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ORIGINAL ARTICLE

Nutrient Intake and Diet Quality in Rheumatoid Arthritis and Gout Arthritis Patients at Hospital Canselor Tuanku Muhriz, Universiti Kebangsaan Malaysia

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ABSTRAK

Artritis reumatoid (AR) dan artritis gout (AG) ialah penyakit radang sendi kronik yang dipengaruhi oleh corak pemakanan. Diet tinggi purin memburukkan AG, manakala diet pro-radang boleh memperburukkan AR. Kajian ini bertujuan menilai pengambilan nutrien dan kualiti diet pesakit AR dan AG berdasarkan 'Recommended Nutrient Intakes' (RNI) 2017, 'Malaysian Dietary Guidelines' (MDG) 2020 dan 'Standardised Malaysian Healthy Eating Index' (S-MHEI) 2021. Kajian keratan rentas ini dijalankan melibatkan 40 orang dewasa (20 AR, 20 AG) berumur 18-60 tahun yang direkrut secara dalam talian dan bersemuka. Data sosiodemografi, antropometri dan rekod diet 3 hari telah dikumpulkan. Analisis nutrien dijalankan menggunakan Nutritionist Pro 2007 dan kualiti diet dinilai menggunakan S-MHEI 2021. Kebanyakan pesakit AR ialah wanita Melayu (100%), manakala pesakit AG kebanyakannya berbangsa Melayu (75%) dan lelaki (85%). Purata indeks jisim badan (BMI) ialah 27.22 ± 5.24 kg/m² bagi AR dan 31.90 ± 7.11 kg/m² bagi AG, menunjukkan prevalens berlebihan berat badan dan obesiti yang tinggi. Pengambilan tenaga dan karbohidrat adalah di bawah saranan RNI, manakala pengambilan protein, lemak tepu, gula dan natrium melebihi saranan. Pengambilan kalsium dan serat didapati tidak mencukupi. Kebanyakan pesakit AR dan AG (85%) mempunyai kualiti diet sederhana berdasarkan S-MHEI. Principal Component Analysis (PCA) mengenal pasti corak tinggi lemak/natrium dan bijirin/tenusu dalam kalangan pesakit AR. Bagi pesakit AG, dua corak utama dikenal pasti: corak tinggi purin dengan pengambilan daging, telur dan kekacang yang tinggi serta buah yang rendah, dan corak tinggi sayur/lemak. Kesimpulannya, pengambilan nutrien dan kualiti diet pesakit AR dan AG masih belum mematuhi sepenuhnya garis panduan pemakanan kebangsaan.

***Kata kunci**: Diet; gout; nutrien; rheumatoid arthritis*

ABSTRACT

Rheumatoid arthritis (RA) and gouty arthritis (GA) are chronic inflammatory joint diseases influenced by dietary patterns. High-purine diets exacerbate GA, while pro-inflammatory diets may worsen RA. This study aimed to assess the nutrient intake and diet quality of RA and GA patients based on the Recommended Nutrient Intakes (RNI) 2017, Malaysian Dietary Guidelines (MDG) 2020 and Standardised Malaysian Healthy Eating Index (S-MHEI) 2021. A cross-sectional study was conducted among 40 adults

(20 RA, 20 GA) aged 18-60 years, recruited online and face-to-face. Sociodemographic, anthropometric, and 3-day dietary records were collected. Nutrient analysis was performed using Nutritionist Pro 2007, and diet quality was assessed using the S-MHEI 2021. Most RA patients were Malay women (100%), while GA patients were predominantly Malay (75%) and male (85%). The mean body mass index (BMI) was 27.22 ± 5.24 kg/m^2 for RA and 31.90 ± 7.11 kg/m^2 for GA, indicating high overweight and obesity prevalence. Energy and carbohydrate intakes were below RNI recommendations, whereas protein, saturated fat, sugar, and sodium intakes exceeded them. Calcium and fibre intake were inadequate. Most RA and GA patients (85%) had moderate diet quality based on the S-MHEI. Principal Component Analysis (PCA) identified high-fat/high-sodium and grain/dairy patterns among RA patients. Among GA patients, two patterns emerged: a high-purine pattern with high meat, egg, and legume intake and low fruit intake, and a high-vegetable/high-fat pattern. In conclusion, nutrient intake and diet quality of RA and GA patients did not fully comply with national dietary guidelines.
Keywords*:* Diet; gout; nutrient; rheumatoid arthritis

INTRODUCTION

Rheumatoid arthritis (RA) and gouty arthritis (GA) are two different but significant chronic inflammatory conditions that affect millions of people worldwide. RA is an autoimmune disorder characterised by persistent synovial inflammation and systemic involvement, whereas GA results from the accumulation of monosodium urate crystals in joints due to elevated serum uric acid, also known as hyperuricemia (Aydın et al. 2024). The prevalence of RA in Malaysia is higher among women, while GA is more common among men, aligning with global trends (Sulaiman et al. 2019).

