Predictors of Quality of Life Among Colorectal Cancer Survivors in Malaysia: A 6-Month Follow-Up Study

Ainaa Almardhiyah Abd Rashid , Hamid Jan Jan Mohamed * , Amal K. Mitra , Lydiatul Shima Ashari , Mohd Razif Shahril , Lee Yeong Yeh , Raja Affendi Raja Ali

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Article

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Ainaa Almardhiyah Abd Rashid [1], Hamid Jan Jan Mohamed [2,*], Amal K. Mitra [3], Lydiatul Shima Ashari [2], Mohd Razif Shahril [4], Lee Yeong Yeh [5] and Raja Affendi Raja Ali [6]

[1] Nutrition Program, Faculty of Food Science and Nutrition, Universiti Malaysia Sabah, Kota Kinabalu, Sabah, Malaysia
[2] Nutrition Program, School of Health Sciences, Universiti Sains Malaysia, Kota Bharu, Kelantan, Malaysia
[3] Department of Public Health, Julia Jones Matthews School *of* Population *and* Public Health, Texas Tech University Health Sciences Center, Abilene, TX 79601
[4] Centre for Healthy Aging and Wellness (HCARE), Faculty of Health Sciences, Universiti Kebangsaan Malaysia, Kuala Lumpur, Malaysia
[5] Department of Medicine, School of Medical Sciences, Universiti Sains Malaysia, Kota Bharu, Kelantan, Malaysia
[6] Sir Jeffrey Cheah Sunway Medical School, Faculty of Medical and Life Sciences, Sunway University, Petaling Jaya, Selangor, Malaysia
* Correspondence: hamidjan@usm.my; Tel.: +60-601-2645-6477

Abstract

Background: Quality of life (QoL) is a crucial outcome measure in cancer care. This study aimed to identify predictors of health-related quality of life (HRQoL) among colorectal cancer (CRC) patients in Malaysia. **Methods:** The study was conducted from January 2021 to July 2022, recruiting CRC patients from two teaching hospitals in Malaysia. The validated Malay versions of EORTC QLQ-C30 and QLQ-CR29 questionnaires assessed physical, psychological, and social functioning. Patients were evaluated at 6 months post-treatment to determine QoL predictors. **Results:** Among 87 CRC patients (55.2% male, mean age 59.8±11.8 years), 37.9% had stage III disease and 13.8% had stage IV. Most patients (93%) underwent surgery and 78% received chemotherapy. The mean Global Health Status score was 66.57±20.75. Multivariate analysis revealed that older age ($p = 0.03$), advanced cancer stage ($p = 0.017$), lower body weight ($p = 0.017$), and reduced hip circumference ($p = 0.040$) significantly predicted poorer QoL. Nutritional parameters specifically predicted functional domains: lower body weight and BMI predicted role and cognitive function, while lower hip circumference predicted emotional function. **Conclusions:** Advanced age, disease stage, and nutritional status are significant predictors of QoL in Malaysian CRC patients. These findings highlight the importance of nutritional assessment and intervention in CRC survivorship care to optimize patient outcomes.

Keywords: colorectal cancer; health-related quality of life; nutritional parameters; follow-up study; Malaysia

1. Introduction

According to the International Agency for Research on Cancer (IARC), which is the cancer agency of the World Health Organization, the most frequently diagnosed cancers worldwide include lung cancer, female breast cancer, and colorectal cancer (CRC) [1]. The most cancer deaths are due to lung cancer and CRC [1]. CRC is a growing burden, especially in developing countries [1].

Quality of life (QoL) has become an important outcome criterion in patients with cancer. Long-term survivors of CRC may experience persistent issues affecting their QoL [2]. Even though

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treatments are not curative for most patients, QoL is often considered the predictor of treatment success. As a result, the goals of treatment are oriented towards improving survival, slowing tumor progression, effectively managing symptoms, and enhancing overall QoL [3,4].

