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RESEARCH ARTICLE

An Interventional Study to Improve Colorectal Cancer Screening Knowledge and Health Perceptions among Jordanians' Average Risk Population

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Abstract:

Context:

Globally, Colorectal Cancer (CRC) is the second most commonly occurring cancer in women and the third most commonly occurring cancer in men.

Aims:

This study was conducted to investigate the current levels of Jordanians' CRC knowledge and health perceptions; and to test the effects of a health education intervention on them.

Settings and Design:

A descriptive quasi-experimental design was used to recruit a convenience sample of 197 Jordanian adult participants from two governmental hospitals in Amman.

Methods and Material:

A rolling enrolment strategy was used to randomly assign participants into intervention (*n*=98) and control (*n*=99) groups. An education intervention included a 1-hour Power Point presentation about CRC.

Results:

The mean knowledge scores were (6.51±1.60) and (6.91± 1.83) for females and males, respectively. The mean of the knowledge level in the intervention group subsequent to the intervention was significantly higher than that for the control group. More than half of the study participants (53.8%) did not believe they were susceptible to CRC, while about one third (37.4%) of the participants believed that CRC is a severe disease. 42.2% of study participants believed there were barriers preventing them from participating in CRC screening. The most frequently perceived barrier among them was the cost of screening tests. The means of the perceived susceptibility and severity subscales of the intervention group was significantly higher than that of the control group.

Conclusion:

Correcting the knowledge gap and improper health perceptions toward CRC could play an important role in facilitating early detection as a primary prevention measure. Findings may enhance health strategies to better address the needs of the average-risk population.

Keywords: Colorectal cancer, Knowledge, Health perceptions, Screening, Cancer prevention, Health promotion.

1. INTRODUCTION

Colorectal Cancer (CRC) has serious health consequences on patients causing pain, reduced quality of life, and death. Early detection of CRC using the recommended screening test

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scan cure CRC, decrease the cost of care, and reduce the mortality rates [1, 2]. The idea of early detection and screening for CRC emerged from the fact that precancerous polyps develop into invasive cancer over a period of approximately 10 years. The length of this period provides an opportunity to detect and remove precancerous polyps at an early stage, improving success rates for CRC treatment [1]. The importance

of screening for CRC emerges from the fact that it often has no symptoms in the early stage. As the tumor develops, it may bleed or lead to intestinal obstruction.

Globally, CRC is the second and third most commonly diagnosed cancer in women and men, respectively, with over 1.2 million new cancer cases and 608,700 deaths occurred in 2008 [3]. Developing countries are particularly affected by the increasing number of cancer cases, due to growing and aging populations. More than 60% of the world's total cases occur in Africa, Asia, and Central South America. Further, 70% of the world's cancer deaths are accounted for by these regions, a situation that is made worse by a lack of access to early detection methods and treatment [4].

Early detection of CRC is essential, and the cure rate is over 90%. In contrast, a diagnosis of late-stage CRC with metastasis to other organs provides a 5-year survival rate of approximately 10% [5]. Despite the importance of CRC screening, screening rates are low. These rates are affected by the level of CRC knowledge and beliefs regarding CRC screening [6]. For example, Lower rates of CRC screening via sigmoidoscopy or colonoscopy have been found to be related to a lack of CRC knowledge [7]. Further, a decrease in CRC knowledge has been shown to increase the number of perceived personal barriers to screening, such as cost, dislike of screening preparation, discomfort during testing, and fear of cancer [8].

In Jordan, CRC ranked second among all new cancer cases (5104 cases during the 14 years period from 1996 to 2009), and it replaced lung cancer as the first most common cancer in men within the period 2001-2009. Also, it is considered the second most common cancer in women after breast cancer [9]. Most of the media attention in Jordan had focused on breast cancer programs with little attention for CRC. Furthermore, it was found in a recent study that CRC screening rates were extremely low in a Jordanian adult sample consisted of 3196 participants from all over the country [10]. Therefore, there is a need to investigate these variables and understand the CRC screening practices within the Jordanian culture. Moreover, conducting culturally appropriate educational interventions could enhance average risk Jordanians' CRC level of knowledge and health perceptions.

Colorectal cancer screening is influenced by the extent of people's knowledge regarding colorectal cancer and screening tests, and their beliefs regarding colorectal cancer screening [11]. Nurses play an important role in preventive health care measures, particularly those working in primary care offices and community clinics [12]. Through education, nurse practitioners could play an important role in increasing screening rates in asymptomatic high-risk populations in the community. Knowledge gained through research examining whether group education interventions influence awareness and perceptions regarding colorectal cancer is important to nursing practitioners in primary care settings,and it may lead to an increase in the likelihood of screening and early detection of colorectal cancer cases in Jordan. There have been no similar studies conducted to determine the effect of a health education intervention on knowledge, perceptions, and screening behaviours regarding colorectal cancer in Jordan.

The major purposes of the current study are to: (a) investigate the current levels of Jordanians' CRC knowledge, health perceptions, and intention to undergo screening; and (b) test the effects of a health education intervention on the Jordanians' CRC knowledge, health perceptions, and intention to undergo screening.

1.1. Research Questions

The current study was designed to answer the following research questions:

(1) To what extent do Jordanian participants know about CRC disease and screening recommendations in the intervention and control groups prior to receiving a health education intervention?

(2) What are the health perceptions (perceived susceptibility, seriousness, benefits, and barriers) of Jordanian participants in the intervention and control groups with respect to CRC and screening prior to receiving the health education intervention?

(3) Is there a difference in Jordanian participants' CRC knowledge levels between the intervention and control groups prior and subsequent to implementation of the health education intervention as assessed at the 4-week follow-up?

