**Supplementary material**

**Table S1.** The search strategy of dietary calcium intake and MS in PubMed

**Table S2.** Detailed list of the number of excluded full-text reviewed articles

**Table S3.** Quality assessment of included cross-sectional studies

**Table S4.** Characteristics of studies and participants included in the dose-response analysis of the association between calcium intake and risk of MS

**Fig S1.** The pooled effects between dietary calcium intake and risk of MS in influence analysis

**Fig S2.** The visual inspection of the funnel plot

**Table S1** The search strategy of dietary calcium intake and MS in PubMed

Step Search term (the number of articles)

#1 calcium AND metabolic syndrome（2115）

#2 calcium AND syndrome X（1052）

#3 calcium AND insulin resistant syndrome（435）

#4 #1 OR #2 OR #3(3067)

MS，metabolic syndrome

**Table S2** Detailed list of the number of excluded full-text reviewed articles

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Step | The number of articles before exclusion | Excluding reasons | The number of articles after exclusion | References number of excluded articles |
| 1 | 53 | No assessment of the relationship between dietary calcium intake and metabolic syndrome. (n=32) | 21 | ([1-32](file:///C:\Users\ASUS\Desktop\11.9\学生改%20Table%20S1%20Detailed%20list%20of%20the%20number%20of%20excluded%20full.docx#_ENREF_1)) |
| 2 | 21 | The outcome of interest was not metabolic syndrome. (n=3) | 18 | ([33-35](file:///C:\Users\ASUS\Desktop\11.9\学生改%20Table%20S1%20Detailed%20list%20of%20the%20number%20of%20excluded%20full.docx#_ENREF_33)) |
| 3 | 18 | Multilevel linear models or multivariable regression models were used in data analysis, and the results could not be converted into ORs with 95%CIs. (n=5) | 13 | ([36-40](file:///C:\Users\ASUS\Desktop\11.9\学生改%20Table%20S1%20Detailed%20list%20of%20the%20number%20of%20excluded%20full.docx#_ENREF_36)) |
| 4 | 13 | Duplicate data from same population (n=3) | 10 | ([41-43](file:///C:\Users\ASUS\Desktop\11.9\学生改%20Table%20S1%20Detailed%20list%20of%20the%20number%20of%20excluded%20full.docx#_ENREF_41)) |
| 5 | 10 | The calculation of OR is not the highest versus the lowest dietary intake of calcium (n=1) | 9 | ([44](file:///C:\Users\ASUS\Desktop\11.9\学生改%20Table%20S1%20Detailed%20list%20of%20the%20number%20of%20excluded%20full.docx#_ENREF_44)) |

1. Zemel MB, Stancliffe R. Dairy attenuation of oxidative and inflammatory stress in metabolic syndrome. Faseb Journal. 2010;24.

2. Velde SJT, Snijder MB, van Dijk AE, et al. Dairy intake from adolescence into adulthood is not associated with being overweight and metabolic syndrome in adulthood: the Amsterdam Growth and Health Longitudinal Study. Journal Of Human Nutrition And Dietetics. 2011;24(3):233-44.

3. van Meijl LE, Vrolix R, Mensink RP. Dairy product consumption and the metabolic syndrome. Nutrition research reviews. 2008;21(2):148-57.

4. Unal G, Akalin AS, Akbulut N. Importance of dairy products - in metabolic syndrome-cardiovascular disease, insulin resistance and diabetes, and hypertension (Part 2). Agro Food Industry Hi-Tech. 2008;19(1):32-4.

5. Troy LM, Jacques PF, Vasan RS, et al. Dairy intake not associated with metabolic syndrome but milk and yogurt intake is inversely associated with prevalence of hypertension in middle-aged adults. Faseb Journal. 2010;24.

6. Stancliffe RA, Thorpe T, Zemel MB. Dairy attentuates oxidative and inflammatory stress in metabolic syndrome. American Journal Of Clinical Nutrition. 2011;94(2):422-30.

