

Effects of Dark Chocolate Consumption on Anxiety, Depressive Symptoms and Health-related Quality of Life Status among Cancer Patients

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ABSTRACT: Anxiety and depressive symptoms (AD) are common among cancer patients and have been shown to adversely affect their health-related quality of life (HRQoL). Dark chocolate is popular for its beneficial effects on mood regulations. This study aims to assess the effects of dark chocolate consumption on AD and the HRQoL status among cancer patients. A sample of 133 cancer patients was recruited from three public hospitals in the East Coast Peninsular of Malaysia. The AD was assessed by the Malay Hospital Anxiety and Depression Scale (HADS) while HRQoL was measured via the Malay McGill Quality of Life (MMQoL). Patients were randomly assigned to Intervention Group (IG, n=65) and Control Group (CG, n=68) whereby dark chocolate (50g) was administered to IG while CG consumed mineral water for three consecutive days. Data was analyzed descriptively and score comparisons were conducted using nonparametric tests. No significant difference in AD and HRQoL was detected at baseline between IG and CG (all $p > 0.05$). At follow-up, significant changes in AD and Total MMQoL Score were demonstrated for both groups. Specifically, the AD was significantly reduced after dark chocolate consumption (mean difference: HADS-A = -4.3 ± 2.6 , HADS-D = -6.5 ± 2.5 , $p < 0.001$). HRQoL-wise, the Total MMQoL Scores was significantly increased in IG compared to CG post-intervention (mean difference = 1.2 ± 1.0 , $p < 0.001$). The IG patients who were anxious or depressed at baseline reported lower AD scores and enhanced HRQoL status at follow-up. These findings indicated that a 3-day dark chocolate consumption may reduce AD and thus also improved the HRQoL status in cancer patients.

Keywords: Dark chocolate, consumption, anxiety, depressive, health-related quality of life, cancer patients.

Introduction

In Malaysia, cancer is one of the five principal causes of mortality and has been estimated that about 30,000 new cases of cancer are being diagnosed annually (Abu and Jegathesan, 2009). The increase of cancer prevalence has resulted in more attention being directed towards the health outcomes of cancer sufferers. Any mood

disorder among cancer patients similarly can increase distress, affect daily function, increase the risk of future depression and dampen their health-related quality of life (HRQoL) (Wilson *et al.*, 2007). Moreover, cancer patients often have to deal with severe side effects and psychological distress during cancer treatment, which have a substantial impact on their HRQoL.

Anxiety and depressive symptoms (AD) are common among cancer patients. Depression is a mental condition marked by ongoing feelings of sadness, despair, loss of energy, and difficulty in dealing with normal daily life. Other depressive symptoms include feelings of worthlessness and hopelessness, loss of pleasure in activities, change in eating or sleeping habits, and thoughts of death or suicide. Depression is common among early diagnosed cancer patients and those who under treatments such as radiotherapy and chemotherapy. According to previous studies, nearly 1 in 4 cancer patients (15-25%) showed symptoms of clinical depression (Rodin *et al.*, 2007). Depression can bring health complications for cancer patients. It increases suffering, reduces the likelihood a patient will comply with cancer treatment, makes hospital stays longer and even hastens death (Bodurka-Bevers, 2000). Study on anxiety is less known compared to depressive symptoms. Anxiety's disabling effects may as burdening as depressive symptoms (Roy-Byrne, 2008). Early detection and treatment of both disorders are therefore essential to enhance HRQoL in their remaining life. Furthermore, undiagnosed and untreated AD may enhance suicidal mindset. Hence, interventions to reduce AD are essential to improve HRQoL status among cancer patients.

Chocolate has been claimed to bring tangible benefits for cardiovascular health as well as for mood. Some previous studies had indicated that ingesting chocolate would produce better mood states (Macht and Dettmer, 2006; Visioli *et al.*, 2009). Chocolate consumption is also claimed to have the ability of lifting up spirits, create highs and inducing the 'feel good' condition. Some people believed that the oro-sensory properties of chocolate are the main contributor of mood regulation (Macht and Muller, 2007). Since dark chocolate is

palatable and weight gain is not undesirable in cancer patients, it is suitable to be used to investigate its effects on emotional states.

The aim of the study is to determine the effect of a 3-day dark chocolate consumption on AD and HRQoL among hospitalised cancer patients which is also hypothesized to create a better emotional state which could also improve HRQoL of cancer patients.

