

## Breastfeeding and mHealth technologies: analysis of mobile applications for tablets and smartphones

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### ABSTRACT

The aims of this study were: to identify mobile applications about breastfeeding in Portuguese and to analyze the content of these applications, based on official recommendations. This is a cross-sectional and descriptive study which investigated the applications in the virtual stores Play Store and Apple Store. Twelve applications were analyzed. All of them presented the chronometer function, which disagrees with the free demand recommendation. The most used figures by the applications were animated cartoons with the use of pacifiers and bottles (66.7%/n=8), mammal animals relating them to human nutrition (16.7%/n=2) and photos produced in studios (8.3%/n=1). Despite the application's support to breastfeeding, some of the information available is contrary to the official recommendations and does not represent the reality of the breastfeeding woman.

**Descriptors:** Breast Feeding; Information Technology; Health Communication; Health Education.

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## INTRODUCTION

Breastfeeding is a complex phenomenon and the woman's decision to breastfeed or not involve many factors, and the support received has been pointed as an important variable related to breastfeeding start and maintenance<sup>(1)</sup>.

With the advent of the Internet, a new possibility emerges for women to search for and receive support to breastfeeding their children through the information available in multimedia, considering that the new generation of mothers has broader access to the online environment. They can connect themselves to the network in their computers, tablets, and smartphones, many times, in more than one of these equipment at the same time<sup>(2)</sup>. The Internet platforms, denominated "Web 2.0" allow the participation in communities, groups and pages of social media, blogs and social networks (as Facebook, Twitter, and Instagram); generating the sharing of knowledge and experiences<sup>(3)</sup>. For this reason, the Internet has been used for the search for information and for sharing opinions and experiences referring to in numerous health and well-being themes, including maternity and breastfeeding.

The use of information technologies and communication for health is called eHealth<sup>(4)</sup>. The mHealth (mobile health) technologies, which are contemplated in the group of eHealth technologies, consist of health practices that are supported by mobile devices like smartphones, tablets, patient monitoring devices, digital personal assistants and, other wireless devices<sup>(5)</sup>.

Nowadays, tablets and smartphones are considered a technological revolution with great impact due to its use in many diverse knowledge areas. They are considered pocket computers and they are increasingly more popular, and the use of these devices is possible without the time and location restriction<sup>(6)</sup>. According to the Research Digital in 2017 Global Overview, about 2/3 of the global population has a smartphone, 50% of the world population uses the internet and of those, 46% access it through a smartphone<sup>(7)</sup>. In Brazil, 68% of the population uses the internet, and 93% of those access the network through a smartphone<sup>(8)</sup>.

In the health field, the use of applications for tablets and smartphones (mobile applications or apps) allow conducting attention and care with assessment and immediate responses, favoring more effective assistance<sup>(9)</sup>. These applications have the use facility and mobility as their main characteristics, and their use in the health field has been growing rapidly, because it favors precision and agility for decision making of health professionals, besides facilitating scientific research in the workplace<sup>(6)</sup>. The applications are available in "virtual stores" specific of the mobile devices, being the two main ones the "Play Store" (for devices with the Android-Google Operational System), and the "Apple Store" (for devices with the IOS – Apple Operational System)<sup>(10)</sup>.

The applications developed for the health field can be found according to the specific needs of each user<sup>(11)</sup>, and they can be useful to promote improvements in the quality of life and adherence to treatment, as well as to facilitate the communication between the health professional and patient<sup>(12)</sup>. However, the lack of accuracy referring to the quality of applications can create insecurities for professionals as well as for patients, as they can expose the users to many risks from the placement or incorrect and/or outdated information<sup>(13-14)</sup>.

Thus, despite the broad use of mHealth technologies in Brazil, specifically regarding the use of mobile applications, no scientific studies were found investigating the information accuracy about breastfeeding. The information is available and accessed without limitations, which calls attention due to the impact that it can have on the woman's decision about breastfeeding or not. For this reason, it justifies the interest to investigate the Brazilian reality about the contents referring to breastfeeding that are available in applications for tablets and

smartphones. The study is in agreement with the new possibilities to acquire information by health users, being an innovation in the processes of health education.

Thus, the aims of this study were: to identify the mobile applications about breastfeeding, available in Portuguese language; and to analyze the content of these applications, based on the scientific evidence preconized by the World Health Organization (WHO) and by the Brazilian Health Ministry (*Ministério da Saúde - MS*) for breastfeeding practice.