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23. Beydoun MA, Wang Y. Dairy and related nutrient consumption among US adults and their association with obesity, central obesity and the metabolic syndrome. Faseb Journal. 2008;22.

24. Azadbakht L, Mirmiran P, Esmaillzadeh A, et al. Dairy consumption is inversely associated with the prevalence of the metabolic syndrome in Tehranian adults. The American journal of clinical nutrition. 2005;82(3):523-30.

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26. Kim MK, Kim G, Jang EH, et al. Altered calcium homeostasis is correlated with the presence of metabolic syndrome and diabetes in middle-aged and elderly Korean subjects: the Chungju Metabolic Disease Cohort study (CMC study). Atherosclerosis. 2010;212(2):674-81.

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43. Shin BR, Choi YK, Kim HN, et al. High dietary calcium intake and a lack of dairy consumption are associated with metabolic syndrome in obese males: the Korean National Health and Nutrition Examination Survey 2010 to 2012. Nutrition research (New York, NY). 2016;36(6):518-25.

44. Ghanei L, Ziaee A, Rostami P, et al. Association of serum 25-hydroxyvitamin d levels and vitamin D dietary intake with metabolic syndrome: a case control study. Journal of research in health sciences. 2015;15(1):32-6.

**Table S3** Quality assessment of included cross-sectional studies

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | First author year[ref.] | | | | | | | |  |
|  | Al-Daghri NM 2013[11] | Kim K 2012[12] | Liu S 2005[13] | Shin SK 2015[14] | Cho GJ 2009[15] | Pannu PK 2017[16] | Motamed S 2013[17] | Bruscato NM  2010 [18] | Kim MK  2017[29] |
| 1. Define the source of information (survey, record review); | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1. List inclusion and exclusion criteria for exposed and unexposed subjects (cases and controls) or refer to previous publications; | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1. Indicate time period used for identifying patients; | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1. Indicate whether or not subjects were consecutive if not population-based; | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 5. Evaluators of subjective components of study were not masked to other aspects of the status of the participants; | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1. Describe any assessments undertaken for quality assurance purposes (e.g., test/retest of primary outcome measurements); | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1. Explain any patient exclusions from analysis; | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1. Describe how confounding was assessed and/or controlled; | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 1. Explain how missing data were handled in the analysis; | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1. Summarize patient response rates and completeness of data collection; | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1. Clarify what follow-up, if any, was expected and the percentage of patients for which incomplete data or follow-up was obtained; | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Overall quality score | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |

The quality of studies was assessed by the Agency for Healthcare Research and Quality (ARHQ) methodology checklist.

1= “Yes”, 0=“No” or “Unclear”. The full score for the scale is 11 points.

**Table S4** Characteristics of studies and participants included in the dose-response analysis of the association between calcium intake and risk of MS