(4) Is there a difference between the intervention and control groups' CRC health perceptions prior and subsequent to the implementation of health education intervention as assessed at the 4-week follow-up?

(5) Is there a difference in participants' intention to undergo colorectal cancer screening between the control and intervention groups prior and subsequent to implementation of the health education intervention?

2. METHODS

2.1. Design and Sample

A descriptive, quasi-experimental, design was conducted to answer the research questions. The average-risk population is defined as individuals who are aged 50 years or older and have no familial history of CRC or bowel signs or symptoms [1]. The target population of this study was all average-risk Jordanian adults aged 50–75 years, who visited the Outpatient Departments (OPD) of Jordan University and Al-Basheer Hospitals in Amman between July 1st and November 3rd 2015.

The G Power program (version 3.0.10) was used to perform a power analysis to determine the estimated sample size for the current study. Based on a formulation of 80% power and a medium effect size of 0.50, to obtain a significance level of $\alpha = 0.05$ (two tailed), the estimated sample size was 64 participants for each group; accordingly, a sample of 128 Jordanian participants was required for the current study. Because of the expected attrition rate, additional participants were recruited. The study adopted non probability convenience sampling method to recruit average-risk Jordanian adults who meet the inclusion criteria for the study. 197 participants were approached to take part in the study in order to detect differences in post intervention knowledge, health

perceptions, and intention to undergo screening.

2.2. Data Collection

Once approval from the Research Ethics Committee (IRB) of the University of Jordan was obtained, the JUH and Al-Basheer Hospital were approached to obtain permission to recruit participants from Out Patient Departments (OPDs). At the hospital, the researcher approached potential participants in OPDs and briefly explained the purpose of the study, screened them for eligibility by asking several questions at the beginning of the meeting, and assured confidentiality of the data obtained. All eligible participants who agreed to participate in the study were given more information about the purpose, risks, and benefits of the study and were asked to sign an informed consent form. Participants were assured that their participation was voluntary, they were free to withdraw at any time, and their refusal to participate would have no effect on the medical care they received.

Baseline data regarding CRC knowledge, perceptions, and intention to screen was collected from the participants in the intervention and control groups after they signed the informed consent (preintervention stage). The researcher was available in a nearby area for any participant to answer their questions or concerns. Later, after finishing the appointments in the OPDs, the researcher implemented the health education intervention for 6-7 participants (Intervention stage). The health education intervention was conducted after finishing the appointments in the OPDs in order to ensure that participants will not miss their appointments or lose concentration during the data collection process.

The researcher collected the baseline questionnaires and placed them in coded packets, to be matched with postintervention questionnaires. The time at which baseline data and participant contact information were collected were attached to the coded packet and stored in a locked secure cabinet, the location of which is known only to the researcher. Four weeks later, the researcher retrieved participants' contact information from the securely stored packets and contacted participants (by telephone) sequentially according to the time of baseline data collection, to request the completion of postintervention questionnaires. The outcome data were collected in the OPDs of Jordan University and Al-Basheer Hospitals at four weeks after the implementation of the health education intervention. A 4-week interval was chosen based on previously mentioned studies that used similar intervals [13, 14]. The following scheme depicted in Fig. **1** demonstrated the steps required to conduct the study and the total number of participants who were approached during the data collection period.

2.3. Randomization

To ensure that all participants have an equal chance of inclusion in the control or intervention group, a randomization procedure based on a rolling enrollment method was implemented. The researcher alternated random assignment of participants to the intervention and control groups, beginning with the assignment of the first participant to the intervention group. The same process repeated daily throughout the data collection period until the desired sample size was achieved. This method is suitable for use when participants do not enter the study site simultaneously [15].

2.4. Description of the Intervention

The content of the health education intervention was drawn from relevant articles in the evidence-based literature [1, 16]. The educational intervention consists of four sections pertaining to the colorectal cancer information needs of average-risk Jordanian participants. The first section presents the basic facts regarding colorectal cancer (definition, pathophysiology, symptoms, and incidence in Jordan). This section was designed to increase participants' knowledge and perceived susceptibility to colorectal cancer. The second section presents the risk factors for colorectal cancer, to increase participants' perceived susceptibility to colorectal cancer and the perceived severity of the disease. The third section presents recommended screening options for colorectal cancer to increase participants' perceived screening benefits and decrease their perceived barriers to screening. The fourth section presents the treatment options for colorectal cancer and survival rates for early and late detection. The educational intervention was reviewed by a professor of community health nursing and two consultant oncologists, who assessed the adequacy of the information intended for the study participants.

The Jordanians' average risk participants who were randomly assigned to the intervention group received a 1-hour health education session regarding CRC and screening recommendations. The health education session was implemented in a well-lit room in the OPDs (Al-Basheer and JUH) using a PowerPoint presentation with open discussion, which was initiated by asking questions at the beginning of each section and answering them upon completion of each section. At the end of the health education session, a transcribed educational material regarding CRC and screening recommendations was distributed on the participants.

2.5. Instruments

Three instruments were used to collect data: An investigator developed demographic characteristics questionnaire (participants' demographic characteristics: age, gender, marital status, educational level, working status, Insurance status, monthly income), Colorectal Cancer Knowledge, Perceptions, and Screening Survey (CRCKPSS) [17], and Intent to Undergo CRC Screening *via* Colonoscopy or Sigmoidoscopy Item. In addition to socio-demographic data, 2 questions were designed to gather information about whether the participants had pressure from family or friends to screen for CRC, and whether they had prior contact with CRC cases.

