



University of Bergen

Faculty of Medicine

**Master Thesis**

**Nutrition Education as Part of a Cancer  
Rehabilitation Program: Evaluation of Short  
Term Efficacy**

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## ABSTRACT

**Background and aim:** The rising number of cancer patients is being followed by increasing number of cancer survivors in Norway. Modifiable lifestyle factors such as changing dietary behaviour can benefit the cancer prognosis and reduce the risk of recurrence. However, changing people's behaviours is complex. The Cancer Centre for Rehabilitation and Education (KOR) at Haukeland University Hospital (HUS) in Norway offers a one-day nutrition course to educate cancer patients and survivors in regards to nutrition and cancer. However, the program has never been formally evaluated. The aim of this study was to evaluate the efficacy of the one-day nutrition course on patients' dietary knowledge and short-term dietary behaviour.

**Method:** A quality control pilot study was conducted at KOR from October 2017 to February 2018 including outpatients diagnosed with cancer and cancer survivors attending the one-day nutrition course. Disease-related information and anthropometric measurements, the patients' satisfaction with current diet, and their motivation to change diet were documented through a self-reported personal questionnaire. Dietary knowledge and dietary intake were measured before and after attending the nutrition course, by the use of a dietary questionnaire and a 3-day food diary, respectively. The results from the dietary questionnaire and 3-day food diary before the course are compared to the answers and food diaries after the course.

**Results:** The study population consisted of 28 patients (50% males), mean age 64 years, mainly prostate- (41%) and female breast (33%) cancer patients, and the majority of the group were currently receiving treatment (82%). 75% of the patients wanted to change their dietary behaviour. 20 of 26 patients scored higher in terms of knowledge after attending the nutrition course. The 3-day food diary showed that patients increased their protein intake with approximately 2.5g per 1000 kcal ( $47.9 \pm 7.7$  to  $50.4 \pm 7.7$ ) and also increased their fibre intake with 2.2g per 1000 kcal ( $12.3 \pm 3.3$  to  $14.5 \pm 3.7$ ), which showed a significant difference ( $0.028$ ,  $p < 0.05$ ). The mean %energy intake from saturated fatty acids decreased ( $13.4 \pm 2.6$  to  $11.1 \pm 3.4$ ,  $p = 0.54$ ).

**Conclusion:** The results of the pilot study show that the one-day nutrition course has efficacy on dietary knowledge and short-term dietary intake in cancer patients attending the course. The main results of the pilot study reflect the course content, both in terms of increased dietary knowledge and positive changes in dietary intake.

## Table of Contents

<b>ACKNOWLEDGEMENTS.....</b>	<b>ii</b>
<b>ABSTRACT .....</b>	<b>iii</b>
<b>LIST OF TABLES.....</b>	<b>vii</b>
<b>LIST OF FIGURES.....</b>	<b>viii</b>
<b>ABBREVIATIONS.....</b>	<b>ix</b>
<b>1. INTRODUCTION .....</b>	<b>1</b>
1.1 Cancer morbidity, incidence, mortality and survival .....	2
1.2 Cancer treatment and side-effects of cancer treatment.....	4
1.3 Diet and cancer.....	5
1.3.1 Dietary factors and cancer prevention.....	5
1.3.2 Dietary advice for cancer patients during treatment.....	6
1.3.3 Dietary advice for cancer survivors.....	8
1.3.4 How do patients get information about diet and cancer.....	9
1.4 Rehabilitation programs for cancer patients.....	9
1.5 Theories of behaviour change .....	10
1.5.1 The Social Cognitive Theory .....	11
1.5.2 The Theory of Planned Behaviour.....	12
1.5.3 The Health Belief Model.....	12
1.5.4 The Transtheoretical Model.....	13
1.5.5 Factors that influences health behaviours .....	14
1.6 Dietary assessment methods.....	15
1.6.1 3-day food diary .....	15
1.6.2 24-hour recall.....	15
1.6.3 FFQ.....	16
<b>2. The Cancer Center for Education and Rehabilitation (KOR).....</b>	<b>17</b>
2.1 The one-day nutrition course at KOR.....	17
<b>3. AIM AND HYPOTHESIS .....</b>	<b>19</b>
3.1 Aim.....	19
3.2 Hypothesis .....	19
<b>4. METHOD.....</b>	<b>20</b>
4.1 Study design and data collection .....	20
4.1.1 Pre one-day nutrition course.....	20
4.1.2 Post one-day nutrition course.....	20
4.2 Patient contact, selection and information .....	21
4.3 Personal questionnaire.....	23
4.4 Dietary questionnaire.....	23
4.5 3-day food diary.....	24
4.6 Food diary analysis.....	24
4.7 Data handling and analysis.....	25
<b>5. RESULTS .....</b>	<b>27</b>
5.1 Characteristics of the patients included and excluded in the study.....	27
5.2 Characteristics of the study population at time of recruitment.....	28
5.2.1 Satisfaction with dietary behaviours.....	31
5.2.2 Motivation to change dietary behaviours.....	32
5.3 Dietary knowledge.....	33
5.3.1 Confusion regarding dietary advice .....	36
5.4 Dietary intake .....	38
<b>6. DISCUSSION.....</b>	<b>44</b>
6.1 Main findings.....	44
6.1.1 Dietary knowledge .....	44
6.1.2 Dietary change .....	46

6.2	Methodological considerations.....	50
6.2.1	Bias.....	50
6.2.2	Limitations.....	52
6.2.2	Strengths.....	53
6.3	Clinical implications and the demand for similar nutrition courses....	53
6.4	Further research.....	54
6.5	Conclusion of the quality control study.....	55
<b>7.</b>	<b>REFERENCES.....</b>	<b>56</b>
<b>8.</b>	<b>Appendix.....</b>	<b>60</b>
8.1	Appendix 1: Personal questionnaire .....	61
8.2	Appendix 2: Dietary questionnaire round 1 .....	62
8.3	Appendix 3: Dietary questionnaire round 2 .....	63
8.4	Appendix 4: Information on how to fill in the 3-day food diary .....	64
8.5	Appendix 5: 3-day food diary registration form.....	65

## LIST OF TABLES

Table 1: Characteristics of the study population at “Pusterommet” based on self-reported data from the personal questionnaire.....	30
Table 2: Satisfaction with diet compared with BMI, age, gender and number of correct answers round 1 and round 2.....	32
Table 3: Wish to change dietary habits in the study population.....	33
Table 4: Difference in knowledge score for those patients who were motivated to change diet and those who were not motivated to change diet.....	36
Table 5: Dietary intake presented as mean $\pm$ SD of 3-day food diaries.....	40
Table 6: Results from the 3-day food diary from the 14 patients that completed both rounds of food registrations compared with the National guidelines for healthy adults.....	43
Table 7: Energy adjusted intake of protein and fibre (mean and SD, g per 1000 kcal for the 14 patients that completed both rounds).....	43

## LIST OF FIGURES

Figure 1: Cancer of all sites in Norway. Trends in incidence, and mortality rates and 5-year relative survival proportions in Norway.....	2
Figure 2: Prostate cancer for males and breast cancer for females. Trends in incidence, and mortality rates and 5-year relative survival proportions in Norway.....	3
Figure 3: Summary of strong evidence on diet, nutrition, physical activity and the prevention of cancer from WCRF International (2017).....	6
Figure 4: The Social Cognitive Theory.....	11
Figure 5: The Theory of Planned Behaviour.....	12
Figure 6: The Transtheoretical Model.....	14
Figure 7: Period for data collection.....	21
Figure 8: A screenshot from ‘Kostholdsplanleggeren’.....	25
Figure 9: Flow-chart of patients included and excluded in the intervention.....	28
Figure 10: Satisfaction with the current dietary behaviours.....	31
Figure 11: Questions and number of correct answers round 1 and round 2 from the dietary questionnaire.....	34
Figure 12: Individual results of the nutrition score in women R1 means round 1, and R 2 means round 2. Each of the female participants is represented by a line (n=14). Maximal score was 7.....	35
Figure 13: Individual results of the nutrition score in men R1 means round 1, and R 2 means round 2. Each of the male participants is represented by a line (n=14). Maximal score was 7.....	36
Figure 14: How confused the patients found dietary advice from different sources before (1,00) and after (2,00) the nutrition course.....	37
Figure 15: How confused each individual female (pink / left), and male (blue / right) felt in regards to receiving dietary advice before and after the nutrition course.....	38
Figure 16: Figure 16: Reported energy intake according to BMI.....	39



## ABBREVIATIONS

ACS	=	American Cancer Society
AICR	=	American Institute for Cancer Research
BW	=	Body weight
ESPEN	=	European Society for Clinical nutrition and Metabolism
FFQ	=	Food frequency questionnaire
HBM	=	Health Belief Model
HUS	=	Haukeland University Hospital
Kcal/kg BW	=	kilocalories per kilogram body weight
KOR	=	Kreftsenteret for oppl�ring og rehabilitering (CCER – Cancer Center for Education and Rehabilitation)
SCT	=	Social Cognitive Theory
TE%	=	Total energy percentage
TPB	=	Theory of Planned Behaviour
WCRF	=	World Cancer Research Fund
WCR	=	World Cancer Report
WHO	=	World Health Organization

## 1. INTRODUCTION

Worldwide cancer is the second leading cause of death after cardiovascular disease (1, 2). In Norway, these disease groups cause an equal amount of deaths per year, both accounting for just under 28% of the deaths nationwide (3). The World Health Organization (WHO) estimates that changes in dietary habits, physical activity and smoking can prevent approximately 30 percent of cancer incidence (4, 5).

