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Use of dietary supplements among lactating women in western Algeria

Prise des compléments alimentaires chez des femmes allaitantes de l'ouest Algérien

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Abstract ***Introduction.*** Supplementation during breastfeeding (BF) has a significant impact on the health of lactating women and their children. However, this topic remains poorly documented in Algeria***. Objective.*** To characterize the use of dietary supplements among BF women. ***Subjects and Methods*****.** A cross-sectional study was carried out using a questionnaire among 510 BF women in the city of Sidi-Bel-Abbès (Algeria). ***Results*****.** This study showed that almost half (49%) of BF women took dietary supplements. The most commonly reported micronutrients were vitamin B6 (41.8%), vitamin B12 (36.3%), vitamin C (33.7%), iron (28.4%), magnesium (28.0%), and zinc (30.0%). The intake rates of vitamins B1, B2, B9, E, D, iodine, and omega-3 ranged from 10% to 25%, while those of vitamins A, B3, B5, B8, and calcium were below 9%. Nearly 80% of these products were purchased on prescription or on the advice of a health professional. One-third of women reported using dietary supplements to address nutritional deficiencies, while 29.3% used them to increase milk supply. The majority of these women took dietary supplements for less than 9 months. Some women believed that dietary supplements could replace dietary nutrients and that they had no negative health effects. Several factors, such as age, professional status, education level, urbanicity, household income, health insurance, health status, weight status, type of breastfeeding, use of dietary supplements during pregnancy, and physical activity, were associated with the use of dietary supplements. ***Conclusion.*** Collecting data on the consumption of dietary supplements among breastfeeding women is an essential step in documenting current trends to better understand their motivations and behaviour. These data can guide future awareness-raising actions regarding the use of dietary supplements during breastfeeding.

Key words: *Lactating women, Dietary supplements, Micronutrients, Supplementation, Algeria*

Résumé ***Introduction***. La supplémentation pendant l'allaitement a un impact significatif sur la santé des femmes allaitantes et de leurs enfants. Cependant, ce sujet demeure peu documenté en Algérie. ***Objectif.*** Caractériser la prise de compléments alimentaires chez les femmes allaitantes. ***Sujets et méthodes***. Une étude transversale a été menée à l'aide d'un questionnaire auprès de 510 femmes allaitantes de la ville de Sidi-Bel-Abbès (Algérie). ***Résultats.*** Cette étude a révélé que près de la moitié (49%) des femmes allaitantes prenaient des compléments alimentaires. Les micronutriments les plus couramment rapportés étaient la vitamine B6 (41,8 %), la vitamine B12 (36,3 %), la vitamine C (33,7 %), le fer (28,4 %), le magnésium (28,0 %) et le zinc (30,0 %). Les taux de prise des vitamines B1, B2, B9, E, D, iode et oméga-3 variaient de 10 à 25 %, tandis que ceux des vitamines A, B3, B5, B8 et du calcium étaient inférieurs à 9 %. Près de 80 % de ces produits ont été achetés sur ordonnance ou sur les conseils d'un professionnel de la santé. Un tiers des femmes ont déclaré prendre des compléments alimentaires pour combler leurs carences nutritionnelles, tandis que 29,3 % les ont utilisés pour augmenter leur production de lait. La majorité des femmes ont pris des compléments alimentaires pendant moins de 9 mois. Certaines femmes croyaient que les compléments alimentaires pouvaient remplacer les nutriments et qu'ils n'avaient pas d'effets négatifs sur la santé. Plusieurs facteurs, tels que l'âge, le statut professionnel, le niveau d'éducation, le lieu de résidence, le revenu du ménage, l'assurance maladie, l'état de santé, le statut pondéral, le type d'allaitement, l'utilisation de compléments alimentaires pendant la grossesse et l'activité physique, ont été reliés à la prise de compléments alimentaires***. Conclusion.*** La collecte de données sur la consommation de compléments alimentaires chez les femmes allaitantes est une étape essentielle pour documenter les tendances actuelles afin de mieux comprendre leurs motivations et leur comportement. Ces données peuvent guider les futures actions de sensibilisation sur l'utilisation des compléments alimentaires pendant l'allaitement.

Mots clés: *Femmes allaitantes, Compléments alimentaires, Micronutriments, Supplémentation, Algérie*

Introduction

Breastfeeding is a natural practice in which the child receives, as simply as possible, the nutrients adapted to his growth [1]. The World Health Organization (WHO) recommends exclusive BF for up to 6 months, starting from the first hour of life [2]. Around the world, especially in developing countries, BF women are more vulnerable to malnutrition than those who are not. The nutritional intake of BF women is one of the most important determinants of their health and well-being, as well as, the health of their babies [3].

