

Nutritional status and lifestyle risk factors associated with colorectal cancer: a case-control study at a tertiary cancer hospital in Jakarta, Indonesia

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Abstract. Colorectal cancer is a major public health concern in Asia, with a rapidly increasing incidence in Indonesia. This study aimed to examine the association between nutritional status and modifiable and non-modifiable risk factors with colorectal cancer incidence at Dharmas Cancer Hospital, Indonesia. A hospital-based case-control study was conducted, which involved 74 participants, consisting of 37 colorectal cancer patients (cases) and 37 non-cancer controls. Data were collected between February and April 2025 through structured interviews, validated questionnaires, and medical record reviews. Bivariate analysis using chi-square tests and logistic regression identified significant differences between cases and controls in age, smoking status, coffee consumption, and physical activity ($p < 0.05$). Multivariate logistic regression analysis demonstrated that age ≥ 50 years was strongly associated with colorectal cancer risk (OR=8.255; 95% CI: 2.240–30.422), as was low physical activity (OR=4.122; 95% CI: 1.182–14.373). Coffee consumption showed a significant association with colorectal cancer, where consumption of 2–3 cups/day was inversely associated with risk (OR=0.054; 95% CI: 0.005–0.566), while lower levels of consumption (< 1 cup/day) were associated with increased risk (OR=1.891; 95% CI: 0.280–12.771). These findings highlight the importance of promoting healthy lifestyle behaviors and nutritional management as part of colorectal cancer prevention strategies in Indonesia.

1 Introduction

Colorectal cancer is a major non-communicable disease contributing substantially to global morbidity and mortality, with 1.83 million new cases reported worldwide in 2020 [1]. In Indonesia, colorectal cancer accounts for 8.6% of all cancer cases and continues to increase, highlighting its growing public health importance [2, 3]. The etiology of colorectal cancer is multifactorial, involving both non-modifiable factors, such as age, and modifiable factors, including lifestyle behaviors and dietary patterns [1, 4]. Established factors associated with

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colorectal cancer include smoking, physical inactivity, and unhealthy dietary intake [4-7], while emerging factors such as sleep duration and coffee consumption remain inconclusive, particularly in non-Western populations [8-10]. Dietary and nutritional factors including low fiber, calcium, vitamin D, and vitamin C intake have also been suggested to contribute to colorectal carcinogenesis [11-13]. Although these factors have been widely studied, most evidence originates from Western populations, and limited research in Indonesia has simultaneously examined both conventional and emerging lifestyle factors within a single analytical framework. This gap limits the understanding of how these factors interact in the Indonesian context.

Therefore, this study aims to examine the association between nutritional status and selected lifestyle and dietary factors—specifically coffee consumption, sleep duration, and physical activity—with colorectal cancer incidence in an Indonesian clinical setting. The specific research question is whether individuals with adverse nutritional status and unhealthy lifestyle behaviors have a higher likelihood of developing colorectal cancer. We hypothesize that overweight/obesity, low physical activity, suboptimal sleep duration, and unfavorable dietary behaviors are positively associated with colorectal cancer, while moderate coffee consumption may be inversely associated [10, 14].

2 Material and methods

This study used an analytical observational design with a case-control approach. The study was conducted at Dharmais Cancer Hospital, Jakarta, Indonesia, from February to April 2025. Participants were recruited using a convenience sampling approach. Eligible colorectal cancer patients attending the outpatient clinic during the study period were approached consecutively by trained enumerators and invited to participate. Controls were recruited from accompanying family members who did not have a history of cancer and met the inclusion criteria. Family members were selected as controls to obtain participants with relatively similar socio-environmental backgrounds; however, this approach may introduce shared exposure bias. The study included 74 participants (37 cases and 37 controls). Cases were patients diagnosed with colorectal cancer aged 19–90 years, while controls were family members without cancer, matched by sex and age range.

Sample size was calculated using the Lemeshow formula for case-control studies with assumptions of a 95% confidence level, 90% power, proportion of exposure among cases ($P_1=0.60$) and controls ($P_2=0.25$). The minimum required sample size was 34 participants per group and was increased to 37 to account for potential non-response or incomplete data. Data collection was conducted through structured interviews and medical record reviews. Dietary intake was assessed using a Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ), reflecting habitual intake during the year preceding diagnosis for cases and the year preceding interview for controls. Nutrient intake, including fiber, fat, calcium, vitamin D, and vitamin C, was estimated using the Indonesian Food Composition Table (Tabel Komposisi Pangan Indonesia, TKPI). Cut-off values for nutrient intake were determined based on established dietary recommendations whenever available. Fiber intake was classified according to the Indonesian Recommended Dietary Allowance (RDA), while calcium and vitamin D intake were categorized based on age- and sex-specific dietary recommendations. For nutrients without established risk-based thresholds, participants were classified using the median intake of the study population, a commonly applied approach in nutritional epidemiology to distinguish lower and higher intake groups and ensure adequate distribution for statistical analysis. Lifestyle variables included smoking status, alcohol consumption, sleep duration, coffee consumption, ultra-processed food intake, and physical

activity. Coffee consumption was categorized into four groups: 2–3 cups/day, 1 cup/day, <1 cup/day, and none.

