

# Evaluation of the Supply of Toothpastes and Toothbrushes in Lebanon



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products in Lebanon.

**Results:** The yearly supply of toothpaste tubes per individual increased progressively from 1.27 tubes to 1.58 tubes between the year 2000 and 2016 respectively. The yearly supply of toothbrushes per individual fluctuated between 3.1 toothbrushes in 2000 and 3.24 toothbrushes in 2016 where the trend of supply reveals a plateau phase followed by steep increases and decreases between 2012 and 2016. Guidelines governing the quality of toothpastes are regulated by LIBNOR and follow the European Standards.

**Conclusion:** The yearly supply and consequently the consumption of both toothpastes and toothbrushes are below the WHO recommendations thus raising the need for increasing the supply and promoting the importance of proper oral hygiene practices.

**Keywords:** Toothpastes, toothbrushes, supply, consumption, WHO recommendations

## Background

Dental caries is the most common oral condition affecting both children and adults where up to 90% of children and almost all adults suffer from dental caries.<sup>1</sup> The prevalence of dental cavities has been raising especially during the past ten years in both high and low income countries.<sup>2,3</sup> This has been specifically affecting those who are of low socio-economic status and are thus suffering the greatest burden of oral diseases.<sup>2,3</sup>

Caries during childhood can result in weight reduction, growth delay and consequently poorer quality of life.<sup>4</sup> According to a report published by the World Health Organization (WHO), dental caries has been linked to several modifiable risk factors; of relevance to this study are poor oral hygiene practices.<sup>5</sup> A preventive approach has been promoted by WHO to reduce the burden of dental cavities and oral diseases and improves oral health; of significance to this study is promoting adequate fluoride intake and proper oral hygiene practices.<sup>5</sup>

An optimal intake of fluoride has been specifically highlighted as a measure to prevent dental caries where this amount can be obtained either from drinking fluoridated water or through the use of fluoride supplemented dental products such as toothpastes, mouthwash, gels and others.<sup>5</sup> Fluoride plays a vital role in preventing dental caries through its anti-caries effect via inhibiting the demineralization and enhancing the remineralization process at the crystal surfaces of the enamel and inhibiting plaque bacteria by inactivating certain essential bacterial enzymes.<sup>6</sup> Several systematic reviews and studies confirm the effect of various forms of fluoride in preventing and reducing dental cavities.<sup>7-10</sup> Tooth brushing at least once a day using fluoridated toothpastes resulted in less dental caries in children and adolescents where tooth brushing twice a day yielded even greater benefit.<sup>8</sup> The use of affordable fluoridated toothpastes has been recognized and advised as a source of fluoride intake especially at low income countries and where national preventive oral health interventions are lacking.<sup>5</sup>

Tooth brushing along with the use of fluoridated toothpaste is highly supported as effective and affordable method to decrease dental cavities.<sup>11</sup> The widespread use of the toothbrush dates back to the 1930's when nylon bristles and plastic handles started to be used in manufacturing thus making it affordable by lay people.<sup>12</sup> Certain standards were then set for toothbrushes to be deemed acceptable which take into consideration the size of the brush and handle, softness, design and pattern of bristles.<sup>12</sup> The presence of toothpastes dates back to the 16<sup>th</sup> century, yet research focusing on improving the manufacturing of toothpastes in terms of usage, effectiveness and quality has only emerged in the 20<sup>th</sup> century.<sup>13</sup> Nowadays, toothpastes are used for caries prevention in addition to several other functions such as prevention of bacterial plaque, calculus and gingivitis in addition to a breath refresher.<sup>13</sup> Since the use of toothpastes is not merely limited to one function, many chemical ingredients function together to provide the multifunctional properties of this toothpaste.<sup>13</sup> Such components consist of but are not limited to humectants, abrasives, organic and inorganic thickeners, actives such as fluoride and triclosan and various types of flavors and sweeteners.<sup>13</sup>