As a result, BF women are increasingly concerned about their health, and are seeking ways to overcome deficiencies. This includes finding an ideal diet tailored to BF woman, and determining whether supplementation with so-called dietary supplements is necessary. The primary objective of these dietary supplements should be to prevent or compensate for deficiencies due to an imperfectly balanced diet. The use of a supplement based on vitamins and minerals can help compensate for minor deficiencies in intake, as well as deficiencies in specific situations, such as BF, where supplementation may be considered [4].

However, although several potential beneficial effects are attributed to them, dietary supplements are not entirely harmless. There have been cases of pharmacological adverse effects related to their misuse (several supplements are contraindicated in BF women, and non-compliance with these contra-indications can lead to serious complications), their interactions (either between supplements themselves or with medications), overdoses, and cases of toxicity. In fact, several cases of harmful effects attributed to dietary supplements have been reported in the literature. These cases should be regarded as true indicators of the potential existence of side effects related to these products. The French Agency for Food, Environmental and Occupational Health & Safety (ANSES) recommends informed consumption of dietary supplements [5-6]. Strengthening the knowledge and vigilance of professionals regarding the use of supplements is crucial. In this regard it is important to note that,

unlike medicines, many dietary supplements have not been evaluated in BF women, and data on their safety remain very limited [7]. In recent years, the general public enthusiasm for dietary supplements has increased significantly. The global dietary supplement market was valued at USD 151.9 billion in 2021 and is expected to grow at a compound annual growth rate (CAGR) of 8.9% from 2022 to 2030 [8].

Given the magnitude of this phenomenon, several studies have focused on the consumption of dietary supplements, in recent decades. These studies have shown that the consumption of dietary supplements is widespread worldwide. However, the majority of these studies have been conducted with the general public, and very few have focused on the consumption of dietary supplements among BF, especially in Algeria. In this context, we deemed it appropriate to conduct a study to characterize the dietary supplements use among BF in the city of Sidi-Bel-Abbès.

Subjects and Methods

Subjects

In this cross-sectional study, 510 BF women consented to participate and completed the questionnaire. The participants were recruited from the major vaccination center, Saadeli Bouamama, in Sidi-Bel-Abbès (western Algeria), between November 2022 and February 2023. Women included in the study were over 18 years of age, had a child under 2 years old, and were providing mixed or exclusive BF for at least 3 months. Exclusion criteria involved women who had stopped BF (for any reason, whether personal or medical) at the time of the survey or earlier, those under 18 years of age, and those with cognitive impairments. Informed consent was obtained from all participants.

Data collection

All collected information was obtained through face-to-face interviews with BF women who came to vaccinate their children.

The questionnaire consisted of several questions, and was divided into different sections: general information (age, place of residence, occupation, education level, number of children and household income), anthropometry (weight, height), BF and lifestyle information: type of BF, health status, physical activity, and information on dietary supplements consumption (type of dietary supplements consumed, reasons, circumstances and duration of intake). Regarding supplements use, both regular and medicinal micronutrient supplements were considered in this study. Dietary supplements based on plants and their extracts were not included. Participants were asked if they currently took any micronutrient supplements (at least 3 days a week). They were also asked to specify the types of micronutrients using a list of 18 different micronutrients (13 vitamins, 5 minerals, and trace elements in addition to omega-3) referring to the nutritional information on the packaging of the supplements they were currently taking.

In the first instance, a pilot study of 30 breastfed women was performed to confirm the reliability and the validity of the questionnaire.

Statistical analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 22.0. Quantitative variables were expressed as means ± standard deviation (SD), and qualitative variables as percentages. The Pearson chi-square test was used to examine differences involving categorical variables. A *p*-value of less than 0.05 was considered statistically significant.

Results

Sample description

The socio-demographic, anthropometric, and health characteristics of BF women are presented in **Table 1**. The average age of participants was 30.0 ± 5.8 years, with ages ranging from 18 to 45 years (the majority of women were between 25 and 39 years old). Ninety percent of the women who participated in the survey were married. Regarding their education level, approximately 66% of the women had a university degree.

The majority of women (92.2%) lived in urban areas. In terms of parity, 38.8% of women had just one child. Almost half of the women (50%) had household incomes above 50,000 DZD. In addition, 76.1% of these women had health insurance. Body Mass Index (BMI) ranged from 17.96 to 38.46 kg/m², and 45.1% of women had a normal BMI. However, more than 50% of women were over-weight or obese (**Table 1**).