Survival rate of CRC patients is greatly dependent on the cancer stage; for example, the 5-year relative survival rate exceeds 90% for the localized stage while less than 10% for the advanced and metastatic stage of the cancer [5]. A significant number of individuals who have survived CRC often endure a substantial load of symptoms, including fatigue, bowel dysfunction, depression, and insomnia [6]. This burden of symptoms has a considerable impact on their QoL following the completion of treatment. It also has a profound influence on the overall CRC survivorship.

Despite growing recognition of QoL as a critical outcome in CRC care, limited research has examined predictors of QoL among Asian populations, particularly in Malaysia where cultural, dietary, and healthcare factors may influence outcomes differently than in Western populations. Most existing studies focus on Western cohorts, and the specific factors predicting QoL in Malaysian CRC patients remain poorly understood. Furthermore, the relationship between nutritional status and QoL in this population has not been adequately explored.

Therefore, this study aimed to identify sociodemographic, clinicopathologic, and nutritional predictors of QoL among CRC survivors in a 6-months post-treatment in Malaysia. Understanding these predictors could inform targeted interventions to improve QoL and optimize survivorship care in this population.

2. Materials and Methods

2.1. Study Design, Setting Study Participants

This study was conducted from January 2021 to July 2022 by patient selection using a convenience sampling technique, as first-come, first-serve basis. Patients were recruited from all eligible CRC patients at two tertiary teaching hospitals in Malaysia namely, Hospital Universiti Sains Malaysia (HUSM) and Hospital Canselor Tuanku Muhriz, Universiti Kebangsaan Malaysia (HCTM UKM).

The units for cancer patients at HUSM included oncology clinic, surgery clinic, and radiology unit. The units for patient recruitments at HCTM UKM included obesity clinic, outpatient clinic and private clinics.

HUSM is located in suburban city of Kota Bharu, a north-eastern region of Peninsular Malaysia, having a population density of 122 people per km^2. HCTM UKM is located in the metropolitan city of Kuala Lumpur at Klang Valley of Peninsular Malaysia, having a population density of 8,045 per km^2. These two hospitals, HUSM and HCTM UKM, represented the suburban and urban areas, respectively in Malaysia.

The study adheres to the **Strengthening the Reporting of Observational Studies in Epidemiology (**STROBE) reporting guidelines. Inclusion criteria included 1) patients between the ages from 18 to 80 years; 2) histopathologically confirmed CRC; 3) diagnosed no more than two years before study enrolment; and 4) had no previous cancer diagnosis at other anatomic sites. Exclusion criteria included 1) mental disorders, such as major depression, schizophrenia, and anxiety; 2) physical disability affecting independent self-care; and 3) females being pregnant or breastfeeding.

Ethical approval was obtained from the Human Research Ethics Committee of USM [USMKK/JEPeM/19060354] (Appendix A) and the Universiti Kebangsaan Malaysia Medical and Research Ethics Committee (UKMREC; FF-2020-005). The study objectives and research procedures were explained to the potential patients, and a written informed consent was obtained from each patient before enrolment.

The patients were followed up for 6 months to assess their QoL in terms of daily activities, physical strength, pain, sleep, and mental health.

2.2. Study Instruments and Administration

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QoL was assessed by household interviews using the Malay version of two sets of established questionnaires obtained from European Organisation for Research and Treatment of Cancer (EORTC). The core questionnaire, QLQ-C30 was used to evaluate the overall health, functions, symptoms, and financial implications of the disease. This questionnaire was composed of both multi-item scales and single-item measures, ranging from 'not at all' to 'very much'. The questionnaire was comprised of one QOL scale, five functional scales, three symptom scales, and six single items.

The supplementary questionnaire module, QLQ-CR29, specifically assessed the health-related QOL (HRQOL) among CRC patients. It included four multi-item scales and 19 single-items. These questions comprised of information about body image, sexual function, and patients' future perspective. In functioning scales, a high score indicated a higher level of functioning and better overall functioning. Conversely, in symptom scales, a high score indicated more severe symptoms or worse symptomatology.