Tooth brushing using fluoridated toothpaste twice a day has been recommended for caries prevention and better control of plaque.<sup>14</sup> Alternatively, it is preferred to perform tooth brushing after meals to help remove food debris thus reducing the contact time between sucrose found in food debris and the enamel.<sup>14</sup> In that respect, the WHO

recommended a yearly consumption of four tooth brushes and 6 toothpastes per individual. This translates to using a new toothbrush every 3 months and one tube of toothpaste every two months.<sup>15</sup> Studies conducted about oral hygiene practices in Lebanon have only tackled the frequency of tooth brushing and revealed that the latter does not comply with the international recommendations.<sup>16,17</sup> To our knowledge, no studies have been conducted to estimate and evaluate the supply of toothpastes and toothbrushes and hence approximate the consumption of these products by the Lebanese population. In view of that, this study aims to evaluate one of the integral oral hygiene practices namely tooth brushing among the Lebanese population through analyzing the yearly supply of toothpastes and toothbrushes per individual between the year 2000 and 2016 and compare it to the WHO consumption recommendations. The supply will be used as a proxy measure of consumption, and accordingly this study will evaluate whether the amount supplied to the market is enough to provide the amount of recommended yearly consumption per individual as per the WHO guidelines.<sup>15</sup> In addition, this study will evaluate the quality of toothpastes available in the Lebanese market by reviewing the standards governing the quality control of these products.

## Methods

This study was based on performing secondary quantitative data analysis of the amount of supplied toothpastes and brushes; and the review of standards governing the quality control of these products in the Lebanese market. Per an oral conversation with a representative from the Ministry of Industry in 2013, Lebanon does not produce local toothpastes and toothbrushes, thereby depending merely on imported items. The amount of imported toothpastes and toothbrushes between the year 2000 and 2016 were retrieved from the Lebanese Customs registry.<sup>18</sup> The data provided by the Lebanese Customs reveals the weight of toothpastes and toothbrushes imported by tons. The average weight of a toothpaste tube and a toothbrush was estimated to be 170 grams and 20 grams respectively. The latter estimates were calculated after performing a review of the items available at pharmacies. The average weight of a toothpaste tube and a toothbrush was used to calculate the total number of imported toothpastes and toothbrushes. Consequently, the yearly number of toothpaste tubes and toothbrushes supplied to every individual was calculated by dividing the total number of toothpaste tubes and

toothbrushes imported by the total number of the Lebanese population, which is approximated to be 4 million.<sup>19</sup>

Furthermore, this study evaluated the quality of toothpastes available in the Lebanese market by reviewing the guidelines that govern the quality and testing standards of oral health products in Lebanon. Imported toothpastes and toothbrushes have to comply with certain standards that are regulated by the Lebanese Standards Institution (LIBNOR) which is a public institution established in 1962 and is granted the right to develop, publish and amend national standards as deemed necessary.<sup>20</sup> It also sets the methods of testing and analysis of a given product.<sup>20</sup> This process is done through a technical committee which approves that a given product conforms to a given set of standards.<sup>20</sup> LIBNOR has adopted the "European Standards EN ISO" which regulate the guidelines for toothpaste requirements, testing methods and marking.<sup>21</sup>

This study was only limited to secondary analysis where data were restricted to the number of imported toothbrushes and toothpastes and did not involve the inclusion of research participants neither the use of data related to human subjects. Therefore, this study was exempted from IRB review and approval.

## Results

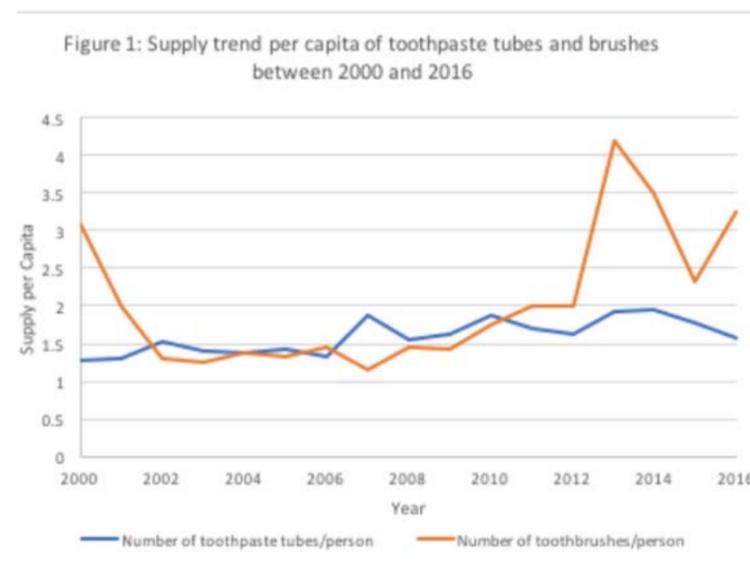
Results of the yearly supply of toothpaste tubes per individual between the year 2000 and 2016 fluctuated between 1.27 tubes in the year 2000 and 1.58 tubes in the year 2016 (table 1). The supply of toothpastes reveals a progressive modest increase between 2000 and 2016 (figure 1). The yearly supply of toothbrushes per individual fluctuated between 3.1 toothbrushes in 2000 and 3.24 toothbrushes in 2016 where the trend of supply reveals a steep decrease between 2000 and 2002 followed by a plateau and then step increases and decreases between 2012 and 2016 (figure 1). The average yearly supply over 17 years was estimated to be 1.6 toothpaste tubes and 2 toothbrushes per individual.