Materials and Methods

The study was a controlled two-armed randomized study including a post study follow-up period of 3-days. A group of cancer care patients were enrolled from Hospital Sultanah Nur Zahirah, Terengganu (HSNZ), Hospital Tengku Ampuan Afzan, Pahang (HTAA) and Hospital Raja Perempuan Zainab II, Kelantan (HRPZ II) located in the East Coast of Peninsular Malaysia. They were enrolled during their admission in the oncology, surgical or palliative wards within a period of 16 months. For this study which involved two groups, a power of 0.80 and α error at 0.05 for significance was used to estimate the number of patient per group for each instrument. According to prospective study formula, the number of patient per group was 57 (Columb and Steven, 2008). Only cancer patients who fulfilled the inclusion criteria were included in the analysis. The inclusion criteria were: 1) 18 years old and above; 2) proficient in Malay language; 3) not on anxiolytic medication, psychological treatments or had previous experience with behavioural therapy; 4) no food allergy particularly to chocolate; 5) non-diabetic; 6) no complication in swallowing; 7) HADS domain scores = 8 (considered as possible case). Patients who were too weak or exhausted to contribute meaningful information for the study were then excluded.

Patients were initially provided with a brief Patient Information Sheet detailing the purpose of the study followed by the written consent form. They were then asked to provide their demographic information in Personal Particulars Form consisting of nine questions which included: gender, age, marital status, race, education level, occupation, monthly salary and type of cancer (Lua *et al.*, 2011). All Cronbach's α coefficient for both instruments exceeded 0.70 with the exception of Support Issues and Total MMQoL Scores (Physical Symptoms = 0.701, Psychological Well-Being = 0.865, Existential Well-Being = 0.817, Support Issues = 0.619, Total MMQoL Score = 0.659, HADS-A = 0.801, HADS-D = 0.739). The Malay Hospital Anxiety and Depression Scale (HADS) is a self-screening questionnaire for psychopathological co-morbidity which had also been used for wide range of patients from clinical to none clinical settings (Zigmond and Snaith, 1983). This validated and Malay translated HADS was the instrument of choice in this study (Hatta *et al.*, 1997; Lua *et al.*, 2011). It consist of 14 questions, seven for anxiety (HADS-A) and seven for depression (HADS-D). The items scored on a four-point scale from zero (not present) to three (considerable). HADS-A include item 2, 4, 6, 8, 11, 12, 14 and HADS-D includes 1, 3, 5, 7, 9, 10, 13. HADS used to screen the anxiety and depressive symptoms in "the past few days". The items are scored on a four-point scale from zero (not present) to three (considerable). Each item score was summed, giving sub-scale scores on the HADS-A and the HADS-D from zero to 21. In brief, any domain scores = 8 was considered as a "possible case".

The McGill QoL Questionnaire (MQoL) was designed to measure HRQoL for people with life threatening illness (Cohen *et al.*, 1997). The validated Malay translation of MQoL

was utilised in this study. It consists of 17 items, including a Global QoL question and open-ended questionnaire where patients were encouraged to report issue which influenced their HRQoL. Five domains were assessed, Physical Symptoms (items 1 to 3), Physical Well-Being (item 4), Psychological Well-Being (items 5 to 8), Existential Well-Being (items 9 to 14) and Support Issues (items 15 and 16).

The response categories ranged from 0 to 10 with anchor ends. The Total MMQoL Score was derived from the mean of all five domains. For this study, the reference frames of 'the past 2 days' was used. All questions in MMQoL could be answered using numerical value from 0 to 10. Larger numbers indicated more positive responses, except for items 1, 2, 3, 5, 6, 7, and 8. The first three questions allow the respondent to list down the three main physical symptoms that imposed the most problems which influenced their HRQoL. Scores for items 1 to 3 and 5 to 8 in MMQoL were transposed prior to data analysis (Lua, 2006; Lua *et al.*, 2011).

The investigators informed the authorities in the study centre to decide on the most suitable time and date to conduct the intervention study. At the first meeting, the research assistants explained about the study to the potential patients followed by invitation to participate. Eligible patients who agreed to be participants were provided with *Patient Information Sheet* and were instructed to complete the Personal Particulars Forms, Informed Consent Form, the Malay HADS and the MMQoL. Furthermore, patients who met all the inclusion criteria were then randomized to either the Intervention Group (IG) or the Control Group (CG). IG members were assigned with a bar dark chocolate, Vochelle@TM (50g; 275 kcal) for 3 consecutive days. On the other hand, the CG

was instructed to consume a bottle of mineral water (325 ml) for 3 consecutive days. All patients were re-assessed at follow-up, using the Malay HADS and MMQoL. At the end of the study, each patient was distributed with a token of appreciation. This study was approved by the Medical Research and Ethics Committee (MREC) and Clinical Research Centre (CRC) of the Ministry of Health Malaysia (reference number: KKM/NIHSEC/08).