Dietary supplement use

Table 2 represents global and specific micronutrients supplement use in BF women. Forty-nine % of BF women took dietary supplements. The most frequently taken supplements were vitamins (43.3%), minerals and trace elements (45.5%), as well as other ingredients, mainly omega-3 (27.5%) (**Table 2**). Vitamins B6, B12, and C, iron, magnesium, and zinc were the most frequently reported micronutrients (more than 28%).

Table 1. Use of dietary supplements during breastfeeding based on socio-demographic, lifestyle, and health characteristics

Characteristics		All BF women(n=510)		Supplement Users (n=250)		Supplement nonusers(n=260)		*p*-value
		(n)	(%)	(n)	(%)	(n)	(%)	
Age (years)	18-24	99	19.4	42	16.8	57	21.9	0.003
	25-39	389	76.3	204	81.6	185	71.2	
	>40	22	4.3	4	1.6	18	6.9	
Marital status	Married	459	90	229	91.6	230	88.4	0.483
	Divorced	35	6.9	14	5.6	21	8.1	
	Widow	16	3.1	7	2.8	9	3.5	
Professional status	Employee	258	50.6	145	58	113	43.5	0.001
	Housewife	252	49.4	105	42	147	56.5	
Educational level	Elementary	17	3.3	3	1.2	14	5.4	0.018
	Intermediate	34	6.7	15	6	19	7.3	
	Secondary	122	23.9	54	21.6	68	26.2	
	Bachelor degree or higher	337	66.1	178	71.2	159	61.1	
Urbanicity	Rural	40	7.8	12	4.8	28	10.8	0.012
	Urban	470	92.2	238	95.2	232	89.2	
Parity	Primiparity	198	38.8	102	40.8	96	36.9	0.369
	Multiparity	312	61.2	148	59.2	164	63.1	
Household income (DZD per month)	< 20.000	75	14.7	25	10	50	19.2	0.013
	20.000 - 50.000	190	37.3	99	39.6	91	35	
	> 50.000	245	48.0	126	50.4	119	45.8	
Health insurance	Yes	388	76.1	205	82	183	70.4	0.002
	No	122	23.9	45	18	77	29.6	
Health status	Chronic disease	98	19.2	64	25.6	34	13.1	0.0001
	Non chronic disease	55	10.8	38	15.2	17	6.5	
	No disease	357	70	148	59.2	209	80.4	
BMI Category (kg/m^2)	Under weight: BMI ≤ 18.5	3	0.6	2	0,8	1	0.4	0.027
	Normal: 18,5 ≤ BMI ≤24.9	230	45.1	100	40	130	50	
	Overweight: 25 ≤BMI ≤29.9	228	44.7	128	51.2	100	38.5	
	Obese: BMI ≥ 30	49	9.6	20	8	29	11.1	
Type of breastfeeding	Exclusive BF	230	45.1	97	38.8	133	51.2	0.005
	Mixed BF	280	54.9	153	61.2	127	48.8	
BF of previous children	Yes	317	62.2	159	63.6	158	60.8	0.510
	No	193	37.8	91	36.4	102	39.2	
Physical activity	Low to moderate	261	51.2	93	37.2	168	64.6	<0.0001
	Intense	249	48.8	157	62.8	92	35.4	
Dietary supplements intake during pregnancy	Yes	281	55.1	214	85.6	67	25.8	<0.0001
	No	229	44.9	36	14.4	193	74.2	

BF: Breastfeeding; BMI: Body mass index categories according to the WHO classification [8]; DZD: Algerian dinar.Pearson chi-square test was used to examine differences involving categorical variables. p-value < 0.05 was considered statistically significant.

Vit. B1, B2, B9, E, and D, iodine and omega-3 were also frequently taken, with intake rates ranging from 10 to 25%. On the other hand, the least consumed micronutrient supplements were vitamins A, B3, B5, and B8, as well as calcium, with intake rates below 9%.

Fig. 1. illustrates the average duration of dietary supplement intake. Some BF women (39.8%) reported consuming dietary supplements for a period of 3 months, while 10.4% reported using supplements for an entire year, and 13.3% continued to consume them for more than one year.

Fig. 2. shows the motives for dietary supplement intake in BF women. Nearly 30% of women took dietary supplements to address nutritional deficiencies, while 29.3% used them to increase milk supply.