Diet plays a critical role in both the development and management of RA and GA. A pro-inflammatory diet, such as one high in saturated fat, sugar and ultra-processed foods can worsen RA symptoms by increasing the pro-inflammatory cytokines, such as interleukin-6 (IL-6) and tumour necrosis factor alpha (TNF-α) (Coras et al. 2020). On the other hand, anti-inflammatory diets, which are rich in omega-3 fatty acids, antioxidants, whole grains and green leafy vegetables, may help to reduce inflammation and improve outcomes of RA (Mohsen et al. 2023). On the other hand, in GA, a high-purine diet which includes red meat, seafood, organ meats and sugar-sweetened beverages (high in fructose) can elevate uric acid levels and trigger flares (Susyanti et al. 2023). Contrariwise, dietary patterns low in purine-rich foods and high in low-fat dairy, fruits and vegetables have been shown to reduce the risk and severity of gout attacks (Zhang et al. 2022).

Despite the existence of dietary and lifestyle recommendations in clinical guidelines, such as the Clinical Practice Guidelines (CPG) for the Management of Gout (Ministry of Health Malaysia 2020), the Clinical Practice Guidelines for the Management of Rheumatoid Arthritis (Ministry of Health Malaysia 2019), the American College of Rheumatology (ACR) 2020 Guideline for the Management of Gout (European League Against Rheumatism 2022) and the European Alliance of Associations for Rheumatology (EULAR) 2022 Recommendations for the Management of Rheumatoid Arthritis ((FitzGerald et al. 2020), many patients with arthritis continue to follow suboptimal diets. These poor dietary habits contribute to inadequate disease control and worsening of clinical outcomes. Therefore, assessing current diet quality and nutrient intake among patients with RA and GA is essential to inform targeted nutrition strategies in clinical care.

Nutritional management is an important component in the development of RA and GA (Mohsen et al. 2023; Susyanti et al. 2023; Zhang et al. 2022; Ministry of Health Malaysia 2020). To assess the nutrient intake of patients with RA and GA, this study used the Recommended Nutrient Intakes (RNI) for Malaysia, 2017 as a reference

guideline (National Coordinating Committee on Food and Nutrition 2017). The dietary intake data of the participants were collected using three-day food records, allowing for a detailed evaluation of individual nutrient consumption patterns. On a side note, this study did not aim to compare RA and GA patients against each other; instead, each group was analysed separately to identify their respective dietary patterns and diet quality.

The diet quality of each patient was assessed using the Standardised Malaysian Healthy Eating Index (S-MHEI) 2021 (Jailani et al. 2021) and compliance with the Malaysian Dietary Guidelines (MDG) (National Coordinating Committee on Food and Nutrition 2021). Furthermore, principal component analysis (PCA) was applied to identify common dietary patterns among the participants, providing insight into habitual food choices that may be associated with disease management outcomes. This cross-sectional study evaluated the nutrient intake and diet quality of patients with rheumatoid and gout arthritis attending Hospital Canselor Tuanku Muhriz (HCTM).

MATERIALS AND METHODS

Written informed consent was obtained from all participants prior to data collection. The study protocol was reviewed and approved by the Research and Ethics Committee of Universiti Kebangsaan Malaysia (UKM) (Approval No.: UKM PPI/111/8/JEP-2025-517) and was conducted in accordance with the ethical standards of the Declaration of Helsinki.

Study Design

A cross-sectional study was conducted between February and May 2024 to assess the nutritional status of adult patients diagnosed with RA (n = 20) and GA (n = 20), aged between 18 and 60 years. Data collection was carried out using both online and face-to-face methods. The objective of the study was to evaluate and compare the dietary quality and patterns of these two distinct patient groups. Each group was analysed independently to identify characteristic dietary patterns and their adherence to national dietary guidelines. Dietary intake was assessed using validated dietary assessment tools and analysed with reference to the RNI 2017 (National Coordinating Committee on Food and Nutrition 2017), MDG 2020 (National Coordinating Committee on Food and Nutrition 2021), and S-MHEI 2021 (Jailani et al. 2021). Disease severity markers, including serum uric acid, CRP/ESR and DAS28 for RA patients, were not consistently available for all participants at the time of dietary assessment and were therefore not included in the analyses.

Location of Study

Data collection for this study was carried out at the Rheumatology Clinic, HCTM, Universiti Kebangsaan Malaysia (UKM). Participants were recruited both in person and remotely via phone calls and WhatsApp after obtaining informed consent. All data were handled with strict confidentiality. Personal identifiers were not recorded; instead, each participant was assigned a unique serial number to ensure anonymity. Upon completion of data collection, all information was analysed in aggregate, and no individual-level data were disclosed.

Sampling Methods

Purposive sampling was used in this study. Only individuals who met specific inclusion criteria were selected to participate in the study. Participation was entirely voluntary, and informed consent was obtained from all respondents prior to data collection.

(i) Inclusion and exclusion criterias

Inclusion criteria included adults aged 18-60 years with a clinical diagnosis of RA or GA who attended the Rheumatology Clinic at HCTM during the recruitment period (February-May 2024), were able to understand and complete a 3-day food record, and provided written informed consent.