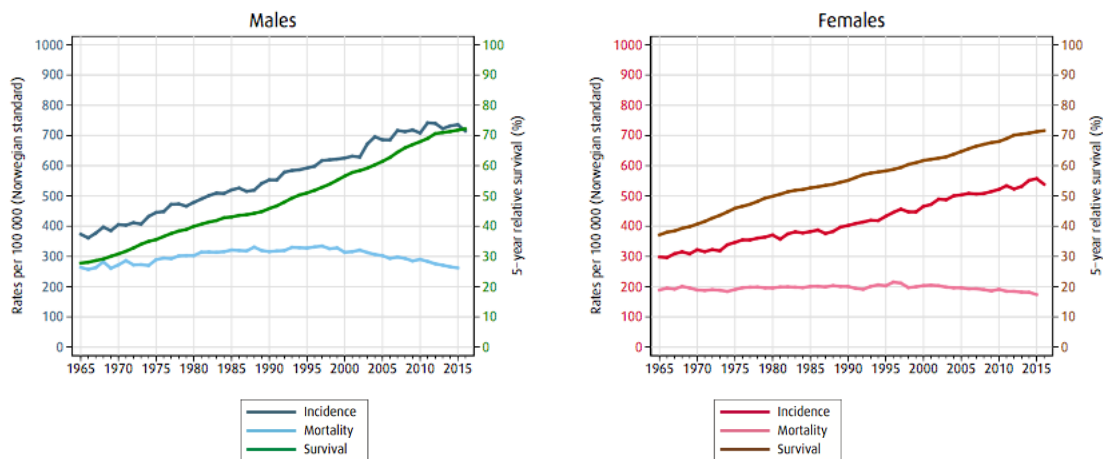
Cancer is a group of diseases defined as cell division out of control with the ability to both invade surrounding tissues and to metastasize through blood or the lymphatic system (4). Although the causes of cancer are often unknown, some factors are known to increase the risk of cancer development. This includes non-modifiable risk factors such as an increased age and genetics and modifiable risk factors such as environmental factors including smoking, unhealthy eating and physical inactivity (6). On the other hand, healthy dietary habits and physical activities are health behaviours and lifestyle factors that have been shown to reduce the risk of cancer development. These lifestyle factors have also been associated with positively influencing cancer prognosis and the quality of life for cancer patients receiving cancer treatment. In addition, when first diagnosed with cancer, lifestyle changes towards a healthier lifestyle have proven to be highly beneficial for cancer survival by improving recovery, lower the risk of cancer recurrence and comorbidities including diabetes and cardiovascular disease (7).

Health professionals like physiotherapists and clinical dietitians can play a major role in promoting and maintaining these lifestyle changes. In particular, clinical dietitians have the opportunity to encourage maintenance or improvement in healthy dietary behaviours for cancer patients and survivors, which is positive for the patients and their relatives.

This thesis will evaluate a nutrition course in cancer patients and cancer survivors, and first, the reader will be introduced to cancer statistics, risk factors, theories of behaviour change and the Cancer Rehabilitation Center at Haukeland University Hospital (HUS).

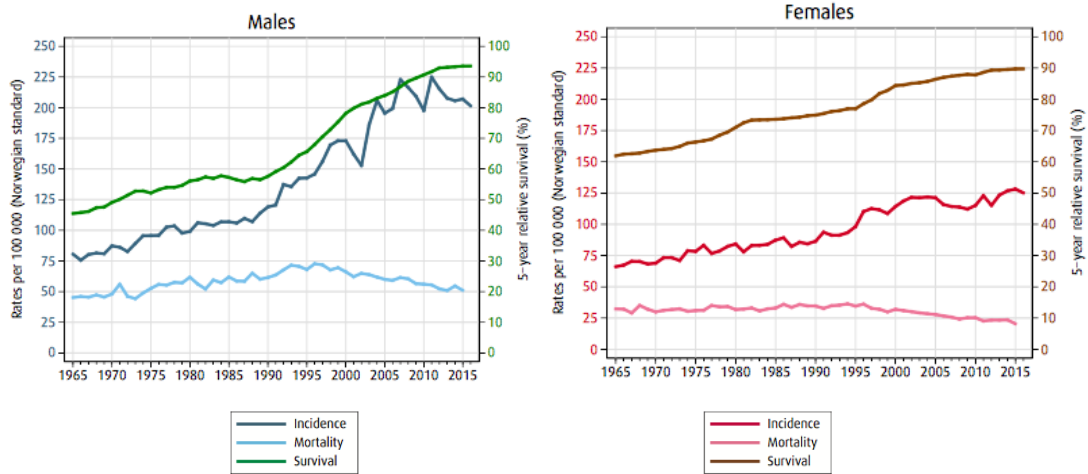
## 1.1 Cancer morbidity, incidence, mortality and survival

The number of people diagnosed with cancer in Norway increases each year. This is mostly due to an aging population, and the number is expected to grow further (8). In 2016 a total of 32 827 new cancer diagnosis were recorded in Norway (9), with prostate-, breast-, lung- and colon- cancer accounting for 45% of these cases (6). Precisely 5118 new cases of prostate cancer, and 3371 new cases of female breast cancer were reported, accounting for approximately 16% and 10% of all new cases in males and females, respectively (6). Furthermore, in terms of lifetime risk of developing cancer, statistics from the Cancer Registry of Norway state that approximately one in three Norwegians will get diagnosed with cancer before the age of 75 (9). Figure 1 shows the trends in incidence, and mortality rates and 5-year relative survival rate proportions in all cancer sites in Norway from 1965 to 2015.



**Figure 1: Cancer of all sites in Norway. Trends in incidence, and mortality rates and 5-year relative survival proportions in Norway. Rates per 100 000 (Norwegian standard). (6)**

Previously, cancer was associated with high mortality rates and low survival rates, as seen in Figure 1. However, this has changed dramatically for some cancer types as they now have higher survival rate. This applies for example to the most common cancers, breast cancer in women and prostate cancer in men, as shown in Figure 2. Prostate and breast cancer have now 5-year survival rates of 93.6% and 89.7%, respectively (6). They are both age related diseases with women being at highest risk of developing breast cancer after menopause (10) with the median age of diagnosis at 62 years (6). The median age for prostate cancer diagnosis is 69 years old (6).



**Figure 2: Prostate cancer for males and breast cancer for females. Trends in incidence, and mortality rates and 5-year relative survival proportions in Norway. Rates per 100 000 (Norwegian standard). (6)**

Higher survival rates are leading to higher numbers of men and women living with cancer, in particular breast cancer and prostate cancer (11). Even though there are still cancer types that have a poor prognosis and are associated with high mortality and short survival time, the overall survival rate and time have increased due to lifestyle changes, and to progression in research, screening and treatment of cancer. The number of cancer survivors has been continuously increasing in Norway, and figures from the Cancer Registry show that approximately 262 884 people in Norway were cured or lived with their cancer disease in 2016, which is about 80 000 more compared to 10 years earlier (2006) (12).

However, cancer survivors have an increased risk for recurrence, development of second malignancies, cardiovascular disease, diabetes, osteoporosis and functional decline (13). In addition, many cancer survivors will develop late sequelae, a phenomenon that is receiving increased attention as more patients survive. Late sequelae can be due to the disease itself, the antitumor therapy and lifestyle habits, such as low physical activity and unhealthy dietary behaviours (14). In addition to increasing risk for the comorbidities previously mentioned, late sequelae can result in fatigue, cognitive impairment and emotional difficulties such as depression, anger or anxiety. These phenomena lead to an increased demand for rehabilitation and follow up in these patients.

