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The Effect of Education on the Knowledge, Attitude, and Practice of Breastfeeding Mothers towards Heavy Metals Transferred from Breast Milk

Ameneh Marzban; PhD[1], Fariba Ramezani-Siakhulak; MSc[2], Vahid Rahmanian; PhD[*3], Maryam Dolatabadi; PhD[4], Abozar Ansari; MSc[5] & Mohammad Afkhami Aghda; PhD[6]

[1] Department of Health in Disasters and Emergencies, School of Health Management and Information Sciences, Iran University of Medical Sciences, Tehran, Iran, [2] Department of Epidemiology, Health Promotion Research Center, Zahedan University of Medical Sciences, Zahedan. Iran; [3] Research Center for Social Determinants of Health, Jahrom University of Medical Sciences, Jahrom, Iran; [4] Environmental Science and Technology Research Center, Department of Environmental Health Engineering, School of Public Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran; [5] Department of Human Ecology, School of Public Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran; [6] Student Research Committee, School of Public Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.

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Corresponding author:
vahid.rahmani1392@gmail.com
Research Center for Social Determinants of Health, Jahrom University of Medical Sciences, Jahrom, Iran.

Postal code:74148-46199
Tel: +98 *9175985204*

ABSTRACT

Background: Since breast milk is one of the ways of transferring toxic elements from the body, breast milk infection in any form can have adverse effects on the development of the baby. This study aims to investigate the effect of education on knowledge, attitude, and practice of breastfeeding mothers about heavy metals transferred by breast milk. **Method**: In this interventional study, 100 women referring to Abarkooh health centers were selected and randomly divided into case (n = 50) and control (n = 50) groups. The data collection tool was a questionnaire consisting of four parts, including background questions and knowledge, attitude, and practice. Then, eight two-hour classes were held weekly during two months by food health and safety expert in coordination with the test group. At the end of two months after the last training session, the questionnaires were repeated between the two groups (post-test). **Results:** The mean score of knowledge, attitude, and practice of the mothers in the intervention group after training significantly increased ($P < 0.05$), while in the control group no significant difference was observed in the variables before and after the intervention. There was a significant difference between mean of knowledge, attitude, and practice in mothers with demographic variables only between knowledge and education level ($P < 0.001$). **Conclusion:** The results showed that breastfeeding training program had a positive effect on promoting the knowledge, attitude, and behavior of the mothers. Therefore, it seems that continuous and varied educational programs are required to prevent the occurrence of heavy metal poisoning caused by breast milk and its consequences in infants.

Keywords: *Knowledge; Attitude; Practice; Breastfeeding; Heavy metals.*

Introduction

Elements whose specific gravity is more than five times the specific gravity of water are called heavy metals. There are at least 20 heavy metals, the four most important of which include lead, cadmium, mercury, and arsenic (Al-Saleh *et al.*, 2003, Rehman *et al.*, 2018). Heavy metals are stable elements and the body cannot break them down and therefore accumulate in living tissue

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(Harnagle and Chawla, 2013). Heavy metals enter the human body in different ways, such as sewage, materials used in dentistry, cosmetics, perfumes, tobacco, factory waste, garbage, dust, etc. (Qin *et al.*, 2020). Food contamination with heavy metals is not only caused by human activity, but may also enter the food cycle naturally. Although water pollution with heavy metals is secondary, it can be considered as an important way of contaminating food of animal origin (Rai *et al.*, 2019).

Breast milk is the first food for the baby and meets all the needs of the baby, especially the provision of all essential trace elements as well as related proteins, enzymes, and other organic compounds. This milk provides numerous health benefits for mother and baby and is an ideal food, which gives the baby all the materials needed for growth and development. The substances in breast milk protect the infant against infectious diseases, increase IQ and emotional and psychological growth of the infant (Samiee *et al.*, 2019).

Many chemicals can be transferred from the body's stores and from the blood to breast milk. Since breast milk is one of the ways of transferring toxic elements from the body, contamination of breast milk in any form can have harmful effects on the growth of the baby. Heavy metals can contaminate breast milk first and then endanger the baby's health (Ekeanyanwu *et al.*, 2020).