Table 2. Global and specific micronutrient supplement use in BF women

	BF women (n =510)	
	(n)	(%)
Overall supplement use	250	49
Specific supplement use		
Vitamins	221	43.3
Vit B1	82	16.1
Vit B2	121	23.7
Vit B3	20	3.9
Vit B5	44	8.6
Vit B6	213	41.8
Vit B8	44	8.6
Vit B9	96	18.8
Vit B12	185	36.3
Vit A (beta-carotene)	39	7.6
Vit D	76	14.9
Vit E	105	20.6
Vit C	172	33.7
Minerals and trace elements	232	45.5
Fe	145	28.4
Ca	2	0.4
Mg	143	28.0
Zn	153	30.0
I	115	22.5
Other	140	27.5
Omega-3	125	24.5

BF : Breastfeeding, Vit: Vitamin, Fe: Iron, Ca: Calcium, Mg: Magnesium, Zn: Zinc, I: Iodine, ω3: Omega 3.

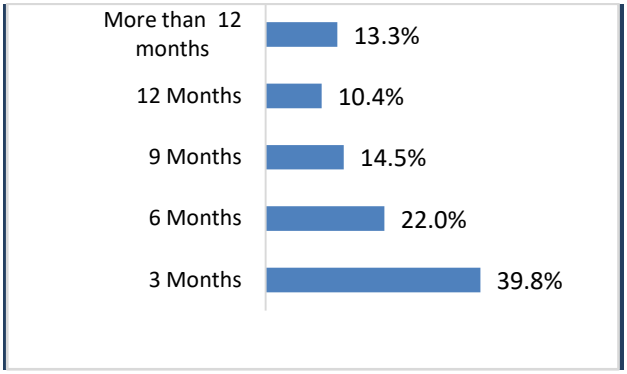

Fig. 2. Intake average duration of dietary supplements
Values are presented as percentages of 250 breastfeeding women.

Approximately, 27% of BF women used these supplements to alleviate fatigue **(Fig. 2)**.

Fig. 3. represents the purchase circumstances of dietary supplement by participants. About 68.3% of consumedsupplements were prescribed by a doctor, while 10% were recommended by a pharmacist (or another health professional), and about 18.5% were taken based on advice from friends or family. Dietary supplements were discovered by 3.2% of participants through advertising and social media.

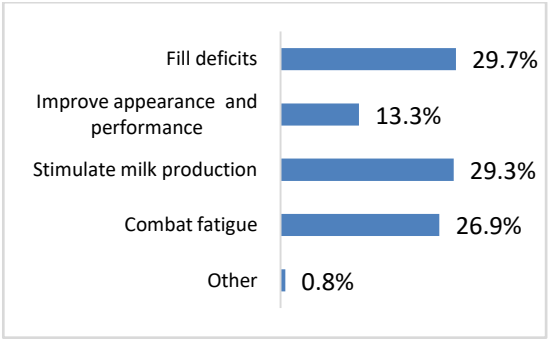

Fig. 2. Motives for dietary supplement intake
Values are presented as percentages of 250 breastfeeding women.

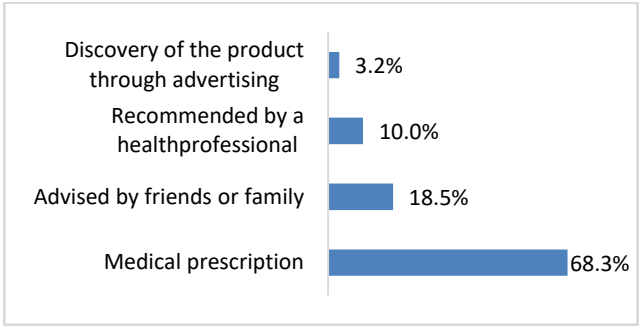

Fig. 3. Purchase circumstances of dietary supplement by participants
Values are presented as percentages of 250 breastfeeding women.

Table 3 represents attitudes of participants towards dietary supplements. It showed that 70.4% of participants believed that dietary supplements could not replace dietary nutrients. Only a quarter of participants believed that dietary supplements could negatively affect health. About half of women considered that nutritional nutrients are sufficient for the proper functioning of BF. Approximately 40% of them believed that food supplements based on natural ingredients were safe and that they underwent safety tests before being marketed. Almost a quarter of the respondents alleged that the effectiveness of dietary supplements had been proven by clinical trials, and that all food supplements sold in pharmacies were safe.