## 1.2 Cancer treatment and side-effects of cancer treatment

Cancer treatment includes different therapeutic approaches including surgery, chemotherapy, radiation, immunotherapy, endocrine therapy, stem cell transplant and others (15). The treatment received depends on the type of cancer, the grading of a tumour and the stage of disease, and factors such as age and overall health (15). Different treatment forms are often combined. In Norway, there are 29 established national guidelines ('pakkeforløp') on the treatment of cancer according to type and classification of cancer that enable for an individualized therapy (16).

Although there are many side effects caused by cancer treatment, only diet-related side effects will be discussed here. Cancer patients are at risk of malnutrition, both because of disease-related metabolic changes in the body, but also due to the effects of cancer treatment (17). The metabolic effects of cancer and cancer treatment can result in unfavourable changes in body composition, such as loss of lean body tissue and gain in adipose tissue that can have an impact on tolerance of treatment and prognosis (15, 17).

Weight loss in cancer patients can be due to the phenomenon sarcopenia, age-associated decrease in lean body mass, and/or cancer cachexia, degradation of lean body mass and adipose tissue due to physiological changes due to the disease (18), or due to side-effects of cancer treatments. Cancer treatments can significantly affect nutritional requirements, give huge side effects that may alter regular eating habits, affect taste, result in nausea, increased or decreased 'hunger', alter body composition and adversely affect how the body digests, absorbs and utilizes nutrients (15).

Although weight loss for cancer patients is associated with reduced prognosis (17), patients might not be aware of this effect, and instead associate weight loss with a positive personal achievement (19).

On the other hand, many cancer patients experience weight gain as a side effect of cancer treatments, including chemotherapy, radiation therapy and endocrine therapy. This has been demonstrated in retrospective and prospective studies, both over 6 months and 5 years periods (10). Especially breast- and prostate cancer patients have reported frequently on additional weight gain after diagnosis of the diseases (11, 15).

Weight gain tends to be gain in adipose tissue and particularly abdominal adipose tissue. Furthermore, obesity and weight gain during cancer treatment, regardless of weight (or BMI) at the time of diagnosis, are associated with greater risk of treatment-related symptoms, cancer recurrence and comorbidities, and reduced quality of life compared with those who maintain stable body weight throughout the disease period (20, 21). A great amount of breast- and prostate cancer patients receive endocrine treatment five to ten years post diagnosis, which increases the chance of unfavourable weight gain in the years after diagnosis. This makes these patient groups more exposed to other lifestyle diseases such as diabetes and coronary heart disease, as well as recurrence and second malignancies. It is therefore vital that these patients continue, or adapt, to a healthy lifestyle and healthy dietary habits to prevent or minimize the change of other lifestyle diseases.

### **1.3 Diet and cancer**

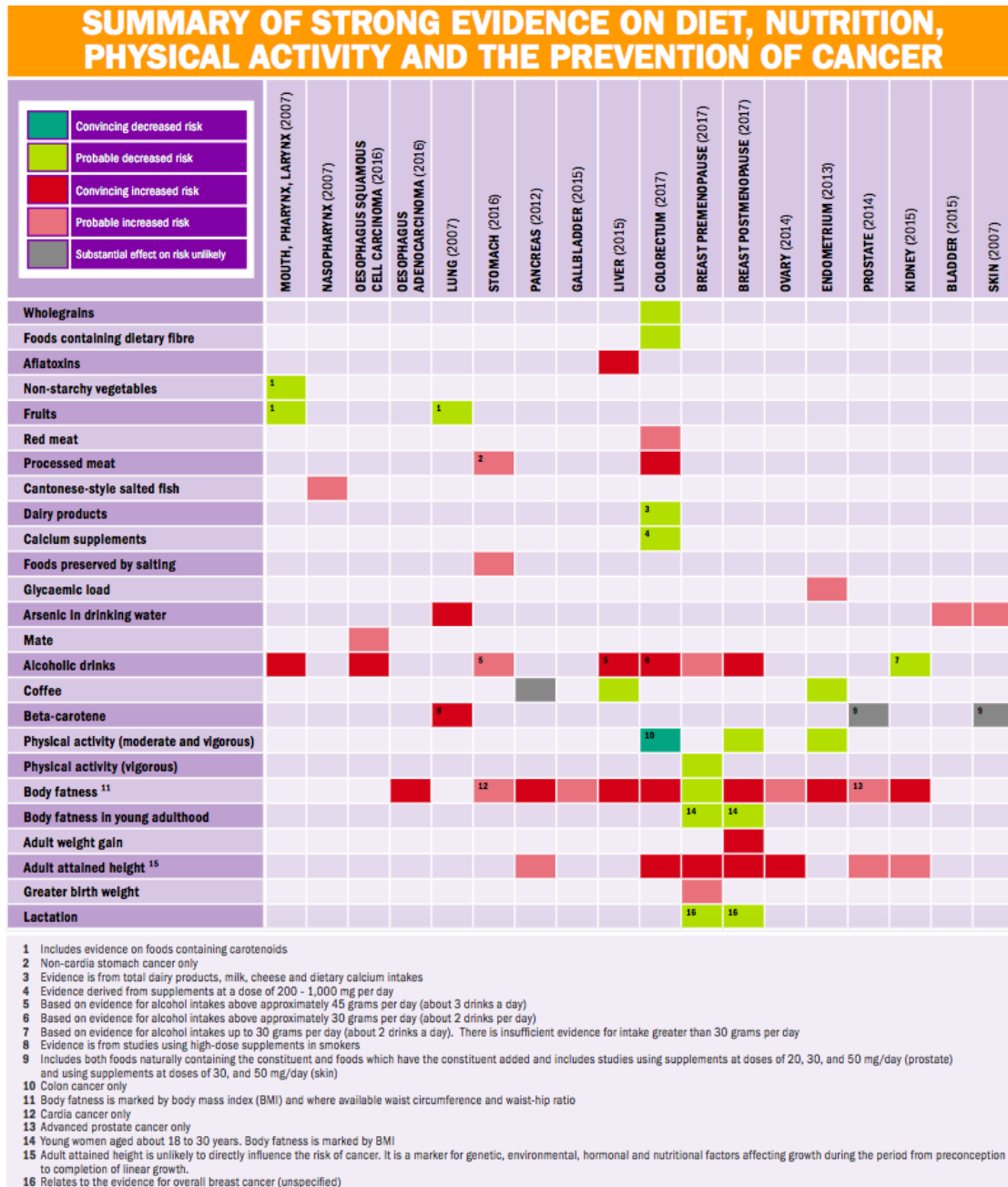
In regards to nutrition treatment or nutrition education programs on dietary behaviours beneficial for cancer, it is important to clarify whether the dietary advices are for 1) cancer prevention, 2) cancer patients receiving treatment, or 3) cancer survivors who have completed treatment, as the advices will differ for each group.

#### **1.3.1 Dietary factors and cancer prevention**

As this thesis deals with cancer patients and survivors, dietary factors that are important in cancer prevention will only briefly be mentioned. There are several lifestyle factors that can increase and decrease the risk of cancer development in human, including diet, smoking, alcoholic beverages, and physical activity (22, 23). Figure 3 from the World Cancer Research Fund International (WCRF) illustrates a summary of strong evidence on diet, nutrition, physical activity and the prevention of cancer (24). Among the dietary factors, obesity in particular has relevance for the development of breast and prostate cancer, which will be discussed in more detail.

There has been established strong evidence that overweight and obesity are factors associated with increased risk of cancer development at several sites of the body (25, 26). Sites include increased risk of postmenopausal breast cancer, prostate-, colon- and rectal cancer (10, 24). Obesity leads to a greater metabolic activity in the body, which may further promote growth and activity of tumour cells. Furthermore, the metabolic syndrome prevalence has increased with the rise of obesity, and this is

significantly associated with a higher risk of postmenopausal breast cancer especially for women with central obesity (26, 27). There has also been established strong evidence that consuming alcohol increases the risk of breast cancer.



**Figure 3: Summary of strong evidence on diet, nutrition, physical activity and the prevention of cancer from WCRF International (2017) (24).**

### 1.3.2 Dietary advice for cancer patients during treatment

Dietary counselling during cancer treatment is confirmed to be beneficial to the patient by improving dietary intake, quality of life and improve outcome (15). The

European Society for Clinical Nutrition and Metabolism (ESPEN) 2016 has published guidelines which aims to “improve early detection and treatment of malnutrition and metabolic derangements in cancer patients” (17). Thus, guidelines are focused on the prevention of malnutrition, and less on the prevention of weight gain that is an important issue in endocrine cancers like breast and prostate cancer. During active treatment, some of the main goals according to this guideline are to;

- prevent or treat malnutrition, or resolve nutrient deficiencies,
- maintain the body weight and preserve lean body mass,
- reduce nutrition related side-effects,
- improve general health condition, enhance the immune system and
- improve life quality (17).

