are in group (bc) then the product P1 is in group (a) with an average of 6,05 and finally the product P12 is in group (c) with an average of -9.55.

### The share of sales of the products of the study in the Moroccan market

Results showed that P3 was predominant with 6.1% of the overall market, followed by P2 with 5% and P1 with 2.5% while P10, P13, P14 and P15 do not count with 0% of the overall market (Table 3).

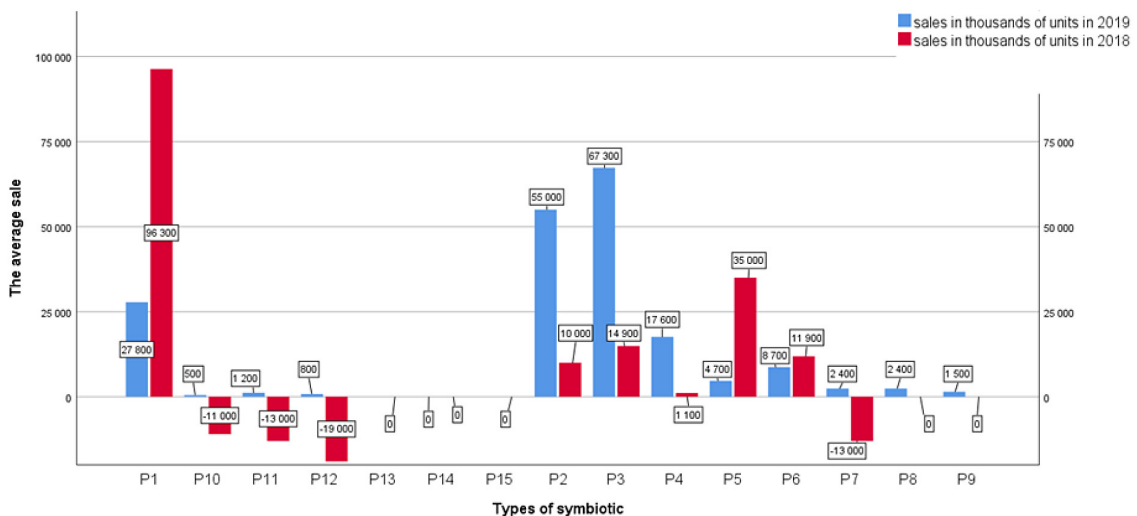


Figure 1. The evolution of sales of symbiotic products during 2018 and 2019

**Table 1.** Symbolization of symbiotic products in this study with their dates of initial sales on the Moroccan market

Trade name	Symbol of symbiotic in the study	Date of initial sales in the Moroccan market
Corn starch; capsule shell: hydroxypropylmethylcellulose; bacterial strain <i>Bifidobacterium infantis</i> (strain 35624 <sup>®</sup> ); anti-caking agents: magnesium salts of fatty acids, magnesium stearate of fatty acids; saccharose, trehalose*; stabilizing agent: sodium citrate	P1	01/2018
fructooligosaccharides 958.2 mg/sachet + <i>Lactobacillus casei</i> (PXN <sup>®</sup> 37 TM); <i>Lactobacillus rhamnosus</i> PXN <sup>®</sup> 54 TM); <i>Streptococcus thermophilus</i> PXN <sup>®</sup> 66 TM); <i>Lactobacillus acidophilus</i> PXN <sup>®</sup> 35 TM); <i>Bifidobacterium breve</i> PXN <sup>®</sup> 25 TM); <i>Bifidobacterium infantis</i> PXN <sup>®</sup> 27 TM); <i>Lactobacillus bulgaricus</i> PXN <sup>®</sup> 39 TM	P2	08/2012
<i>Saccharomyces boulardii</i> 282.5 mg per sachet	P3	06/2012
Fiber (fructooligosaccharides 25.4 mg), inulin (25.4 mg), <i>Lactobacillus helveticus</i> Rosell-52, <i>Lactobacillus helveticus</i> Lafti <sup>®</sup> L10, <i>Lactobacillus rhamnosus</i> Rosell-11, <i>Bifidobacterium longum</i> Rosell-175, vitamin D3 (0.75 µg).	P4	08/2010
<i>Bifidobacterium lactis</i> , <i>Bifidobacterium bifidum</i> , <i>Bifidobacterium infantis</i> , <i>Bifidobacterium breve</i> , <i>Lactobacillus acidophilus</i> , <i>Lactobacillus brevis</i> , <i>Lactobacillus casei</i> , <i>Lactobacillus plantarum</i> , <i>Lactobacillus rhamnosus</i> , <i>Lactobacillus salivarius</i> , <i>Lactobacillus lactis</i> <i>Streptococcus thermophilus</i> , <i>Saccharomyces boulardii</i> , <i>Bacillus coagulans</i> , fructooligosaccharides (Actilight), inulin, corn maltodextrin (bulking agent), hydroxymethylcellulose (coating agent), magnesium stearate, silicon oxide (anti-caking agent), gelatin gum (thickener)	P5	10/2017
Rhubarb; guimauve, Pale Pink, Artichoke (support: maltodextrine, antioxydant: acide citrique), Basil, Coriander, yeast, anti-caking agent: tricalcium phosphate; potato dextrin, lactic ferments (support: maltodextrin): <i>Bifidobacterium bifidum</i> , <i>Lactobacillus acidophilus</i>	P6	08/2017