Colorectal Cancer Knowledge, Perceptions, and Screening Survey (CRCKPSS) [17] allows the evaluation of the overall level of knowledge (13 true or false questions) and health perceptions (35 items measured *via* 5-point Likert scale). CRCKPSS consists from 3 main sections: the first section, entitled "the CRC Knowledge test," measures participants' knowledge in 3 major domains of knowledge (knowledge regarding incidence and risk of CRC, knowledge of warning signs and symptoms, myths and truths, and knowledge

regarding performing screening tests). The internal consistency for first section's was 0.81 using Kuder-Richardson [17]. The second section, entitled "health perceptions," measures participants' perceived susceptibility to CRC, perceived seriousness of CRC, perceived benefits of screening, and perceived barriers to screening). The Cronbach's α for the second section was .85 [17]. The third section measures the participants' screening practices regarding CRC (9 Questions are measured on a yes or no response scale).

Intention to undergo CRC screening *via* colonoscopy or sigmoidoscopy was measured using one item developed by the researcher for the current study. The item was based on studies described in the literature [18, 19]. Cronbach's alphas for the items were 0.94 for the Griffin study and 0.98 for the Sieverding *et al.* (2010) study.

The total Cronbach's alpha of the health perceptions subscales of the CRCKPSS in the current study was .80, with the following breakdown: perceived susceptibility: .84, perceived severity: .81, perceived benefits: .80, and perceived barriers: .79.

2.6. Ethical Consideration

The approval from the Institutional Review Board (IRB) at the Jordan University Hospital (10/2015/20609), and Al-Basheer Hospital (MOH REC 150080) were obtained prior to the beginning of the study. Participation in the study was completely voluntary and participants were informed that they have the right to withdraw at any time without intimidation or prejudice. The participants received oral and written information regarding the purpose, content, and extent of the study and informed consent to participate in the study was obtained. Confidentiality and anonymity were maintained at all times, both during and subsequent to the study, *via* the assignment of code numbers known only to the researchers and used in data collection and analysis.

2.7. Statistical Analysis

Data was analyzed using Statistical package of social sciences version 20 [20]. Descriptive statistical tests (Percentages, frequencies, means, standard deviations, and range) were utilized to describe the various demographic characteristics, level of knowledge regarding CRC, and health perceptions. Two-tailed independent sample t tests were used to assess the difference in Jordanian participants' CRC knowledge levels and health perceptions between the intervention and control groups prior and subsequent to implementation of the health education intervention.
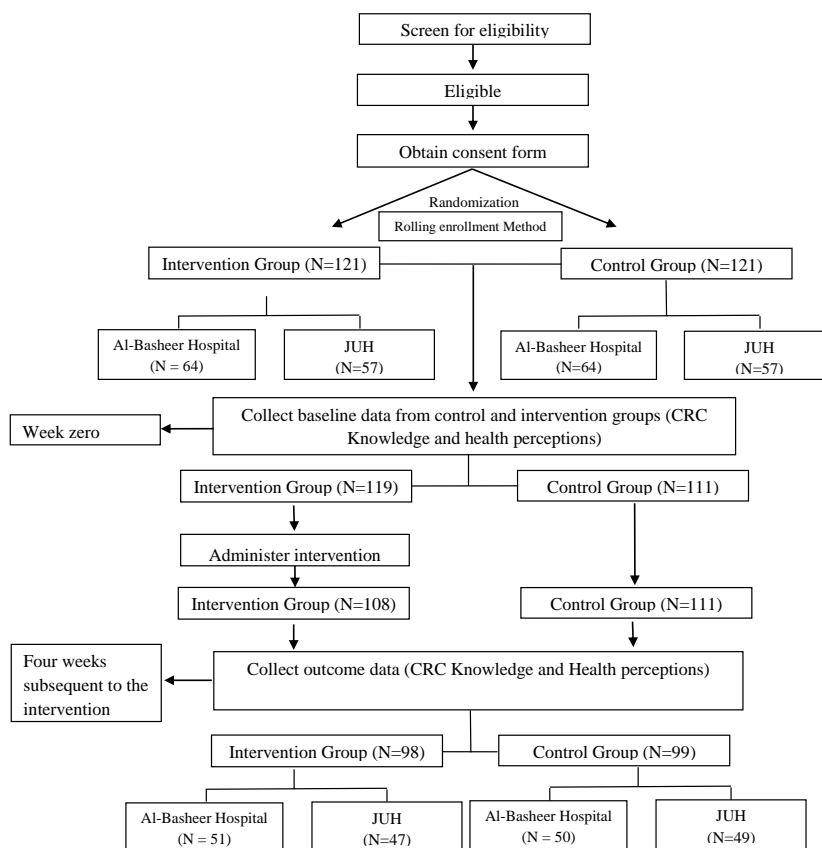
(Fig. 1). Schematic diagram representing the study protocol and data collection.

3. RESULTS

3.1. Demographic Characteristics

One hundred ninety-seven participants out of two hundred forty-two participants (about an 81.4% response rate) completed all study phases. Ninety-eight participants were in the intervention group and 99 in the control group. The mean age of the participants in the intervention group was 59.1 ± 7.4 years, whereas the mean of the participants in the control group was 60.9 ± 7.9 years. Marital status was divided into four categories: married, widowed, divorced, and single. Most of the participants (86.3%) were married, 8.6% were widowed, and 5% were either single or divorced. Level of education was divided into six categories: less than secondary education, secondary education, diploma, bachelor's degree, and master's degree or higher. The majority of the participants (46.7%) had a secondary education, 19.8% had a bachelor's degree, 19.3% had less than secondary education, 10.7% had a diploma, and 3.6% had a master's degree or higher. Regarding religion, 96.4% of the study participants comprised Muslims and 3.6%, Christians.