The review of the standards adopted by LIBNOR showed that the latter adopted the European Standards where toothpastes must adhere to specified requirements (fluoride and heavy metals concentration, alkalinity, demineralization, compatibility with oral tissues, microbiology testing, abrasiveness, stability and absence of readily fermentable carbohydrates), testing methods and marking and labeling thereby ensuring the safe use

of toothpastes.<sup>21</sup> Our study reveals that products imported to Lebanon abide by LIBNOR guidelines and thus are considered to be of high quality.

| Year | Quantity of toothpastes (tons) | Number of toothpaste tubes/person | Quantity of Toothbrushes (ton) | Number of toothbrushes/person |
|------|--------------------------------|-----------------------------------|--------------------------------|-------------------------------|
| 2000 | 866                            | 1.27                              | 248                            | 3.1                           |
| 2001 | 894                            | 1.31                              | 163                            | 2                             |
| 2002 | 1042                           | 1.53                              | 105                            | 1.3                           |
| 2003 | 959                            | 1.41                              | 101                            | 1.26                          |
| 2004 | 934                            | 1.37                              | 111                            | 1.38                          |
| 2005 | 971                            | 1.42                              | 107                            | 1.33                          |
| 2006 | 908                            | 1.33                              | 117                            | 1.46                          |
| 2007 | 1277                           | 1.87                              | 92                             | 1.15                          |
| 2008 | 1063                           | 1.56                              | 117                            | 1.46                          |
| 2009 | 1113                           | 1.63                              | 114                            | 1.42                          |
| 2010 | 1283                           | 1.88                              | 141                            | 1.76                          |
| 2011 | 1160                           | 1.7                               | 161                            | 2                             |
| 2012 | 1107                           | 1.62                              | 166                            | 2                             |
| 2013 | 1310                           | 1.92                              | 341                            | 4.2                           |
| 2014 | 1329                           | 1.95                              | 280                            | 3.5                           |
| 2015 | 1212                           | 1.78                              | 186                            | 2.33                          |
| 2016 | 1074                           | 1.58                              | 259                            | 3.24                          |

Table 1: Supply quantity per capita of toothpastes and brushes 2000 to 2016



## Discussion

This study shows that the yearly supply of toothpastes per individual in Lebanon has increased progressively from 1.27 in 2000 to 1.58 toothpastes in 2016 with an average

of 1.6 toothpastes per individual. However, the results show a fluctuation in the supply of toothbrushes especially between 2012 and 2016.

In the year 2002, our data showed that 1.53 toothpaste tubes were supplied for every citizen. This is higher than the average yearly consumption in Argentina in 2002 that is estimated at 0.21 kg/individual<sup>22</sup>, which is equivalent to 1.26 toothpaste tubes (170-gram toothpaste tube). On the other side, our supply of toothpaste tubes during 2002 was comparable to the average consumption in Canada during the same year; estimated at 0.26 kg/individual<sup>22</sup>, which is equivalent to 1.53 toothpaste tube (170-gram toothpaste tube). However, our supply figures during 2002 are lower than the yearly consumption averages in both Mexico and Brazil where 0.3 kg and 0.4 kg of toothpastes per individual were reported<sup>22</sup> which equate to 1.76 and 2.35 toothpaste tubes per year respectively. Our results reveal an increasing trend in the import of toothpastes between 2000 and 2016 which is comparable to the trend in Brazil that witnessed an increase in the market of oral hygiene products between 2002 and 2006.<sup>22</sup> However, this increase is modest with an increase of only 24.4% in 2016 when compared to the year 2000. Furthermore, the supply average over 17 years estimated to be 1.6 tubes per year per individual is well below the WHO recommendation which is 6 tubes of toothpastes per year per individual.<sup>15</sup>