Note that the study was carried out with the appropriate informed consent from patients who were allowed to withdraw from the study at any time they wish. All the information collected was treated as confidential. Statistical analyses were carried out with licensed SPSS 17.0 for Windows. Socio-demographic data was analyzed descriptively and presented as frequencies. Test of data normality was initially carried out on *Total MMQoL Score* and *Total HADS Score* to determine the type of data distribution which subsequently emerged skewed. Subsequent score comparisons were performed using the non-parametric techniques Mann Whitney U test and

Wilcoxon Signed Rank Test to compute for groups score comparisons for Total MMQoL Score, HADS-A and HADS-D. The value of $p < 0.05$ was considered significant.

Results

Demography Characteristics

221 eligible patients were included in the study. 65 subjects (29.4%) were excluded at the baseline assessment. In addition, the dropout rate was 10.4% (23). The mean age of participants was 49.9 years (10.55). Majority of the patients were Malays (85.7%) which included 65 males and 68 females. Over 50% of the patients had completed LCE education, were not employed, liked chocolate and have been diagnosed with cancer for less than 2 years. The largest proportion of the cancer patients in our study suffered from breast cancer (30.1%), followed by colorectal (27.1%) and gynaecologic cancers (15.0%). The more comprehensive socio-demographic characteristics of the recruited patients were tabulated in **TABLE 1**.

TABLE 1- Demographic and Clinical Characteristics of Patients

	All patients (n = 133) Frequency (%)	Study group (n = 65) Frequency (%)	Control group (n = 68) Frequency (%)
Mean (SD) age (years)	49.9 (10.6)	50.2 (11.5)	49.6 (9.7)
Gender			
Male	65 (48.9)	30 (46.2)	35 (51.5)
Female	68 (51.1)	35 (53.8)	33 (48.5)
Marital Status			
Married	119 (89.5)	58 (89.2)	61 (89.7)
Single	10 (7.5)	5 (7.7)	5 (7.4)
Divorce	4 (3.0)	2 (3.1)	2 (2.9)
Race			
Malay	114 (85.7)	59 (90.8)	55 (80.9)
Others	19 (24.3)	6 (9.2)	13 (9.1)
Level of education			
> PMR	87 (65.4)	38 (58.5)	49 (72.0)
< PMR	46 (34.6)	27 (41.5)	19 (28.0)
Occupation			
Employed	49 (36.8)	27 (41.5)	22 (32.3)
Not employed	84 (63.2)	38 (58.5)	46 (67.7)
Monthly salary			
< RM 500	78 (58.6)	33(50.8)	45 (66.2)
> RM 500	55 (41.4)	32 (49.2)	23 (33.8)
Site of cancer			
Breast	40 (30.1)	21 (32.3)	19 (27.9)
Gynaecological	20 (15.0)	9 (13.8)	11 (16.2)
Colorectal	36 (27.1)	17 (26.2)	19 (27.9)
Lung	14 (10.5)	6 (9.2)	8 (11.8)
Others	23 (17.3)	12 (18.5)	11 (16.2)
Duration since diagnosis			
Up to 1 year	89 (66.9)	47 (72.3)	42 (61.8)
More than 1 year	44 (33.1)	18 (27.7)	26 (38.2)

Key: PMR= equivalent to lower secondary level

Comparison of Scores

No significant difference was found between IG and CG in AD and *total MMQoL score* at baseline ($p > 0.05$) as shown in **TABLE 2**. In contrast, significant reduction of AD levels was demonstrated between baseline and follow-up in IG compared to CG ($p < 0.01$). At post-consumption, IG respondents were apparently less anxious and less depressed than CG. The over-time effect sizes of both HADS sub-scales also demonstrated

significant improvement in IG respondents ($p = < 0.001$). At post-consumption, *the total MMQoL score* was significantly greater in IG (Baseline_{mean} = 7.8, Follow-up_{mean} = 7.3, $p < 0.05$). Overall, significant differences in all MMQoL domains were also exhibited across the study period except for *Support Issues* between IG and CG respondents ($p = 0.07$). Within the domains in MMQoL, the IG reported its greatest change in *Psychological Well-Being* and *Physical Symptoms* (both $d=0.80$).