Results in **Table 1** showed that several factors were related to dietary supplement intake, including age, professional status, education level, urbanicity, house -hold income, health insurance, health status, weight status, type of BF, dietary supplements intake

during pregnancy, and physical activity. Dietary supplement consumption was not linked with factors, such as marital status, parity, and BF of previous children.

Table 3. Participants attitudes towards dietary supplements

	True (%)	False (%)	Don't know (%)
Dietary supplements can replace food nutrients	9.6	70.4	20
Dietary supplements affect negatively our health	25.7	41.2	33.1
Food nutrients are sufficient for the smooth running of breastfeeding	53.3	26.5	20.2
Dietary supplements based on natural ingredients are safe	41.4	20	38.6
Dietary supplements are subject to safety tests before being marketed	40.8	10.6	48.6
Effectiveness of dietary supplements is based on clinical trials	22.4	13.9	63.7
Dietary supplements sold in pharmacies are all safe	29	24.9	46.1

Values are presented as percentages of 250 Breastfeeding women.

Discussion

This study aimed to characterize the use of dietary supplements among BF women. The findings indicated that nearly half of the BF women had consumed dietary supplements. This prevalence was similar to that reported in other countries, such as Italy (52.5%) [10], the United States of America (70%) [11], Spain (57.1%) [12], and among African women living in the United Kingdom (33.2%) [13].

About half of these dietary supplement consumers used multi-supplements. This is consistent with the results reported by Stultz *et al.,*on the use of multivitamins and certain micronutrients, in a prospective cohort of 46 lactating women. Their data showed that 73% of women have chosen a multivitamin supplement [35].

Health professionals often recommend multiple micronutrient supplements for lactating women, especially, in populations with nutritional deficiencies. Two small studies have shown that this could improve maternal nutritional status and breast milk content in various nutrients. However, the evidence for the benefits of multiple micronutrient supplementation for both mother and baby was limited in these studies. Another study demonstrated that multiple micronutrient supplementation was beneficial for hemoglobin, copper, and zinc levels in mothers. Sneed *et al*., highlighted the importance of maintainning adequate levels of folic acid and Vit. B6, either through diet or supplements [35].

However, it should be remembered that the use of multivitamin supplements should be approached with caution, and reserved for specific medical indications, as excessive use may pose risks to the health of both mother and baby, including overdoses, drug interactions, toxicity, and nutritional imbalances [43]. Therefore, it is important to consult a health professional before taking multivitamins and to adhere to the recommended dosages in order to avoid adverse reactions.

With regard to dietary supplements consumed, it should be noted that nearly half of BF women in the study were taking supplements based on vitamins, minerals and trace elements. They favoured Vit. B6, followed by Vit. B12, Vit. C, iron, magnesium and zinc. During pregnancy and lactation, women have an increased need for Vit. B6, as do infants [46].

Indeed, Vit. B6 is important for many biological processses in BF women, as it helps produce neurotransmitters, such as serotonin, dopamine, and noradrenaline, which regulate mood, anxiety, and stress. It is also necessary for haemoglobin production, as well as, for the synthesis of several hormones, including insulin, adrenaline, and thyroid hormones, which regulate energy metabolism and growth [14]. In BF women, a deficiency in Vit. B6 can lead to a decrease in breast milk production and the nutriational quality of milk, as well as, a reduction in the cytokine composition of milk, which can affect infant health [15]. On the other hand, Vit. B6 deficiency can also cause problems, such as skin and mucosal lesions, anemia, and disorders of the central nervous system [46]. In addition, studies have shown that Vit. B6 supplementation can have a positive effect on cognitive and behavioral development of breastfed infants [16].

For lactating women, the World Health Organization (WHO) recommends 2 mg/day of Vit. B6 [17], while the European Food Safety Authority (EFSA) has set an average requirement of 1.4 mg/day, and the Population Reference Intake (PRI) is 1.7 mg/day of Vit. B6 [18]. To avoid negative effects, including a decrease in breast milk production, it is crucial to adhere to the recommended doses of Vit. B6.

As for Vit. B12, it is an essential vitamin that plays an important role in many biological processes, including

red blood cell production, nervous system function, and DNA synthesis. BF Women may be at risk for Vit. B12 deficiency due to their increased Vit.B12 needs to support their baby growth and development [14]. Indeed, the development of breastfed infants requires Vit. B12, which is present in breast milk. However, if the mother has a Vit. B12 deficiency, it can cause a deficiency in her breastfed baby, leading to problems, such as slowed growth and developmental delays. BF women, and at risk of Vit. B12 deficiency, such as vegans or those with absorption issues, should take Vit. B12 supplements to ensure that their baby receives enough of this important vitamin [19]. During BF, a satisfactory Vit. B12 intake is approximately 5 µg per day [18].