Regarding energy requirements for cancer patients 25-30 kcal/kg BW/day, depending on patient performing status are recommended (17). Compared to the healthy population, the recommendations estimate 30 kcal/kg BW/day for adults with low activity levels (28). However, the energy requirement is highly individual and depends on activity level, age, overweight and so on.

In terms of nutrient-specific requirement, a protein supply of 1.2-2.0 gram/kg BW/day is recommended by ESPEN guidelines to enhance clinical outcome and preserve loss of lean body mass (17). The ESPEN guidelines from 2016 emphasise that energy and nutrient-specific requirement will vary among cancer patients, and it is therefore important to take each patient into consideration (17).

All cancer patients are recommended to keep a stable weight throughout treatment and disease period, and optimally remain at the same weight as before the disease, due to the metabolic effects of cancer and cancer treatment (17). As elaborated in section 1.2, body weight alterations are unfavourable to the disease, the disease prognosis, quality of life and the patient’s general health (10).

Oncologists and other cancer experts advice against taking supplementation during or after treatment, unless there is a need to treat a deficiency or promote another aspect of health (15, 17).



### **1.3.3 Dietary advice for cancer survivors**

Cancer survivors should aim to follow the same recommendations as given to help prevent cancer (29). The Norwegian Directorate of Health recommends the same dietary advice to promote public health and prevent disease (30) as the dietary recommendations from the WCRF and American Institute for Cancer Research (AICR) (4). The recommendations include (30);

- to consume at least 500 grams of fruit, vegetables and berries per day
- to consume at least 25 gram of fibre per day
- to consume less than 500 grams per week of red and processed meat
- to consume fatty fish 2 times per week
- to limit salt intake to less than 6 grams per day
- to let low fat dairy products to be a part of the daily diet
- to limit the intake of saturated fatty acids to <10% of the total energy intake.

WCRF & AIRC (2007) highlight the benefits of healthy dietary behaviours including improved health and well-being for cancer survivors (4), and lowering the risk of recurrence and comorbidities (7). However, the prevalence of unhealthy eating is estimated to be approximately 60-85 percent among cancer survivors (20), which increases the risk of overweight and obesity, lifestyle diseases, recurrence and second malignancies. Furthermore, it is reported by Kanera et al. (2016) that only 15-34 % of cancer survivors follow the recommended five servings of fruits and vegetables per day (7). Moreover, among prostate cancer survivors only approximately 28% adhere to these fruit and vegetable recommendations and are less likely than other cancer patients to initiate or maintain diet and lifestyle changes following diagnosis (31).

WCFR-AICR and American Cancer Society (ACS) recommend weight control in terms of weight loss in individuals who are overweight or obese. A healthy weight should be recommended for cancer survivors to further lower the risk of recurrence or other lifestyle diseases (4) (15). ACS provides guidelines for weight loss after cancer treatment, and the number of weight loss interventions among cancer survivors appears to be increasing (15).

#### **1.3.4 How do patients get information about diet and cancer**

There is a great amount of controversial information about nutrition and cancer. A lot of the information does not come from health professionals and can be misleading, inconsistent and not supported by scientific data (15). An increasing number of cancer patients and cancer survivors search the internet and seek advice for diet related information such as food choices, dietary supplements and complementary nutritional therapies to improve their response to treatment, improve recovery and reduce the risk of recurrence and improve their quality of life (7, 15). It is estimated that 50% of all cancer patients consume complementary or alternative medical products (17), although oncologists and other cancer experts advice against it unless there is a need to treat a deficiency or promote another aspect of health (15, 17). Nutrition plays a vital role in cancer patients, and correct information about nutrition and its relation to cancer is important. This information should come from a certified health professional in order to prevent controversial dietary choices, e.g., take antioxidant supplements, and to prevent possible hampering of the patients' survival or recurrence.

#### **1.4 Rehabilitation programs for cancer patients**

In conjunction with an increase in survival rates, especially among the most common cancer types including breast- and prostate cancers, there has simultaneously been an increase in cancer rehabilitation demand as cancer treatment can have a substantial impact on a person's physical and mental health.

Rehabilitation can be defined as *“A process of active change by which a person who has become disabled acquires the knowledge and skills needed for optimal physical, psychological and social function”* (32).

In 2012 the Norwegian Directorate of Health shared a rapport called “Rehabilitation programs for patients with cancer, assessments and recommendations” (16). This report states that there is little documentation on the effect of rehabilitation programs for cancer patients. Furthermore, there is little documentation in regards to number cancer patients in need of rehabilitation, but it is estimated that approximately 30-40% of patients have uncovered needs for interdisciplinary assistance for individual rehabilitation courses. Interdisciplinary teamwork among health professionals was highly emphasized to promote quality programs and develop competence.

Interdisciplinary collaboration in rehabilitation often involves physiotherapist, coaches, medical doctors and clinical dietitians to improve overall patient health. However, a clinical dietitian was never mentioned throughout the report.

The Norwegian Directorate of Health found that there is limited rehabilitation offers to the patients in the communities and municipalities. The secondary healthcare services are required to offer necessary rehabilitation in- and outside the institution, whereas most rehabilitation institutions for cancer patients were private rehabilitation institutions, with agreements with the four main health regions. It was further assessed what information was provided to the patients about rehabilitation programs from the Norwegian health care services, and there was a large agreement that there is little or no information provided.

Furthermore, as more than 60% of all cancer survivors live 5 years or more after their primary diagnosis, it is important to focus on up to date literature, further research and prevention of late sequelae caused by cancer or cancer treatment. However, when assessing the patient treatment course ('pasientforløpet') the Norwegian Directory of Health found that there is little follow up of late sequelae for the patients. Although cancer patients are a heterogeneous group of patients, most cancer patients are believed to benefit from rehabilitation from an early stage of diagnosis and throughout their life (32).

At HUS in Norway, a rehabilitation program is directed and offered to outpatients during treatment, and up to six months after the end of treatment. This rehabilitation program is aimed to be a low-threshold offer, which allows patients to attend different courses and activities, in combination with their treatment schedule.

### **1.5 Theories of behaviour change**

In order to evaluate the efficacy of the rehabilitation program at HUS and assess whether it results in dietary behavioural changes, it is necessary to introduce some theories of behaviour change. Cancer patients and cancer survivors are encouraged to focus on a healthy lifestyle and make healthy changes to their dietary intake that can positively impact their recovery or the chance of recurrence, and improve quality of life. However, changing health behaviour is a difficult task for most individuals, and is dependent on several different factors but is mainly up to the person's individual

choice. Changing individual's dietary choices is possible but not easily accomplished (33).

Whether a person chose to change behaviour, and which requirements and factors are needed to perform changes can be explained by different models. Behaviour change can be defined as *“in the public health field, behaviour change refers to the explicit intention to shift behaviours in a more ‘desirable’ direction, away from health damaging towards more health enhancing forms“* (34). In health behaviour, the most important theories are the social cognitive theory (SCT), the theory of planned behaviour (TPB), the health belief model (HBM), and the Transtheoretical Model, also called the stages of change (35). Research which aims to identify, assess or modify individual determinants of dietary behaviour are often build on several of these models (36).

### 1.5.1 The Social Cognitive Theory

The Social Cognitive Theory recognises the important relationship and constant interaction between environmental-, personal- and behavioural factors, which affects human behaviour, as shown in Figure 4 (37). It further builds on theories that learning new behaviour can be accomplished by observing others. This observational information can be used to engage in a new behaviour, as e.g. observing most of your co-workers always eating a healthy salad for lunch. According to Schiavon, et al. (2015) most nutrition education intervention methods for breast cancer are based on the Social Cognitive Theory (21).