The Malay version of QLQ-C30 had 30 questions and the Malay version of QLQ-CR29 included 29 questions with answers using a Likert scale, ranging from "not at all" to "very much." Each response scale was recorded and transformed into a score between 0 and 100 using a description.

2.3. Statistical Analysis

Data analyses were conducted using IBM SPSS statistic version 22.0 (Chicago, IL, USA). The data were tested, cleaned and explored to investigate the graphical distribution of the data by using histogram, box whisker plot and Shapiro-wilk to understand the data distribution. For descriptive results, numerical and continuous data with normal distribution were presented as mean and standard deviation (SD) while skewed distributed data were presented as median and interquartile range (IQR). In addition, categorical data were presented as frequency and percentage.

Linear regression analyses were used to determine factors that predicted HRQOL, functional scales, and symptom scales for the QLQC30 and CR29 questionnaires. Both numerical (age and anthropometry) and categorical (sex and CRC stages) independent variables were used in the model. A p-value of ≤0.05 indicated statistical significance.

3. Results

3.1. Patient Characteristics and Treatments

The mean (SD) patient age was 59.83 (11.79) with majority being male (55.2%). Most of CRC patients had stage III (37.9%) cancer, followed by stage II (29.9%), stage I (14.9%), stage IV (13.8%) and unknown (3.4%). The majority of the patients underwent surgical treatment (93.1%); among the surgery types, about 45% were performed laparoscopic anterior resection. Chemotherapy was given in 78.2% patients, and radiotherapy in 37.9% patients. In the chemotherapy/radiotherapy group, most of them had adjuvant chemotherapy (44.8%), meaning the chemotherapy was implemented after surgery. A combination of folinic acid, fluorouracil and oxaliplatin (FOLFOX) was the most frequent chemotherapy regime provided to the CRC patients (Table 1).

Table 1. Baseline characteristics of CRC patients.

Variables	No (%)
Age (years), mean (SD)	59.83 (11.79)
Sex	
Male	48 (55.2)
Female	39 (44.8)
Stage of CRC	
Stage I	13 (14.9)
Stage II	26 (29.9)
Stage III	33 (37.9)
Stage IV	12 (13.8)

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Unknown	3 (3.4)
Surgical treatment	
Yes	81 (93.1)
No	6 (6.9)
Surgical types	
Laparoscopic anterior resection	39 (44.8)
Laparoscopic anterior resection + Hartmann's procedure	4 (4.6)
Anterior resection	2 (8.0)
Laparoscopic abdominoperineal resection	8 (9.2)
Sigmoid colectomy	10 (11.5)
Others	13 (14.9)
None	8 (6.9)
Chemotherapy treatment	
Yes	68 (78.2)
No	19 (21.8)
Radiotherapy treatment	
Yes	33 (37.9)
No	54 (62.1)
Chemotherapy/ Radiotherapy treatment types	
Neoadjuvant chemotherapy	1 (1.1)
Adjuvant chemotherapy	39 (44.8)
Palliative chemotherapy	4 (4.6)
Neoadjuvant radiotherapy	4 (4.6)
Adjuvant radiotherapy	8 (9.2)
Neoadjuvant CCRT	12 (13.8)
CCRT	3 (3.4)
Adjuvant CCRT	6 (6.9)
Adjuvant palliative	1 (1.1)
None	9 (10.3)

3.2. Assessment of Global Health Status, Functioning and Symptoms

In general, mean (SD) score for global health status (GHS/QoL) was 66.57 (20.75). Scores above 60 in functioning scores represented high or better functioning status. GHL/QoL score for cognitive function had the highest scores (86.76 ± 19.56), whereas physical functioning had the lowest scores (65.13 ± 22.61). Of the symptom scales, fatigue was the worst common symptom having a QoL score of 47.06 ± 23.96, followed by pain (43.68 ± 24.54), loss of appetite (39.08 ± 27.00), and nausea and vomiting (36.59 ± 25.52) (Table 2).