## **METHODS**

This is a cross-sectional and descriptive study that used search mechanisms of the virtual stores Play Store and Apple Store, with the key-words: “*aleitamento materno*” and “*amamentação*”, to identify the existing applications about the theme, during September 1<sup>st</sup> to 30<sup>th</sup> 2016. The inclusion criteria for applications in the study were: applications in Portuguese, free and that addressed breastfeeding in its content. The exclusion criteria were: duplicated applications, difficulty to download it, difficulty to open it, with only audio or video information, application specific for advertisement and, applications with game-specific ludic functions and not for breastfeeding orientation.

For the data collection of the applications, a specific instrument was used to identify information about breastfeeding in Internet media, validated for Brazil<sup>(15)</sup>. This instrument presents a descriptive structure of questions that characterize the Internet media based in variables related to the creator, target audience, artistic resources used in the media and, sources used to create the content, within others<sup>(15)</sup>. Thus, after finishing the selection, each application was downloaded directly from the virtual store (“Apple Store” or “Play Store”) to a smartphone, and individually analyzed regarding the following characteristics: country of origin, target audience, main subject, update, type of language, resources, attractiveness, authorship rights, sponsorship, contact with the author, references used and presented by the author.

For the data analysis, the most present coded in the content of applications were identified, that is, the main information that characterizes each one of the applications. After this identification, the codes were structured to create a coding chart, and from this chart, the central themes and subthemes present in the applications were identified<sup>(16)</sup>. The analysis was conducted according to the information precision, using the scientific evidence as criteria for the breastfeeding practice<sup>(17)</sup>.

## **RESULTS**

The results found in the analysis of applications are presented in the Chart 1.

**Chart 1:** Presentation of applications searched in the virtual stores “Apple Store” and “Play Store” according to the characteristics: country of origin, target audience, main subject, update, type of language, the resource used, attractiveness, authorship rights, sponsorship, contact with the author and, references.

	Country of origin	Target audience	Main subject	Update	Type of language	Resources	Attractiveness	Authorship rights	Sponsorship	Contact with the author	References
1	Brazil	Mothers and/or parents	Breastfeeding	July/2016	Plain language terminology	Texts and graphs	Attractive and Easy to use	Yes	Pharmaceutical industry	Not available	No
2	Brazil	Mothers and/or parents	Breastfeeding	June/2013	Plain language terminology	Chronometer	Colorful and Easy to use	Yes	Hygiene products for mothers and babies	Available	No
3	Brazil	Not defined	Maternity and paternity	September/2016	Technical / academic / scientific	Texts, images, and graphs	Attractive, colorful and easy to use	Yes	Umbilical cord Blood Bank	Available	Yes
4	Not informed	Mothers and/or parents	Breastfeeding	August/2016	Plain language terminology	Texts and graphs	Easy to use	Yes	No	Available	No
5	Not informed	Mothers and/or parents	Breastfeeding	September/2016	Plain language terminology	Texts and graphs	Attractive, colorful and easy to use	Yes	No	Available	No
6	Not informed	Mothers and/or parents	Breastfeeding	February/2015	Plain language terminology	Texts and images	Attractive and easy to use	Yes	No	Not available	No
7	Not informed	Mothers and/or parents	Breastfeeding	March/2016	Plain language terminology	Texts and graphs	Colorful and confusing	Yes	No	Not available	No
8	Not informed	Mothers and/or parents	Breastfeeding	January/2016	Plain language terminology	Texts and graphs	Colorful and easy to use	Yes	No	Not available	No
9	The United States of America	Mothers and/or parents	Breastfeeding	September/2016	Plain language terminology	Images and graphs	Colorful and easy to use	Yes	No	Available	No
10	Brazil	Mothers and/or parents	Nutrition (breastfeeding and bottle)	March/2016	Plain language terminology	Images and graphs	Attractive, colorful, but deficient in contents	Yes	No	Available	No
11	Brazil	Mothers and/or parents	Breastfeeding	April/2016	Plain language terminology	Image and calculator	Attractive, colorful, but deficient in contents	Yes	No	Available	No
12	Russia	Mothers and/or parents	Nutrition (breastfeeding and bottle)	August/2016	Plain language terminology	Images and graphs	Attractive, colorful, but deficient in contents	Yes	No	Available	No