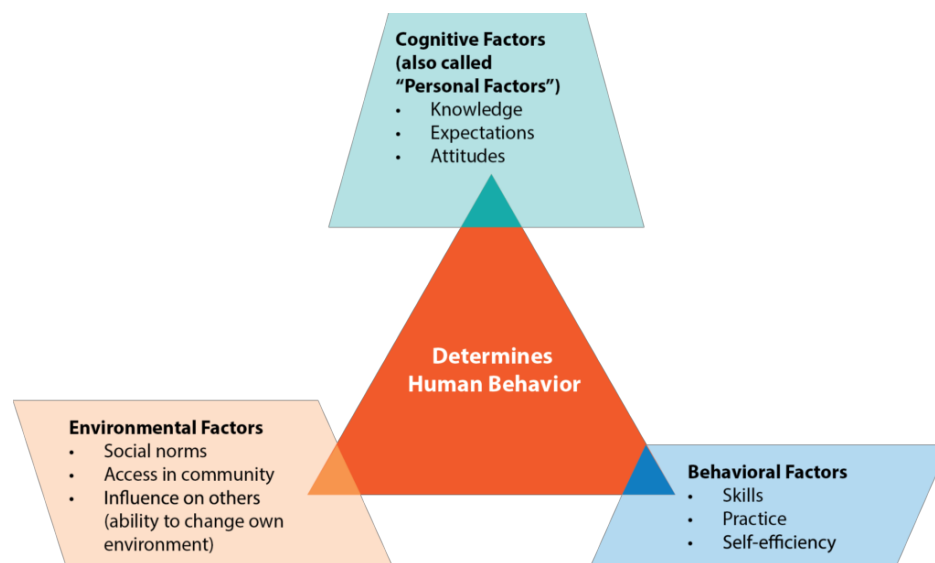


Figure 4: The Social Cognitive Theory (38)

### 1.5.2 The Theory of Planned Behaviour

Although the Social Cognitive Theory explains factors that might influence a behavioural change, it does not assess the process of going through the change. The same accounts for the theory of planned behaviour, which includes three factors important for shaping an individual's behavioural intention- and actual behaviour. This is divided into subjective norms, perceived behavioural control and attitude towards the behaviour. These are further illustrated in Figure 5 and explained as;

- 1) Normative beliefs and subjective norms consider an individual's perception of social normative pressures and the individual's perception about the behaviour, which is influenced by the judgment of others (e.g. parents).
- 2) Control beliefs and perceived behavioural control involve the individual's beliefs about factors that may help or hinder the behaviour change, and the perception of ease or difficulty of performing the behaviour.
- 3) Behavioural beliefs and attitude towards the behaviour are indicators of an individual's readiness to perform a given behaviour. These indicators are based on attitude, subjective norm, and perceived behavioural control, and to what degree does the individual find the behaviour of interest.

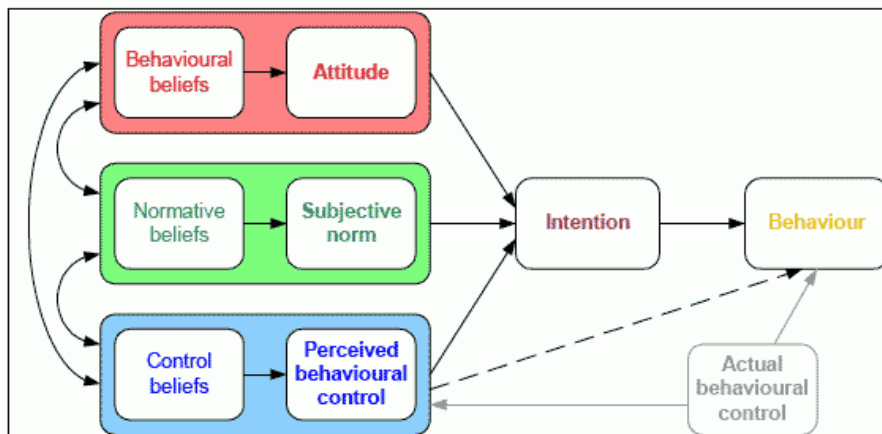


Figure 5: The Theory of Planned Behaviour (39)

### 1.5.3 The Health Belief Model

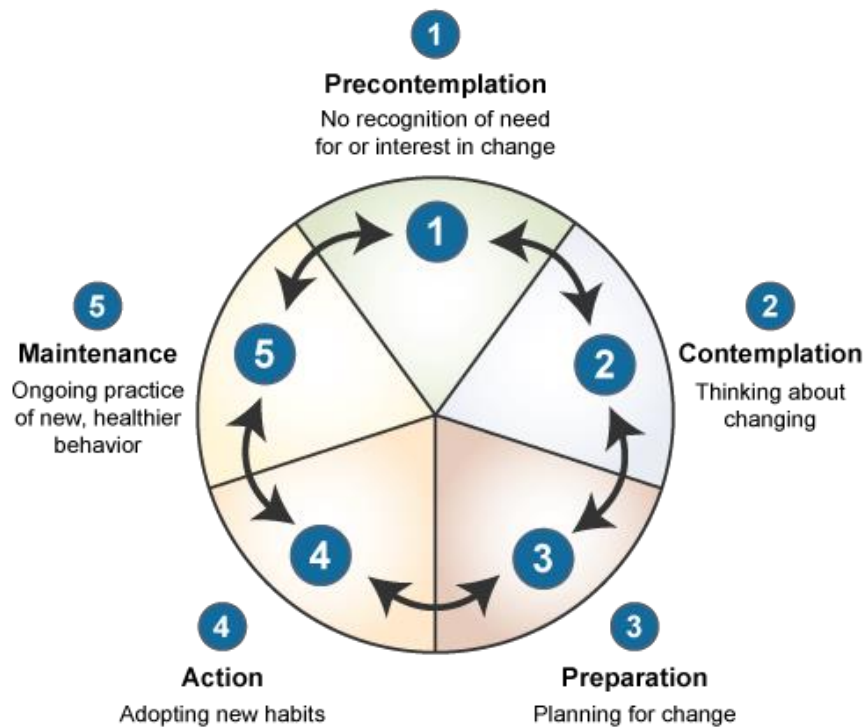
The Health Belief Model, on the other hand, describes how people assess their chance of getting a disease or condition and how they can prevent this themselves (40). In addition, it describes how exposed people feel of getting a disease or condition (40), e.g., “although I smoke I will not get lung cancer, as my father was a smoker and he never got the diagnosis”. However, the environment's role of influence is not taken

into consideration, and people are often uncritical and unrealistically optimistic in relation to their own situation. This can, unfortunately, result in people not making changes beneficial for their health. This model is often used to measure the health beliefs and behaviours about cancer screening, for example for breast- and prostate cancer (41).

#### **1.5.4 The Transtheoretical Model**

Compared to the three theories mentioned above, where identification and assessment of factors which may influence a person's belief to change, the transtheoretical model is used when there is a desire to change. The transtheoretical model is used to identify; a) persons readiness and motivation for behavioural change; b) the process of changing behaviour and c) when maintenance of change is obtained (42). A dietary behavioural change often requires maintenance to benefit an individual's health. However, long-term adherence to a dietary change is according to Schiavon, et al. (2015) a challenge for most individuals as eating habits are often established from a young age (21). The transtheoretical model, however, takes maintenance into account while the other three theories mentioned do not, and this is the reason why this theory will be the primary theory used in this thesis.

The Transtheoretical Model theory involves six stages of change; pre-contemplation, contemplation, preparation, action, maintenance, and termination (43). All stages are illustrated in Figure 6, except termination, which is the stage where the individual has no temptation to relapse to the previous behaviour. It is common that the individual's determinants, e.g. attitude or motivation, differ across the different phases of the behaviour change process, and therefore relapse can occur. Intervention techniques that help people initiate change may not have the same effect on behaviour maintenance (35). Although there are some programs that offer nutritional advice and support to cancer survivors, according to Short (2013) et al. few of the programs seem to be based on theories of behaviour change (37).



**Figure 6: The Transtheoretical Model (44)**

### *1.5.5 Factors that influences health behaviours*

The theories of behaviour change build on factors that can influence health behaviours including social, economic and individual determinants (36). Individual determinants include age, knowledge of e.g. the health risks and benefits of their behaviour, self-efficacy, attitude, motivation, outcome expectations, goals, health and gender (36).

According to the Transtheoretical model, changing behaviour requires a wish or a need for a change that is important for the person. To understand people’s dietary choices, this is important to know when planning a nutrition intervention or an intervention where the aim of a change is desired (33). Consequences drive behaviour, therefore to educate cancer patients on dietary factors and food choices that can have an impact on one’s health situation, will hopefully result in a desire for them in wanting to do positive dietary changes. Furthermore, educating individuals about healthy eating can be quite straightforward, but it is however more complex to get patients to change their dietary behaviour more permanently.

## **1.6 Dietary assessment methods**

In order to assess dietary behaviour or dietary intake, dietary assessment methods are used. Dietary assessment is an evaluation of an individual's food and beverage intake, used to assess the nutritional status of a person. There are several methods used for dietary assessment including 3-day food diary, 24-hour recall and food frequency questionnaire (FFQ) (45). The different methods have their strengths and limitations of use.