Concerning Vit. C which is an essential nutrient for human body, it actively participates in maintaining immune system health, collagen production, wound healing, protection of cells from free radical damage, bone and tooth health, and iron absorption [20]. BF women, generally, have a lower Vit. C status due to the transfer of vitamin C to the growing infant *via* breast milk. Vit. C deficiency can have negative health consequences for both mother and baby, leading to symptoms, such as fatigue, muscle weakness, loss of appetite, bleeding gums, and increased susceptibility to infections. Breastfed infants by mothers deficient in Vit. C are more likely to develop Vit. C deficiency themselves, as their diet depends entirely on breast milk which may have insufficient Vit. C content. This Vit. C deficiency in infants can lead to growth and developmental issues, increased susceptibility to infections, and anemia. However, infant scurvy is rarely observed in breastfed infants, as breast milk usually provides a sufficient amount of Vit. C, and infant formulas are enriched with Vit. C [21].

In this context, many global health authorities have accounted for the increased nutritional needs of lactating women, with recommendations that are higher than the standard dietary intake, ranging from +20 to 60 mg/day for BF women [22]. According to the WHO, a daily intake of 50 mg of Vit. C is recommended for lactating women [17], while in France, the PRI for Vit. C in lactating women is set at 170 mg/day [18].

Iron supplementation is often recommended for BF women. Iron is an essential mineral required for the production of hemoglobin, the protein in red blood cells that carries oxygen throughout the body. Iron is also important for growth and development, immune system and energy metabolism [23]. During pregnancy,mother iron needs increase significantly because substantial amount of iron is transferred to fetus for its development and growth, and maternal iron reserves are often already low. Thus, iron supplementation is frequently recommended to compensate for iron losses during childbirth and to meet the increased needs of mother during pregnancy and lactation [8]. The WHO recommends an iron intake of 10.5 mg/day for lactating women [17], while in France,PRI is 16 mg/day [18]. Iron deficiency is common among pregnant and lactating women, as well as infants. Iron deficiency anemia is the most common iron deficiency in women, and can negatively affect lactation, leading to reduced milk production and impaired milk quality [24]. Infants have different iron requirements, depending on their feeding mode, as exclusive BF, artificial or mixed BF. The amount of iron in breast milk is usually lower than in infant formula, but this does not necessarily mean that breastfed infants are iron-deficient. Indeed, breast milk contains bioavailability factors that help increase iron absorption by infants [25]. However, maternal iron deficiency can impact iron amount available in breast milk. If mother is iron-deficient, iron content of her breast milk may be reduced, increasing the risk of iron deficiency in the breastfed infant. Research has shown that early iron supplementation can improve cognitive development, and studies suggest that early iron deficiency may be linked to neurological developmental alterations later in life [26].

Magnesium is an essential mineral that plays multiple roles in the body, including regulating metabolism, muscle function, blood pressure, and bone health [27]. It is also an important component of breast milk, contributing to infant growth and development. It is suggested that the magnesium requirements of infants are largely met through BF, with its content varying according to the mother diet and nutritional status [64]. For lactating women, the recommended magnesium intake is 300 mg/day [29].

Zinc is a crucial trace element for growth and development, as well as, for immune system functioning [29]. It is also an indispensable nutrient during pregnancy and BF. In fact, zinc plays a significant role in fetal development and milk secretion in nursing mothers. Zinc deficiency in mothers can have negative consequences for both maternal and child health, including impaired immune function, and decreased milk production. Narváez-Caicedo *et al.,* highlighted the importance of zinc supplementation during BF to protect the nutritional status of both mother and her child during this period of life [30]. By ensuring adequate zinc intake, supplementation can help prevent the negative effects of zinc deficiency,

such as an increased risk of infections and impaired growth and development of fetus and infant. In summary, zinc supplementation during BF is an effective way to safeguard the health of both mother and child by ensuring sufficient zinc intake [30]. The WHO recommends a daily intake of 11.7 mg of zinc during BF [17]. However, in France, the recommended intake (PRI) for this mineral ranges from 10.5 to 13.9 mg/day for lactating women, depending on phytate intake levels [18].

