

Rheumatoid Arthritis and Breast-feeding in Korea: The Fifth Korea National Health and Nutrition Examination Survey (2010-2012)

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Abstract

Female hormonal and reproductive factors such as breast-feeding, oral contraception and early life factors are reported to be implicated in the risk of rheumatoid arthritis. In order to assess the association of rheumatoid arthritis and breast-feeding, we analyzed the data from 4,584 women of aged 40–64 with using the 5th KNHANES. As results, breast-feeding duration (>24M) was significantly associated with preventing the rheumatoid arthritis and was also observed the trend of longer breast-feeding duration and lowering rheumatoid arthritis. BMI (<18.5) was also the contributing factor on increasing the risk of rheumatoid arthritis, while age at menarche, education level, smoking and use of oral contraceptives were not related with the risk of rheumatoid arthritis. It might be important to recommend the proper breast-feeding duration policy and further research on the factors of the biological mechanism to prevent the rheumatoid arthritis onset and developing burden in the future.

Keywords: Age, BMI, Duration of Breast-Feeding, Oral Contraceptives, Rheumatoid Arthritis

1. Introduction

Even though the relations between female hormonal and reproductive factors and the rheumatoid arthritis (RA) which is the most common autoimmune inflammatory joint disease, have been reported lately, but the etiology is not known well^{1–3}. In view on the increasing, Rheumatoid arthritis is also caused with morbidity and disability.

Especially the previous studies on the relationships between breast-feeding and the rheumatoid arthritis are on issue^{1,4,5}. Rheumatoid arthritis is three to four times higher in women compared to men in Korea and so the hormonal factors may be supposed to be contributing role in that etiology. Despite lots of benefits as well as lowering the mortality rate of rheumatoid arthritis⁶, the rates of exclusive breast-feeding is constantly decreasing from 31.7% (2007-2009) to 26.9% (2010-2012) and they were dramatically decreasing to 50.0%, 40.5%, and 11.4% at 3, 4, and 6 months⁷.

According to some studies, oral contraceptive (OC) use was reported on preventing rheumatoid arthritis⁴ but was also reported on not preventing rheumatoid arthritis².

On the other hand, rheumatoid arthritis is a chronically inflammatory disease reporting on the interaction by genetic and environmental factors such as smoking, ultraviolet, climatic difference and life-style factors⁸.

In view on the increasing importance of the hormonal factors such as breast-feeding and the menopause in addition to the environmental factors in many advanced countries, it is very rare to study for the association of rheumatoid arthritis and breast-feeding duration in Korea. Also no study was reported on the rheumatoid arthritis and breast-feeding from nationwide, population-based data in Korea to our knowledge.

Therefore this study was performed to identify the associations between breast-feeding duration, including age at menarche and exposure to oral contraceptives

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and the rheumatoid arthritis developing in middle aged women. Also we aim to obtain a representative result using the Korea National Health and Nutrition Examination Survey data.

2. Methodology

2.1 The Data Source

We used the available data selected from the 5th Korea National Health and Nutrition Examination Survey (2010-2012).

Since 1998, the Korea National Health and Nutrition Examination Survey (KNHANES) have been initiated in the public health level on health and health related behaviors, in addition to the food and nutrition data as a nationally representative data⁹. Also this survey was a cross-sectional one with stratified random sampling⁹. So we analyzed the data for the complex sampling method. Because complex sampling data was designed from the Korea National Health and Nutrition Examination Survey, if they will be used by applying a weight to analyze the parameters it has the advantage that can be generalized¹⁰. Raw data were used to the procedure of provided guidance published on the website¹¹.

2.2 Selection Process of the Subject

Considering the incidence of breast-feeding duration and the age with rheumatoid arthritis, the study population was 40 years of age or older. And older people over 65, due to the high potential probability that this disease was caused by aging and other factors were excluded. Also the missing values for each variable were excluded (Figure 1).