Breast milk has all the ingredients needed by the infant in the right amount and along with the safety ingredients and is known as a unique food for feeding infants (Habib *et al.*, 2019). Observing hygiene and proper nutrition during breastfeeding and adequate awareness of the importance of the issue depend on the correct health attitude, and attitude is the driving force behind the proper functioning of individuals. Breastfeeding health education for mothers is the first and most effective step in achieving this goal (Hegazi *et al.*, 2019).

Because fetuses and infants are evolving and undergoing rapid changes in the structure and function of large organs, they are at greater risk for the toxic effects of chemicals (Gangwal *et al.*, 2020).The results of previous studies showed that the concentrations of lead and cadmium in breast milk are higher than the standard limits. Women are less aware of this issue and do not know the methods of transferring heavy metals to humans and ways to prevent and control it (Marzban A *et al.*, 2017, Palmieri *et al.*, 2019).

Education is one of the effective ways to increase awareness and create the right attitude. Therefore, this study aims to investigate the effect of education on knowledge, attitude, and practice of women referring to health centers in Abarkooh city towards heavy metals transferred from breast milk.

Materials and Methods

Design and participants: This research is an experimental intervention study conducted among women referring to health centers in Abarkooh city in Yazd province in 2020. The number of samples was estimated to be $Z1\text{-}\alpha / 2 = 1.96$, $Z1\text{-}\beta = 1.28$, $\sigma=16.66$, and $d = 12$ and using the following formula, 50 people in each group were estimated.

$$n=2(Z_1-\alpha^2+Z1-\beta)2\sigma^2/d^2$$

For sampling, first, two centers were randomly selected from 5 health centers of Abarkooh city, of which 50 people from the intervention group and the other control group were randomly entered into the study.

The inclusion criteria were breastfeeding women with infants under two years of age who did not have a specific disease. They referred to health care. In order to prevent the transfer of information from the control group to the control, the intervention group was selected from people who were not in the neighborhood and kinship of the control group.

Educational materials for breastfeeding mothers are mostly in the field of nutritional status and dishes used in cooking that contain heavy metals. Moreover, these educational programs include people's lifestyle in using perfumes, cosmetics, dental services (especially filling teeth during pregnancy), using insecticides and pesticides containing heavy metals that can be reduced under individual control.

Measurements: Data were collected through a

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questionnaire used in a similar study (Marzban A *et al.*, 2017) and its validity was confirmed by professors and relevant experts and its reliability was confirmed by Cronbach's alpha test above 0.7. Cronbach's alpha values for knowledge, attitude, and practice questions were 0.9, 0.81, and 0.75, respectively. First, the questionnaires were completed by both experimental and control groups. Then, two two-hour classes were held by the food health and safety expert with prior coordination for the experimental group. At the end of two months after the last training session, the questionnaires were distributed and completed again between the two groups.

The questionnaire consisted of four sections. Demographic information included age, education, residence status, income adequacy, number of children, employment status, source of information, and lactation. Awareness questions were 17 multiple choice questions that were assigned score 1 to the correct answer of and zero to the incorrect answer with the score range of 0-17 for each person. The attitude questions were 10 questions in the form of 5-point Likert scale from 'I completely agree' to 'strongly disagree', scored from one to five, and each person scored in the range of 10-50. Ten practice questions were in the form of 5-point Likert scale from 'always' to 'never' and each person scored in the range of 10-50.

Ethical considerations: It is worth mentioning that this article is the result of research project 6162 of the Student Research Committee of Shahid Sadoughi University of Medical Sciences, Yazd, which has an ethics code approved by the University Ethics Committee IR.SSU.REC.1398.053.

Data analysis: The data were coded using SPSS24 software and analyzed by descriptive statistics, Chi Square, and Paired t-test, Independent t-test and ANOVA.