In our study, 22.5% of BF women consumed iodine *via* dietary supplements, which contrasts with the findings of a study conducted in the United States, when only 19% of BF women used a dietary supplement containing iodine [31]. For lactating women, the WHO recommends an intake of 200 µg/day for iodine [17]. In France, the satisfactory intake for lactating women is also about 200 µg/day of iodine [18]. It is important to emphasize that iodine deficiency is common among pregnant and BF women, which can lead to health problems for both mother and baby. Iodine is a key element in the production of thyroid hormones necessary for development of infant brain and nervous system, highlighting the importance of iodine supplementation for lactating women [32]. BF women have higher iodine requirements than pregnant women, due to the importance of iodine in breast milk production and infant cognitive development [31]. In fact, since BF is the only source of iodine intake for infants during their first months of life, BF women must meet their baby iodine needs in addition to their own, highlighting the need for supplementation [33]. Iodine deficiency in lactating women can have negative consequences for the health of both mother and child, including decreased breast milk production, as well as, developmental and growth disorders in infants [34].

According to our results, only 0.4% of lactating women were supplemented with calcium. In contrast, other studies reported higher rates of calcium supplementation in lactating women, such as 6% [13] and 11% [35]. However, the WHO guidelines recommend a daily calcium intake of 1000-1200 mg for lactating women [17], while in France, the calcium recommended intake (PRI) for lactating women is approximately 950 mg per day [18]. Calcium plays a crucial role during BF. Mother calcium needs increase significantly during pregnancy and lactation to support her baby growth and promote breast milk production, and also maintaining the health of her own bones [8]. During BF period, mother can adapt to her baby calcium requirements by adjusting regulatory mechanisms, such as increasing intestinal calcium absorption and decreasing renal calcium excretion. In cases of deficiency, the body can draw necessary calcium from the mother bones, which increases the risk of bone loss, osteoporosis, and fractures. Additionally, hormonal regulation can change during BF, with elevated levels of parathyroid hormone mobilizing calcium from the bones. Therefore, it is essential for mother to consume adequate calcium in her diet to support these adaptations and prevent deficiency [36].

Concerning the other B vitamins (B1, B2, B9), their consumption levels ranged between 10 and 23%, while vitamins B3, B5, and B8 were the least consumed, with intake rates varying between 3 and 8%. The PRI for these vitamins in lactating women are as follows: 1.8 mg/day for thiamine (B1) [38], 2 mg/day for riboflavin (B2) [18], 15 mg/day for niacin (B3) [37], 7 mg/day for pantothenic acid (B5), and 500 µg/day for folate (B9) [18]. The WHO recommends a Vit. B9 intake of 270 µg/day for lactating women [17]. Insufficient intake of these vitamins by mother can lead to low concentrations in breast milk, subsequently affecting infant development. Lactating women may be at risk of Vit. B1 deficiency due to the increased nutritional requirements during BF [38].

Riboflavin is essential for energy production, cell growth, and metabolism of Vit. B6 and folic acid. Lactating women have increased nutritional needs for riboflavin to support both their own health and infant growth and development [39].

Folate is an essential B Vit. crucial for cell growth and development. BF women require adequate folate intake to support both their own health and their baby growth and development. Folate level in breast milk is influenced by mother dietary intake and her folate status. Women with insufficient folate levels tend to have lower folate concentrations in their breast milk [40]. However, folic acid should be taken with caution in high doses, particularly, by women with Vit. B12 deficiency or those taking antiepileptic medications. High doses of folic acid can mask Vit. B12 deficiency, potentially causing neurological damage, and can also interfere with the effectiveness of antiepileptic drugs [41].

For fat-soluble vitamins (A, D, and E), the intake percentages among our participants were 7.6%, 14.9%, and 20.6%, respectively. These findings align with those reported by Gila-Díaz *et al.,* [12]. Additionally, Vit. D intake rate in our study is comparable to that (19.7%) reported by Rodrigues *et al.,* [13]. According to the WHO, lactating women should consume daily 10 µg of Vit. D, while the recommend-

ded intake for Vit. A is 950 µg/day [17]. In France, the PRI for Vit. D, A, and E, in lactating women, is 15 µg/day, 1300 µg/day (in retinol equivalents), and 9 mg/day, respectively [18].

Vit. D is particularly important for lactating women as it plays a crucial role in bone health and calcium absorption. When breastfed, infant relies on mother breast milk for Vit. D. Insufficient maternal intake of Vit. D can lead to a deficiency in infant, increasing the risk of rickets (a bone disease affecting infants and young children) [42]. Vit. D deficiency is common among pregnant and lactating women, and it can have serious health consequences for both mother and baby, particularly with regard to bone growth and development. Vit. D supplementation can help prevent or correct this deficiency in lactating women, offering potential health benefits for both the mother and the infant [42].