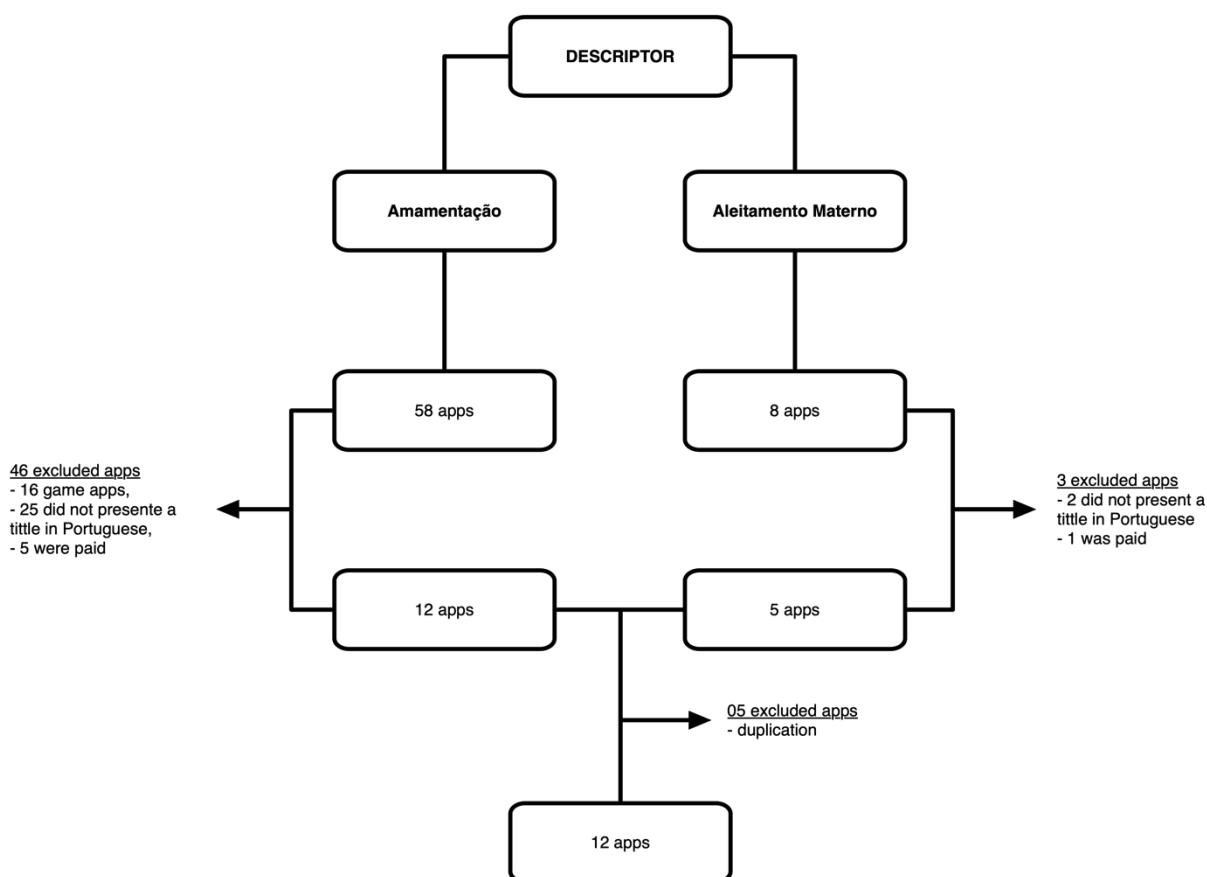
Table 1 shows the number of applications found in each virtual store, according to the descriptor used, totaling 567 applications.

**Table 1:** Number of applications found in the virtual stores “Apple Store” and “Play Store” with the descriptors “Amamentação” and “Aleitamento Materno”. Brazil, September 2016.

Descriptor	Apple Store	Play Store	Total
<i>Amamentação</i>	58	252	310
<i>Aleitamento Materno</i>	08	249	257
<b>Total</b>	<b>66</b>	<b>501</b>	<b>567</b>

Applying the inclusion and exclusion criteria, within the 58 applications found in the “Apple Store” using the descriptor “Amamentação”, 46 were eliminated being 16 game apps, 25 did not have a title in Portuguese and five were paid, resulting in a list with 12 applications for analysis. With the descriptor “Aleitamento Materno”, of the eight applications found, three did not meet the inclusion criteria, resulting in five for analysis. But this five were repeated when crossing with the results of the descriptor “Amamentação”, therefore also being excluded. Thus, the list of applications of the “Apple Store” was composed by 12 applications found using the descriptor “Amamentação”. These results are presented in the Figure 1.