<i>Bifidobacterium longum</i> LA101, <i>Lactobacillus helveticus</i> LA102, <i>Lactococcus lactis</i> LA103, <i>Streptococcus thermophilus</i> LA104	P7	03/2010
<i>Lactobacillus plantum</i> CECT 7484, <i>Lactobacillus plantarum</i> CECT 7485, <i>Pediococcus acidilactici</i> CECT 483, Excipients: maltodextrin, silicon dioxide, magnesium stearate, hydroxypropyl methylcellulose, titanium dioxide	P8	09/2018
<i>Lactobacillus rhamnosus</i> GG, <i>Bifidobacterium lactis</i> + Tormentil root, Excipients: maltodextrin, hypromellose (capsule); microcrystalline cellulose; titanium dioxide (colorant); magnesium stearate (anticlotting agent)	P9	04/2019
<i>Bifidobacterium longum</i> LA101, <i>Lactobacillus helveticus</i> LA102, <i>Lactococcus lactis</i> LA103, <i>Streptococcus thermophilus</i> LA104, <i>Lactobacillus Rhamnosus</i> LA801, Vitamine D	P10	03/2010
<i>Lactobacillus rhamnosus</i> R0011, <i>Lactobacillus helveticus</i> R0052, Vitamine D	P11	06/2016
Bulking agent: cellulose, <i>Lactobacillus acidophilus</i> , <i>Bifidobacterium lactis</i> , <i>Lactobacillus plantarum</i> , <i>Bifidobacterium breve</i> ; anti-caking agent: magnesium salts of fatty acids	P12	01/2010
Sweetener (xylitol), <i>Lactobacillus reuteri</i> DSM 17938, <i>Lactobacillus reuteri</i> Protectis, vitamin D3 20 µg + flavor enhancer: citric acid	P13	06/2014
<i>Lactobacillus fermentum</i> ; <i>Lactobacillus delbrueckii</i> <ul style="list-style-type: none"> <li>• Fermented culture Lactose monohydrate, casein peptone, yeast extract, sodium acetate trihydrate, dipotassium phosphate anhydrous;</li> <li>• Excipients: hydrated colloidal silica, talc, magnesium stearate, anhydrous lactose;</li> <li>• Lyophilization adjuvants: lactose monohydrate, calcium carbonate;</li> <li>• colorant (capsule): titanium dioxide</li> </ul>	P14	unknown
<i>Lactobacillus acidophilus</i> (DSM 13241); <i>Bifidobacterium animalis</i> subsp. <i>lactis</i> (DSM 15954) + Oligofructose, <ul style="list-style-type: none"> <li>• bulking agent: cellulose, potato starch,</li> <li>• humectant: fatty acids.</li> </ul>	P15	06/2013

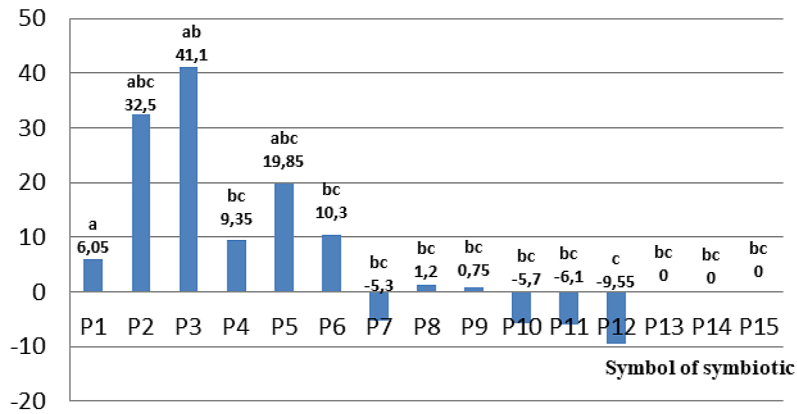


Figure 2. The average sale of symbiotic products

Table 2. The relationship between the sales of symbiotic in the two successive years 2018 and 2019

Description	N	Moy/Et	Student test t
Sales in thousands of units in 2018	15	7546.66 ± 27940.29	*p = 0.496
Sales in thousands of units in 2019	15	12660 ± 21291.57	

Note: \* Difference not significant between the sales.