TABLE 2- Comparisons of anxiety, depressive symptoms and HRQoL profiles at baseline and follow-up according to groups

		Baseline		Follow-up		Within group (p^+)	Effect size ⁺
		Mean	Between group (p^*)	Mean	Between group (p^*)		
HADS-A	IG	8.3	> 0.05	4.0	< 0.001	< 0.001	0.83
	CG	7.5		7.0		< 0.05	0.25
HADS-D	IG	10.6	> 0.05	4.1	< 0.001	< 0.001	0.87
	CG	10.0		8.0		< 0.001	0.73
Physical symptoms	IG	6.9	> 0.05	9.0	< 0.01	< 0.001	0.80
	CG	7.2		8.1		< 0.01	0.48
Physical Well-Being	IG	5.5	> 0.05	6.6	< 0.05	< 0.001	0.52
	CG	5.7		6.0		> 0.05	0.21
Psychological Well-Being	IG	4.0	> 0.05	5.5	< 0.05	< 0.001	0.80
	CG	4.5		4.8		< 0.05	0.31
Existential Well-Being	IG	7.5	> 0.05	8.5	< 0.05	< 0.001	0.78
	CG	7.2		7.8		< 0.01	0.40
Support Issues	IG	9.0	> 0.05	9.3	> 0.05	< 0.05	0.27
	CG	8.8		9.2		> 0.05	0.20
Total MMQoL Score	IG	6.6	> 0.05	7.8	< 0.001	< 0.001	0.84
	CG	6.7		7.3		< 0.001	0.62

Key: Mann-Whitney U test; ⁺ Wilcoxon Sign Rank Test; $p < 0.05$ = significant

Discussion

Cancer has adverse effects on patients’ HRQoL with several accompanying negative mood symptoms. A comprehensive care of cancer patients requires not only curative efforts but also attention to the psychological needs of patients. Although patient’s daily food intake was not controlled but they were instructed to abstain from food 4 hours before the intervention study to avoid possible food interaction effects. No significant difference was observed in domain scores for HADS and MMQoL at pre-consumption, indicating that overall patients were comparable in terms of anxiety, depression, mood and HRQoL levels before intervention.

Similarly, patients in both intervention group and control group experienced beneficial changes in AD and HRQoL scores more profound in with changes being observed in the patient with dark chocolate intervention. This study demonstrated better mood states after chocolate intervention which is also found in previous studies (Parker and Brothie, 2006; Martin *et al.*, 2009). Accumulating evidence from the chocolate studies (Parker *et al.*, 2006; Macht and Muller, 2006) had further convinced that chocolate consumption enhances mood. It was found that oro-sensory aspect of dark chocolate can be a possible contributor in alleviating AD as well as the main contributor of mood regulation (Schenker, 2000). Mood regulation is mediated by dark’s chocolate palatability and its unique combination of sweetness and aroma (Scott,

2005; Parker *et al.*, 2006). These are the most popular explanations for creating better mood states among chocolate lovers (Scott, 2005; Parker *et al.*, 2006). The production of endorphin during chocolate ingestions could enhance mood. Apart from endorphin, the sweetness and fat content in dark chocolate stimulate the release of tryptophan and serotonin in blood (Schenker, 2000). Both substances could immediately lead to the increase of energy, alertness and mood (Wolfe *et al.*, 2008).

The effects of dark chocolate on AD are also influenced by situational variables. The availability of the intervening food and the pleasure derived from dark chocolate consumption was also perceived to alter the emotional states. All of the hospitalized patients included in our study were experiencing a mixture of emotions such as anxiety, depression, and stress (mild anxiety cases = 61.5%; mild depressive cases = 44.1%). Therefore, we could not control the increase of junk food preference such as dark chocolate in low emotional state (Solomon, 2001). Further limitations of this study included possible biasness in response due to prior perception that dark chocolate consumption may alleviate mood as well as enhance HRQoL levels. In personal chocolate preference could also exert influence on the outcomes of this study. We observed that when anxiety and depressive symptoms were ameliorated, the HRQoL status had also improved at post-intervention stage among the cancer patients, indicating that intervention which reduced anxiety and depressive symptoms would indirectly improve the HRQoL status tremendously in cancer patients (Grossman *et al.*, 2010). A previous cohort study has also proven that chocolate consumption and preference was associated with better health, optimism and better psychological well-being among older adults (Strandberg *et al.*, 2008). However, these findings could not be compared with

other similar past research data because the chocolate research studies were not conducted among cancer patients.

Conclusion

It was concluded that AD and HRQoL improved significantly in the group of patients who consumed dark chocolate for 3 consecutive days compared to those who did not. These findings suggested that there were mood-elevating effects of dark chocolate consumption. Studies on dark chocolate investigating the effect on AD and well-being along with structured diagnostic interviews and examination of bio physiological factors are highly recommended in larger sample sizes in multiple centers in Malaysia among cancer patients.

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