As for exclusion criteria included patients who were pregnant or lactating, had other inflammatory or autoimmune diseases (e.g., systemic lupus erythematosus, inflammatory bowel disease), had severe renal or hepatic impairment, were on specialised therapeutic diets (e.g., enteral/parenteral nutrition) or were unwilling or unable to complete dietary records were excluded. Patients who had acute gout flares at the time of data collection were deferred until stable.

(ii) Clinical and medication data

Data on prior dietary counselling and medication use, including corticosteroids and other relevant treatments were collected from medical records when available. However, not all participants had complete records for these variables at the time of dietary assessment. Corticosteroids and other medications may influence appetite, weight and dietary behaviours. Similarly, previous dietary advice may have affected participants' current food intake. These limitations were acknowledged and future studies should consider controlling for medication effects and prior dietary counselling when examining dietary intake and patterns.

Statistical Analysis

Data were analysed using Statistical Package for the Social Science (SPSS), veriosn 28.0) (IBM Corp. Armonk, NY, USA). Descriptive statistics were used to summarise participants' sociodemographic characteristics, anthropometric data and biochemical parameters. Prior to analysis, the normality of continuous variables was assessed using multiple methods. The Shapiro-Wilk test was conducted for all continuous variables, as it is the most reliable for small sample sizes ($n < 50$). Additionally, descriptive and graphical methods were used to support normality, including histograms, Q–Q plots, stem-and-leaf plots, detrended Q–Q plots and coefficients of variation. Based on these assessments, all continuous variables were determined to be approximately normally distributed.

Therefore, continuous variables were presented as mean ± standard deviation (SD) and analysed using one-sample t-tests to compare mean nutrient intakes with the age- and gender-specific RNI2017 (National Coordinating Committee on Food and Nutrition 2017). Categorical variables were presented as frequencies and percentages and analysed using Chi-square or Fisher's exact test, where appropriate. A two-tailed p-value < 0.05 was considered statistically significant.

Diet quality was evaluated using the S-MHEI (Jailani et al. 2021). There were 11 components of S-MHEI, such as total grains, whole grains, fruits, vegetables, fish, meat, poultry and eggs, legumes and nuts, milk and milk products, total fat, sodium and sugar. The total S-MHEI scores were analysed descriptively and categorised into three levels of diet quality: poor (0–50), needs improvement (51-80) and good (81-100). Chi-square tests were conducted to determine the association between categorised diet quality levels and selected categorical variables, such as employment status, education level and disease duration.

PCA was conducted separately for the RA and GA patient groups to identify underlying dietary patterns based on reported food group intakes. The suitability of the data for PCA was evaluated using the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, with values ≥ 0.50 considered acceptable, and Bartlett's Test of Sphericity, with significance set at $p < 0.05$. Components with eigenvalues greater than 1.0 were retained, and food items with factor loadings ≥ 0.30 were deemed meaningful contributors to the identified dietary patterns.

This approach allowed for a comprehensive and structured analysis of diet quality and food consumption trends within each patient group, without making direct statistical comparisons between the RA and GA cohorts.

RESULTS AND DISCUSSION

Sociodemographic Data of Rheumatoid Arthritis and Gouty Arthritis Patients

Table 1 summarised the baseline sociodemographic data. A total of 40 patients participated in this study, comprising 20 RA patients and 20 GA patients. Among RA patients, all were female (100%) and were between the ages of 30 and 50. In contrast, most of the GA patients (85%) were men, while three were female (15%), and the ages of the participants ranged from 19 to 54. Our findings aligned with earlier research, showing a higher prevalence of RA in women (Favalli et al. 2019) and GA in men (Yang et al. 2022), aligning with typical gender and age distribution patterns.

The majority of RA patients were 100% Malay, whereas GA patients were 75% Malays and 25% Chinese, demonstrating a lower ethnic variety. This contrasts with national data where RA patients were predominantly Chinese (58%), while Malay made up only 16% of RA cases in the paper of Sha et al. (2022). For gout, a regional primary care study reported 48.6% Chinese, 35.5% Malay and 15.9% Indian among gout patients (Ng et al. 2025). The discrepancy between our findings and those of larger studies may be due to our relatively small sample size, which may not be able to reflect the actual

TABLE 1: Sociodemographic data of rheumatoid arthritis patients (n = 20) and gouty arthritis patients (n = 20)

