

Dairy Consumption: Does It Make an Impact on Self-Reported Disease Activity of Inflammatory Arthritis?

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Abstract

Background

As researchers and the public become more cognizant of the impacts of diet and nutrition on health, continued research is needed to provide evidence to support dietary claims. At present, there exists mixed reporting on the effects of dairy consumption and disease activity of inflammatory arthritis (IA).

Objective

This study attempts to advance current research on the relationship between dairy consumption and self-reported disease activity in patients with IA and to investigate whether dietary modifications can be helpful as a conservative, cost-effective, and accessible supplement to established treatments.

Methods

Participants completed a modified diet history questionnaire (DHQ), which assessed dairy consumption over the past year, and a Routine Assessment of Patient Index Data 3 (RAPID3) questionnaire, which assessed a participants' self-reported inflammatory disease activity. DHQ and RAPID3 were analyzed using a Pearson product-moment partial correlation to assess variables' relationships. Participants completed the questionnaire in the setting of a rheumatology clinic. Two hundred and four participants were recruited for this study. All of the participants were at least 18 years of age, capable of giving informed consent, and were formally diagnosed with either rheumatoid arthritis or psoriatic arthritis by a board-certified rheumatologist.

Results

The results from the questionnaires found that dairy consumption does not contribute to self-reported IA disease activity. While 11 of the 16 DHQ variables maintained a positive correlation with the overall RAPID3 scores, none of these possessed statistical significance. Only when controlling for age and sex did the study find two statistically significant variable correlations between the quantity of milk consumed as a beverage ($r=0.147$, $n=193$, $p=0.043$) and milk added to cereal ($r=0.170$, $n=189$, $p=0.019$) with the RAPID3 scores.

Conclusion

In summation, the study found no notable correlation between dairy consumption and patients' self-reported IA disease activity.

Categories: Internal Medicine, Rheumatology

Keywords: inflammatory arthritis, diet therapy, joint diseases, psoriatic arthritis, rheumatoid arthritis

Introduction

Inflammatory arthritis (IA) is a group of chronic autoimmune diseases that affects the joints and the surrounding tissues. IA affects 2%-3% of the general population and is associated with a wide range of comorbidities and a decrease in the quality of life [1,2]. While there are many types of IA, the most common types in adults include rheumatoid arthritis (RA) and psoriatic arthritis (PsA) [3]. The mainstay of management of IA has focused on disease-modifying anti-rheumatic drugs (DMARDs) and non-steroidal anti-inflammatory drugs (NSAIDs) [4,5]. Over the last 20 years, great strides have been made in the pharmacologic management of IA with the introduction of biological DMARDs and targeted synthetic DMARDs [6,7]. Despite this, access to DMARDs is often limited due to their high cost [8,9]. Additionally, not all patients respond to DMARDs with favorable outcomes and DMARDs can have serious side effects, such as the increased risk of cardiovascular events, infections, and malignancies [10,11]. Thus, a need still exists for additional therapeutic options in the management of IA.

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Diet plays an important role in the disease activity of IA [12,13]. Various diet regimens are believed to have anti-inflammatory effects and patients with IA often make modifications to their diet in hopes to lessen the disease activity. Popular dietary regimens include vegan, Mediterranean, and elimination diets. Some diet regimens, such as the Mediterranean diet, have shown promising outcomes in patients with IA, with a statistically significant reduction in pain scores and morning stiffness [14]. However, other diets, such as elimination diets and vegan diets, have demonstrated mixed results [15,16]. A recent study by Winkvist found that disease activity of RA, as measured by Disease Activity Score in 28 joints - erythrocyte sedimentation rate (DAS28-ESR), was lower after 10 weeks of an anti-inflammatory diet (composed of fish, whole-grain cereals, vegetables, and low-fat dairy) than before the intervention [17].

Of particular interest for this study is the effect of dairy on IA. Studies into the effect of dairy and inflammation have been mixed and often contradictory [18,19]. Dairy has been hypothesized to have pro-inflammatory effects and contribute to an increase in inflammatory biomarkers. This belief can be found throughout popular media and scientific journals [20]. Due to these beliefs, many patients often go to extreme lengths to minimize their dairy consumption [21]. However, recent data have suggested that dairy does not actually lead to an increase in circulatory inflammatory biomarkers [21,22]. In fact, some studies have demonstrated how dairy has either a neutral or a protective effect against inflammatory processes [18,23]. At present, there exists no definitive relationship between dairy and inflammation, nor clear guidelines on the suggested dietary dairy intake for patients with IA. As a result, patients are often left without a clear answer on the recommendations or effects of dairy consumption on IA. This study investigated the role of dairy intake using a modified diet history questionnaire (DHQ) and compared it to the self-reported disease activity of patients with RA and PsA using the Routine Assessment of Patient Index Data 3 (RAPID3) questionnaire.

Materials And Methods

All protocol for the study was reviewed and approved by the Institutional Review Board at the authors' institution in compliance with the Helsinki Declaration and in accordance with the ethical standards on human experimentation. Written consents of human subjects were obtained from all participants prior to the initiation of the study. Participants were recruited from an ambulatory setting rheumatology clinic, over the course of 10 months. During the participants' regularly scheduled visits, they were informed about the study and asked if they were interested in participating. Participants were informed that their decision to participate in the study would not impact the level of care they received. However, if they choose to participate, they would be asked to complete two questionnaires—a modified DHQ and a RAPID3 questionnaire (Appendices I, II). The former is an assessment on the participant's dairy intake frequency and quantity over the past 12 months, while the latter is a measurement tool which assessed patients' self-reported disease activity of their IA. The RAPID3 questionnaire is a tool that is commonly used in the clinical setting to measure self-reported disease activity. Participants were informed that the two questionnaires should take 10-15 minutes to complete.