### **1.6.1 3-day food diary**

A 3-day food diary requires that individuals record all foods and beverages consumed over preferably three consecutive days (including two weekdays and one weekend day) (45). The individuals are further required to record time of consumption, portion size, cooking methods and supplement intake if any. Trained professionals often provide detailed instructions on how to record the intake as accurately as possible, and go through the completed record with individual's to clarify uncertainties. Software programs can be used to analyse the diet and to further assess the individual's nutrient intake. This dietary assessment method has been considered a precise and reliable method for assessing an individual's food and nutrient intake (45) (4). Although, according to literature, overweight and obese individuals tend to underreport their dietary intake, and underweight individuals tend to overreport their intake this method is considered the most reliable method for individual assessments (46). However, it required honesty, motivation and detailed information recorded by the individual, as inaccurate answers can give the wrong impression of the situation, hereby resulting in invalid data. Furthermore, it might be an unfitted method for patients who are very ill, as it requires some time to record everything that is eaten. As this is a prospective method, it can also change dietary behaviour during the recording process.

### **1.6.2 24-hour recall**

The dietary assessment method 24-hour recall requires the individuals to recall exact foods and drinks consumed within the last 24 hours or the preceding day. The recall is usually recorded by a second person who has been trained in interviewing techniques (45). Details including time consumed, portion size, cooking methods and supplement intake need to be clarified. This method can be useful and a give a valid measure



when assessing a group or population (45). However, a single 24-hour recall is not sufficient to describe an individual's food or nutrient intake and all days of the week should be preferably equally represented. Therefore, multiple recalls are required to be able to assess the person's intake. This method can be repeated throughout a longer period to estimate the food intake over months or a year.

### **1.6.3 FFQ**

In a FFQ subjects report how frequent they consume certain foods and drinks over a specific period, including portion size and cooking practices. The FFQ aims to assess the frequency of which certain foods and food items are consumed (45). The time period is often over a longer period of weeks, months or a year, but less precise. FFQ is a pre-made answering sheet with options of food and beverages, and can focus on particular foods or specified food groups. The FFQ should consist of closed questions with simple and predefined food categories. The World Cancer Report (WCR) (2014) state that most cancer epidemiological studies have predominantly used the FFQ as dietary assessment method (4). The method can be used to rank individuals. However, the method has limitations in regards to validity and reliability when aiming to assess an individual's absolute food or nutrient intake, as details required for a valid analysis is often not present (4).

## 2. The Cancer Center for Education and Rehabilitation (KOR)

At HUS in Bergen, Norway, the Cancer Department offers a rehabilitation program free of charge at the Cancer Center for Education and Rehabilitation (Kreftsentret for oppl ring og rehabilitering (KOR)) for curative and palliative cancer patients  $\geq 18$  years old (excluding patients with bone metastasis) (47). KOR is a low-threshold place for patients prior to-, during- and up to six months after the end of treatment.

A physical activity center called “Pusterommet” within KOR, patients are offered gender-specific physical activity lessons with qualified trainers during treatment and up to six months after the end of treatment. KOR also offers individual counselling and group discussions on several medical and lifestyle topics related to cancer disease and treatment, among these once a month a one-day nutrition course that the patients can sign up and join, also free of charge. Alongside with courses and activities, KOR is also a meeting place and social arena for patients affected by similar diseases. The program at KOR is directed to outpatients and is low-threshold.

### 2.1 The one-day nutrition course at KOR

The nutrition course consists of three parts, where the first two are theoretical, and the final part is practical. First, the patients get a theoretical lecture about nutrition and cancer, which is held by a clinical dietitian working at the hospital. Then the patients have a lecture about nutrition and physical activity, which is held by a health and fitness advisor. Finally, the patients are guided through a cooking session where they learn how to make healthy meals in a quick and simple way with a qualified chef. Between 5 and 12 participants can attend each course due to practical reasons.

The clinical dietitian responsible for the nutrition and cancer lecture at KOR aims to provide patient-specific information based on scientific evidence and to educate the patients about healthy eating behaviours 1) during their disease period, and 2) for cancer survivors.

Main topics are

- to maintain a stable weight (during disease period),
- to consume sufficient protein (during disease period),
- learn to have a critical approach to what they hear and read in terms of dietary advice during disease period,

- to consume  $\geq 500$  gram of fruit, vegetables and berries per day, equivalent to “5-a-day”,
- to choose light or low-fat products over whole fat products, and to understand how food items are labelled to present the amount of fat in different ways dependent on product type, as for example, 35 % fat versus 10% on dairy products.

The purpose of this lecture is to inform-, help patients to modify- and manage food choices and eating behaviour, so that they can improve their overall health by improving quality of life, possibly benefit their diagnosis and perhaps reduce the chance of recurrence, co-morbidities, and late sequelae. The course uses a variety of different teaching methods (verbal instruction, power point presentation, written materials and practical tasks). Although the course is group-based, it is individually adapted, with the possibility to ask questions and have a dialog throughout the course.

The course is offered for several years, but it has not been controlled whether the course is effective to increase nutritional knowledge of the participants and whether the course is leading to dietary changes. Therefore, the present quality control evaluation was made.

### **3. AIM AND HYPOTHESIS**

#### **3.1 Aim**

The one-day nutrition course is a part of the rehabilitation program and is offered free of charge to patients attending KOR. After the course, there is a standard evaluation whether the participants liked the course similar as for all courses at KOR. However, the content of the course and its ability to change patients' knowledge and behaviour have not been formally evaluated. As substantial resources are used for the rehabilitation program, a formal quality control is justified.

It was therefore the aim of the study to evaluate the efficacy of the one-day nutrition course on patients' dietary knowledge and dietary behaviour.

More specifically, we wanted to know whether attendance to this course would result in higher scoring to nutrition knowledge questions and to changes in dietary intake in a time course of about 3-4 weeks.

#### **3.2 Hypothesis**

The one-day nutrition course will result in increase in nutritional knowledge measured by a dietary questionnaire, but this will not result in significant changes of nutrient intake.

## **4. METHOD**

### **4.1 Study design and data collection**

The study is a quality control study with the aim to evaluate the efficacy of the one-day nutrition course at KOR. The nutrition course is offered once a month and free of charge to patients attending KOR. The usual number of participants is between 5 and 12. The patients attending the KOR and signing up for the nutrition course during the study period of October 2017 to February 2018 formed the eligible patients for this quality control. Within this period, all patients who signed up for the course were asked to take part in the quality control study, and asked to report their dietary habits before the course and 3-4 weeks after the course over a period of three days. In addition, they underwent a 'nutrition knowledge test' consisting of 8 questions (Appendix 2). The patients were further asked for their age and gender, weight and height, disease state (radiation/chemotherapy), and whether they wanted to change their diet (Appendix 1).

The dietary assessment and the questionnaire were pre-tested during the nutrition course in September on four randomly selected patients. Usually, the patients of the nutrition course also participate in physical activities at KOR and sign up orally approximately one or two weeks before the course. At this time point, the patients were asked to fill out the questionnaire and were instructed to fill out their food diary record forms for the 3-day food diaries. The dietary questionnaire (with the order of questions changed to reduce any learning effect) and the 3-day food diary were repeated 3-4 weeks after the nutrition course.

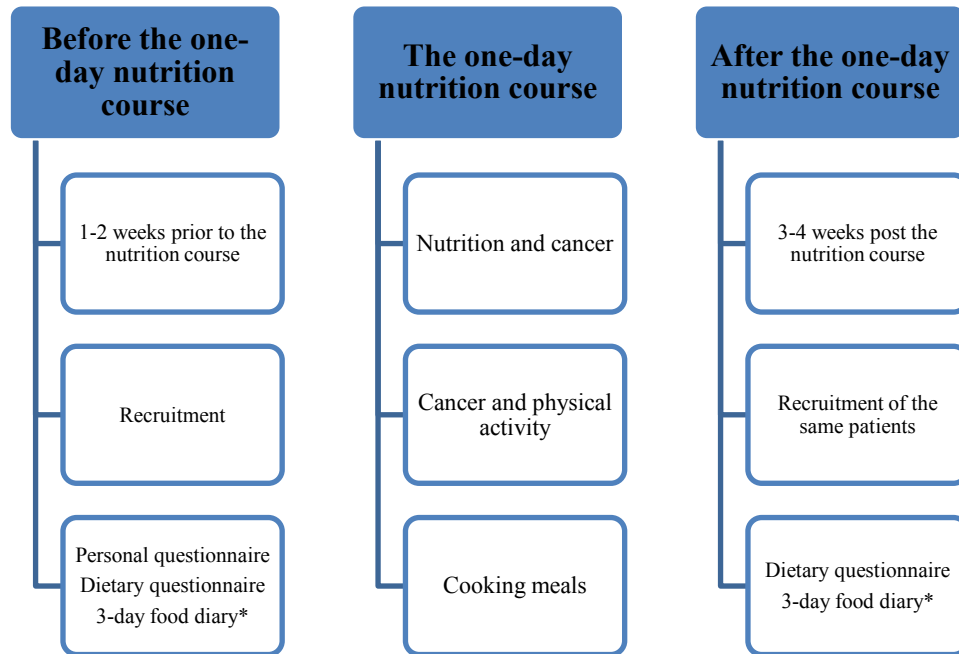
#### **4.1.1 Pre one-day nutrition course**

At the time of recruitment, the patients filled out both the personal questionnaire and the dietary questionnaire in the presence of the researcher. The researcher in charge overlooked this situation to make sure there was no chatting among the patients or resources being used which could affect the answering of the dietary questionnaire. The food diary was sent home with the patients to fill out and return for collection on the day of the one-day nutrition course.