Table 2. Mean scores of all items in QLQ-C30 of CRC patients.

Variables	Mean (SD)

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Global Health Status/ QoL	66.57 (20.75)
Functioning scale	
Physical functioning	65.13 (22.61)
Role functioning	66.47 (25.98)
Emotional functioning	77.30 (18.96)
Cognitive functioning	86.67 (19.56)
Social functioning	69.73 (22.38)
Symptom scales	
Fatigue	47.06 (23.96)
Nausea and vomiting	36.59 (25.52)
Pain	43.68 (24.54)
Dyspnea	10.34 (18.93)
Insomnia	16.09 (24.07)
Appetite loss	39.08 (27.00)
Constipation	15.58 (21.53)
Diarrhea	13.41 (19.99)
Financial difficulties	22.73 (27.47)

Most CRC patients expressed that they were satisfied with their body image as it scored the highest (85.95 ± 17.73) among the functioning scale in QLQ-C29. However, mean score for anxiety was low (57.47 ± 22.56), indicating the presence of significant anxiety among CRC patients. The other common symptoms and their corresponding QoL scores were as follows: urinary frequency (43.29 ± 19.93), abdominal pain (22.60 ± 24.11) and stool frequency (21.26 ± 21.37) (Table 3).

Table 3. Mean scores of all items in QLQ-C29 of CRC patients.

Variables	Mean (*SD*)
Functioning scale	
Body image	85.95 (17.73)
Anxiety	57.47 (22.56)
Weight	73.95 (22.40)
Sexual interest (men)	76.39 (25.69)
Sexual interest (women)	78.63 (23.55)
Symptom scales	
Urinary frequency	43.29 (19.93)
Blood and mucus in stool	9.00 (13.88)
Stool frequency	21.26 (21.37)
Urinary incontinence	9.20 (16.81)
Dysuria	8.81 (12.15)
Abdominal pain	22.60 (24.11)
Buttock pain	12.65 (17.79)
Dry mouth	13.60 (20.89)
Hair loss	10.92 (15.21)
Taste	16.09 (21.18)
Flatulence	17.43 (19.51)
Fecal incontinence	14.75 (20.24)
Sore skin	9.96 (17.69)
Embarassment	7.09 (11.26)
Stoma care problems	31.11 (36.66)
Impotence	7.64 (19.73)
Dyspareunia[a]	0.00 (0.00)

3.3. Multivariate Analysis Predictors of QoL

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Results of multivariate regression analysis in predicting QoL in CRC patients are presented in Tables 4–7. Independent variables included in the model were sociodemographic variables (age and sex), clinicopathologic feature (stage of cancer), and changes in anthropometry such as body weight, BMI, waist circumference (WC), and hip circumference (HC). More than half of the CRC patients presented with malnutrition in terms of lower body weight, BMI and HC.

Table 4. Predictor factors of quality of life of CRC for functioning scales (C30).