Only patients who had been formally diagnosed with either rheumatoid arthritis or psoriatic arthritis by a board-certified rheumatologist were asked to participate in the study. Eligible adult patients, over 18 years of age, capable of giving informed consent were entered into the study and completed the modified DHQ and RAPID3 questionnaires. Patients from vulnerable populations, including patients who are pregnant or prisoners, were not included in the study. Additionally, due to limitations of the questionnaires, only patients who were able to read English were included in the study.

The primary objective of this study was to evaluate if there was a relationship between dairy consumption and the self-reported disease activity of IA. To this end, the National Institutes of Health (NIH) DHQ was modified to only include questions that were relevant to dairy products. In total, there were 16 questions included in the modified DHQ that asked about both the frequency and the quantity of consumption of various dairy products such as milk, yogurt, cheese, ice cream, and creamers (Appendix I). In order to measure the self-reported disease activity of IA, the routine assessment of patient index data 3 (RAPID3) questionnaire was given to participants (Appendix II). The endpoint of the study was when 200 participants had completed both the modified DHQ and RAPID3 questionnaires.

The NIH DHQ contained questions regarding the frequency of consumption of dairy products in various formats ranging from number of times per year to number of times per week and days. In order to make analysis more consistent, all questions regarding frequencies were converted to the total number of times per year. Likewise, NIH DHQ contained questions assessing the quantity of dairy products consumed per consumption in various formats ranging from cups, tablespoons, and ounces. All questions regarding the quantity were converted to quantity in fluid ounces.

The RAPID3 questionnaire was composed of three categories that quantified 1) self-reported level of difficulty experienced while performing various activities of daily living, 2) self-reported pain experienced during daily activities, and 3) self-reported well-being of the patient. These three categories were scored from 0 to 10 points in each category, for a total of up to 30 points. RAPID3 scores ≤ 3 were considered to be in remission, scores 3-6 were of low severity, scores 6-12 were of moderate severity, and scores >12 were of high severity.

All the data from both questionnaires were collected and analyzed using IBM Statistical Package for the Social Sciences (SPSS) version 24.0 (SPSS Inc., Chicago, IL, USA).

Results

In total, 204 participants completed both the modified DHQ and RAPID3 questionnaires. The average age of the participants were 58.6 years of age, with a median of 58 years of age. There were 157 females, 39 males, and 8 patients who preferred not to answer. The average RAPID3 score was 9.9 with a median score of 8.9. There were 38 participants who were in remission, 33 in low severity, 55 in moderate severity, and 78 in high severity. Male participants had statically significantly lower RAPID3 scores (6.7282 ± 5.7893) compared to female participants (10.8459 ± 6.46494), $t(194) = -3.631$, $p = <0.001$ (Figure 1).

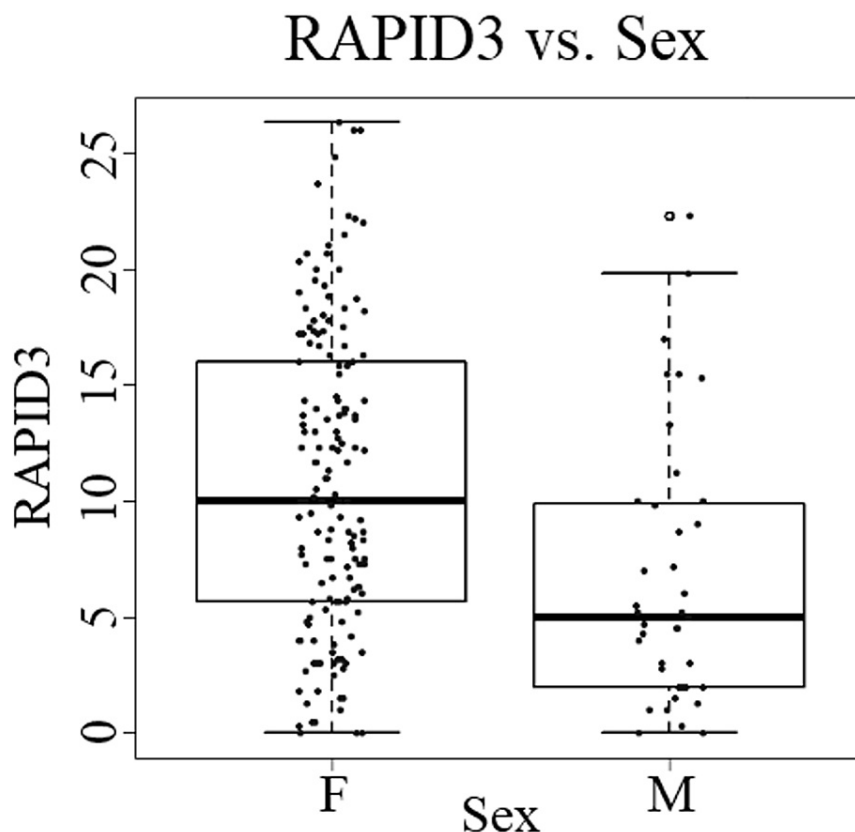


FIGURE 1: RAPID3 self-reported disease activity vs. sex

Females had a statistically significant higher average self-reported overall disease activity of IA (10.8459 ± 6.46494) as measured by the RAPID3 questionnaire compared to males (6.7282 ± 5.7893).

RAPID3 - Routine Assessment of Patient Index Data 3

IA - inflammatory arthritis

A Pearson product-moment partial correlation was run to determine the relationship between each of the 16 questions of the modified DHQ and the overall RAPID3 score. There was a positive correlation in 11 of the 16 dairy intake variables of the modified DHQ and the overall RAPID3 scores. However, none of the correlations was statistically significant.