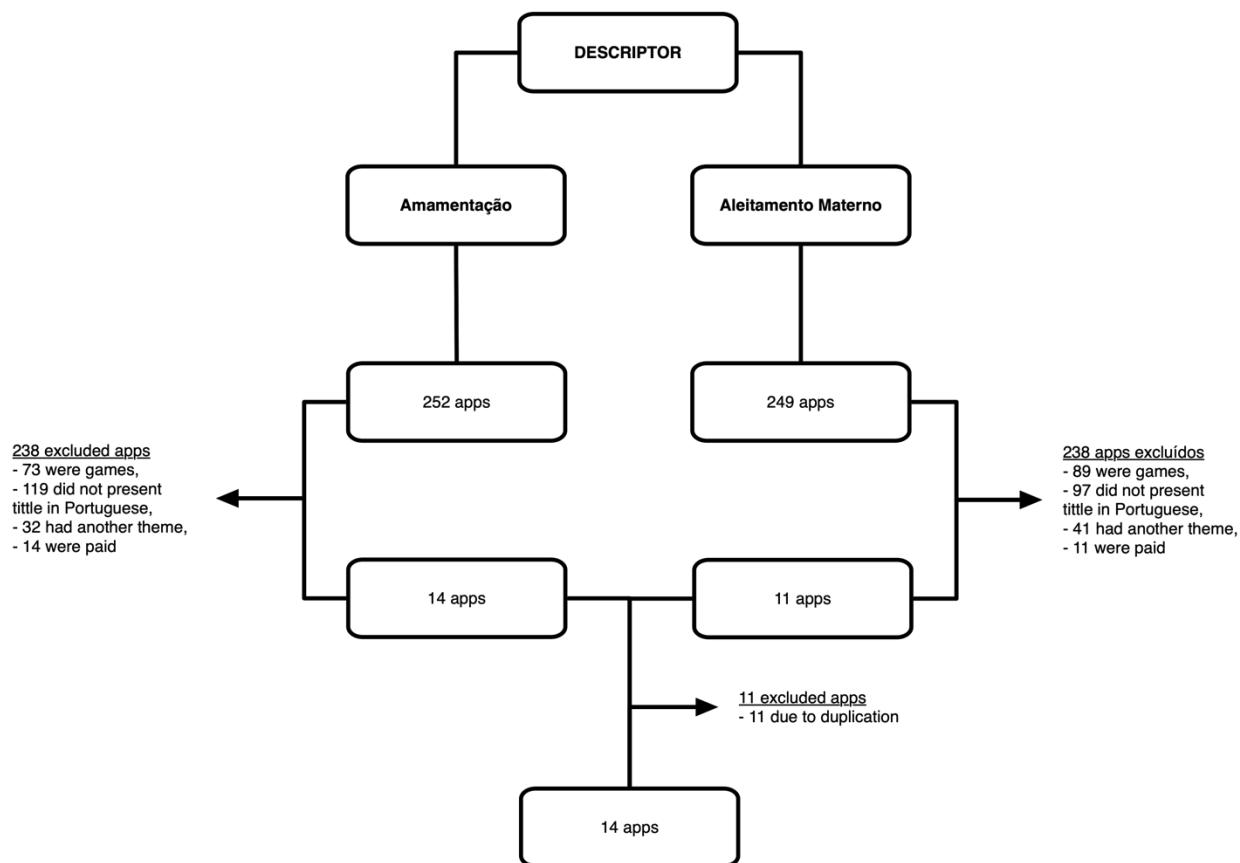
**Figure 1:** Selection of applications in the virtual store “Apple Store” according to the inclusion criteria.



In the virtual store “Play Store”, for the descriptor “Amamentação”, applying the inclusion and exclusion criteria for the 252 identified applications, 238 were eliminated, of these, 73 applications were games, 119 were not in Portuguese language, 32 were related to other theme and did not address breastfeeding in its content and, 14 were paid, resulting 14 applications to be analyzed. With the descriptor “aleitamento materno”, of the 249

identified applications, 238 were eliminated: 89 were games, 41 addressed another theme without addressing breastfeeding, 97 were not in the Portuguese language, and 11 were paid, resulting in 11 applications for analysis. But when comparing these 11 applications with those identified with the descriptor “*amamentação*”, they were repeated and were eliminated. Thus, there were 14 applications left to have their content analyzed in the platform “Play Store”. This step is described in the Figure 2.