Predictive factors	*β*	95% *CI*	*p*-value	*β*	95% *CI*	*p*-value	*β*	95% *CI*	*p*-value
	Global health status/ QOL			Physical functioning			Role functioning		
Age	-0.409	-0.778, -0.040	**0.030**	-0.673	-1.060, -0.286	**0.001**	-0.590	-1.047, -0.132	**0.012**
Sex	1.723	-7.214, 10.659	0.702	-3.109	-12.835, 6.617	0.527	7.318	-3.771, 18.408	0.193
Stage of cancer	-5.203	-9.463, -0.943	**0.017**	-2.316	-7.091, 2.460	0.338	-8.528	-13.729, -3.326	**0.002**
Weight changes	1.018	0.184, 1.852	**0.017**	0.129	-0.811, 1.068	0.786	1.715	0.700, 2.729	**0.001**
BMI changes	1.092	-0.899, 3.083	0.278	-0.249	-2.433, 1.936	0.821	3.083	0.662, 5.504	**0.013**
WC changes	0.473	-0.211, 1.158	0.173	0.395	-0.357, 1.147	0.300	-0.414	-1.272, 0.445	0.341
HC changes	0.509	0.024, 0.994	**0.040**	0.438	-0.091, 0.967	0.104	0.421	-0.166, 1.008	0.158
	Emotional functioning			Cognitive functioning			Social functioning		
Age	-0.049	-0.396, 0.297	0.778	-0.539	-0.877, -0.201	**0.002**	-0.241	-0.647, 0.165	0.240
Sex	-3.005	-11.156, 5.146	0.466	2.991	-5.417, 11.399	0.481	-0.908	-10.555, 8.738	0.852
Stage of cancer	-4.285	-8.205, -0.366	**0.032**	-3.431	-7.518, 0.655	0.099	-1.268	-6.012, 3.477	0.597
Weight changes	0.519	-0.261, 1.299	0.189	1.288	0.524, 2.052	**0.001**	0.418	-0.507, 1.344	0.371
BMI changes	-0.021	-1.854, 1.812	0.982	2.294	0.470, 4.118	**0.014**	0.503	-1.657, 2.663	0.645
WC changes	0.0451	-0.170, 1.072	0.152	0.196	-0.453, 0.845	0.549	0.293	-0.446, 1.031	0.433
HC changes	0.456	0.016, 0.896	**0.043**	0.394	-0.063, 0.851	0.090	0.042	-0.483, 0.567	0.874

Table 5. Predictor factors of quality of life of CRC for symptoms scales (C30).

Predictive factors	*β*	95% *CI*	*p*-value	*β*	95% *CI*	*p*-value	*β*	95% *CI*	*p*-value
	Fatigue			Nausea and vomiting			Body Pain		
Age	0.411	-0.018, 0.840	0.060	0.241	-0.223, 0.705	0.305	0.608	0.179, 1.037	**0.006**
Sex	-9.135	-19.275, 1.006	0.077	5.716	-5.219, 16.650	0.302	-5.582	-16.095, 4.931	0.294
Stage of cancer	4.448	-0.549, 9.444	0.080	-0.630	-6.048, 4.787	0.818	3.777	-1.370, 8.924	0.148
Weight changes	-1.641	-2.572, -0.710	**< 0.001**	0.032	-1.029, 1.093	0.952	-0.906	-1.907, 0.095	0.076
BMI changes	-3.396	-5.592, -1.199	**0.003**	-0.017	-2.483, 2.449	0.989	-1.844	-4.182, 0.494	0.121
WC changes	-0.406	-1.178, 0.366	0.299	-1.192	-2.004, -0.380	**0.005**	-0.029	-0.854, 0.795	0.944
HC changes	-0.299	-0.852, 0.253	0.284	-0.147	-0.753, 0.458	0.629	-0.210	-0.783, 0.362	0.467
	Dyspnea			Insomnia			Loss of appetite		
Age	0.091	-0.255, 0.437	0.602	-0.023	-0.463, 0.418	0.919	0.013	-0.481, 0.506	0.959
Sex	-3.775	-11.895, 4.345	0.358	-2.315	-12.680, 8.050	0.658	-1.122	-12.759, 10.515	0.848
Stage of cancer	-0.043	-4.062, 3.976	0.983	5.040	0.047, 10.034	**0.048**	2.954	-2.743, 8.651	0.305
Weight changes	-0.638	-1.413, 0.136	0.105	-1.017	-1.993, -0.041	**0.041**	-0.430	-1.548, 0.688	0.447
BMI changes	-0.976	-2.793, 0.841	0.289	-2.304	-4.576, -0.032	**0.047**	-1.050	-3.649, 1.549	0.424
WC changes	-0.310	-0.868, 0.247	0.272	-0.893	-1.654, -0.133	**0.022**	-0.527	-1.417, 0.362	0.242
HC changes	-0.131	-0.533, 0.272	0.520	-0.286	-0.846, 0.275	0.313	-0.201	-0.836, 0.435	0.531

Table 6. Predictor factors of quality of life of CRC for functioning scales (CR29).