Next, the Pearson product-moment partial correlation was run comparing the individual variables of the modified DHQ to the overall RAPID3 score whilst controlling for age and sex. There was a positive partial correlation between the quantity of milk consumed as a beverage (4.35 ± 4.12 fl oz/year) and the overall RAPID3 score (10.04 ± 6.57) whilst controlling for age (58.5 ± 14.6 years) and sex (77% female), which was statistically significant, $r(189) = 0.147$, $N = 193$, $p = .043$ (Figure 2). No statistically significant was found with zero-order correlations between the quantity of milk consumed as a beverage and the overall RAPID3 score ($r(203)=0.071$, $n=204$, $p=0.312$) when not controlled for age and sex. Additionally, there was another positive partial correlation identified between the quantity of milk added to cereal and the overall RAPID3 score whilst controlling for age and sex $r=0.170$ ($p=0.019$, $df=189$), which decreased to $r=0.160$ ($p=0.025$, $df=193$).

when only controlled for sex. All other correlations between the individual variables of the modified DHQ and the overall RAPID3 scores were non-significant even whilst controlling for age and sex.

Quantity of Milk Consumed as a beverage vs. Overall RAPID3 score

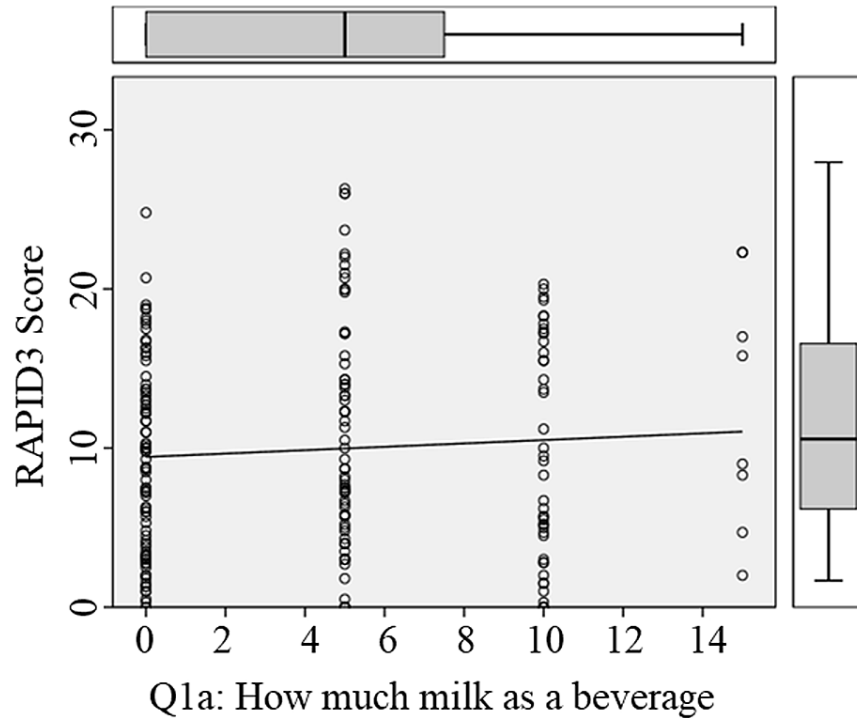


FIGURE 2: Quantity of milk consumed as a beverage vs. overall RAPID3 score

A statistically significant positive correlation was found between the quantity of milk consumed as a beverage and the overall self-reported disease activity measured by the RAPID3 score. The average drinks consumed was 4.35 ± 4.12 fl oz/year and the overall RAPID3 score (10.04 ± 6.57) whilst controlling for age (58.5 ± 14.6 years) and sex (77% female). This statistically significant positive correlation was only observed after controlling for age and sex.

RAPID3 - Routine Assessment of Patient Index Data 3

Lastly, in order to analyze the individual variables of DHQ further, the Pearson product-moment correlation was run between the individual variables of the modified DHQ and the individual variables of the RAPID3 questionnaire (Table 1). Positive correlations were found between individual variables from the RAPID3 questionnaire and the following questions from the DHQ- quantity of milk consumed as a beverage (Q1a), the quantity of milk added to cereal (Q2d), the quantity of ice cream consumed (Q7a), frequency of milk added to the coffee (Q10), and quantity of milk added to the coffee (Q10a). Additionally, positive correlations were identified between the individual variables from the RAPID3 questionnaire and the age of the participants.

Pearson Correlation Value Table													
	RAPID3 Questionnaire												
	1a.	1b.	1c.	1d.	1e.	1f.	1g.	1h.	1i.	1j.	2	3	RAPID 3 Score
Age	0.074	0.005	0.137	0.101	0.075	0.089	.158*	.258**	.209*	.202*	0.111	0.076	0.126
Q1.	0.079	0.071	0.095	0.015	0.05	0.08	0.05	0.126	0.052	0.086	-0.004	0.001	0.022
Q1a.	0.072	0.073	0.115	-0.076	0.116	.158*	0.088	0.113	0.08	0.106	0.056	0.051	0.071
Q2.	0.068	0.07	0.053	-0.004	0.084	0.04	0.106	0.036	-0.037	-0.026	0.049	0.03	0.044
Q2d.	0.127	0.06	0.023	-0.062	0.131	0.054	.166*	0.054	0.045	0.11	0.072	0.091	0.094
Q3.	-0.028	0.017	-0.029	-0.058	-0.083	0.015	0.049	-0.082	-0.085	0.01	0.08	-0.003	0.017
Q3a.	-0.085	0.029	0.062	0.039	0.016	0.092	0.01	-0.011	-0.03	-0.047	0.043	-0.028	0.002
Q4.	-0.085	-0.091	-0.023	0.016	0.039	-0.008	-0.012	0.032	0.013	-0.006	-0.056	-0.084	-0.08
Q4a.	-0.005	-0.043	0.03	-0.093	-0.015	0.011	-0.021	0.091	-0.021	-0.008	-0.02	0.01	-0.01
Q5.	-0.004	0.032	0.078	-0.064	-0.014	-0.024	-0.01	-0.065	0.067	0.064	-0.055	-0.027	-0.028
Q5a.	0.017	0.056	0.115	0.058	0.1	0.009	-0.014	-0.016	0.002	0.055	-0.017	0.082	0.038
Q7.	0.112	0.079	0.109	0.126	0.049	0.104	0.119	0.038	0.086	0.054	0.047	0.08	0.084
Q7a.	0.057	0.104	0.082	0.011	.156*	0.07	-0.017	-0.034	0.018	0.032	0.058	0.083	0.072
Q9.	0.006	-0.097	0.1	-0.114	-0.04	-0.098	0.024	-0.078	-0.033	-0.074	-0.037	-0.037	-0.052
Q9a.	0.065	-0.118	0.011	-0.087	0.005	-0.077	0.02	0.001	0.045	0.061	0.006	-0.055	-0.021
Q10.	0.128	0.127	.150*	0.021	0.115	0.093	0.102	0.122	-0.024	0.075	.164*	0.058	0.116
Q10a.	0.074	.176*	0.094	0.05	0.066	0.114	0.027	.147*	0.063	0.131	0.128	0.077	0.12