Characteristic	RA, n (%)	Mean ± SD	Range	GA, n (%)	Mean ± SD	Range
Age (years)						
<30	0 (0%)			5 (25%)	26.2 ± 3.63	
30-39	5 (25%)	35.00 ± 3.39	30-60	3 (15%)	34.67 ± 4.04	30-60
40-49	12 (60%)	44.58 ± 2.65		9 (45%)	42.89 ± 2.09	
50-59	3 (15%)	50.0 ± 0		3 (15%)	52.0 ± 2.00	
Gender						
Male	0 (0%)			17 (85%)		
Female	20 (100%)			3 (15%)		
Races						
Malay	20 (100%)			15 (75%)		
Chinese	0 (0%)			5 (25%)		
Marital Status						
Married	16 (80%)			11 (55%)		
Single	4 (20%)			8 (40%)		
Widowed	0 (0%)			1 (5%)		
Educational Status				7 (35%)		
Secondary education	3 (15%)			6 (30%)		
Diploma	8 (40%)			5 (25%)		
Postgraduate	6 (30%)			2 (10%)		
Bachelor's degree	3 (15%)					
Working Status	16 (80%)			17 (85%)		
Working	4 (20%)			3 (15%)		
Not working						
Household Income (based on DOSM)						
< RM 4849	11 (55%)			8 (40%)		
RM 4850-10959	8 (40%)			10 (50%)		
> RM 10960	1 (5%)			2 (10%)		

RA: Rheumatoid arthritis; GA: Gouty arthritis; SD: Standard deviation
Household income categories based on the Department of Statistics Malaysia (DOSM) income classification (B40, M40, T20).

population distribution.

In terms of marital status, 80% of RA patients were married. In our sample, GA patients were more varied, with 55% married, 40% single and 5% widowers, consistent with earlier multicentre data in Malaysia showing 83.3% married among RA patients (Shahrir et al. 2008). For GA patients, we observed 55% married, 40% single, and 5% widowed. However, due to the absence of local marriage-status data for gout patients, direct comparison was not possible. Available international studies reported much lower married proportions (51%) among gout patients (Singh 2017).

In terms of education, RA patients were most likely to hold diplomas (40%), followed by postgraduate degrees (30%), with the remainder having bachelor's (15%) or secondary education (15%), differing slightly from earlier studies where lower educational backgrounds were more common among arthritis patients (Singh & Gaffo 2020). Meanwhile, GA patients' backgrounds in education were diverse, with 35% having completed secondary school, 30% with diplomas, 25% holding bachelor's degrees and 10% having polytechnic certificates.

The majority of participants in both groups were employed (RA: 80%, GA: 85%), with RA patients mostly working in government sectors (60%), while GA patients had a greater split between government (40%) and private sectors (30%), as well as self-employed individuals (15%). In terms of household income, 55% of RA patients fell into the B40 group (<RM 4849), whereas 50% of GA patients were in the M40 range (RM 4850-10959), indicating differences in socioeconomic status that may impact food choices and management of the illness. RA patients in our study were more likely to fall within the B40 income group, which aligned with the disease's chronicity and impact on work capacity (Singh & Gaffo 2020).

Anthropometric Data of Rheumatoid Arthritis and Gouty Arthritis Patients

Table 2 showed the anthropometric data for RA and GA patients. RA patients had an average body weight of (66.35 ± 13.47 kg), a mean height of (1.56 ± 0.08 m) and a body mass index (BMI) of (27.22 ± 5.24 kg/m^2). GA patients had a greater mean weight of (90.73 ± 23.43 kg) and a taller mean height of (1.68 ± 0.09 m), resulting in an average body mass index (BMI) of (31.90 ± 7.11 kg/m^2).

According to the Malaysian Clinical Practice Guidelines on Obesity (2023), BMI classification found that 65% of RA patients and 85% of GA

TABLE 2: Anthropometric data of rheumatoid arthritis patients (n = 20) and gouty arthritis patients (n = 20)

Characteristics	RA n (%)	GA n (%)
Weight, kg (Mean ± SD)	66.35 ± 13.47	90.73 ± 23.43
Height, m (Mean ± SD)	1.56 ± 0.08	1.68 ± 0.09
BMI, kg/m^2 (Mean ± SD)	27.22 ± 5.24	31.90 ± 7.11
Normal (18.5-22.9 kg/m^2)	3 (15%)	3 (15%)
Overweight (23.0-27.49 kg/m^2)	10 (50%)	3 (15%)
Obese I (27.5-32.4 kg/m^2)	4 (20%)	5 (25%)
Obese II (32.5-37.4 kg/m^2)	2 (10%)	4 (20%)
Obese III (>37.5 kg/m^2)	1 (5%)	5 (25%)

SD: Standard deviation
BMI classification based on the Clinical Practise Guidelines (CPG) for the Management of Obesity Malaysia (2023).

patients were overweight or obese. Among RA patients, 15% had a normal BMI (18.5-22.9 kg/m^2), 50% were overweight (23.0-27.49 kg/m^2), and 35% were classified as obese (Obese Class I-III). Specifically, 20% were in Obese Class I (27.5-32.4 kg/m^2), 10% in Obese Class II (32.5-37.4 kg/m^2) and 5% in Obese Class III (>37.5 kg/m^2). In GA patients, 15% were normal weight, 15% were overweight and 70% fell into various obesity groups, including 25% in Obese Class I, 20% in Obese Class II and 25% in Obese Class III. These findings highlighted the high incidence of excess body weight, particularly among GA patients, which may worsen inflammatory processes and disease burden in arthritis (Ebrahimpour-Koujan et al. 2020).