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Author (Year) | Study design | Gender | Dose  (mg/day) | *OR*(95%*CI*) | Cases | Controls | Adjustment for covariant |
| Pannu PK（2017） | C-S-S | both | 579  858  1233 | 1  0.92(0.63-1.33)  0.83(0.56-1.21) | 245  187  163 | 847  908  924 | Age, gender, country of birth, income, education, smoking, season, energy intake, physical activity level, body weight, alcohol, dietary fiber, Mg and 25-hydroxyvitamin D concentration. |
| Shin SK (2015) | C-S-S | men | 190.8  278.7  370.8  530.8 | 1  0.98(0.75-1.27)  0.86(0.65-1.14)  0.82(0.6-1.14) | 180  190  184  194 | 442  433  439  429 | Age, education, glycemic load and daily intake of fat, fiber, and sodium |
| Shin SK (2015) | C-S-S | women | 166.2  252.6  353.6  516.7 | 1  0.96 (0.78-1.18)  0.85 (0.67-1.06)  0.71(0.54-0.94) | 337  340  323  301 | 634  631  648  670 | Age, education, farmer, marital status, exercise habits, glycemic load, daily intake of fat, fiber, sodium and energy |
| Kim K (2012) | C-S-S | men | 282.9  404  567.2 | 1  0.92 (0.76-1.13)  0.77(0.61-0.98） | 344  358  332 | 938  924  950 | Age, educational level, smoking status, exercise, glycemic load, and intakes of energy, protein, fat, cholesterol, and fiber |
| Kim K (2012) | C-S-S | women | 287.6  431.4  628.7 | 1  0.81(0.67-0.98)  0.65(0.52-0.81) | 506  460  416 | 889  935  979 | Age, educational level, exercise, glycemic load, and intakes of energy, protein, fat, cholesterol, and fiber |
| Liu S（2005） | C-S-S | women | 486  740  1168 | 1  0.87(0.73-1.04)  0.74(0.6-0.92) | 409  346  288 | 1604  1667  1725 | Age, smoking, exercise, total calories, alcohol use, multivitamin use, parental history of myocardial infarction before age 60 years, dietary intakes of total fat, cholesterol, protein, glycemic load, and total vitamin D |
| Motamed S (2013) | C-S-S | both | 430.5  603.3  736.8  887.9  1130.1 | 1  1.04(0.8-1.2)  1.08(0.8-1.2)  1.12(0.9-1.4)  1.17(0.9-1.4) | 339  339  339  339  339 | 387  387  387  387  387 | Sex, age, physical activity level, smoking, past medical history, energy intake, and BMI |
| Cho GJ (2009)  Cho GJ (2009)  Cho GJ (2009) | C-S-S  C-S-S  C-S-S | men  Premenopausal woman  postmenopausal women | 265  429  623  848  229  371  537  725  181  325  503  715 | 1  0.96(0.76-1.22)  0.92(0.72-1.18)  0.79(0.60-1.03)  1  1.11(0.78-1.57)  1.06(0.74-1.53)  0.97(0.65-1.45)  1  0.93(0.69-1.26)  0.91(0.66-1.26)  0.63(0.45-0.89) | 275  275  275  275  106  106  106  106  237  237  237  237 | 753  753  753  753  733  733  733  733  229  229  229  229 | Age, body mass index, marital status, education level, alcohol intake, smoking history, exercise, and energy intake  Age, body mass index, marital status, education level, alcohol intake, smoking history, exercise, and energy intake  Age, body mass index, marital status, education level, alcohol intake, smoking history, exercise, hormone therapy use, and energy intake |
| Bruscato NM （2010） | C-S-S | women | 669  756  789  748 | 1  2.43(1.12-5.27)  1.59(0.73-3.47)  1.5(0.68-3.31) | 22  22  22  22 | 48  48  48  48 | Age, smoking, years of education, physical activity and dietary fiber |
| Kim MK  （2017） | C-S-S | men | 200  600  1000  1400 | 1  1.012(0.81-1.25)  0.908(0.65-1.26)  1.942(1.23-3.05) | 291  291  291  291 | 905  905  905  905 | Total calorie intake, calcium supplement intake, age, living area, education level, income, occupation, marital status, alcohol consumption, smoking, exercise level, stature, BMD, fatness, and BMI |
| Kim MK  （2017） | C-S-S | Premenopausal woman | 200  600  1000  1400 | 1  0.791(0.55-1.12)  1.172(0.64-2.13)  0.722(0.23-2.24) | 63  63  63  63 | 937  937  937  937 | Total calorie intake, calcium supplement intake, age, living area, education level, income, occupation, marital status, alcohol consumption, smoking, exercise level, stature, BMD, fatness, and BMI |
| Kim MK  （2017） | C-S-S | postmenopausal women | 200  600  1000  1400 | 1  0.788(0.64-0.96)  0.921(0.63-1.33)  0.801(0.41-1.55) | 334  334  334  334 | 789  789  789  789 | Total calorie intake, calcium supplement intake, age, living area, education level, income, occupation, marital status, alcohol consumption, smoking, exercise level, stature, BMD, fatness, and BMI |

MS, metabolic syndrome; *OR*, Odds Ratio; C-S-S, cross-sectional study.