TABLE 1: Pearson correlation value

Pearson correlational relationship between individual questions of the diet history questionnaire and the RAPID3 questionnaire. Statistically significant correlations are highlighted in gray. In total, there were 10 statistically significant Pearson correlations. All of the statistically significant correlations were positive correlations, suggesting that increased intake in frequency or quantity in dairy products led to increased self-reported disease activity of IA. (For a complete list of the individual questions on both DHQ and RAPID3 questionnaires please refer to Appendices I, II, respectively.)

Discussion

The purpose of this study was to determine if there was a correlational relationship between dairy consumption and self-reported disease activity of IA, specifically RA and PsA. At the conclusion of the study, no statistically significant relationship between the frequency and quantity of consumption of various dairy products and the self-reported disease activity, measured by the overall RAPID3 score, were identified. This finding is in line with recent studies that have suggested that dairy products do not make a clinically significant difference in the disease activity of IA [24].

One potential reason that variations in dairy consumption did not make a difference in the overall disease activity of IA may be the fact that most of the patients in this study were already on pharmacologic therapy. Pharmacologic agents such as DMARDs, biologic agents, and NSAIDs are the first line therapeutic options for RA and PsA [25,26]. Patients often experience favorable outcomes with these pharmacologic agents; and thus, other factors such as variations in dairy consumption may not have played as critical of a role in the self-reported disease activity. Variations in dairy consumption presumably have a lesser impact on the disease activity compared to the impact of directed pharmacologic therapy. Despite this, it is important to note that not all patients experience favorable outcomes with pharmacologic agents. Additionally, for some, pharmacologic agents may not be accessible. In these patients, even minor factors such as variations in diet may have a greater impact on their disease activity.

Another potential reason for the failure to reject the null hypothesis may be that the self-reported disease activity of IA had confounding variables that masked the effects of dairy consumption. In particular, the sex

and age of the participants appeared to have an impact on the overall RAPID3 score. Support for this theory was demonstrated when statistically significant relationships were identified with the Pearson product-moment partial correlation whilst controlling for age and sex. Statistically significant relationships between the quantity of milk consumed as a beverage and the overall RAPID3 score and the quantity of milk added to cereal and the overall RAPID3 score were identified, which were not found with zero-order correlations without controlling for age and sex. Furthermore, the positive correlational relationship between quantity of milk added to cereal and the overall RAPID3 score decreased from 0.170 to 0.160 when only controlled for sex compared to when controlled for both age and sex. This suggested that in addition to sex, the age of the participants have an influence in controlling for the positive correlational relationship. In fact, of all the statistically significant correlational relationships that were examined, the highest correlational relationships were identified between the age of the participants and “difficulty walking two miles or more” ($r=0.209$) and “difficulty participating in recreational activities and sports” ($r=0.202$). Additionally, the prevalence of IA was greater in females and the results of the RAPID3 questionnaire seem to suggest that females experienced statistically significant higher overall self-reported disease activity of IA compared to males (Figure 1). This lends support to prior studies that indicated female patients with RA tend to have worse disease activity than their counterparts [27].

Despite being unable to identify statistically significant relationship between individual questions from the modified DHQ and the overall self-reported RAPID3 scores, 10 statistically significant correlational relationships were identified between individual questions from the modified DHQ and individual questions from the RAPID3 questionnaire (Table 2). A distinction must be made that these statistically significant relationships were identified in individual questions of the RAPID3 questionnaire, pertaining to the self-reported difficulties in performing individual activities of daily living, and not the overall self-reported disease activity of IA. Nevertheless, of these 10 statistically significant relationships, three were between the ages of the participants and questions from the RAPID3 questionnaire, while the remaining seven were between questions about dairy consumption and questions from the RAPID3 questionnaire.