A very high percentage of the participants (69.5%) had health insurance; 50.4% of the insured were male and 49.6% were female. The majority of those (89.8%) had governmental insurance, 3.6% had university insurance, 2.9% had private insurance, 2.2% had military insurance, and 1.5% had UNRWA insurance. The participants (30.5%) who had no health insurance were covered by the Hashemite Royal Court medical exemption. Two-thirds of the study participants (72.6%) were unemployed (housewife, retired, unemployed). Approximately half of the participants (44.7%) reported a monthly household income between 300 JD and 600 JD, 37.1% reported income less than 300 JD a month, and 18.3% reported a monthly income of more than 600 JD a month. Details of the socio-demographic characteristics are displayed in Table **1**.

At baseline, comparisons were made between the intervention and control groups on study sample characteristics. Taking into account the level of measurement of the variables, a two-tailed independent sample t test was performed for continuous variables, while a Chi-square (χ^2) test was performed for categorical variables. The results revealed non-significant statistical differences between the intervention and control groups for all the study sample characteristics, as presented in Table **1**.

3.2. Research Question 1

Descriptive statistics showed that more than half of the study participants (56.9%) had not ever read or heard about CRC, while (43.1%) had read or heard some information about CRC. The most frequently reported source of information (multiple answers were allowed) was friends (41.2%), followed by TV/radio (32.9%), newspaper or magazine (28.2%), physicians (12.9%), family members (7.1%), do not remember (2.4%), and nurses (1.2%).

Regarding levels of knowledge about CRC and CRC screening recommendations, responses on the 13-item CRC knowledge test were measured using the nominal scale of "True" and "False". One point was given for a correct answer and zero for an incorrect or no answer. Thus, the maximum score for knowledge was 13 (100%), and the minimum score was 0 (0%). Knowledge scores ranged between 2 and 11. The overall mean of the knowledge score was (6.71 ± 1.73), which meant that correct responses were given to approximately half of the questions. The mean knowledge scores were (6.51 ± 1.60) and (6.91 ± 1.83) for females and males, respectively. The participants' responses to the CRC knowledge scale items are summarized in Table **2**. Furthermore, the comparison between the control and intervention groups regarding the participants' responses to the CRC knowledge scale items are summarized in Table **3**.

The content domains measured by the CRC knowledge scale test include:

(1) Knowledge of CRC Incidence and Risk Domain

Five items (2nd, 3rd, 4th, 5th, and 6th) of the CRC knowledge scale test of the CRCKPSS measured incidence and risk domain [17]. Less than one-third of the participants (31.5%) believed CRC was a leading cause of cancer death; only one-third of the participants (34.5%) chose correct answer for the statement, "The risk of developing CRC increases with age", and less than half of the participants (47.7%) chose correct answer for the statement that "Both men and women are at risk for getting CRC". However, 62.9% of the participants chose the correct answer for the statement "there are no known causes of CRC," and the majority of the participants (71.1%) knew that "Most CRCs begin as a growth in the colon or rectum" (Table **2**).

(2) Knowledge of Warning Signs and Symptoms Domain

Two items (7th and 8th) of the CRC knowledge scale test of the CRCKPSS measured the warning signs and symptoms domain [17]. More than half of the participants (56.9%) knew that "Bleeding from the rectum and blood in your stool or in the toilet after a bowel movement may be symptoms of CRC and should be reported to the doctor," and 57.9% of the participants knew that symptoms may include changes in bowel habits, such as "Having a stools that are narrower than usual" (Table **2**).

(3) Myths and Truths Domain:

Two items (9th and 10th) of the CRC knowledge scale test of the CRCKPSS measured the myths and truths domain [17]. The majority of participants reported fatalistic beliefs regarding CRC, so 65.5% of the participants chose incorrect answers for the statement "There is nothing you can do about getting CRC". Furthermore, 85.3% of the participants chose an incorrect answer for the statement "CRC is usually fatal" (Table **2**).

(4) Knowledge of CRC Screening Recommendations:

Three items (11th, 12th, and 13th) of the CRC knowledge scale test of the CRCKPSS measured the CRC screening recommendations domain [17]. The results showed that nearly three-quarters (73.1%) of the participants knew that "There are several screening tests for CRC." However, a much smaller number (55.3%) correctly agreed with the statement "Men and women should begin screening for CRC after turning 50 years

of age," and only 43.7% of the participants correctly disagreed with the statement "Screening tests are not necessary for individuals who do not have symptoms" (Table **2**).

3.3. Research Question 2

To answer this question, participants' average response frequencies, means, and standard deviations were calculated for the health perceptions subscales prior to the implementation of the health education intervention (Table **4**). The results showed that more than half of the study participants (53.8%) did not believe they were susceptible to CRC, while (20.7%) were unsure. Furthermore, the low mean (2.60) for the CRC perception scale relating to susceptibility shows that the majority of participants tended to disagree with the statements of susceptibility.

Regarding severity, 37.4% of the participants believed that CRC is a severe disease, whereas 19.5% were unsure of its severity. Furthermore, the majority of study participants (86%) recognized the benefits of CRC screening, while 12.3% were unsure of the benefits. In addition, 42.2% of study participants believed barriers were preventing them from participating in CRC screening, while 33.9% believed there were no barriers, and 23.9% were unsure. Furthermore, the average for the CRC screening barriers subscale (3.1) shows that the study participants tended to agree that barriers would prevent them from participating in CRC screening. The most frequently perceived barrier among Jordanians in the current study was the cost of the CRC screening tests. Furthermore, more than half of the participants believed CRC screening might be painful and expose them to high doses of radiation.