Results

The mean age of the women in the two groups (Intervention and control) was 22.67 ± 3.79 year. The majority of the mothers in the two groups were in the age group of 20-30 years (Intervention 42% and control 44%), 74% of mothers in Intervention group and 70 control group had a private home, 40% in the intervention group and 50% in the control group were in the second 6 months of breastfeeding. Education level of 40% of mothers in two groups was high school and diploma. 70% of the mothers in the intervention group and 66% in the control group were housewives. The income of 54% of them in two groups provided some of their livelihood and 50% of mothers in both groups had 2 children. The results showed that the two groups were homogeneous in terms of demographic variables (**Table 1**).

There was no significant difference in the mean of knowledge, attitude and practice of the studied women between the intervention and control groups before the intervention. While after the intervention, there was a statistically significant difference in the mean score of knowledge, attitude and practice between groups (**Table 2**).

There was a significant difference between the mean of knowledge in mothers in terms of education level ($P < 0.001$, **Table 3**).

The result shows that the most important sources of information for breastfeeding mothers in the two groups who referred to health centers about successful breastfeeding were friends and family, and later books and magazines.

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Table 1. Frequency distribution of demographic variables in the studied mothers.

Variables	Intervention group (n=50)	Control group (n=50)	P-value[a]
Age (year)			
<20	13 (26)[b]	12 (24)	0.15
20-30	21 (42)	22 (44)	
30-40	14 (28)	14 (28)	
40 <	2 (4)	2 (4)	
Residence			
Rented house	13 (26)	15 (30)	0.13
Personal house	37 (74)	35 (70)	
Period of Breastfeeding			
The first 6 months	12 (24)	13 (26)	0.20
The second 6 months	20 (40)	25 (50)	
More than a year	18 (36)	12 (24)	
Level of Education			
Illiterate	7 (14)	6 (12)	0.18
Elementary school	6 (12)	7 (14)	
Junior high school	6 (12)	6 (12)	
High school and diploma	20 (40)	20 (40)	
Associate degree	3 (6)	4 (8)	
Bachelor	4 (8)	2 (4)	
Master's degree and higher	4 (8)	5 (10)	
Employment status			
Employed	15 (30)	17 (34)	0.22
Housewife	35 (70)	33 (66)	
Sufficient income			
Yes	11 (22)	10 (20)	0.17
Somewhat	27 (54)	27 (54)	
No	12 (24)	13 (26)	
Number of children			
1	7 (14)	10 (20)	0.20
2	25 (50)	25 (50)	
3	10 (20)	7 (14)	
4 <	8 (16)	8 (16)	

[a]: Chi Square test; [b]: n (%)

Table 2. Mean (±SD) of the studied variables in the intervention and control groups before and after the intervention.

Variables	Intervention group (n = 50)	Control group (n = 50)	P-value[b]
Knowledge			
Before	10.14 ± 3.15	10.11 ± 3.80	0.98
After	15.25 ± 3.77	10.02 ± 3.72	0.01
P-value[a]	0.01	0.89	
Attitude			
Before	23.54 ± 9.64	22.91 ± 9.87	0.62
After	45.74 ± 9.91	22.02 ± 9.20	< 0.001
P-value	< 0.001	0.55	
Practice			
Before	21.47 ± 9.31	20.61 ± 9.04	0.69
After	47.10 ± 9.30	20.60 ± 9.31	< 0.001
P-value	< 0.001	0.65	

[a]: Paired t-test; [b]: Independent t-test

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Table 3. Mean (±SD) of knowledge, attitude, and practice of breastfeeding mothers in terms of demographic variables