During the year 2002, the yearly supply of toothbrushes was 1.3 per individual which is higher than the yearly average consumption of toothbrushes in Argentina, Canada, Mexico and Brazil where the consumption was reported to be 0.41, 0.88, 0.69 and 0.86 toothbrushes per individual respectively.<sup>22</sup> Between 2002 and 2009, our supply increased from 1.3 to 1.42 toothbrushes per person revealing a slow increase rate of 9.2% in comparison with 49% in Brazil where consumption per individual increased from 1.12 in 2002 to 1.67 toothbrushes in 2009.<sup>22</sup> However, our results show steep fluctuations in the supply of toothbrushes between 2010 and 2016. Although our yearly average supply of two toothbrushes per individual is well below the WHO recommendations of 4 toothbrushes per year<sup>15</sup>, there has been an observed increase in the supply of toothbrushes that reached<sup>23,24</sup> toothbrushes per individual in 2016; thus closing the gap with the WHO recommendation.

**The supply of toothpastes and toothbrushes which is below the recommended amount by WHO can reflect a**

**deficiency in the yearly consumption of toothpastes and brushes by the Lebanese population which in turn may reflect poor oral hygiene practices.** This correlates with an earlier study about oral hygiene practices in Lebanon which revealed that only 50% of females and 30% of males brush their teeth twice a day.<sup>16</sup> Another study conducted in Lebanon showed that only 65% of university students brush their teeth two times or more per day.<sup>17</sup> Poor hygiene practices reflected by brushing the teeth less than two times a day has also been documented in several Arab countries.<sup>23,24</sup>

A study conducted on children in Syria reported that around a quarter of the children did not brush their teeth on daily basis and only a quarter brushed their teeth more than once daily.<sup>23</sup> A study conducted in Saudi Arabia revealed poor oral hygiene practices among children too, where only 19% brushed their teeth twice daily.<sup>24</sup> On the contrary, a study conducted in European countries that evaluated the frequency of tooth brushing showed improvement in tooth brushing frequency in 2010 as compared to 1994 and revealed that European countries are more likely to abide by the international tooth brushing recommendations.<sup>25</sup> Accordingly, Lebanon still lags behind in relation to oral hygiene practices in general and tooth brushing in specific as compared to Western countries.

Even though the supply and consumption of toothpastes and toothbrushes is behind the optimal level, yet the quality of toothpastes and toothbrushes available in the Lebanese market are of high standards where products imported are regulated and controlled by LIBNOR who has adopted the European ISO standards for toothpaste requirements, testing and marking procedures.<sup>21</sup>

This study has several limitations which need to be considered when analyzing and interpreting its results. The use of supply of toothpastes and toothbrushes rather than data of the market sales to reflect the consumption practices of individuals is one of the limitations of this study. Although supply can generally predict the number of products consumed by individuals, consumption of toothpastes and toothbrushes is more accurately reflected through the market sales of these products. Yet our results are to be considered a valid estimation of consumption patterns since the inadequacy of supply will only indicate deficiency in consumption rather than an optimal or over consumption of toothpastes and toothbrushes given the absence of local production of these products in Lebanon. Another limitation in our study is the inaccessibility of local or regional studies reporting the supply and consumption

of toothpastes and toothbrushes that need to be taken into consideration when comparing our results.

### Conclusion

Our results indicate an insufficient yearly supply of toothpastes and toothbrushes and consequently reflect yearly consumption patterns that are below the WHO recommendations. This raises the need for several interventions. Given that tooth brushing using fluoridated toothpaste is one of the fundamental oral hygiene practices in preserving oral health,<sup>5</sup> there is a need to increase the amount of supplied toothpastes and brushes to provide the adequate recommended yearly amount of these products for every individual. Moreover, promotion programs targeting mainly children and their parents focusing on the importance of using a new toothbrush every 3 months and one toothpaste every two months are of paramount importance to comply with WHO recommendations. In addition, such recommendations need to be emphasized by the pediatricians and dentists as part of the teaching provided to children and their parents. Finally, there is a need for further studies that assess the consumption of toothpastes and toothbrushes through evaluating the market sales of such products as it would provide more accurate data about the actual use of toothpastes and toothbrushes by individuals. The latter information can then be correlated with the oral health status of the Lebanese population for better estimates of needs and respectively supply of oral hygiene products.

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