3.4. Research Question 3

Prior to the implementation of a health education intervention, a two-tailed independent sample t test revealed that there were no significant differences ($t = .88$, $p = .38$) in levels of knowledge between the intervention ($M = 6.60$, $SD = 1.65$) and control ($M = 6.82$, $SD = 1.80$) groups. The mean of the knowledge levels after the implementation of the health education intervention differed significantly, $t (195) = -4.88$, $p < .001$, two-tailed. The mean for the intervention group ($M = 7.77$, $SD = 1.43$) was significantly higher than that for the control group ($M = 6.74$, $SD = 1.52$). The effect size, as indexed by η^2, was .108; this is a medium effect (Table **5**).

3.5. Research Question 4

Prior to the implementation of a health education intervention, the results of the two-tailed independent sample t test (pooled variance version) revealed no significant differences between the intervention and control groups in terms of health perceptions of susceptibility, severity, benefits, and barriers (Table **6**). Subsequent to the implementation of health education intervention, the two-tailed independent sample t test (pooled variance version) revealed significant differences in the health perceptions of susceptibility, severity, and barriers between the intervention and control groups. However, there were no significant differences in the health perceptions of benefits between the intervention and control groups (Table **6**).

Table 1. Comparison of the participants' characteristics between the two groups at baseline (Independent sample t and chi-square tests).

Variables	Intervention Group (N = 98)		Control Group (N = 99)		χ^2	p
	M (SD)	N (%)	M (SD)	N (%)		
Age (Years)	59.13 (7.36)	-	60.91 (7.88)	-	-	.104
Gender	-	-	-	-	-	-
Male	-	51 (52)	-	49 (49.5)	.13	.72
Female	-	47 (48)	-	50 (50.5)		
Marital status	-	-	-	-	-	-
Married	-	90 (91.8)	-	80 (80.8)	6.35	.096
Widowed	-	4 (4.1)	-	13 (13.1)		
Divorced/Single	-	4 (4.1)	-	6 (6.1)		
Educational level	-	-	-	-	-	-
Less than secondary	-	15 (15.3)	-	23 (23.2)	4.12	.39
Secondary	-	50 (51)	-	42 (42.4)		
Diploma	-	9 (9.2)	-	12 (12.1)		
Bachelor's degree	-	19 (19.4)	-	20 (20.2)		
Master / PhD	-	5 (5.1)	-	2 (2)		
Currently work	-	-	-	-	-	-
Yes	-	24 (24.5)	-	30 (30.3)	.87	.36
No	-	74 (75.5)	-	69 (69.7)		
Insurance	-	-	-	-	-	-
Yes	-	63 (64.3)	-	74 (74.4)	2.55	.08
No	-	35 (35.7)	-	25 (25.3)		
Monthly income (JD)	-	-	-	-	-	-

(Table 1) contd.....

Variables	Intervention Group (N = 98)		Control Group (N = 99)		χ^2	*p*
	M (SD)	**N (%)**	**M (SD)**	**N (%)**		
(<300)	-	41 (41.8)	-	32 (32.3)	3.88	.14
(300–600)	-	44 (44.9)	-	44 (44.4)		
(>600)	-	13 (13.3)	-	23 (23.2)		
Peer/family pressure to screen	-	-	-	-	-	-
Yes	-	8 (8.2)	-	4 (4)	1.46	.23
No	-	90 (91.8)	-	95 (96)		
Know someone with CRC	-	-	-	-	-	-
Yes	-	32 (32.7)	-	27 (27.3)	.68	.41
No	-	66 (67.3)	-	72 (72.7)		

Table 2. Summary of participants' frequency distribution of CRC knowledge scale test responses.

No	CRC Knowledge Test Items	Correct (n) %	Incorrect (n) %	Total (n)
1	CRC is a cancer of the colon or rectum.	172 (87.3)	25 (12.7)	197
2	CRC is a leading cause of cancer death.	62 (31.5)	135 (68.5)	197
3	The risk of developing CRC increases with age.	68 (34.5)	129 (65.5)	197
4	Both men and women are at risk for getting CRC.	94 (47.7)	103 (52.3)	197
5	There are no known causes of CRC.	124 (62.9)	73 (37.1)	197
6	Most CRCs begin as a growth in the colon or rectum.	140 (71.1)	57 (28.9)	197
7	Bleeding from the rectum and blood in your stool or in the toilet after a bowel movement may be symptoms of CRC and should be reported to the doctor.	112 (56.9)	85 (43.1)	197
8	You should see your doctor if you have a change in your bowel habits, such as having stools that are narrower than usual.	114 (57.9)	83 (42.1)	197
9	There is nothing you can do about getting CRC.	68 (34.5)	129 (65.5)	197
10	CRC is usually fatal.	29 (14.7)	168 (85.3)	197
11	There are several screening tests for CRC.	144 (73.1)	53 (26.9)	197
12	Men and women should begin screening for CRC soon after turning 50 years of age.	109 (55.3)	88 (44.7)	197
13	Screening tests are not necessary for individuals who do not have symptoms.	86 (43.7)	111 (56.3)	197

Note: Modified (3 items were omitted) with permission from Green & Kelly's CRCKPSS (2004).

Table 3. Comparison of participants' frequency distribution of CRC knowledge scale test responses between the two groups at baseline.

No	CRC Knowledge Test Items	Correct (n) %	Incorrect (n) %	Total (n)
	CRC is a cancer of the colon or rectum			
	Control group	86 (86.9)	13 (13.1)	99
	Intervention group	86 (87.8)	12 (12.2)	98
	CRC is a leading cause of cancer death			
	Control group	33 (33.3)	66 (66.7)	99
	Intervention group	29 (29.6)	69 (70.4)	98
	The risk of developing CRC increases with age			
	Control group	30 (30.3)	69 (69.7)	99
	Intervention group	38 (38.8)	60 (61.2)	98
	Both men and women are at risk for getting CRC			
	Control group	44 (44.4)	55 (55.6)	99
	Intervention group	50 (51)	48 (49)	98
5	There are no known causes of CRC			
	Control group	58 (58.6)	41 (41.4)	99

(Table 3) contd.....