Predictive factors	*β*	95% *CI*	*p*-value	*β*	95% *CI*	*p*-value
	Body image			Anxiety		
Age	0.186	-0.136, 0.507	0.254	0.044	-0.368, 0.457	0.832
Sex	6.357	-1.162, 13.876	0.096	-1.923	-11.639, 7.793	0.695
Stage of cancer	-4.633	-8.262, -1.004	**0.013**	-2.021	-6.791, 2.748	0.402
Weight changes	0.922	0.212, 1.631	**0.011**	0.168	-0.768, 1.105	0.721
BMI changes	1.912	0.249, 3.575	**0.025**	1.058	-1.110, 3.226	0.335
WC changes	-0.413	-0.966, 0.139	0.140	0.424	-0.307, 1.155	0.252
HC changes	-0.088	-0.465, 0.289	0.643	-0.027	-0.557, 0.502	0.919

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Table 7. Predictor factors of quality of life of CRC for symptom scales (CR29).

	β	95% *CI*	*p*-value	*β*	95% *CI*	*p*-value	*β*	95% *CI*	*p*-value
	Blood and mucus in stool			Urinary incontinence			Buttock pain		
Age	0.226	-0.023, 0.475	0.075	0.432	0.139, 0.725	**0.004**	-0.027	-0.353, 0.298	0.868
Sex	-8.574	-14.263, -2.884	**0.004**	-1.950	-9.186, 5.287	0.594	1.095	-6.569, 8.759	0.777
Stage of cancer	3.639	0.799, 6.479	**0.013**	0.518	-3.050, 4.087	0.774	4.094	0.423, 7.766	**0.029**
Weight changes	-0.536	-1.100, 0.029	0.063	-0.560	-1.248, 0.128	0.109	-0.429	-1.162, 0.305	0.248
BMI changes	-1.088	-2.408, 0.232	0.105	-0.617	-2.236, 1.003	0.451	0.159	-1.559, 1.878	0.854
WC changes	0.705	0.274, 1.135	**0.002**	-0.570	-1.066, -0.073	**0.025**	-0.079	-0.671, 0.513	0.792
HC changes	-0.066	-0.388, 0.257	0.687	-0.260	-0.623, 0.104	0.159	0.037	-0.388, 0.462	0.863
	Frequent stools			Fecal Incontinence			Bloating		
Age	0.413	0.032, 0.793	**0.034**	0.184	-0.184, 0.552	0.322	0.436	-0.030, 0.902	0.066
Sex	-0.588	-9.800, 8.624	0.899	-8.146	-16.694, 0.402	0.062	-5.662	-16.795, 5.471	0.315
Stage of cancer	6.083	1.739, 10.427	**0.007**	6.969	2.942, 10.995	**0.001**	6.761	1.442, 12.081	**0.013**
Weight changes	-0.734	-1.608, 0.140	0.099	-0.952	-1.768, -0.136	**0.023**	-0.195	-1.005, 0.614	0.632
BMI changes	-1.595	-3.631, 0.441	0.123	-2.050	-3.956, -0.145	**0.035**	0.861	-1.015, 2.737	0.364
WC changes	0.605	-0.082, 1.292	0.083	0.053	-0.598, 0.704	0.872	0.147	-0.501, 0.795	0.653
HC changes	-0.118	-0.606, 0.369	0.631	0.030	-0.435, 0.496	0.897	-0.165	-0.628, 0.299	0.482