Nutrient intake and adequacy of Rheumatoid Arthritis and Gouty Arthritis Patients

The nutrient intakes for RA patients were evaluated based on the RNI Malaysia 2017 for adult females aged 30-50 years.

Based on Table 3, among RA patients (n = 20; adult females aged 30-50 years), the mean energy intake was (1558.60 ± 318.08 kcal). Of these, 45% of patients fell below, 40% met and 15% exceeded the recommended intake. This relatively low energy intake was somewhat inconsistent with the high proportion of overweight and obese individuals in this group. This discrepancy may be due to patient under-reporting, or the Hawthorne effect, where participants intentionally altered

TABLE 3: Nutrient intake and adequacy of rheumatoid arthritis patients (n = 20) and gouty arthritis patients (n = 20), including gouty arthritis age- and gender-specific subgroups

Nutrient	RA Mean + SD (n = 20)	RA %B/M/E	GA Mean + SD (n = 20)	GA %B/M/E	GA Adult Male (30-59 years) n = 15 Mean ± SD	GA Adult Female (19-29 years) n = 3 Mean ± SD	GA Adult Male (19-29 years) n = 2 Mean ± SD
Energy (kcal)	1558.6 ± 318.1	45/40/15	1933.6 ± 294.1	15/70/15	1996.7 ± 254.8	1734.3 ± 333.5	1759.0 ± 521.8
Carbohydrate (g)	205.6 ± 47.1	90/0/10	244.8 ± 34.1	95/0/5	248.2 ± 35.1	238.0 ± 23.3	229.5 ± 54.5
Protein (g)	60.0 ± 16.5	15/15/70	75.3 ± 14.5	5/5/90	78.4 ± 14.3	69.3 ± 7.0	60.5 ± 19.1
Fat (g)	55.6 ± 14.9	0/30/70	72.7 ± 18.2	40/0/60	76.7 ± 14.9	56.0 ± 26.9	67.0 ± 24.0
Saturated Fat (g)	12.0 ± 4.0	0/0/100	17.2 ± 4.7	0/10/90	17.9 ± 4.1	13.0 ± 7.2	18.0 ± 4.2
Dietary Fibre (g)	6.8 ± 2.3	100/0/0	9.7 ± 3.5	100/0/0	9.8 ± 3.9	9.3 ± 2.3	9.0 ± 1.4
Calcium (mg)	509.8 ± 193.3	100/0/0	583.2 ± 175.5	100/0/0	580.0 ± 173.9	584.0 ± 199.4	605.5 ± 285.0
Iron (mg)	21.4 ± 11.0	85/0/15	26.8 ± 10.4	5/0/95	28.1 ± 10.1	22.0 ± 13.0	23.5 ± 12.0
Sodium (mg)	1896.8 ± 674.4	30/0/70	2838.9 ± 784.0	0/0/100	2999.7 ± 792.7	2405.7 ± 556.7	2282.5 ± 832.3
Total Sugar (g)	28.0 ± 22.1	0/0/100	27.6 ± 9.0	0/0/100	26.8 ± 9.6	33.7 ± 6.8	24.0 ± 2.8

GA: Gouty arthritis; RA: Rheumatoid arthritis; REC: Recommended Nutrient Intake (RNI) Malaysia 2017; SD: Standard deviation

Values were presented as mean ± SD; %B/M/E denoted the percentage of participants with intakes below, meeting, or exceeding the age- and gender-specific REC; REC comparisons were made based on the respective age- and gender-specific recommendations; GA subgroup data were presented to illustrate variations in nutrient intake across age and gender categories and were not subjected to separate adequacy classification.

their food intake or report more desirable dietary behaviours when they were aware their diet was being monitored. Alternatively, some patien may have been actively attempting to lose weight, either through intentional energy restriction or self-directed dieting, which may explain the low reported energy intake. This could have adversely affected the overall nutritional quality of their diet, as observed in several nutrient inadequacies below.

The average protein intake was (60.00 ± 16.54 g), where 70% of patients exceeded, 15% met, and 15% fell below the recommended level. In 90% of patients, carbohydrate intake (205.55 ± 47.05 g) fell below the recommended level. In 70% of patients, their fat intake (55.55 ± 14.90 g) surpassed recommended levels. All patients consumed more saturated fat than recommended amounts (11.95 ± 3.98 g). All patients consumed less fibre (6.80 ± 2.26 g) and calcium (509.75 ± 193.26 mg) than recommended 70% of patients consumed more sodium (1896.80 ± 674.36 mg) than recommended. Total sugar intake averaged 28.00 ± 22.05 g, with 85% of patients exceeding and 15% meeting the recommendation.