No	CRC Knowledge Test Items	Correct (n) %	Incorrect (n) %	Total (n)
	Intervention group	66 (67.3)	32 (32.7)	98
	Most CRCs begin as a growth in the colon or rectum			
	Control group	75 (75.8)	24 (24.2)	99
	Intervention group	65 (66.3)	33 (33.7)	98
	Bleeding from the rectum and blood in your stool or in the toilet after a bowel movement may be symptoms of CRC and should be reported to the doctor			
	Control group	63 (63.6)	36 (36.4)	99
	Intervention group	49 (50)	49 (50)	98
	You should see your doctor if you have a change in your bowel habits, such as having stools that are narrower than usual			
	Control group	59 (59.6)	40 (40.4)	99
	Intervention group	55 (56.1)	43 (43.9)	98
	There is nothing you can do about getting CRC.			
	Control group	33 (33.3)	66 (66.7)	99
	Intervention group	35 (35.7)	63 (64.3)	98
	CRC is usually fatal.			
	Control group	21 (21.2)	78 (78.8)	99
	Intervention group	8 (8.2)	90 (91.8)	98
	There are several screening tests for CRC.			
	Control group	74 (74.7)	25 (25.3)	99
	Intervention group	70 (71.4)	28 (28.6)	98
	Men and women should begin screening for CRC soon after turning 50 years of age.			
	Control group	59 (59.6)	40 (40.4)	99
	Intervention group	50 (51)	48 (49)	98
	Screening tests are not necessary for individuals who do not have symptoms.			
	Control group	40 (40.4)	59 (59.6)	99
	Intervention group	46 (46.9)	52 (53.1)	98

Table 4. Descriptive statistics (Participants' average response frequencies, means, and standard deviations) for the health perceptions subscales (N = 197).

Subscale	Strongly Disagree, % (n)	Disagree, % (n)	Neutral, % (n)	Agree, % (n)	Strongly Agree, % (n)	Mean	SD	R
Susceptibility	14 (28)	39.8 (78)	20.7 (41)	23 (45)	2.5 (5)	2.6	.69	1.2-4
Severity	12.9 (25)	30.2 (60)	19.5 (39)	30.2 (59)	7.2 (14)	2.9	.65	1.4-4.3
Benefits	.3 (1)	1.4 (3)	12.3 (24)	64 (126)	22 (43)	4.1	.44	3-5
Barriers	12.8 (26)	21.1 (42)	23.9 (47)	32.3 (64)	9.9 (19)	3.1	.58	1.1-4.1
Health motivation	12.5 (25)	16.4 (32)	5.9 (12)	47.5 (93)	17.7 (35)	3.4	.66	1-5

SD, Standard deviation; R, Range

Table 5. Independent sample *t* test of the level of knowledge prior & subsequent to implementation of intervention.

Variable		Control Group M(SD)	Intervention Group M(SD)	t	p
Level of knowledge	Pre-intervention	6.82 (1.80)	6.60 (1.65)	.88	.38
	Post-intervention	6.74 (1.52)	7.77 (1.43)	-4.88	.00**

M, mean; *SD*, standard deviation; * $p < 0.05$; ** $p < 0.01$ (two-tailed)

Table 6. Independent sample *t* test of health perceptions prior & subsequent to implementation of intervention.

Variable		Control Group M(SD)	Intervention Group M(SD)	t	p
Susceptibility	Pre-intervention	2.64 (.69)	2.57 (.68)	.73	.47
	Post-intervention	2.79 (.64)	3.11 (.69)	-3.38	.001**

(Table 6) contd.....

Variable		Control Group M(SD)	Intervention Group M(SD)	t	p
Severity	Pre-intervention	2.87 (.58)	2.91 (.73)	-.41	.69
	Post-intervention	2.95 (.50)	3.13 (.55)	-2.35	.02*
Benefits	Pre-intervention	4 (.43)	4.11 (.45)	-1.54	.13
	Post-intervention	3.98 (.44)	4.07 (.46)	-1.47	.15
Barriers	Pre-intervention	3.06 (.54)	3.05 (.62)	.15	.88
	Post-intervention	3.03 (.52)	2.82 (.62)	2.63	.009**
Health motivation	Pre-intervention	3.38 (.70)	3.47 (.61)	-.98	.33
	Post-intervention	3.33 (.62)	3.47 (.57)	-.1.60	.11

M, mean; *SD*: standard deviation; * $p < 0.05$; ** $p < 0.01$ (two-tailed)

Table 7. Comparisons of participants' intentions to screen for CRC *via* colonoscopy or sigmoidoscopy between the intervention and control groups prior & subsequent to intervention.

Question Do you intend to do colonoscopy or sigmoidoscopy screening in the next 12 months?	Intervention Group (n= 82)		Control Group (n= 81)		χ^2	p
	N	%	N	%		
Pre-intervention Yes No	25 57	30.5 69.5	17 64	21 79	1.92	.17
Post-intervention Yes No	43 39	52.5 47.5	19 62	23.5 76.5	14.52	** .00

χ^2, Chi-square; * $p < 0.01$; ** $p < 0.001$

The mean of the perceived susceptibility subscale of the intervention group ($M = 3.11$, $SD = .69$) was significantly higher than that of the control group ($M = 2.79$, $SD = .64$). The effect size, as indexed by η^2, was small, at .055. Similarly, the mean of the perceived severity subscale of the intervention group ($M = 3.13$, $SD = .55$) was significantly higher than that of the control group ($M = 2.95$, $SD = .50$). The effect size, as indexed by η^2, was small, at .028. In addition, the mean of the perceived barriers subscale scores for the intervention group ($M = 2.82$, $SD = .62$) was significantly lower than that for the control group ($M = 3.03$, $SD = .52$). The effect size, as indexed by η^2, was small, at .034.