Sig. (2-tailed) Value Table													
	RAPID3 Questionnaire												RAPID 3 Score
	1a.	1b.	1c.	1d.	1e.	1f.	1g.	1h.	1i.	1j.	2	3	
Age	0.306	0.944	0.058	0.16	0.299	0.217	0.028	0	0.003	0.005	0.125	0.296	0.079
Q1.	0.259	0.313	0.178	0.827	0.48	0.256	0.477	0.073	0.46	0.223	0.95	0.989	0.752
Q1a.	0.305	0.301	0.102	0.279	0.098	0.024	0.21	0.107	0.256	0.132	0.43	0.473	0.312
Q2.	0.332	0.319	0.447	0.951	0.23	0.567	0.132	0.609	0.596	0.717	0.487	0.671	0.532
Q2d.	0.07	0.396	0.739	0.379	0.063	0.44	0.017	0.443	0.526	0.116	0.308	0.199	0.182
Q3.	0.689	0.812	0.682	0.406	0.24	0.834	0.486	0.246	0.227	0.886	0.258	0.964	0.811
Q3a.	0.224	0.681	0.375	0.575	0.825	0.19	0.883	0.877	0.674	0.501	0.546	0.697	0.981
Q4.	0.226	0.193	0.749	0.817	0.583	0.909	0.866	0.65	0.852	0.937	0.431	0.233	0.257
Q4a.	0.944	0.545	0.669	0.186	0.836	0.87	0.764	0.193	0.763	0.915	0.775	0.891	0.889
Q5.	0.956	0.651	0.266	0.364	0.842	0.733	0.885	0.353	0.338	0.36	0.433	0.7	0.692
Q5a.	0.809	0.426	0.1	0.41	0.155	0.899	0.841	0.821	0.973	0.435	0.812	0.242	0.592
Q7.	0.111	0.263	0.122	0.072	0.482	0.14	0.089	0.594	0.223	0.439	0.504	0.259	0.234
Q7a.	0.422	0.139	0.243	0.879	0.026	0.319	0.813	0.625	0.802	0.647	0.409	0.241	0.304
Q9.	0.929	0.167	0.156	0.105	0.566	0.165	0.733	0.267	0.643	0.29	0.602	0.602	0.459
Q9a.	0.357	0.094	0.875	0.218	0.943	0.271	0.78	0.989	0.522	0.384	0.937	0.436	0.77
Q10.	0.068	0.069	0.033	0.762	0.101	0.188	0.147	0.081	0.728	0.287	0.019	0.407	0.098
Q10a.	0.296	0.012	0.182	0.475	0.351	0.105	0.702	0.036	0.371	0.062	0.07	0.274	0.087

TABLE 2: Significant values

P-values of the two-tailed Pearson product-moment correlation was run between the individual variables of the modified DHQ and the individual variables of the RAPID3 questionnaire.

DHQ - Diet history questionnaire

RAPID3 - Routine Assessment of Patient Index Data 3

Of these seven questions, debate remained whether the frequency of consumption or the quantity consumed with each consumption of dairy products had a greater impact on the self-reported difficulty of performing activities of daily living. In total, five statistically significant correlational relationships were identified between varying quantities of dairy products consumed, while only two statistically significant correlational relationships were identified between varying frequencies of consumption. Interestingly, all seven statistically significant correlational relationships were positive relationships, suggesting that an increase in either the quantity or the frequency of dairy products consumption led to increased difficulties with activities of daily living. However, in regard to quantity versus frequency, the quantity consumed with each consumption appeared to have a greater influence compared to the frequency of consumption in the past 12 months. If true, these results suggest that patients should prioritize consuming fewer quantities of dairy products with each consumption rather than consuming less frequently at the cost of consuming more each time.

One potential downside of this study is that only the correlational relationships between the self-reported disease activity of IA and frequency and quantity of dairy consumption was examined. Due to the design of the study, a cause-and-effect relationship is difficult to determine. However, for future studies, a prospective study or randomized control trial in which the patients are recruited and randomized into different groups with modifications to their diet with varying levels of dairy intake at different frequencies could be performed to assess if it makes an impact on the self-reported disease activity of IA. Furthermore, before guidelines for dairy consumption in IA patients can be developed, additional studies need to be conducted that control for the effect of pharmacologic agents.

Additionally, the validity of DHQ may be questioned in accurately recalling a diet from the past 12 months and the potential for recall bias. Nevertheless, multicenter randomized controlled trials have demonstrated the validity of DHQ to be strong particularly for frequency of intake of milk and dairy products in men and within acceptable range in women [28]. Similarly, questions on the validity of RAPID3 can be raised in accurately measuring the self-reported disease activity of RA and PsA. However, numerous studies have demonstrated that results from RAPID3 are comparable to other methods such as disease activity scored based on 28-joint count (DAS28), erythrocyte sedimentation rate (ESR), and clinical disease activity index (CDAI) [29,30].

Lastly, this study did not distinguish between participants who had RA versus those with PsA. However, recent studies suggest that there may be greater differences between the pathophysiology of RA and PsA, which may lead to differences in the effect of dairy on the self-reported disease activity [20,24].

Conclusions

Overall, the results of this study suggest that there is no correlational relationship between dairy consumption and the overall self-reported disease activity of IA, given that the majority of the correlations identified in this study were non-significant and small in magnitude. However, whilst controlling for age and sex, two positive correlational relationships were identified between the quantity of milk consumed as a beverage ($r=0.147$) and the quantity of milk added to cereal ($r=0.170$) and the overall RAPID3 score. No other questions from the DHQ demonstrated statistically significant correlational relationships with the overall RAPID3 score. Comparisons between the individual questions of the modified DHQ and the individual variables of the RAPID3 questionnaire resulted in seven positive correlational relationships being identified. Furthermore, variations in the quantity of dairy products consumed with each consumption appeared to have a greater impact compared to variations in the frequency of dairy consumed in the past 12 months. Despite these results, additional prospective studies would need to be performed before firm guidelines on dairy consumption and disease activity can be established. Nevertheless, results from this study suggest that avoidance of dairy products would not be a significant method for controlling the symptoms of IA.

Appendices

Appendix I

NATIONAL INSTITUTES OF HEALTH

Diet History Questionnaire



GENERAL INSTRUCTIONS

- Answer each question as best you can. Estimate if you are not sure. A guess is better than leaving a blank.
- Use only a No. 2 pencil.
- Be certain to completely blacken in each of the answers.
- Erase completely if you make any changes.
- Do not make stray marks on this form.
- If you blacken NEVER or NO for a question, please follow any arrows or instructions that direct you to the next question.

BEFORE TURNING THE PAGE, PLEASE COMPLETE THE FOLLOWING QUESTIONS.