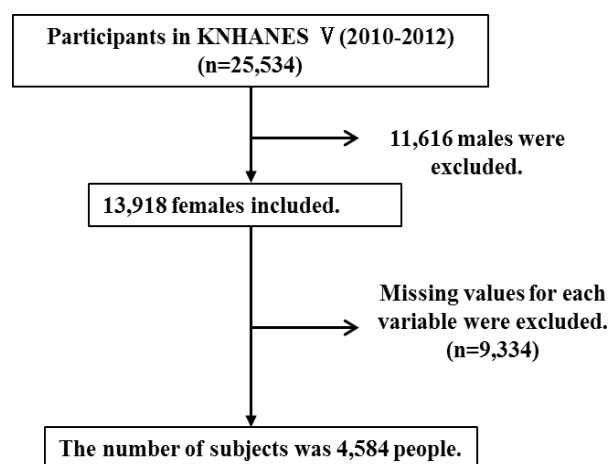


Figure 1. Study Flow Diagram

And the rheumatoid arthritis was defined with physician-diagnosed one.

2.3 Confounding Factors

With reference to previous studies, age, smoking, educational level, age at menarche, exposure to oral contraceptives and Body Mass Index (BMI) were considered as potential confounding factors^{4,6,7}.

2.4 Outcome Measures and Statistical Analysis

Baseline characteristics of the groups were compared by using the chi-square test and used data from 4,584 women aged 40-64 (demographic characteristics, weighted frequency and percentages). Logistic regression was used to assess the association of breast-feeding and the rheumatoid arthritis by using SPSS (ver. 21.0). A probability (P) value of less than 0.05 was regarded as significant level.

3. Results

3.1 General Characteristics of the Subjects

Data were available for 4,584 women as the mean age of 50.7. The mean duration of breast-feeding was 26.5 months. 'Did not breastfeed at all (never-breastfeeding)', or if it is 'less than 1 month' was 21.3% and if females have 'more than 24 months of breastfeeding' was 27.7%. People who are physician-diagnosed of the rheumatoid arthritis from study subjects were 2.8% (Table 1).

3.2 Characteristics of the Subjects, according to whether or not Rheumatoid Arthritis

We used a total of 2.8% of the subjects (136 women) as physician-diagnosed one of rheumatoid arthritis. Among women diagnosed of rheumatoid arthritis, the one of 50-64 age groups (3.8%) was more common than that of 40-49 age groups (1.6%) (Table 2).

3.3 Rheumatoid Arthritis and Breast-feeding

Risk analysis of rheumatoid arthritis according to duration of breastfeeding is the same as Table 3. Controlling for confounding factors was considered. As the risk analysis results, breast-feeding duration of more than 24 months compared to those of never breast-fed was the

Table 1. Summary of weighted frequency analysis of characteristics

Variables	Categories	Frequency	Weighted Frequency (%)
Age (y)	40-49y	1,757	3,920,844 (46.6)
	50-64y	2,827	4,495,191 (53.4)
	No or <1m	918	1,791,519 (21.3)
	≤3m	311	42,552 (7.3)
Duration of breast-feeding (m)	3m < ≤6m	231	33,800 (5.2)
	6m < ≤12m	567	51,523 (12.0)
	12m < ≤24m	1,202	82,815 (26.6)
	>24m	1,355	87,110 (27.7)
Smoking	Never smoker	4,242	7,655,348 (91.0)
	Ex-smoker	176	380,258 (4.5)
	Current smoker	166	380,429 (4.5)
Education level	≥ University	2,019	3,590,022 (42.7)
	High School	1,674	3,238,604 (38.5)
	≤Middle School	891	1,587,409 (18.9)
	≤12y	312	565,285 (6.7)
Age at menarche (y)	>12y	4,272	7,850,750 (93.3)
	No or <1m	730	1,289,959 (15.3)
Exposure to oral contraceptives	Yes	3,854	7,126,076 (84.7)
	18.5 ≤ <25	2,960	5,411,612 (64.3)
Body mass index(BMI)(kg/m ²)	<18.5	109	196,641 (2.3)
	≥25	1,515	2,807,783 (33.4)
	No	444,8	8,181,721 (97.2)
Rheumatoid arthritis	Yes	136	234,314 (2.8)
Total		4,584	8,416,035(100.0)

Table 2. Characteristics of the subject, according to whether or not rheumatoid arthritis