Nutritional status was assessed using Body Mass Index (BMI). Body weight was measured using a calibrated digital scale to the nearest 0.1 kg, while height was measured using a microtoise to the nearest 0.1 cm. BMI was calculated as weight in kilograms divided by height in meters squared (kg/m²). Variables were categorized based on established guidelines or data distribution. Data were analyzed using chi-square tests and multivariate logistic regression. Variables with a p-value <0.25 in the bivariate analysis were considered candidates for inclusion in the multivariate logistic regression model, following the recommendation of Hosmer and Lemeshow, who suggest using a more liberal significance level during variable selection to avoid excluding potentially important predictors or confounders at an early stage of model building. Statistical significance in the final model was set at p<0.05, indicating that associations with less than a 5% probability of occurring by chance were considered statistically significant. This threshold is widely used in epidemiological and health research as a conventional criterion for balancing the risks of Type I and Type II errors. Potential biases include recall bias due to retrospective assessment, selection bias from convenience sampling, and measurement bias from self-reported data.

3 **Results and discussion**

This study analyzed 74 participants to examine associations between nutritional status, lifestyle factors, and colorectal cancer. Individuals aged ≥50 years were more common in the case group, indicating that older age was strongly associated with colorectal cancer. Similar findings have been reported in Indonesian and Southeast Asian populations, where colorectal cancer incidence increases with advancing age, possibly due to cumulative genetic mutations, prolonged environmental exposures, and age-related physiological changes [3, 4, 10]. Smoking behavior and low physical activity were also more frequently observed among cases.

Several variables assessed in this study, including nutritional status (BMI), fat intake, sleep duration, alcohol consumption, ultra-processed food intake, and Stunkard Figure Rating Scale categories, did not show statistically significant associations with colorectal cancer in the bivariate analysis and were therefore not retained in the final multivariate model. Dietary intake patterns showed that cases tended to have lower intake of fiber, calcium, vitamin D, and vitamin C; however, these variables were also not statistically significant. Previous studies have suggested that inadequate intake of these nutrients may contribute to colorectal carcinogenesis through impaired gut health, inflammation, and oxidative stress pathways [11, 12].

Table 1. Bivariate associations between selected sociodemographic, lifestyle, and dietary factors and colorectal cancer status (n=74).

Variable	Case (n=37)	Control (n=37)	p-value
Age ≥50 years	28 (75.7%)	15 (40.5%)	0.003
Smoking (Yes)	20 (54.1%)	10 (27.0%)	0.018
Low physical activity	22 (59.5%)	12 (32.4%)	0.021
Coffee 2–3 cups/day	5 (13.5%)	18 (48.6%)	0.001
Coffee <1 cup/day	18 (48.6%)	10 (27.0%)	0.045
Low fiber intake	25 (67.6%)	18 (48.6%)	0.102

Note: p-values were obtained from chi-square tests for categorical variables; reference categories are defined in the footnotes.

Multivariate logistic regression analysis (Table 2) showed that age ≥ 50 years (OR=8.255; 95% CI: 2.240–30.422) and low physical activity (OR=4.122; 95% CI: 1.182–14.373) were significantly associated with colorectal cancer. These findings are consistent with previous Indonesian studies reporting that physically inactive individuals have a higher likelihood of colorectal cancer occurrence [5, 7, 15]. Reduced physical activity may influence colorectal carcinogenesis through metabolic dysregulation, chronic inflammation, and prolonged gastrointestinal transit time [1].

Table 2. Adjusted odds ratios for colorectal cancer according to selected sociodemographic, lifestyle, and dietary factors (n=74).

Variable	OR	95% CI	p-value
Age ≥ 50 years	8.255	2.240–30.422	0.002
Low physical activity	4.122	1.182–14.373	0.026
Coffee 2–3 cups/day	0.054	0.005–0.566	0.017
Coffee <1 cup/day	1.891	0.280–12.771	0.017

Moderate coffee consumption (2–3 cups/day) was inversely associated with colorectal cancer (OR=0.054; 95% CI: 0.005–0.566). Although evidence from Indonesian populations remains limited, studies from other Asian populations, including Korea, have reported similar findings [10, 14]. Coffee contains bioactive compounds such as polyphenols and diterpenes that may exert antioxidant and anti-inflammatory effects, modulate gut microbiota, and improve insulin sensitivity [10]. However, findings regarding coffee consumption and colorectal cancer remain inconsistent across studies, and the observed association in this study may also reflect residual confounding or clustering of health-conscious lifestyle behaviors. Furthermore, the wide confidence intervals indicate limited precision, likely related to the relatively small sample size.

These findings highlight the potential importance of modifiable lifestyle factors, particularly physical activity, in colorectal cancer prevention. Nevertheless, larger prospective studies in Indonesian populations are needed to further clarify the role of dietary and lifestyle factors in colorectal cancer occurrence

4 Conclusions

These findings highlight opportunities for colorectal cancer prevention in Indonesia through the strengthening of lifestyle-based interventions. Older age and low physical activity were associated with colorectal cancer, while the inverse association observed with moderate coffee consumption should be interpreted cautiously due to possible residual confounding and inconsistent findings across studies.

Promoting regular physical activity and healthier lifestyle behaviors may support colorectal cancer prevention efforts, particularly among older adults and other high-risk groups. Although dietary intake variables were not statistically significant in the final model, balanced dietary patterns remain important for overall colorectal health. Further large-scale prospective studies are needed to clarify the role of dietary and lifestyle factors and to support evidence-based prevention policies in Indonesia.

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