3.4. Predictors of QoL for Functioning Scales

Table 4 shows that older age ($p = 0.030$), advanced stage of cancer ($p = 0.017$), lower body weight ($p = 0.017$) and lower HC ($p = 0.040$) were significant predictors of a lower global health status / QoL (GHS/QoL) among the patients. Older age was found a significant predictor for worsening of physical function ($p = 0.001$), role function ($p = 0.012$), and cognitive function ($p = 0.002$). The advanced stage of CRC was another independent and significant predictor of role function ($p = 0.002$) and emotional function ($p = 0.032$). Among the anthropometry parameters, lower body weight significantly predicted role functioning ($p = 0.001$) and cognitive functioning ($p = 0.001$), while lower HC predicted emotional function ($p = 0.043$).

3.5. Predictors of QoL for Physical Symptoms

Among the physical symptoms presented in Table 5, more body pain was predicted by older age ($p = 0.006$), symptoms of fatigue was predicted by lower body weight ($p < 0.001$) and low BMI ($p = 0.003$), and insomnia was significantly predicted by an advanced stage of the cancer ($p = 0.048$), lower body weight ($p = 0.041$), and low BMI ($p = 0.047$). As expected, body image was predicted by nutritional parameters such as body weight ($p = 0.048$) and BMI ($p = 0.041$), and an advanced stage of the cancer (Table 6).

Among other symptoms (Table 7), older age predicted urinary incontinence ($p = 0.004$), and frequent stool motions ($p = 0.034$). An advanced disease stage significantly predicted stools having blood and mucus ($p = 0.013$), buttock pain ($p = 0.029$), frequent stool motions ($p = 0.007$), fecal incontinence ($p = 0.001$). and bloating ($p = 0.013$).

4. Discussion

This study identified several significant predictors of HRQoL among Malaysian CRC patients at 6 months post-treatment. Advanced age, chronic disease stage, and poor nutritional status (lower body weight and hip circumference) emerged as primary determinants of reduced QoL. Notably, nutritional parameters showed domain-specific associations, with anthropometric measures differentially predicting physical, cognitive, and emotional functioning.

In the present study, although the overall GHS/QoL was somewhat high, it was poorer among patients of older age and those with an advanced stage of CRC. These findings are consistent with another study from Malaysia which reported a poorer score of GHS/QOL among patients aged more than 60 years, and those with TNM (tumor, node and metastases) staging of IV compared with stage I to III of CRC [7]. Another study in Greece in patients with CRC, QoL was shown to significantly deteriorate from stage 1 to stage II and from stage II to stage III of cancer [8]. Based on these data, one

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may deduce a reasonable conclusion that patients with early CRC stage when the disease has not yet impaired their fundamental biological, physical and health function and activities should be expected to have a better QoL. The age-related decline in QoL likely reflects the cumulative impact of treatment toxicity, reduced physiological reserve, and increased comorbidity burden in older patients. This finding underscores the need for age-adapted survivorship care plans.

Body image is generally a critical psychosocial trauma for most cancer patients as they often undergo significant loss to body weight, in addition to deterioration of appearance and functioning. Interestingly, our study subjects had a high overall QoL scores and remained satisfied with their body image. This could be attributable to a stronger social support of the cancer patients (or any sick patients) which is more of a cultural norm in many developing countries. However, these patients must have gone through much pain, agony, and anxiety as demonstrated by deterioration of their physical function, role function, and cognitive functions in this study.

The prominent role of nutritional status in predicting QoL represents a key finding of our study. Over half of our patients presented with malnutrition, which significantly impacted multiple functional domains. This contrasts with Western studies where overweight/obesity is more common [14]. The association between hip circumference and emotional function may reflect body image concerns or indicate muscle wasting affecting psychological well-being. These findings suggest that comprehensive nutritional assessment and intervention should be integral components of CRC survivorship care in Malaysia.