These trends were consistent with findings from a Swedish cross-sectional study where RA patients similarly demonstrated high saturated fat intake, low fibre, and insufficient calcium levels (Turesson Wadell et al. 2022). Moreover, National Health and Nutrition Examination Survey data (2010-2020) showed that low fibre intake was associated with increased risk and inflammatory markers of RA, while higher fibre intake (>19.1 g/day) was linked to a 25% reduction in RA risk (Liu & Xie 2023). A separate Iranian cohort also found that low dietary fibre consumption correlated with higher RA disease activity, whereas anti-inflammatory, higherprotein diets are associated with lower activity scores (Elahi et al. 2022). Furthermore, a 2019 review described Western-style diets, characterised by high saturated fat and refined sugar, along with low fibre, as promoting gut microbiota dysbiosis and inflammation, which were implicated in RA pathogenesis (Häger et al. 2019). Finally, a 2024 cross-sectional study of 110 RA patients found that higher intake of saturated fat and sugar, combined with nutritional deficiencies, were associated with elevated inflammatory markers and higher disease activity (Uysal et al. 2024).

The nutrient intakes of GA patients (n = 20) were evaluated according to the RNI for Malaysia 2017, based on their respective age and gender subgroups, such as adult males aged 30-59 years (n = 15), adult females aged 19-29 years (n = 3), and adult males aged 19-29 years (n = 2).

For GA patients (n = 20), the average energy intake was 1933.60 ± 294.12 kcal, with 70% meeting, 15% exceeding and 15% falling below the recommended energy intake. Protein intake (75.25 ± 14.54 g) exceeded norms in 90% of patients. In 95% of cases, carbohydrate consumption (244.80 ± 34.11 g) fell below the recommended amount. Meanwhile, 60% of patients exceeded fat intake (72.65 ± 18.18 g), and 90% consumed saturated fat (17.15 ± 4.72 g) above recommendations. All patients consumed low fibre (9.65 ± 3.45 g) and calcium (583.15 ± 175.51 mg). All patients consumed more sodium (2838.85 ± 784.01 mg) and sugar (27.55 ± 8.95 g) than recommended. These findings aligned with established dietary risk factors for gout, high saturated fat and sugar intake had been linked to elevated serum uric acid (SUA) and increased gout risk (Ryu et al. 2014; Zhang et al. 2022; Zhou et al. 2022). Meta-analyses suggested that sugar-sweetened beverages and free sugars can double or even triple the risk of gout (Turesson Wadell et al. 2022).

Although the average intake appeared within the recommended range, the high prevalence of overweight and obesity among GA patients raises the possibility of under-reporting, particularly of total caloric intake, similar to the RA group. This may be attributed to social desirability bias or increased of awareness of being observed, leading participants to alter or misreport their usual intake. Another potential explanation was that some individuals may have been intentionally restricting their calorie intake to manage body weight.

(i) Average nutrient intake of gouty arthritis patients by age and gender subgroups (n = 20)

To further explore dietary differences within the GA group, nutrient intake was analysed by age and gender subgroups, as shown in Table 3. Among adult male GA patients aged 30-59 years (n = 15), the mean energy intake was 1996.73 ± 254.80 kcal, slightly below the RNI (2190-2240 kcal/day). However, protein intake (78.40 ± 14.30 g) and fat intake (76.73 ± 14.91 g) exceeded recommended levels, while carbohydrate intake (248.20 ± 35.13 g) remained within the recommended range of 50-65% of total energy intake. Notably, saturated fat intake (17.87 ± 4.14 g) surpassed the <10% total energy intake guideline. Furthermore, dietary fibre (9.80 ± 3.90 g) and calcium (580.00 ± 173.91 mg) were significantly lower than the RNI recommendations (20-30 g and 1000 mg, respectively). Sodium (2999.67 ± 792.67 mg) and total sugar (26.80 ± 9.55 g) were also well above recommended levels.

These findings aligned with existing literature indicating that diets high in animal protein, saturated fats, sodium and sugar, but low in fibre and dairy, were positively associated with serum uric acid (SUA) levels and increased gout risk. For example, Zhang et al. (2022) emphasised that high purine intake from meat and seafood leads to increased SUA production. Zhou et al. (2022) further observed that Northern Chinese adults consuming animal-based, high-fat diets exhibited significantly higher uric acid levels. Ryu et al. (2014) found that individuals with hyperuricemia had significantly lower intakes of dietary fibre and calcium compared to controls. These patterns directly support the nutrient deficiencies and excesses observed in this study's GA cohort.

Among female GA patients aged 19-29 years (n = 3), the mean energy intake was 1734.33 ± 333.46 kcal, within recommended ranges. However, protein intake (69.33 ± 7.02 g) exceeded the RNI (53 g), and although carbohydrates (238.00 ± 23.26 g) and fat (56.00 ± 26.85 g) were within acceptable limits, saturated fat intake (13.00 ± 7.21 g) exceeded the recommended threshold in some individuals. Importantly, fibre intake (9.33 ± 2.31 g) and calcium (584.00 ± 199.37 mg) remained below recommended levels. Sodium (2405.67 ± 556.71 mg) and sugar (33.67 ± 6.81 g) were also excessive.

This was consistent with previous findings where low fibre and calcium intake, combined with high sodium and protein was associated with hyperuricemia and increased inflammation (Ryu et al. 2014). Moreover, excessive sugar intake, particularly from sugar-sweetened beverages (SSBs), has been shown to significantly elevate SUA and increase the frequency of gout flares.