#### **4.1.2 Post one-day nutrition course**

The same researcher in charge met the same patients for the second round of data collection (after the nutrition course). A new dietary questionnaire with identical

questions, but with changed order of questions was answered under observation of the researcher. Also, a new identical 3-day food diary was provided to the patients. When they had filled out the food diary they brought it back to “Pusterommet” and delivered it to the researcher some weeks after.



**Figure 7: Period for data collection. Data collection before and after the one-day nutrition course. Content of the course shown in the middle.**

Note: \*This did not apply for the patients attending the February course

#### 4.2 Patient contact, selection and information

Patients were contacted at KOR whether they would be interested to take part in the nutrition course and in the quality control study. Inclusion criteria were:

1. Patients at KOR who signed up for the one-day nutrition course and completed the course.
2. Willing to fill out the questionnaire and food diary in two separate periods.

Exclusion criteria were:

1. Patients who were not competent to give informed consent were not eligible for the study. However, this was in praxis not relevant.

The health research act defines quality control as follows: ‘*Quality control can be defined as projects, investigations, evaluations or similar that that the aim to control that diagnostics and treatment in fact the intended results*’. (48) <sup>1</sup>

Based on former experience, quality control studies are not subject to ethical approval (personal communication of main supervisor) and the REK (regional ethic committee) had earlier neglected to evaluate such applications. The study was conducted according to the principles of the declaration of Helsinki in its latest version (49). The integrity of the patients, their data and patients’ wellbeing had highest priority during the study. All patients were included on a voluntarily basis and had the option to withdraw from the study at any time, without any effect on their participation in the course. All data were anonymized before entered into the electronic data systems. The data handling is described in more detail in chapter 4.7.

#### **Sample size calculation:**

The sample of this survey was based on convenience sampling. Assuming 5 course days with each 5-12 participants would have resulted in 25-60 possible participants. As the course in January was cancelled due to administrative reasons, this number was reduced to 20-48 participants. No formal power calculation was performed prior to survey start as this is regarded as a pilot study and as there was uncertainty on the magnitude of change and the variation that could be expected in the primary outcome (score and dietary intake of protein, saturated fatty acids and dietary fibre).

#### **Information to the subjects**

The subjects were informed about the protocol of the study prior to answering the personal questionnaire, dietary questionnaire and completing the food diary registration. They were informed about the handling of their personal data orally and had the opportunity to ask questions, both face-to-face and on the phone. They were informed that there would be two separate rounds of data collection, both rounds including a dietary questionnaire and food diary registration in order to get a sufficient amount of data for solid dietary analysis and feedback.

<sup>1</sup> Helseforskningsloven definerer kvalitetssikring på følgende måte: “*Kvalitetssikring kan defineres som prosjekter, undersøkelser, evalueringer o.l. som har som formål å kontrollere at diagnostikk og behandling faktisk gir de intenderte resultater*” (48)

However, they were only partly informed of the purpose of the study in order to avoid bias by deliberately making dietary changes after attending the one-day nutrition course to satisfy the study. The patients were told the aim was to evaluate whether the one-day nutrition course was beneficial for the patients in terms of relevance of the content and information. They were offered individual feedback after the analysis after the end of round 2. Therefore, the patients were highly encouraged to eat as they normally would, and to be as honest and accurate as possible when completing the food diary in order to get an accurate feedback. It was emphasised that their honesty was very relevant for the analysis and feedback.

### **4.3 Personal questionnaire**

The aim of the personal questionnaire was to collect information with impact on their dietary knowledge and behaviour. This included living conditions, diagnosis and treatment type, use of supplements, self-reported weight and height and weight changes related to the disease and treatment. It was also asked how satisfied they are with their own diet and whether they were motivated for dietary change. The personal questionnaire is provided as appendix along with dietary questionnaire (both before and after nutrition course) and 3-day food diary with information (Appendix 1-5).

### **4.4 Dietary questionnaire**

The aim of the dietary questionnaire was to assess the patient's knowledge on core nutrition topics that are presented during the one-day nutrition course, and whether knowledge was changed after attending the course. The researcher in charge developed the questionnaire with guidance from the clinical dietitian who lectured at KOR. The topics included dietary guidelines for cancer patients, macro- and micronutrients requirements and their functions, the impact of weight change during cancer disease, and fruit and vegetable consumption. Seven out of eight questions had four answer-options with only one correct answer, which was both explained to the patients and also stated in the questionnaire. The last question the patients were asked to self-assess to what degree they found nutrition advice confusing. They should include all information they received from newspapers, media, friends and acquaintances and rate this from 1 to 6 where 1 was 'very confusing' and 6 was 'not confusing'. The patients filled out the questionnaire both before and after attending



the course. In order to minimize a learning effect, the order of the questions was at random (Appendix 3).

#### 4.5 3-day food diary

The participants were asked to complete a 3-day food diary, approximately 1-2 weeks prior to the nutrition course day, and repeatedly 3-4 weeks after attending the nutrition course. All the participants were provided with written and oral information on how to complete the food diary to ensure accuracy (Appendix 4).

Completion of the 3-day food diary was carefully explained, for example;

- preferably three consecutive days including two weekdays and one weekend day;
- note all foods and drinks consumed, including what (in as much details as possible such as, brand, normal or light product) and the amount consumed.

In order to limit inaccuracy, the participants were provided with the researchers personal mobile phone number in case of questions during the food registration. Each time data was collected the researcher went through all information registered by the participants to clarify any uncertainties or misunderstandings with the participant.

#### 4.6 Food diary analysis

The program 'Kostholdsplanleggeren' ([www.kostholdsplanleggeren.no](http://www.kostholdsplanleggeren.no)) was used to analyse the food diaries and calculate the intake of macro- and micronutrients and the energy percentage from macronutrients. 'Kostholdsplaneleggeren' is a dietary tool developed by the Norwegian Directorate of Health and the Norwegian Food Safety Authority. The registrations were placed under 'My week menus' and saved as the participant's ID number and whether it was round 1 (before nutrition course) or round 2 (after nutrition course) as the Figure 8 illustrates. When uncertainties of portion measurements occurred, 'Mål, vekt og porsjonsstørrelser for matvarer' by the Norwegian Directorate of Health was used (50). In cases where for example 'homemade stew' was registered, the participants were asked to register what the meal contained, and approximately how much of each ingredient was consumed. If they consumed any restaurant meals they were asked to note what the meal contained and approximately how much was consumed. In case specific food was not found in the program, the food and its nutritional values were manually registered in program.

After collection and analysis of two rounds with food diary registration, the participants were given detailed feedback.



**Figure 8: A screenshot from ‘Kostholdsplanleggeren’**

#### 4.7 Data handling and analysis

The participants were provided with a unique ID number consisting of four random digits. For contact purposes, these ID number was linked to a phone number or email address, but this information was always kept separate from the personal data and only kept on a physical sheet and not saved electronically.

All data collected from the participants contained the patients’ ID number only and tracing to the individual patient was no longer possible. All electronic documents were password coded. All the physical sheets with identifiable information have been kept at KOR throughout the study period and will be destroyed at the end of the study.

The statistic software used for data analysis was IBM SPSS Statistics, version 25.0 (51). All data was manually plotted into an SPSS file. All the values inserted from ‘Kostholdsplanleggeren’ and the results of the questionnaires into SPSS were double checked by a fellow health professional student who was familiar with the rules of confidentiality.

Most of the questions on the information sheet had answer options, which were coded into numbers. The participants were also required to fill out specific numbers such as age, height, weight and so on. All decimals noted were rounded to the nearest whole number. Open questions were noted as text. Tumour type was categorized into breast; prostate; and other cancer types.