3.6. Research Question 5

Baseline comparisons were performed between the intervention and control groups regarding the participants' intentions to screen for CRC *via* colonoscopy or sigmoidoscopy. The results of the Chi-square test ($\chi^2 = 1.92$, $p = .17$) revealed no significant differences between the responses of the participants in the control and intervention groups.

Eighty-three percent of the participants answered the question concerning their screening intentions *via* colonoscopy and sigmoidoscopy subsequent to implementation of the health education intervention; 38% of them (n = 62) reported having intentions to screen in the next 12 months, and 61.3% of these participants (n = 38) were males. 69.4% (n = 43) of the participants who reported having intentions to screen for CRC *viaM* colonoscopy or sigmoidoscopy in the next 12 months were in the intervention group, and 30.6% (n = 19) of them were in the control group.

A Chi-square results ($\chi^2 = 14.52$, $p < .001$) revealed that there were significant statistical differences between the intervention (52.5%, n = 43) and control (23.5%, n = 19) groups regarding intentions to screen *via* colonoscopy or sigmoidoscopy, as shown in Table 7. These results suggest that receiving health education intervention about CRC and screening recommendations may significantly increase the participants' intentions to screen for CRC *via* colonoscopy or sigmoidoscopy.

4. DISCUSSION

4.1. Knowledge of CRC and Screening Recommendations

The current study showed that Jordanian average-risk men and women have a low level of knowledge and need more information to increase their awareness of CRC and the importance of screening. These findings are congruent with previous Jordanian studies [10, 21] and international studies [16, 22, 23] in which investigators reported low levels of knowledge in relation to CRC and screening tests.

The majority of Jordanian participants mentioned friends, TV/radio, and newspapers or magazines as their primary sources of information about CRC. Furthermore, the least frequently reported sources of information concerning CRC were physicians and nurses. These findings that underscore the effectiveness of health care providers could explain Jordanians' low levels of knowledge regarding CRC.

In comparison with Jordanian studies, Omran and Ismail [21] identified similarly family members, newspaper or magazine, and TV/radio as the main sources of information regarding CRC. Moreover, they identified physicians and nurses as the least likely sources of information regarding CRC. In addition, Ahmad, Dardas [10] identified the media as

the most frequent source of information about CRC screening, and newspapers as the least likely source of information regarding CRC screening. Therefore, there is an urgent need to initiate media campaigns that can effectively change the current views of Jordan's average-risk population about CRC and screening recommendations, thus increasing screening rates.

Surprisingly, the majority of Jordanian participants in the current study chose incorrect answers for the statements of "CRC is usually fatal", and "There is nothing you can do about getting CRC." These results provide more evidences on the low level of knowledge regarding CRC and screening recommendations among average-risk participants. From the researcher's point of view, correcting these myths about CRC could play an important role in raising consciousness about the importance of screening and lead to more screening among Jordanians.

The results of the current study regarding Myths are congruent with a previous study conducted by Oh, Kreps [24] that evaluated the impact of fatalistic beliefs on CRC screening behaviors among Asians, Hispanics, and white Americans. In this study, the majority of the Asian American participants chose incorrect answer for the statement "There is no way to slow down or disrupt colon cancer," and approximately half of the participants chose incorrect answer for the statement "There is not much you can do to lower your chances of getting colon cancer." Similar findings regarding these Myths were reported by Christou and Thompson [25], who found that large proportions of indigenous Western Australians agreed that getting CRC was a death sentence, and believed nothing could be done to lower the chances of getting colon cancer.

Additionally, "Screening tests are not necessary for individuals who do not have symptoms" was the response of more than half of the participants. From the researcher's point of view, this could be one of the main reasons for not performing CRC screening. Similarly, Ahmad, Dardas [10] reported that about two-third of their Jordanian participants revealed being free from health problems as a reason for not undergoing a CRC screening test. The majority of Jordanians believe that wellness and illness are attributable to God's will. Therefore, they use prayer to help them overcome health crises, which might delay their health care-seeking decisions.

4.2. Level of Knowledge Between the Two Groups Prior and Subsequent to Intervention

The significant difference regarding the level of knowledge between the two groups subsequent to intervention supports the effectiveness of using the health education intervention. The significant result of the current study is consistent with that of Rawl, Skinner [13], in which the knowledge score for the intervention group who received a tailored health education intervention *via* computer was significantly higher than that of the control group, who received untailored printed material regarding CRC at the 1-week follow-up. Moreover, Gimeno-García, Quintero [26] conducted an experimental study with 158 participants, aged 50–79 years, to assess the effectiveness of an educational intervention on knowledge, beliefs, and screening behaviors related to CRC screening in average-risk

participants. In this study, the experimental group demonstrated similarly significant improvement in CRC knowledge scores 2 weeks subsequent to the intervention. Generally, the literature supports the argument that educational interventions could increase participants' knowledge regarding CRC and, as a result, CRC screening rates among average-risk populations [13, 26, 27].

4.3. Jordanians' Health Beliefs about CRC and Screening Recommendations

4.3.1. Perceived susceptibility to CRC

A large proportion of Jordanian participants did not believe they were susceptible to CRC. These findings are congruent with Jordanian studies, which reflect similarly low levels of Jordanians' perceived susceptibility to CRC [10, 21]. This could be attributed to the perception of being healthy among Jordanian participants and the absence of any warning clinical manifestations.