Table 3. The share of sales of the products symbiotic (in thousands of units) in the Moroccan market as a percentage during the year 2019

Symbol of symbiotic in the study	Moroccan market share in percentage
P1	2.50%
P2	5%
P3	6.10%
P4	1.60%
P5	0.40%
P6	0.80%
P7	0.20%
P8	0.20%
P9	0.10%
P10	0%
P11	0.10%
P12	0.10%
P13	0%
P14	0%
P15	0%

Table 4. Share of the Moroccan market as a percentage (thousands of dirhams)

Symbol of symbiotic in the study	Moroccan market share in percentage (dirhams)
P1	10.30%
P2	8.30%
P3	6%
P4	2.20%
P5	1.50%
P6	1.50%
P7	1%
P8	0.90%
P9	0.30%
P10	0.20%
P11	0.20%
P12	0.10%
P13	0%
P14	0%
P15	0%

### Share of the Moroccan market as a percentage

From the results of Table 4 we observed that P1 was predominant with 10.3% of the overall market despite not being the leader in sales units, followed by P2 with 8.3% and P3 with 6%. Conversely, P13, P14 and P15 represent 0% of the overall market.

### DISCUSSION

The history of probiotics began several centuries ago. The consumption of fermented milk, for example, is a way of using prebiotics for their health. Henry Tessler is the first researcher who demonstrated the presence of *bifidobacteria* in the digestive tract of an infant in 1899. (Islam, 2016) The field of use of probiotics is increasingly wide and its use is gradually increasing. In

fact, since the beginning of the twentieth century Metchnikoff (Metchnikoff 1908) has shown the beneficial effects of fermented milk and lactic acid bacteria on health, using the probiotics initially to treat gastrointestinal diseases such as diarrhea and infections resulting from *Clostridium difficile* (Butel, 2014).

This study suggested that the sale of the symbiotic products was fluctuated. The sale of certain products increased such as *Corn starch* which reached 96.000 products in 2019 instead of 27.800 products in 2018, while the sale of the products decreased such as *fructoolligosaccharides* and which reached 55000 products in 2019 instead of 10000 products in 2018 and the major share in the market is occupied by *Corn starch*, with a sale rate reaching 10, 30 % of total sales in the Moroccan market.

A study in the United States revealed that the sale of probiotic products has grown exponentially, and between 2007 and 2013 the sale of probiotic products reached \$19.6 billion in 2013 (Agheysi, 2008).

A Euromonitor report revealed that in china the sales of the symbiotic used to make dairy yogurt reached \$ 4.994564 in 2014 (Ewa Hudson, 2014) and the other study shown that it has more than 3000 industrial types of probiotic unit products, 559 of which are foreign companies located in China, which enrich the market with more than 10000 different probiotic products. In the United States of America, the market for probiotics has also undergone an increasing evolution due significant knowledge and acceptance of the American population of the benefits of these products (Basu et al., 2017). Further, in 2014 the revenues from American sales of probiotics reached 1.1 billion dollars (Raghuwanshi et al., 2015).

According to a study, the international demand for probiotics was 27.9 billion dollars in 2011 and will reach 44.9 billion dollars in 2018 Asia-Pacific and Europe (Statista, 2016).

In India, probiotics have been widely used in the veterinary field as food supplements. However, their use in human medicine remains limited (pediatrics only mainly in the form of *lactobacillus* suspension) (Sharma et al., 2013).

The evolution of sales in our study perhaps came due to the impact of the Covid-19 pandemic in Morocco which requires further investigation and other more recent studies should be undertaken in order to be able to perceive the evolution of

consumer awareness of the benefits of symbiotic that would be reflected in the increase in sales.

## CONCLUSION

The consumption and use of symbiotic in Morocco have experienced significant fluctuations. The slow and complicated administrative procedures of import and authorization, combined with poor management of promotion and distribution in the medical and pharmaceutical channels, could be the origin of the decline in sales. Further comparative studies are still needed to improve the state of sales and use of symbiotic products of proven healing benefits.

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