Today's date:

MONTH	DAY	YEAR
<input type="checkbox"/> Jan		2018
<input type="checkbox"/> Feb	<input type="checkbox"/> 0 <input type="checkbox"/> 0	
<input type="checkbox"/> Mar	<input type="checkbox"/> 1 <input type="checkbox"/> 1	
<input type="checkbox"/> Apr	<input type="checkbox"/> 2 <input type="checkbox"/> 2	
<input type="checkbox"/> May	<input type="checkbox"/> 3 <input type="checkbox"/> 3	
<input type="checkbox"/> Jun	<input type="checkbox"/> 4 <input type="checkbox"/> 4	
<input type="checkbox"/> Jul	<input type="checkbox"/> 5 <input type="checkbox"/> 5	
<input type="checkbox"/> Aug	<input type="checkbox"/> 6 <input type="checkbox"/> 6	
<input type="checkbox"/> Sep	<input type="checkbox"/> 7 <input type="checkbox"/> 7	
<input type="checkbox"/> Oct	<input type="checkbox"/> 8 <input type="checkbox"/> 8	
<input type="checkbox"/> Nov	<input type="checkbox"/> 9 <input type="checkbox"/> 9	
<input type="checkbox"/> Dec		

In what year were you born?

19

<input type="checkbox"/> 0	<input type="checkbox"/> 0
<input type="checkbox"/> 1	<input type="checkbox"/> 1
<input type="checkbox"/> 2	<input type="checkbox"/> 2
<input type="checkbox"/> 3	<input type="checkbox"/> 3
<input type="checkbox"/> 4	<input type="checkbox"/> 4
<input type="checkbox"/> 5	<input type="checkbox"/> 5
<input type="checkbox"/> 6	<input type="checkbox"/> 6
<input type="checkbox"/> 7	<input type="checkbox"/> 7
<input type="checkbox"/> 8	<input type="checkbox"/> 8
<input type="checkbox"/> 9	<input type="checkbox"/> 9

Are you male or female?

Male
 Female

Who is completing this questionnaire?

Applicator
 Spouse
 Someone else

To whom do your responses refer?

Myself
 Spouse
 Both

FIGURE 3: Modified diet history questionnaire: assessed patient's dairy intake within the last 12 months (page 1)

Over the past 12 months...

1. How often did you drink milk as a beverage (NOT in coffee, NOT in cereal)? (Please include chocolate milk and hot chocolate.)

NEVER (GO TO QUESTION 2)

1 time per month or less 1 time per day

2-3 times per month 2-3 times per day

4-5 times per month 4-5 times per day

6 or more times per day

1a. Each time you drank milk as a beverage, how much did you usually drink?

Less than 1 cup (8 ounces)

1 to 1½ cups (8 to 12 ounces)

More than 1½ cups (12 ounces)

1b. What kind of milk did you usually drink?

Whole milk

2% fat milk

1% fat milk

Skim, nonfat, or 1/2% fat milk

Flavored milk

Other

2. How often did you eat cold cereal?

NEVER (GO TO QUESTION 3)

1-4 times per year 2 times per week

5-11 times per year 3-5 times per week

1 time per month 1 time per day

2-3 times per month 2 or more times per day

2a. Each time you ate cold cereal, how much did you usually eat?

Less than 1 cup

1 to 1½ cups

More than 1½ cups

2b. Was milk added to your cold cereal?

NO (GO TO QUESTION 3)

YES

2c. What kind of milk was usually added?

Whole milk

2% fat milk

1% fat milk

Skim, nonfat, or 1/2% fat milk

Flavored milk

Other

2d. Each time milk was added to your cold cereal, how much was usually added?

Less than 1/4 cup

1/4 to 1/2 cup

More than 1/2 cup

3. How often did you eat yogurt (NOT including frozen yogurt, sorbet, sorbet, or ice cream)?

NEVER (GO TO QUESTION 4)

1-4 times per year 2 times per week

5-11 times per year 3-5 times per week

1 time per month 5-6 times per week

2-3 times per month 1 time per day

3a. Each time you ate yogurt, how much did you usually eat?

Less than 1/2 cup or less than 1 container

1/2 to 1 cup or 1 container

More than 1 cup or more than 1 container

4. How often did you eat cottage cheese (including low-fat)?

NEVER (GO TO QUESTION 5)

1-4 times per year 2 times per week

5-11 times per year 3-5 times per week

1 time per month 5-6 times per week

2-3 times per month 1 time per day

1 time per week 2 or more times per day

4a. Each time you ate cottage cheese, how much did you usually eat?

Less than 1/4 cup

1/4 to 1/2 cup

More than 1/2 cup

5. How often did you eat cheese (including low-fat including on cheeseburgers or in sandwiches or salads)?

NEVER (GO TO QUESTION 6)

1-4 times per year 2 times per week

5-11 times per year 3-5 times per week

1 time per month 5-6 times per week

2-3 times per month 1 time per day

1 time per week 2 or more times per day

5a. Each time you ate cheese, how much did you usually eat?

Less than 1/4 ounce or less than 1 slice

1/4 to 1/2 ounce or 1 to 2 slices

More than 1/2 ounce or more than 2 slices

5b. How often was the cheese you ate light or low-fat cheese?

Almost never or never

About 1/4 of the time

About 1/2 of the time

About 3/4 of the time

Almost always or always

5c. How often was the cheese you ate fat-free cheese?

Almost never or never

About 1/4 of the time

About 1/2 of the time

About 3/4 of the time

Almost always or always

6. How often did you eat frozen yogurt, sorbet, or ice cream (including low-fat or fat-free)?

NEVER (GO TO QUESTION 7)

1-4 times per year 2 times per week

5-11 times per year 3-5 times per week

1 time per month 5-6 times per week

2-3 times per month 1 time per day

1 time per week 2 or more times per day

6a. Each time you ate frozen yogurt, sorbet, or ice cream, how much did you usually eat?

Less than 1/4 cup or less than 1 scoop

1/4 to 1 cup or 1 to 2 scoops

More than 1 cup or more than 2 scoops

7. How often did you eat ice cream, ice cream bars, or sherbet (including low-fat or fat-free)?

NEVER (GO TO QUESTION 8)

1-4 times per year 2 times per week

5-11 times per year 3-5 times per week

1 time per month 5-6 times per week

2-3 times per month 1 time per day

1 time per week 2 or more times per day

7a. Each time you ate ice cream, ice cream bars, or sherbet, how much did you usually eat?