For younger male GA patients aged 19-29 years (n = 2), energy intake (1759.00 ± 521.84 kcal) was slightly below recommendations, but the macronutrient distribution was generally adequate, except for elevated saturated fat (18.00 ± 4.24 g) and sugar (24.00 ± 2.83 g). Fibre (9.00 ± 1.41 g) and calcium (605.50 ± 284.96 mg) remained inadequate. Sodium intake (2282.50 ± 832.26 mg), while within the acceptable range on average, exceeded safe limits in some individuals. These dietary trends are similarly reflected in large-scale studies showing that high saturated fat and refined sugar intake correlate with elevated SUA levels and gout prevalence. A meta-analysis by Ebrahimpour-Koujan et al. (2020) revealed that frequent consumption of SSBs was associated with a 35% higher risk of gout, reinforcing the risks observed in this subgroup.

Diet Quality of Rheumatoid Arthritis and Gouty Arthritis Patients Based on Standardised Malaysian Healthy Eating Index

According to Table 4, the majority of RA patients (85%) had a moderate diet quality, while 10% had poor diet quality and only 5% achieved good diet quality according to S-MHEI 2021 scores. A similar pattern was observed among GA patients, with 85% rated as moderate diet quality, with the remaining 15% achieving good diet quality. The mean and standard deviation S-MHEI score for RA patients was 65.3 ± 9.24, while GA patients recorded a slightly higher mean and standard deviation score of 68.6 ± 7.81. These findings were consistent with other studies using diet-

TABLE 4: Diet quality of rheumatoid arthritis patients (n = 20) and gouty arthritis patients (n = 20) based on S-MHEI 2021

Group	Mean S-MHEI Score ± SD	Poor Diet n (%)	Moderate Diet n (%)	Good Diet n (%)
RA (n = 20)	65.3 ± 9.2	2 (10%)	17 (85%)	1 (5%)
GA (n = 20)	68.6 ± 7.8	0 (0%)	17 (85%)	3 (15%)

New Standardised Malaysian Healthy Eating Index 2021: SMHEI 2021; SD: Standard deviation
Diet quality categories according to S-MHEI 2021: Poor (<50), Moderate (51–80), Good (>80)

quality indices, such as a Swedish study using the HEI-2010 among RA patients (n = 84) reported a mean score of 58.7 ± 15.9, with only 7.1% rated "good", 58.3% "fair", and 34.5% "poor", indicating widespread need for improvement in diet quality (Berube et al. 2017). In a cohort of American adults, each 10-point increase in HEI-2015 was associated with a 12%–32% lower risk of incident gout, highlighting the protective role of better diet quality (Yokose et al. 2022).

It is important to note that all participants in the present study were follow-up patients attending routine clinic visits. Some individuals may have received prior dietary counselling and partially implemented the recommended changes, while others may have made minimal adjustments to their eating habits. This variability in behavioural response may have contributed to the predominance of moderate diet quality scores observed in both groups.

This pattern suggests that the majority of arthritis patients require dietary modifications to better align with the Malaysian Dietary Guidelines (MDG). The overall moderate diet quality observed in both RA and GA patients indicates inadequate adherence to national nutritional standards, which may have implications for disease progression and symptom management.

Previous studies have consistently shown that patients with arthritis often exhibit suboptimal diet quality, typically characterised by low intake of fruits, vegetables, legumes and whole grains, and excessive consumption of sodium, saturated fat and added sugars. These dietary imbalances have been linked to increased systemic inflammation, oxidative stress, and poor clinical outcomes in inflammatory arthritis conditions such as RA and gout (Zhou et al. 2022).

The difference in diet quality between RA and GA patients in this study may reflect variability in food choices, cultural dietary patterns, or differences in exposure to nutrition education and medical nutrition therapy (MNT). It is also possible that the observed variation is influenced by differences in socioeconomic background, access to healthcare, or disease duration, which can shape dietary behaviours over time. As such, targeted dietary interventions and continuous patient education should be emphasised as part of integrated arthritis management, especially in Malaysian clinical settings.

Dietary Pattern Rheumatoid Arthritis and Gouty Arthritis Patients based on Principal Component Analysis

As shown in Table 5, PCA identified two dominant dietary patterns among RA patients, collectively accounting for 76.4% of the total variance. The first component (48.5%) reflected a high-fat, high-sodium dietary pattern, primarily characterised by frequent consumption of processed foods and animal-based products. The second component (27.9%) represented a grain and dairy-rich pattern, with higher intake of rice, cereals and milk-based items, suggesting a more balanced macronutrient profile.

Among GA patients, PCA revealed two main dietary patterns explaining 69.1% of the variance. The first component (43.0%) described a high-purine dietary pattern, with elevated consumption of meat, eggs and legumes, coupled with lower fruit intake, features known to contribute to increased serum uric acid levels.