Similar to patients with other types of cancer [9], physical and role functioning were better preserved among younger group CRC compared to older CRC patients. The present study exhibited significant association between CRC stage with emotional functions, role function and insomnia. This study results align with previous studies which reported emotional functions deteriorating with advanced stage of the disease [10], role functions significantly declining with increased stage of the disease [11] and insomnia being a disturbing side effect of treatment of cancer [12].

Patients' poor nutritional status adversely affected their QoL, as shown consistently in our study data and in another cross-sectional Mexican study with 65 men and 48 women with CRC [13]. In both the studies, malnutrition was shown to have a profound effect on the patients' functionality and QoL indices. However, these studies being cross-sectional in nature, could not show any changes in the functioning and QoL of the patients over time.

In a prospective cohort study, 459 CRC survivors (stage I to II) were followed from diagnosis up to 24 months post-treatment in The Netherlands [14]. The patients' nutritional status of this cohort was not comparable to our study patients, as 44% of the patients in The Netherland study were overweight and 31% were obese at diagnosis, where more than half of our patients were malnourished. Still the findings of the Netherlands study are worth mentioning because of an increase in adipose tissue and muscle function of the patients were longitudinally associated with better QoL and less fatigue, regardless of pre-treatment body composition. These findings are consistent with our present study, which also observed better QoL among individuals with higher body weight and HC within a similar time frame from the diagnosis to the first two years post-treatment. Moreover, a normal BMI level was associated with better physical, role function, and social functions from 6 weeks to 24 months after CRC treatment [15], which are consistent with the present study findings of a positive association between BMI, fat mass and role function.

Regarding specific symptom scale items, significant associations were documented in our study between CRC stage and buttock pain, increased stool frequency, blood and mucus in stool, bloating, and fecal incontinence. These symptoms more frequently reported by patients with advanced TNM stages [16]. Most of our CRC patients had stage III cancer, and tumours were located in the rectosigmoid region of the colon.

4.1. Clinical Implications

Our findings have important clinical implications. First, routine screening for malnutrition using anthropometric measures could identify patients at risk for poor QoL outcomes. Second, targeted

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nutritional interventions may improve not only physical outcomes but also cognitive and emotional functioning. Third, age-stratified survivorship care programs may better address the diverse needs of CRC survivors.

4.2. Limitations

Several limitations warrant consideration. The study design precludes causal inferences and temporal assessment of QoL changes. The convenience sampling method may limit generalizability, and the relatively small sample size may have reduced statistical power for subgroup analyses. Additionally, we lacked baseline QoL data from diagnosis, preventing assessment of QoL trajectories. Future longitudinal studies with larger, more diverse samples and baseline assessments would strengthen evidence in this area.

Another limitation was the lengthy list of EORTC QLQ C30 and QLQ-CR29, which could potentially limit the accurate responses of the study patients. Furthermore, QLQ C30 and QLQ-CR29 assessments were not conducted at diagnosis, preventing evaluation of QoL trends from diagnosis to survivorship. Thus, repeated assessments of QoL are suggested to follow patient courses of QoL [17]. Incorporating qualitative data into quantitative research could provide deeper insights into the barriers and challenges faced by patients. Collaboration with psychologists or psychiatrists may also assist in providing emotional support and motivation the patients during data collection.

Despite limitations, one of the major strengths of the study was the use of local (Malay) versions of EORTC questionnaires which were validated in earlier studies.

5. Conclusions

This study demonstrates that age, disease stage, and nutritional status are significant predictors of HRQoL in Malaysian CRC survivors. The prominent impact of malnutrition on multiple functional domains highlights the critical importance of nutritional assessment and intervention in survivorship care. Healthcare providers should implement routine nutritional screening and develop targeted interventions to optimize QoL outcomes. Future longitudinal research with larger samples and baseline assessments is needed to better understand QoL trajectories and inform evidence-based survivorship care programs for CRC patients in Malaysia and similar populations.

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Data Availability Statement: The datasets generated and/or analyzed during the current study are not publicly available but are available from the corresponding author on reasonable request.

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