Variables	Knowledge	Attitude	Practice
Age (year)			
<20	10.25 ± 3.05	22.65 ± 9.51	20.61 ± 9.45
20-30	10.58 ± 3.14	23.01 ± 9.87	20.11 ± 9.84
30-40	9.69 ± 3.87	22.35 ± 9.09	21.03 ± 8.89
40 <	9.98 ± 3.91	21.74 ± 9.36	21.64 ± 9.36
P-value[a]	0.32	0.65	0.24
Residence			
Rented house	21.65 ± 3.65	22.35 ± 9.64	21.32 ± 9.64
Personal house	21.03 ± 3.14	21.98 ± 9.25	22.61 ± 9.37
P-value[b]	0.09	0.97	0.87
Period of Breastfeeding			
The first 6 months	9.98 ± 3.64	22.36 ± 9.07	21.54 ± 8.99
The second 6 months	10.68 ± 3.11	21.14 ± 9.12	22.34 ± 8.74
More than a year	10.74 ± 3.18	22.08 ± 9.14	21.68 ± 8.35
P-value	0.61	0.13	0.64
Level of education			
Illiterate	3.34 ± 3.34	21.36 ± 9.25	22.67 ± 9.98
Elementary school	8.14 ± 3.19	22.97 ± 9.37	21.68 ± 9.35
Junior high school	7.98 ± 3.06	21.47 ± 8.14	22.98 ± 9.64
High school and diploma	8.69 ± 3.11	22.37 ± 9.11	21.39 ± 9.37
Associate degree	9.14 ± 3.34	20.94 ± 9.89	22.67 ± 8.79
Bachelor	10.36 ± 4.01	21.54 ± 9.47	21.46 ± 9.36
Master's degree and higher	15.97 ± 3.69	22.67 ± 9.98	21.58 ± 9.97
P-value	0.00	0.37	0.49
Employment status			
Employed	10.67 ± 3.15	21.35 ± 9.35	22.34 ± 8.88
Housewife	9.99 ± 3.17	22.60 ± 9.64	21.07 ± 9.09
P-value	0.67	0.64	0.37
Sufficient income			
Yes	10.36 ± 3.15	21.35 ± 9.35	22.34 ± 8.88
Somewhat	9.99 ± 3.17	22.60 ± 9.64	21.07 ± 9.09
No	10.98 ± 3.64	21.07 ± 9.14	21.97 ± 8.11
P-value	0.15	0.97	0.09
Number of children			
1	10.35 ± 3.96	21.67 ± 8.91	22.36 ± 9.97
2	10.87 ± 3.67	21.25 ± 8.35	21.87 ± 9.84
3	10.98 ± 4.01	22.67 ± 8.11	22.98 ± 8.87
4 <	10.68 ± 3.36	21.32 ± 9.54	21.54 ± 9.98
P-value	0.11	0.32	0.36

[a]: ANOVA test; [b]: Independent t-test

Discussion

Breast milk is the first food for the baby and meets all the needs of the baby, especially the provision of all essential trace elements as well as related proteins, enzymes, and other organic compounds that protect the infant against infectious diseases, and increase IQ and growth. It has emotional and psychological effects (Sinkiewicz-Darol *et al.*, 2021). This study aims to investigate the effect of education on knowledge, attitude, and practice of breastfeeding women in Abarkooh city in the field of heavy metals transferred from breast milk.

The mean score of knowledge of women in the field of heavy metals transferred from breast milk in the experimental and control groups was 15.25

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± 3.77 and 10.02 ± 3.72, respectively, from the range of 0 to 17. It indicates that the level of knowledge of women is in a good position, although they are far from ideal. This finding is consistent with the results of the study of Sartorio (Sartorio *et al.*, 2017) and Hassan (Hassan *et al.*, 2018) but is not in line with the results of the study of Mosaffa (Mosaffa, 2004) and Ghaffari (Ghaffari *et al.*, 2012). In Marzban's study (Marzban A *et al.*, 2017) which was conducted under the title of knowledge, attitude, and practice of breastfeeding women in Yazd in the field of heavy metals transferred from breast milk, the results showed that the level of awareness of breastfeeding women was moderate. Epidemiological studies have shown that heavy metal contamination during pregnancy and lactation causes intrauterine growth retardation, birth weight loss, and developmental delay in children (Neves *et al.*, 2021, Saha *et al.*, 2019). According to the studies, there is a possibility of sewage, effluent, and toxic chemicals entering the environment, which can cause the accumulation of various pollutants in adjacent soils, surface and groundwater, plant leaf area, food chain, and etc. They eventually enter the human body and may enter breast milk during breastfeeding (Samiee *et al.*, 2019). There is a correlation between the level of heavy metals in the mother's blood and the possibility of their transmission through the umbilical cord and breast milk to the fetus and a relationship with factors, such as smoking or smoking exposure, history of anemia, maternal age, maternal weight, maternal occupation, maternal nutrition (consumption of fish, liver, iron tablets, and vitamin supplements), and type of dishes used in cooking. Therefore, it is necessary to give the necessary information to pregnant mothers and women of childbearing age, as well as information on dental affairs and the number of teeth filled during pregnancy and after pregnancy, which can cause the transfer of heavy metals into breast milk.