Jordanian participants revealed being free from health problems as a reason for not being susceptible. Perceptions of not being at risk for CRC (being healthy) have been verified as valid reasons for not performing CRC screening in previous studies [10, 11, 23, 28]. Furthermore, the religious beliefs in western culture could explain the low perceived susceptibility among average risk Jordanian participants. The majority of Jordanians believe that health and illness are God's will. Therefore, they use some religious practices to assist them in overcoming health problems, which might affect their health perceptions.

4.3.2. Perceived severity of CRC

The moderate level of perceived severity can be explained by the low level of knowledge about CRC and screening recommendations. Another reason could be the belief in the evil eye as a cause of any illness in some Arab and Muslim families. Consequently, they might choose to seek support from a religious healer (the sheik) and use prayer instead of treatment.

Omran and Ismail [21] reported a higher level of perceived severity; more than half of the participants perceived CRC as a severe disease. In addition, several international studies have revealed a higher perceived level of CRC severity [25, 29].

4.3.3. Perceived benefits of CRC screening

The high level of agreement with the perceived benefits could be attributed to the religious beliefs in the eastern culture, in which individuals are encouraged to utilize different prophylactic measures to detect the health problems early or prevent the occurrence of them.

Similarly, Omran and Ismail [21] study revealed the same proportion of Jordanian participants who recognized the benefits of CRC screening. In comparison with international studies, Green and Kelly [17] reported a higher percentage of agreement with the perceived benefits. Similar results have been reported in other studies [13, 24]. In contrast, Christou and Thompson [25] reported a lower percentage of agreement

with the perceived benefits.

4.3.4. Perceived barriers to CRC screening

The most frequently perceived barrier among Jordanians in the current study was the cost of the CRC screening tests. Furthermore, more than half of the participants believed CRC screening might be painful and expose them to high doses of radiation. One possible explanation is the low levels of income among participants (approximately half the participants reported a monthly household income between 300 and 600 JD, and about one-third reported income less than 300 JD a month). Moreover, the health insurance in Jordan does not cover CRC screening tests. Furthermore, the absence of an official guideline for CRC screening in Jordan could be one of the main factors that shape the perceived barriers perception.

Compared to international studies, Jordanian participants perceive more barriers in relation to CRC screening. A previous study conducted by Guessous, Dash [30] found that the most commonly reported perceived barriers were unpleasantness (pain), discomfort, and perceived risk related to undergoing screening. In addition, a number of previous studies concluded that time, cost, unpleasantness, and embarrassment are barriers to undergoing CRC screening [23, 26, 28, 29].

4.4. Participants' Health Perceptions Between the Two Groups Prior and Subsequent to Intervention

The baseline results revealed no significant differences in the health perceptions of susceptibility, severity, benefits, and barriers between the intervention and control groups. Subsequent to the implementation of health education intervention, Jordanian participants in the intervention group showed significantly higher levels of perceived susceptibility and severity, and significantly lower levels of perceived barriers compared to participants in the control group. However, there were no significant differences in the health perceptions of benefits between the intervention and control groups subsequent to the implementation of health education intervention. This is congruent with the findings of the previously mentioned studies [13, 26, 31].

The significant results of this study could be explained based on Health Believe Model [32], in which the cue to action (health education intervention) may exert an indirect influence on the individual's health beliefs by increasing the perceptions of susceptibility and severity, and decreasing the perceived barriers; thus, it may lead to engagement in health-promoting behaviors [32].

4.5. Implications

This study adds to the body of nursing knowledge by increasing nurses' understanding of the current views of Jordanians' average-risk population about CRC and screening recommendations. This current view should be addressed as an essential component of nursing education and curriculum to enable nurse educators to construct an informative database. Moreover, nurse educators are in a key position to make use of the study results by participating in the health education intervention as essential partners in providing holistic nursing

care to motivate average-risk Jordanians to start screening for CRC.

CONCLUSION

The results of this study may be used to provide direction for the development of culturally appropriate nursing interventions that will facilitate improvements in knowledge levels and will modify the health perceptions of the average-risk Jordanian population regarding CRC and screening recommendations. These improvements may lead to an increase in Jordanians' participation in early CRC screening programs and may consequently lead to a reduction in incidence and mortality rates.

Knowledge gained through research examining whether group education interventions influence knowledge levels and perceptions regarding CRC is important for nurses in primary care settings, and it may lead to an increase in the likelihood of screening and early detection of CRC cases. Policies in health care institutions should include organized steps to implement health education intervention among average-risk Jordanians, and it should consider such interventions to be an integral part of the care provided.

The study findings need to be replicated with a larger and more heterogeneous sample recruited randomly from different settings. The effectiveness of the health education interventions were still of reasonable magnitude one month following the intervention. A randomized clinical trial should be implemented to provide results that are more definitive and measure the long-term effects of such interventions.

ETHICS APPROVAL AND CONSENT TO PARTI-CIPATE

The approval from the Institutional Review Board (IRB) at the Jordan University Hospital in Amman (10/2015/20609), and Al-Basheer Hospital Jordan (MOH REC 150080) were obtained for the study.

HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All human research procedures were followed in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2013.

CONSENT FOR PUBLICATION

Informed consent was obtained from all participants.

AVAILABILITY OF DATA AND MATERIALS

The data sets analyzed during the current study are available from the corresponding author upon request.

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None.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

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KEY MESSAGES

Colorectal cancer is a curable disease if it is detected early One of the main primary prevention measures could be raising consciousness and correcting health perceptions toward CRC.

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