Less than 1/4 cup or less than 1 scoop

1/4 to 1/2 cup or 1 to 2 scoops

More than 1/2 cup or more than 2 scoops

7b. How often was the ice cream you ate light, low-fat, or fat-free ice cream or sherbet?

Almost never or never

About 1/4 of the time

About 1/2 of the time

About 3/4 of the time

Almost always or always

8. How many cups of coffee, caffeinated or decaffeinated, did you drink?

NEVER (GO TO QUESTION 9)

Less than 1 cup per month 1-4 cups per week

1-2 cups per month 5-6 cups per week

3-4 cups per month 7-8 cups per day

5-6 cups per month 9 or more cups per day

8a. How often with the coffee you drank decaffeinated?

Almost never or never

About 1/4 of the time

About 1/2 of the time

About 3/4 of the time

Almost always or always

9. How often was cream or half and half added to your coffee or tea?

NEVER (GO TO QUESTION 10)

Less than 1 teaspoon

1 to 2 teaspoons

More than 2 teaspoons

9a. Each time cream or half and half was added to your coffee or tea, how much was usually added?

Less than 1 tablespoon

1 to 2 tablespoons

More than 2 tablespoons

10. How often was milk added to your coffee or tea?

NEVER (GO TO QUESTION 11)

Less than 1 time per month 1-4 times per week

2-3 times per month 5-6 times per day

1 time per week 7-8 times per day

2-4 times per week 9 or more times per day

10a. Each time milk was added to your coffee or tea, how much was usually added?

Less than 1 tablespoon

1 to 2 tablespoons

More than 2 tablespoons

10b. What kind of milk was usually added to your coffee or tea?

Whole milk

2% milk

1% milk

Skim, nonfat, or 1/2% milk

Evaporated or condensed (sweetened)

Flavored milk

Other

The following questions are about the kinds of margarine, mayonnaise, ketchup, and salad dressings that you eat. If possible, please check the labels of these foods to help you answer.

11. Over the past 12 months, did you eat margarine?

YES

NO (GO TO QUESTION 12)

11a. How often was the margarine you ate regular-fat margarine (stick or tub)?

Almost never or never

About 1/4 of the time

About 1/2 of the time

About 3/4 of the time

Almost always or always

FIGURE 4: Modified diet history questionnaire (pages 2 and 3)

Over the past 12 months...

11b. How often was the margarine you ate light or low-fat margarine (stick or tub)?

Almost never or never

About 1/4 of the time

About 1/2 of the time

About 3/4 of the time

Almost always or always

11c. How often was the margarine you ate fat-free margarine?

Almost never or never

About 1/4 of the time

About 1/2 of the time

About 3/4 of the time

Almost always or always

12. Over the past 12 months, did you eat butter?

YES

NO (GO TO QUESTION 13)

12a. How often was the butter you ate light or low-fat butter?

Almost never or never

About 1/4 of the time

About 1/2 of the time

About 3/4 of the time

Almost always or always

13. Over the past 12 months, did you eat mayonnaise or mayonnaise-type dressing?

YES

NO (GO TO QUESTION 14)

13a. How often was the mayonnaise you ate regular-fat mayonnaise?

Almost never or never

About 1/4 of the time

About 1/2 of the time

About 3/4 of the time

Almost always or always

13b. How often was the mayonnaise you ate light or low-fat mayonnaise?

Almost never or never

About 1/4 of the time

About 1/2 of the time

About 3/4 of the time

Almost always or always

13c. How often was the mayonnaise you ate fat-free mayonnaise?

Almost never or never

About 1/4 of the time

About 1/2 of the time

About 3/4 of the time

Almost always or always

14. Over the past 12 months, did you eat sour cream?

YES

NO (GO TO QUESTION 15)

14a. How often was the sour cream you ate regular-fat sour cream?

Almost never or never

About 1/4 of the time

About 1/2 of the time

About 3/4 of the time

Almost always or always

14b. How often was the sour cream you ate light, low-fat, or fat-free sour cream?

Almost never or never

About 1/4 of the time

About 1/2 of the time

About 3/4 of the time

Almost always or always

15. Over the past 12 months, did you eat cream cheese?

YES

NO (GO TO QUESTION 16)

15a. How often was the cream cheese you ate regular-fat cream cheese?

Almost never or never

About 1/4 of the time

About 1/2 of the time

About 3/4 of the time

Almost always or always

15b. How often was the cream cheese you ate light, low-fat, or fat-free cream cheese?

Almost never or never

About 1/4 of the time

About 1/2 of the time

About 3/4 of the time

Almost always or always

16. How often did you eat eggs, egg whites, or egg substitutes (NOT counting eggs in baked goods and dressings)? (Please include eggs in salads, quiche, and soufflés.)

NEVER

1-4 times per year 2 times per week

5-11 times per year 3-5 times per week

1 time per month 5-6 times per week

2-3 times per month 1 time per day

1 time per week 2 or more times per day

16a. Each time you ate eggs, how many did you usually eat?

1 egg

2 eggs

3 or more eggs

16b. How often were the eggs you ate egg substitutes?

Almost never or never

About 1/4 of the time

About 1/2 of the time

About 3/4 of the time

Almost always or always

16c. How often were the eggs you ate egg whites only?

Almost never or never

About 1/4 of the time

About 1/2 of the time

About 3/4 of the time

Almost always or always

16d. How often were the eggs you ate regular whole eggs?

Almost never or never

About 1/4 of the time

About 1/2 of the time

About 3/4 of the time

Almost always or always

16e. How often were the eggs you ate cooked in oil, butter, or margarine?

Almost never or never

About 1/4 of the time

About 1/2 of the time

About 3/4 of the time

Almost always or always

16f. How often were the eggs you ate part of egg salad?