TAB:E 5: Principal component analysis of dietary patterns in rheumatoid arthritis patients (n = 20), and gouty arthritis patients (n = 20)

Group	Component	Dietary Pattern Description	Variance Explained (%)
RA (n = 20)	1	High fat, high sodium (processed/animal foods)	48.5
RA (n = 20)	2	Grain and dairy-rich (rice, cereal, milk products)	27.9
GA (n = 20)	1	High- purine (meat, eggs, legumes; low fruit)	43.0
GA (n = 20)	2	Vegetables and high fat	26.1

Dietary patterns extracted using principal component analysis with varimax rotation. Components retained based on eigenvalue >1 and scree plot.

The second component (26.1%) was defined as a vegetable and high-fat dietary pattern, indicating greater intake of vegetables along with high levels of dietary fats.

These findings correspond with earlier research indicating that arthritis patients frequently consume meals high in animal-based proteins and fats, which contribute to pro-inflammatory states and raised uric acid levels, especially in GA patients (Jandari et al. 2021). These findings highlight the importance of dietary treatments that aim to reduce fat, salt and purine while increasing fibre and micronutrient intake.

Clinical Implications and Recommendations

Our findings highlight suboptimal dietary patterns, nutrient inadequacies, and a high prevalence of overweight and obesity among RA and GA patients, suggesting the need for targeted nutrition interventions in clinical practice (Jandari et al. 2021; Turesson Wadell et al. 2022; Yang et al. 2022). Routine dietary screening should be integrated into standard care for these patients to identify nutrient deficiencies, excessive sodium and saturated fat intake, and high-purine food consumption (American College of Rheumatology 2020; Ministry of Health Malaysia 2020). Early identification of dietary risks allows clinicians to tailor interventions to each patient's specific needs.

Medical Nutrition Therapy (MNT) should focus on increasing intake of fibre-rich foods such as fruits, vegetables and whole grains, as well as calcium, to support bone health and overall metabolic function (Häger et al. 2019; Liu & Xie 2023). Simultaneously, saturated fat, sodium and free sugar intake should be reduced to lower inflammatory risk and improve cardiovascular outcomes (Coras et al. 2020; Jandari et al. 2021). For GA patients, moderation of high-purine animal foods is particularly important to prevent elevated serum uric acid levels and gout flares (Yokose et al. 2022).

Weight management should also be emphasised, given the high proportion of overweight and obese participants, especially in the GA group (Singh & Gaffo 2020). Personalised dietary counselling combined with guidance on physical activity can support healthy weight maintenance, reduce disease burden and improve long-term outcomes (American College of Rheumatology 2020). Continuous nutrition education, including guidance on portion sizes, food label reading and balanced meal planning, should be part of follow-up care to enhance patient adherence to dietary recommendations (Susyanti et al. 2023).

By translating these findings into actionable clinical strategies, healthcare providers can address both nutritional inadequacies and lifestyle factors, integrating preventive nutrition care alongside pharmacological management to optimise health outcomes in RA and GA patients.

Limitations

This study has several limitations that should be acknowledged. The use of self-reported 3-day dietary records introduces recall and

reporting bias and under-reporting, particularly among overweight, obese or weight-conscious participants may have affected nutrient intake estimates. Social desirability bias may also have influenced participants to report more favourable dietary behaviours. Furthermore, the questionnaire-based method relies on participants' understanding and accurate estimation of portion sizes, which may reduce data accuracy.

Another limitation is the absence of disease severity markers, including serum uric acid, inflammatory markers (CRP/ESR) and DAS28 for RA patients, which were not consistently available at the time of dietary assessment. Incorporating these biomarkers in future studies would allow stronger correlations between nutrient intake, dietary patterns, and disease activity.

The relatively short study duration (four months), small sample size and limited ethnic diversity also restrict the generalisability of the findings to the broader Malaysian population. Prior dietary counselling received during earlier clinic visits may have influenced current dietary choices and medication use, particularly corticosteroids may affect appetite, weight and dietary behaviours. However, medication data were not consistently available for all participants.

Collectively, these limitations highlight the need for larger, multi-centre studies that incorporate biomarker measurements, detailed medication data and longer-term dietary assessments to better understand the relationship between diet and disease activity in RA and GA patients.

CONCLUSION

This study found that patients with RA and GA attending HCTM, UKM, had suboptimal nutrient intake and diet quality. Both groups consumed excessive saturated fat, sodium and added sugars, while dietary fibre, calcium and other key nutrients were insufficient. RA patients had low energy and carbohydrate intake, whereas GA patients followed a high-purine dietary pattern with high consumption of meat, eggs and legumes. Diet quality, assessed using the S-MHEI was predominantly moderate, and PCA identified distinct dietary patterns in each group, highlighting specific targets for dietary interventions. These findings emphasise the importance of individualised nutrition counseling and medical nutrition therapy to promote anti-inflammatory diets, adequate nutrient intake, and moderation of high-purine foods, which may improve disease management, reduce comorbidity risks and support overall health. Future studies with larger, more diverse cohorts are warranted to confirm these findings and strengthen dietary guidance for RA and GA patients.

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