The mean score of attitude of women in the field of heavy metals transferred from breast milk in the experimental and control groups was 45.74 ± 9.91 and 22.02 ± 9.20 from the range of 10 to 50, respectively, indicating that the attitude level of women is in a good position, which was consistent with the results of the study of Dukuzumuremyi (Dukuzumuremyi *et al.*, 2020) and Zakria (Zakria *et al.*, 2020). In the study by Marzban (Marzban A *et al.*, 2017), women did not have a good attitude towards heavy metals transferred from breast milk and the mean attitude score in working breastfeeding women was higher than breastfeeding housewives. The good level of attitude of women depends on the fact that they have information and knowledge in the field of heavy metals transferred from breast milk and their beliefs in this field are well formed.

The mean practice scores of the women in the intervention and control groups were 47.10 ± 9.30 and 20.60 ± 9.31, respectively, from the range of 10 to 50. It indicates that the practice of women was moderate, which is better compared to other studies (Chand *et al.*, 2020, Manchegowda and Hulugappa, 2018, Sunanda *et al.*, 2017). In the study by Marzban (Marzban A *et al.*, 2017), the practice was not at a good level and the mean score of practice in breastfeeding women aged less than 30 years was higher than women over the age of 30 years. It seems that women benefit from their information and awareness in this regard, requiring the necessary sensitivity and encouragement to perform better to maintain the health of themselves and their children.

The mean of knowledge, attitude, and practice of women were not significantly different between the intervention and control groups before the intervention, indicating the observance of study conditions and non-intervention of confounding variables.

There was a significant difference between the mean and standard deviation of the variables of knowledge, attitude, and practice of the studied women between the intervention and control groups after the intervention in knowledge, attitude, and practice, which indicates that women may become sensitive after the pre-test. They have obtained information on heavy metals transferred from breast milk.

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There was a significant difference between the mean of knowledge, attitude and practice in women with demographic variables, only between knowledge and education level ($P < 0.001$). This finding was not consistent with the results of Marzban's study (Marzban A *et al.*, 2017). Women with higher education level had higher knowledge and health literacy regarding heavy metals derived from breast milk.

One of the executive problems of this study was the refusal of some breastfeeding women to participate in the study and the lack of honest cooperation, which was solved by providing explanations and objectives of the project.

Conclusion

The results showed that the training program in the field of heavy metals transferred from breast milk had a positive effect on improving the knowledge, attitude, and behavior of women under study. Therefore, it seems that to prevent the occurrence of this type of poisoning and its effects on infants and children, it is necessary to explain and implement various and continuous educational programs. In this regard, it is suggested to hold workshops on heavy metals and ways of transferring it from breast milk during the year to increase the awareness of pregnant and breastfeeding women and perform proper hygienic behaviors.

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Authors' contributions

Marzban A and Afkhami-aghda M designed the research. Dolatabadi M, Ramezani F, and Ansari A collected the data. Marzban A and Ansari A conducted statistical analysis. Rahmanian V and Dolatabadi M wrote the manuscript. Marzban A had primary responsibility for final content. All authors read and approved the final manuscript.

Conflict of interest

The authors declare that there is no conflict of interest.

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