Variables	Categories	Frequency of RA (n=4,584)		Weighted Frequency of RA (n=8,416,035), (%)		Rao-Scott χ^2 (p-value)
		No	Yes	No	Yes	
Age (y)	40-49y	1,729	28	3,859,513(98.4)	61,331(1.6)	13.494 (0.000)
	50-64y	2,719	108	4,322,208(96.2)	172,983(3.8)	
Duration of breast-feeding (m)	No or <1m	892	26	1,745,434(97.4)	46,085(2.6)	8.860 (0.115)
	≤3m	305	6	597,827(97.7)	14,265(2.3)	
	3m < ≤6m	226	5	431,754(98.8)	5,226(1.2)	
	6m < ≤12m	551	16	980,867(97.0)	30,792(3.0)	
	12m < ≤24m	1,176	26	2,190,156(98.0)	45,168(2.0)	
	>24m	1,298	57	2,235,684(96.0)	92,779(4.0)	
Smoking	Never smoker	4,114	128	7,433,032(97.1)	222,315(2.9)	3.300 (0.192)
	Ex-smoker	171	5	372,032(97.8)	8,227(2.2)	
	Current smoker	163	3	376,657(99.0)	3,772(1.0)	
Education level	≥ University	1,938	81	3,468,119(96.6)	112,732(3.4)	4.550 (0.103)
	High School	1,631	43	3,153,024(97.4)	85,580(2.6)	
	≤Middle School	879	12	1,560,578(98.3)	26,831(1.7)	
	≤12y	307	5	558,881(98.9)	6,404(1.1)	
Age at menarche (y)	>12y	4,141	131	7,622,839(97.1)	227,910(2.9)	1.175 (0.278)
	No or < 1m	702	28	1,244,306(96.5)	45,653(3.5)	
Exposure to oral contraceptives	Yes	3,746	108	6,937,415(97.4)	188,661(2.6)	3.373 (0.185)
	18.5 ≤ < w 25	2,867	93	5,243,506(96.9)	168,105(3.1)	
Body mass index (BMI) (kg/m ²)	<18.5	107	2	193,592(98.4)	3,049(1.6)	3.373 (0.185)
	≥25	1,474	41	2,744,622(97.8)	63,160(2.2)	
Total		4,448	136	8,181,721(97.2)	234,314(2.8)	(0.185)

a. RA: Rheumatoid Arthritis

Table 3. Analyze the risk factors of rheumatoid arthritis (included to past breast-feeding practice).

Variables	Categories	OR(95% CI) for RA ^a	p
Age (y)	40–49y	1.00(referent)	
	50–64y	0.41(0.23–0.73)	0.001
Duration of breast-feeding (m)	No or <1m	1.00(referent)	
	≤3m	0.95(0.50–1.82)	0.887
	3m < ≤6m	0.83 (0.29–2.36)	0.722
	6m < ≤12m	0.41(0.12–1.36)	0.146
	12m < ≤24m	0.91(0.43–1.95)	0.813
	>24m	0.55(0.31–0.97)	0.038
Smoking	Never smoker	1.00(referent)	
	Ex-smoker	3.12(0.94–10.37)	0.064
	Current smoker	2.79(0.61–12.80)	0.187
Education level	≥ University	1.00(referent)	
	High School	1.21(0.50–2.91)	0.673
	≤Middle School	1.41(0.65–3.06)	0.381
Age at menarche (y)	≤12y	1.00(referent)	
	>12y	0.53(0.19–1.50)	0.231
Exposure to oral contraceptives	No or < 1m	1.00(referent)	
	Yes	0.20(0.69–2.10)	0.521
Body mass index (BMI) (kg/m ²)	18.5 ≤ < 25	1.00(referent)	
	<18.5	1.54(1.01–2.35)	0.045
	≥25	0.85(0.19–3.81)	0.828

a. RA: Rheumatoid Arthritis

significantly decreasing factor on the risk of rheumatoid arthritis ($p = 0.038$; odds ratio: 0.55; 95% CI: 0.31–0.97).

3.4 Other Risk Factors of Rheumatoid Arthritis

The risk of rheumatoid arthritis was lower in 50–64 age group ($p = 0.001$; odds ratio, 0.41; 95% CI, 0.23–0.73) than that of 40–49 age group. And BMI (<18.5) was associated as an increasing factor on the risk of rheumatoid arthritis ($p = 0.045$; odds ratio: 1.54; 95% CI: 1.01–2.35). But oral contraceptive use was not related with rheumatoid arthritis (Table 3).