Almost never or never

About 1/4 of the time

About 1/2 of the time

About 3/4 of the time

Almost always or always

Thank you for completing this questionnaire.

FIGURE 5: Modified diet history questionnaire (pages 4 and 5)

Appendix II

RAPID 3

ROUTINE ASSESSMENT OF PATIENT INDEX DATA

The RAPID3 includes a subset of core variables found in the Multi-dimensional HAQ (MD-HAQ). Page 1 of the MD-HAQ, shown here, includes an assessment of physical function (section 1), a patient global assessment (PGA) for pain (section 2), and a PGA for global health (section 3). RAPID3 scores are quickly tallied by adding subsets of the MD-HAQ as follows:

1. PLEASE CHECK THE ONE BEST ANSWER FOR YOUR ABILITIES AT THIS TIME:				
OVER THE LAST WEEK, WERE YOU ABLE TO:	WITHOUT ANY DIFFICULTY	WITH SOME DIFFICULTY	WITH MUCH DIFFICULTY	UNABLE TO DO
a. Dress yourself, including tying shoelaces and doing buttons?	___ 0	___ 1	___ 2	___ 3
b. Get in and out of bed?	___ 0	___ 1	___ 2	___ 3
c. Lift a full cup or glass to your mouth?	___ 0	___ 1	___ 2	___ 3
d. Walk outdoors on flat ground?	___ 0	___ 1	___ 2	___ 3
e. Wash and dry your entire body?	___ 0	___ 1	___ 2	___ 3
f. Bend down to pick up clothing from the floor?	___ 0	___ 1	___ 2	___ 3
g. Turn regular faucets on and off?	___ 0	___ 1	___ 2	___ 3
h. Get in and out of a car, bus, train, or airplane?	___ 0	___ 1	___ 2	___ 3
i. Walk two miles or three kilometers, if you wish?	___ 0	___ 1	___ 2	___ 3
j. Participate in recreational activities and sports as you would like, if you wish?	___ 0	___ 1	___ 2	___ 3
k. Get a good night's sleep?	___ 0	___ 1.1	___ 2.2	___ 3.3
l. Deal with feelings of anxiety or being nervous?	___ 0	___ 1.1	___ 2.2	___ 3.3
m. Deal with feelings of depression or feeling blue?	___ 0	___ 1.1	___ 2.2	___ 3.3

1. +j FN (0-10):

1=0.3 16=5.3
2=0.7 17=5.7
3=1.0 18=6.0
4=1.3 19=6.3
5=1.7 20=6.7
6=2.0 21=7.0
7=2.3 22=7.3
8=2.7 23=7.7
9=3.0 24=8.0
10=3.3 25=8.3
11=3.7 26=8.7
12=4.0 27=9.0
13=4.3 28=9.3
14=4.7 29=9.7
15=5.0 30=10

2. PN (0-10):

3. PTGE (0-10):

RAPID3 (0-30)

2. HOW MUCH PAIN HAVE YOU HAD BECAUSE OF YOUR CONDITION OVER THE PAST WEEK?
PLEASE INDICATE BELOW HOW SEVERE YOUR PAIN HAS BEEN:

NO PAIN
●
●
●
●
●
●
●
●
●
●
●
PAIN AS BAD AS IT COULD BE

0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10

3. CONSIDERING ALL THE WAYS IN WHICH ILLNESS AND HEALTH CONDITIONS MAY AFFECT YOU AT THIS TIME, PLEASE INDICATE BELOW HOW YOU ARE DOING:

VERY WELL
●
●
●
●
●
●
●
●
●
●
●
VERY POORLY

0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5 10

CONVERSION TABLE

Near Remission (NR): 1=0.3; 2=0.7; 3=1.0	High Severity (HS): 13=4.3; 14=4.7; 15=5.0; 16=5.3; 17=5.7; 18=6.0; 19=6.3; 20=6.7;
Low Severity (LS): 4=1.3; 5=1.7; 6=2.0	21=7.0; 22=7.3; 23=7.7; 24=8.0; 25=8.3; 26=8.7; 27=9.0; 28=9.3; 29=9.7; 30=10.0
Moderate Severity (MS): 7=2.3; 8=2.7; 9=3.0; 10=3.3; 11=3.7; 12=4.0	

HOW TO CALCULATE RAPID 3 SCORES

1. Ask the patient to complete questions 1, 2, and 3 while in the waiting room prior to his/her visit.
2. For question 1, add up the scores in questions A-J only (questions K-M have been found to be informative, but are not scored formally). Use the formula in the box on the right to calculate the formal score (0-10). For example, a patient whose answers total 19 would score a 6.3. Enter this score as an evaluation of the patient's functional status (FN).
3. For question 2, enter the raw score (0-10) in the box on the right as an evaluation of the patient's pain tolerance (PN).
4. For question 3, enter the raw score (0-10) in the box on the right as an evaluation of the patient's global estimate (PTGE).
5. Add the total score (0-30) from questions 1, 2, and 3 and enter them as the patient's RAPID 3 cumulative score. Use the final conversion table to simplify the patient's weighted RAPID 3 score. For example, a patient who scores 11 on the cumulative RAPID 3 scale would score a weighted 3.7. A patient who scores between 0-1.0 is defined as near remission (NR); 1.3-2.0 as low severity (LS); 2.3-4.0 as moderate severity (MS); and 4.3-10.0 as high severity (HS).

FIGURE 6: Routine assessment of patient index data 3 (RAPID3) questionnaire that measures patient's self-reported disease activity of inflammatory arthritis

Additional Information

Disclosures

Human subjects: Consent was obtained or waived by all participants in this study. University Of Central Florida College of Medicine issued approval CR00000435. All protocol for the study was reviewed and approved by the Institutional Review Board at the authors' institution in compliance with the Helsinki Declaration and in accordance with the ethical standards on human experimentation. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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