**Figure 2:** Selection of applications in the virtual store “Play Store” according to the inclusion criteria.



Thus, 26 applications were selected for analysis. Within these, three were excluded due to duplication, that is, they were presented in the list of applications in the iOS platform as well as in Android platform; one was excluded after downloading in the smartphone for presenting difficulty in the access to its functions and 10 for being in another language, despite the title in Portuguese. Thus, the final study sample counted with 12 applications.

Among the 12 analyzed applications, five (41.7%) were Brazilian, five (41.7%) did not inform the country of origin in its description, and two (16.6%) were foreign with translation to Portuguese, one was from the United States of America and one from Russia. Eleven applications (91.7%) were destined to mothers and/or parents, and one (8.3%) did not have a specific target audience, contemplating health professionals and families. None of the analyzed applications were specifically destined to health professionals.

Regarding the theme addressed, nine applications (75%) had breastfeeding as a central theme, one (8.3%) dealt with subjects related to maternity and paternity and two (16.7%) about the child’s nutrition. But, the approach of subjects referring to breastfeeding was limited to support for its conduction through the registry of

nursing times, and only two applications (16.7%) had texts and information about breastfeeding techniques and handling.

Referring to the language used, 11 applications (91.7%) used plain language, and one (8.3%) used technical-scientific language. Regarding the updating of the availability date, 10 (83.3%) were updated in the year 2016, and two (16.7%) had their last update conducted in more than a year. Among the 12 applications, eight (66.7%) had some contact channel with the author/creator available and only one (8.3%) had bibliographic references of the available information.

All the applications had authorship rights, and three (11.5%) were sponsored by health industries or of cosmetic and hygiene products for the mother and baby.

All the applications had the chronometer and/or nursing time registry function, with a start and end time, and a function to mark if the feeding was on the breast (right or left) or with the bottle. Besides, all presented the function to transform this information into summaries, graphs or tables.

Regarding the used resources, the majority of applications (n=10; 83.3%) had texts, images, and graphs and, the majority (n=11; 91.7%) were attractive, colorful and easy to use. Only one (8.3%) presented difficulty in access to functions due to lack of clarity in the presented information and difficulty to include data.

Specifically, regarding the images, the most used pictures by the applications were animated cartoons with the use of pacifiers and bottles (n=8; 66.7%), mammal animals relating them to the human feeding (n=2; 16.7%), and pictures produced in studios (n=1; 8.3%).

## DISCUSSION

The World Health Organization (WHO) incentivizes the use of mobile technologies in the health field as a tool to reach the objectives in health assistance, once these technologies have the potential to cause modifications in the way of caring, besides being low-cost and of easy access, especially in the assistance to maternal-infant health<sup>(5,12)</sup>.

Studies with the objective to analyze mobile health applications has been becoming a concern among researchers and professionals of different countries, especially about the breastfeeding theme<sup>(11-14)</sup>. Studies that assess the quality of existing applications point to the low quality or information inadequately provided, which shows the need of more rigor in building these tools, as well as being more accessible to families and professionals<sup>(14)</sup>.

The present study analyzed the characteristics and the content of 12 mobile applications about breastfeeding available in Portuguese. It was verified that none of the applications about breastfeeding was built as a tool for health professionals, despite their use in the professional practice being broadly incentivized by the WHO<sup>(5)</sup>. The assistance offered by health professionals to women during postpartum and breastfeeding become more effective if the professional present positive attitudes and necessary skills for this practice; and the mobile technologies allow learning in any place, at any time, increasing the quality of the assistance provided<sup>(1)</sup>.

Among the applications analyzed, most had breastfeeding as a central theme, they had the accessible language to the general population, there was recent information available, and they had a communication channel with the author/creator. But only two applications had necessary practical information to manage to

breastfeed. The breastfeeding promotion involves educational actions, as well as, practical support during the process. Thus, it is important to note that, when mothers and fathers search for information about breastfeeding on the internet and social networks, they are also looking for support and practical help<sup>(2)</sup>. Thus, the majority of applications were not appropriate for the needs of mothers and fathers who search for help about breastfeeding in these devices.

It is noteworthy that only one application had references to available information. The lack of scientific evidence, quality control, and standardization to create applications, as well as the lack of clinical tests to prove its real health efficacy are the main concerns for researchers<sup>(11,13)</sup>. It was seen that the development of breastfeeding applications lack more scientific basis.