4. Discussion

Through our study, we examined that breast-feeding duration (especially >24 M) was significantly associated with the lowering risk of rheumatoid arthritis in Korean middle aged women (40–64 age groups) after adjustment for lots of confounding factors including oral contraceptives etc. Our study was performed on the basis of general population for representative result using the Korea National Health and Nutrition Examination Survey (KNHANES) data.

According to Chinese study released in 2014 which was implemented with 7,349 women (≥ 50 years), breast-feeding (≥ 36 M) was the influencing factor for lowering rheumatoid arthritis¹, and it was similar to our result on breast-feeding as the protective role against rheumatoid arthritis.

In the study of 121,700 women cohort of the US, breast-feeding (≥ 12 M) was also inversely connected with the developing of rheumatoid arthritis².

By the study of 25,455 EPIC (European Prospective Investigation of Cancer) participants, breast-feeding (≥ 52 weeks) was inversely related with the risk of rheumatoid arthritis developing¹².

These results were also confirmed with our results on the protective effect of longer duration of 24 months of breast-feeding.

But in Korea, average breast-feeding rate of 6 months (2007–2012) was 25%, and it was very low compared to that of the Hungary (breast-feeding rate: 95%)¹³.

Therefore, breast-feeding which was identifying as the protective role against rheumatoid arthritis should be considered and encouraged as preventing strategy. And also breast-feeding may need to be supported by midwives including nurses, pediatricians and many other health professionals as the substitution in view of decreasing

state of breast-feeding. They should have more opportunities for getting information on breast-feeding benefits, as well as on the recommendation of more than two years of breast-feeding by WHO (World Health Organization).

But oral contraceptive use was not associated with the risk of rheumatoid arthritis in our result, and it was also the same one of the late Chinese study¹. Oral contraception was known as protective effect of rheumatoid arthritis cause of prolactin and estrogen against rheumatoid arthritis⁴, but it had a difference with our result which had no association with rheumatoid arthritis¹².

While BMI (<18.5) was the influencing factor on the developing risk of rheumatoid arthritis in our results, and it showed difference with the one of the European study which BMI (≥ 30) was associated with developing rheumatoid arthritis¹². And it was thought to be due to the races and environmental factors difference such as diet and exercise.

As the another environmental risk factor, smoking was also contributing one about 25% on the burden of rheumatoid arthritis according to the case-control and cohort studies and systemic reviews (1948-2011) of UK¹⁴. But smoking was known and reported as a strong factor to increase the rheumatoid arthritis even if it was not significant (Ex-smoker: $p = 0.064$; Current smoker: $p = 0.187$) in our study. It is supposed to be cause of the small proportion of smokers among the rheumatoid arthritis subjects. But smoking was the contributing factor of the rheumatoid arthritis in some studies and was already identified as the most common association factor of the other disease such as cardiovascular diseases as well as cancer through the epidemiological studies. Unfortunately, breast-feeding rate is currently decreasing and smoking rate is getting more increasing in adolescents including adults in Korea.

These results reflect that the importance of modifiable factors like smoking and body weight might be reconsidered and should be included in public health programs to control the rheumatoid arthritis as well as preventing other diseases.

In the aspects of education level, though it was thought to be an unmeasured lifestyle factor, the risk of the rheumatoid arthritis showed more in low educational level group though it was not significant.

As another factor, age at menarche, the risk of the rheumatoid arthritis of the less than 12 years old group was more increasing than that of the over 12 years old group and had no significance.

The limitation of our study was that we may have a possibility of missing on defining probable cases of rheumatoid arthritis in addition to physician diagnosed one due to personal difference on diagnosis criteria.

But in the view of the strength, our study will be the turning point as the valuable one in the situation of decreasing state of breastfeeding-duration which may have the important role against rheumatoid arthritis as well as preventing other disease in both mothers and babies and especially preferring and increasing the formula feeding of younger generation in Korea. Also we included lifestyle factors as modifiable one, such as using of oral contraceptives, breastfeeding and smoking.

In Poland, material awareness on natural feeding was very diverse and they reported it should be encouraged by midwives, pediatric doctors and health professionals¹⁵. So we think it is required to consider to survey about the concept and useful materials of the midwives on breastfeeding in Korea and Asian countries in advance even though the breast-feeding rate of Asian countries is higher than that of the European one until now.