The content of vitamins A and E in breast milk varies throughout the lactation period. Inadequate dietary intake of these vitamins can affect their levels in breast milk [43]. Additionally, Vit. A plays a critical role in retinal health and vision, and is also essential for bone and tooth development, immune function, as well as tissue growth and repair [8].

Vit. E is an important antioxidant that protects cells from oxidative damage. It is also important for cardiovascular health and immune function. For infants, Vit. E is essential for healthy nervous system development. Consuming foods rich in vitamins A and E is crucial for lactating women to ensure their breast milk contains adequate amounts of these nutrients [43].

Regarding omega-3, the intake percentage in our BF women was 24.5%, which was higher than the 15.1% reported by Rodrigues *et al.,* [13].

Upon comparing various studies on dietary supplement consumption, it was evident that the reported percentages differed significantly. These discrepancies could be attributed to several factors, including the participants dietary habits, socio-demographic characteristics, and education level. Such factors likely influence eating patterns and, consequently, supplement intake. It is essential to consider these variations when interpreting the results of these studies.

The comparative study between consumers and non-consumers of dietary supplements revealed that supplement consumption was associated with several factors: Age: Lactating women aged 25 to 39 years were more likely to consume dietary supplements compared to those in other age groups. This could be attributed to increased awareness of the importance of a healthy lifestyle and the need to address nutritional gaps with appropriate supplements. Urbanicity**:** Women living in urban areas consumed more dietary supplements than those in rural areas. This trend may be explained by the greater availability and accessibility of health products and supplements in urban areas. Professional status: Working women were more inclined to use dietary supplements compared to housewives. This may be partly due to the higher incomes typically associated with employed women, allowing them to afford more expensive non-reimbursed health products. Educational level**:** Women with secondary or university degrees were more likely to take supplements than those with lower educational levels. This may reflect the greater health and nutrition knowledge of educated women, who are better equipped to understand the potential benefits and risks of dietary supplements. Household income**:** Women with higher household incomes were more likely to consume dietary supplements. Since these products can be costly, higher-income women are more able to afford them. Weight status**:** BF women who were overweight were more likely to use dietary supplements. This could be due to a perceived need to support their nutritional intake and manage their weight during BF. Dietary supplement intake during pregnancy**:** Women who used dietary supplements during pregnancy were more likely to continue taking them after childbirth. This could be explained by the benefits they experienced during pregnancy, which motivated them to maintain their supplement regimen to support their health and that of their baby during BF. Health insurance: Women with health insurance were more likely to consume dietary supplements compared to those without coverage. This may be due to the fact that health insurance often covers a portion of medication costs, making supplements more accessible. Type of BF**:** Women who practiced mixed BF tended to consume more dietary supplements than those who exclusively breastfed. Mixed BF, which often involves bottle-feeding and using teats, can disrupt the natural sucking pattern, and reduce milk production stimulation. As a result, women who engaged in mixed BF might turn to supplements to support milk production and ensure their baby nutritional needs are met. Health status**:** Healthy women were more likely to use dietary supplements to enhance their diet, while women with diseases might require more controlled dietary supervision. Certain medical conditions can also make dietary supplements inappropriate or risky for use. Physical activity**:** BF women who engaged in

intense physical activity may have higher nutritional demands due to the increased energy expenditure from both exercise and lactation.

According to **Table 3**, many BF women held positive perceptions of dietary supplements. However, to prevent potential health risks for both mothers and their infants, it is crucial for healthcare professionals to provide adequate education, and guidance on safe and effective use of dietary supplements.

The authors acknowledge some limitations of this study, as the potential memory bias, the lack of available research on dietary supplement use among BF women in Algeria, and the MENA (Middle East and North Africa) region for comparison, and the limited geographic scope, as the study was confined to the city of Sidi-Bel-Abbès. Nevertheless, this study provided an initial quantitative and qualitative exploration of dietary supplement use among BF women, which could serve as a foundation for larger-scale studies in the future.

Conclusion

This study, conducted in the city of Sidi-Bel-Abbès reveals that nearly half of BF women take dietary supplements. Undoubtedly, adequate micronutrient supplementation is essential for the health of both mother and child, especially during the BF period. Thus, accurate and reliable data collection can help improve quality of nutrition and health information and education for BF women, ultimately contributing to better maternal and child health outcomes.

Conflict of interests

The authors declare no conflict of interests.

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