The applications were also analyzed regarding the presence or not of sponsorship, because in accordance with the law 11.265/06, based on the Brazilian Norm of Commercialization of Breast-Milk Substitutes (NBCAL), it is forbidden to sponsor people, being only allowed to sponsor scientific entities for teaching and research, or pediatrics and nutrition associations, limiting it to the distribution of technical-scientific material only<sup>(18)</sup>. Within the analyzed applications, three were sponsored, but none of these sponsorships were related to the food industry or with products that could interfere with breastfeeding, in accordance with the existing legislation.

A prevalent fact in all analyzed applications was the presence of a “chronometer and/or nursing registry” function, destined to register the duration time and interval between nursings, therefore in contrast with the recommendation of the WHO and the Brazilian Health Ministry about free demand breastfeeding<sup>(19-22)</sup>.

This recommendation is justified by the importance to satisfy the physical and emotional needs of the child when they demand them, respecting the individual need of each baby; besides being a factor that contributes to maintaining the breastfeeding practice, being the breast milk production regulated by the release of oxytocin and prolactin, hormones stimulated by the baby’s demand to the maternal breast. The free demand breastfeeding is also an important factor to prevent postpartum hemorrhage in the woman, one of the most significant causes of maternal mortality, because it stimulates the uterine contraction through the oxytocin action<sup>(21)</sup>. It is also noteworthy that rigid breastfeeding schedules increase the risk of early weaning, and of breast issues, as breast engorgement and mastitis<sup>(19)</sup>.

The application’s design and aesthetics can influence the decision making and the user’s behavior, once it directly impacts the perception regarding the functionality of this tool and its usability<sup>(11)</sup>. The interface presented by the application is directly linked to the user’s interaction with the system, considering how it is presented influences how the user will receive and process the information, therefore, attending to his needs and facilitating his learning process and use of the tool. Thus, it leads to user’s satisfaction and the achievement of objectives with the use of the system<sup>(23)</sup>.

Most analyzed applications had texts, images, and graphs, being attractive and easily used. However, in the images’ analysis, two situations were noted, and they are described ahead.

The first situation refers to the use of drawing of pacifiers and bottles, that can confuse the user, it can lead to the understanding that these objects are part of the child’s nutrition process. The use of these images are not in accordance with the recommendations of the International Code of Marketing of Breast-Milk Substitutes and of the NBCAL, which guide that any type of information or material about the child’s nutrition cannot use images



inducing the use of these products that can interfere in the breastfeeding process<sup>(18,24)</sup>. The use of artificial beaks during the maternal milk production, reducing the number of nursing events and provoking the called “beaks confusion”, which increase the chance of early weaning<sup>(22)</sup>.

The second noted situation refers to the representativity of women who breastfeed with the use of mammal animals and pictures produced in studios. For the woman, the postpartum period that includes the breastfeeding, is associated to adaptations related to the new routine and changes that occur in her body; due to that, her self-image perception can be modified, interfering in her confidence to practice maternity and, especially, to breastfeed<sup>(25)</sup>. Thus, when facing images that are not part of her reality, the woman can feel unmotivated, insecure and incapable of breastfeeding.

## CONCLUSION

From the results of this study, it is possible to conclude that despite the analyzed applications promoting and supporting breastfeeding, the resources, and the available information are limited to the use of chronometers to register the nursing time and the interval between nursing episodes, which can negatively impact the breastfeeding, once the official recommendations for this practice should be of free demand. Besides, few applications support the woman’s real needs during this period, not being a source of support for those who have issues with breastfeeding.

The fact that only one application had references about the content presented calls attention to the need for more scientific rigor in the construction of health applications, with the intention that available contents present reliable information. A quality application is that one that follows technical norms in its elaboration, which guarantees safety and effectiveness of the tool, especially in what refers to health promotion.

The images used in the analyzed applications can also negatively interfere in the breastfeeding, once few of them did not follow the official recommendations as they presented bottles and pacifiers and in others, the woman’s representation was through pictures produced in a studio, which can decrease the woman’s confidence for this practice.

It is noted as a limitation of this study, the analysis of applications only in the Portuguese language. Other applications available in Brazil in foreign languages could be analyzed, with the intention to verify the accuracy of their information. Thus, applications developed from clinical tests and based on scientific evidence could be translated and adapted to the Brazilian reality, offering more access to reliable information to the professional and general public.

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