In summary, breast-feeding duration (24M<) was significantly associated with lowering rheumatoid arthritis, and it was confirmed through our study including the late studies and it has to be considered as the very important strategy to prevent rheumatoid arthritis. So we recommend further studies on the links between breast-feeding and rheumatoid arthritis in other settings and exploring other risk factors or protecting factors to prevent it on the large community people in Korea.

5. Conclusions

Over 24 months of Breast-feeding was closely associated with lowering the rheumatoid arthritis in middle aged women of Korea. But low body weight was an increasing factor of the rheumatoid arthritis. Therefore, focusing on the healthy lifestyle like breast-feeding and body weight control may be the cost-effective policy and strategy to prevent the rheumatoid arthritis. Further research on proper breast-feeding duration to prevent the rheumatoid arthritis should be continued for the future.

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and Prevention (KCDC) and Institutional Review Board (IRB) numbers of research ethics committee were the first year '2010-02CON-21-C', second year '2011-02CON-06-C' and third year '2012-01EXP-01-2C'¹².

7. References

1. Adab P, Jiang CQ, Rankin E, Tsang YW, Lam TH, Barlow J, Thomas GN, Zhang WS, Cheng KK. Breastfeeding practice, oral contraceptive use and risk of rheumatoid arthritis among Chinese women: The Guangzhou bio bank cohort study. *Rheumatology*. 2014; 53(5):860–6.
2. Karlson EW, Mandl LA, Hankinson SE, Grodstein F. Do breast-feeding and other reproductive factors influence future risk of rheumatoid arthritis? Results from the nurses' health study. *Arthritis and Rheumatism*. 2004; 50(11):3458–67.
3. Liao KP, Alfredsson L, Karlson EW. Environmental influences on risk for rheumatoid arthritis, Current Opinion in Rheumatology. 2009; 21(3):279–83.
4. Jorgensen C, Picot MC, Bologna C, Sany J. Oral contraception, parity, breast feeding, and severity of rheumatoid arthritis. *Annals of the Rheumatic Disease*. 1996; 55(2):94–98.
5. Simard JF, Costenbader KH, Hernan MA, Liang MH, Mittleman MA, Karlson EW. Early life factors and adult-onset rheumatoid arthritis. *The Journal of Rheumatology*. 2010; 37(1):32–7.
6. Rea MF. Benefits of breastfeeding and women's health. *Journal de Pediatria (Rio J)*. 2004; 80(suppl. 5):S142–146.
7. Chung SH, Kim HR, Choi YS, Bae CW. Trends of breast-feeding rate in Korea (1994-2012): comparison with OECD and other countries. *J Kor Med Sci*. 2013; 28:1573–80.
8. Colebatch AN, Edwards CJ. The influence of early life factors on the risk of developing rheumatoid arthritis. *Clin Exp Immunol*. 2011; 163(1):11–6.
9. Available from: <https://knhanes.cdc.go.kr/knhanes/index.do>
10. Kim HS, June KJ, Kim YM. Gender differences in factors affecting suicidal ideation among the Korean elderly. *Journal of the Korean Gerontological Society*. 2013; 33(2):349–63.
11. Available from: https://knhanes.cdc.go.kr/knhanes/sub03/sub03_02_02.do
12. Lahiri M, Luben RN, Morgan C, Bunn DK, Marshall T, Lunt M, Verstappen SM, Symmons DP, Khaw KT, Wareham N, Bruce IN. Using lifestyle factors to identify individuals at higher risk of inflammatory polyarthritis (results from the European Prospective Investigation of Cancer-Norfolk and the Norfolk Arthritis Register-the EPIC-2-NOAR Study). *Ann Rheum Dis*. 2014; 73:219–26.
13. Lee WS, Cho J, Choi YS, Chung SH, Bae CW, Jung JA. Breastfeeding rate in below 6 months infants during recent 6-year in Korea based on childcare database. *Neonatal Medicine*. 2013; 20(2):221–7.
14. Lahiri M, Morgan C, Symmons DP, Bruce IN. Modifiable risk factors for RA: prevention, better than cure? *Rheumatology*. 2012; 10(51):499–512.
15. Plagens-Rotman K, Kubiak S, Pieta B, Wszolek K, Iwanowicz-Palus G, Opala T. Maternal awareness on natural feeding. *Annals of Agricultural and Environmental Medicine*. 2014; 21(2):440–4.