The nutrition questionnaire contained eight questions. Seven of them had right-or-wrong answers and was further coded as ‘0’ is wrong or ‘1’ is correct. The total score,

built from the number of correct answers per round, was used as the main outcome variable. Thus, the maximum value was 7 (all questions correctly answered) and the lowest 0 (no question correctly answered). The total score of correct answers was plotted as one variable. One question was a rating question where the participants could give a score from 1 to 6. Norwegians are familiar with such procedure ('terningkast').

The variables used for food registration/analysis were; total amount of energy (in kcal), protein (in grams), carbohydrate (in grams), fat (in grams), saturated fatty acids (in grams), omega-3 polyunsaturated fatty acids (in grams), and fibre (in grams). Furthermore, energy-adjusted dietary intakes were used (percent energy from protein, carbohydrate, fat and saturated fatty acids, respectively), and amount of fibre and protein in gram per 1000 kcal. All decimals were rounded to the nearest whole number, excluding omega-3 fatty acids, which contained one decimal.

Descriptive statistics were reported as means and standard deviations. Analysis of change in nutrition knowledge was made by comparing the score from the questionnaire before and after the course. This was made with the non-parametric Wilcoxon rank sum test for dependent variables. Furthermore, dietary changes (intake of protein, saturated fatty acids and fibre) were compared before and after the nutrition course, also by use of the Wilcoxon rank sum test for dependent variables. Comparisons of proportions were made using the Chi-squared test ( $\chi^2$  test). The question on 'how satisfied are you with your diet?' with answers from 1 to 6 was analysed as 3 groups: 'low' satisfaction: self-score 1 or 2 (2 patients), 'medium' satisfaction: self-score of 3 or 4 (16 patients), and 'high' satisfaction, self-score of 5 or 6 (9 patients). Due to the low number of patients with low satisfaction, this category was left out in the analysis. Differences according to dietary satisfaction were analysed with the non-parametric Mann-Whitney U-test for independent variables. The proportion of correct answers to individual questions of the nutrition questionnaire is provided graphically.

For all tests, a significance level of  $p < 0.05$  was regarded as significant.

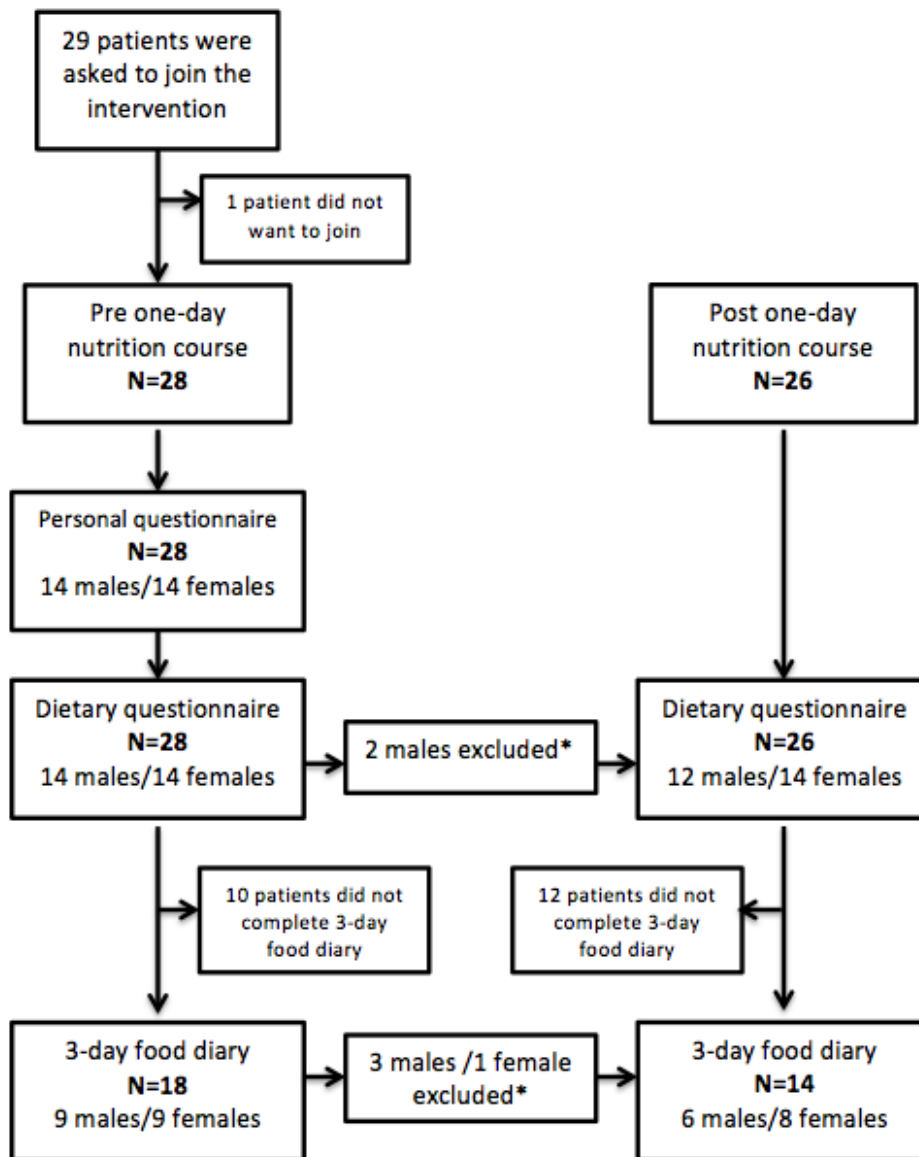
## 5. RESULTS

### 5.1 Characteristics of the patients included and excluded in the study

The flowchart illustrates patients included and excluded from the quality control study (Figure 9) based on different reasons for not being included. The one-day nutrition course was conducted 4 times during the study period, with a total of 29 patients signed up. All 29 patients were asked to join the intervention, and 28 of them volunteered and completed the personal questionnaire and dietary questionnaire before the one-day nutrition course. Out of the 28 patients, 18 completed the first round of 3-day food diary. There was an equal distribution between the genders throughout round 1.

For the data collected after attending the one-day nutrition course, 26 out of the 28 patients completed the dietary questionnaire. 14 out of 18 filled out food diaries after the course. In total, 4 patients did not complete the 3-day food diary, corresponding to a dropout rate of 22%. This resulted in an unequal distribution between the genders in round 2.

The 2 patients that did not complete the dietary questionnaire after attending the nutrition course, they were 2 out of the 4 patients who did not complete the 3-day food diary after the course.



**Figure 9: Flow-chart of patients included and excluded in the intervention.**

\*The same two men were lost to follow up from both dietary questionnaire and 3-day food diary and therefore excluded from the analysis.

## 5.2 Characteristics of the study population at time of recruitment

The characteristics of the 28 patients included in the quality control study are presented in Table 1 and are based on self-reported data from the personal questionnaire. The personal questionnaire was filled out once before attending the one-day nutrition course and is therefore based on their current situation in regards to treatment and living situation at that moment. The questions were voluntary to answer, resulting in some patients choosing to skip certain questions, therefore the total number does not always add up to 28 in Table 1.

There was a random equal distribution between the genders. The mean age was 72 years among men, and 55 years among women. 27 of 28 patients reported type of cancer with; 11 men had prostate cancer; 9 women had breast cancer, and the remaining 7 reported other types of cancers. These were not further specified due to patient confidentiality. 23 patients (82%) were receiving cancer treatment, chemotherapy or radiotherapy, while 5 patients had completed treatment when filling out the personal questionnaire. 12 patients (43%) currently lived at Haukeland hotel during round 1 of data collection, these were mainly male patients, whereas no patients lived there round 2. Haukeland hotel is a hotel close to HUS mostly used by patients and their relatives.

Overweight is classified as  $BMI \geq 25 \text{ kg/m}^2$  and the mean BMI was  $26 \text{ kg/m}^2$  ( $SD \pm 4$ ) of the total study population. Among male patients, the mean BMI was  $27 \text{ kg/m}^2$  ( $SD \pm 4$ ) and the mean BMI was  $25 \text{ kg/m}^2$  ( $SD \pm 5$ ) among the female patients. Self-reported weight change (which was not further specified) after being diagnosed with cancer was reported from 17 patients (61%), where 9 patients had experienced weight loss and the remaining 8 had experienced weight gain. 11 patients had not experienced any changes in weight after diagnosis.

17 patients (61%) had not experienced any changes in dietary consumption after being diagnosed with cancer, the remaining 11 patients (39%) reported a change in consumption, 8 of them being females. The minority of the participants, 4 patients (14%), reported that they had received dietary advice after diagnosis. 2 of these patients reported receiving dietary advice from a clinical dietitian, whereas the remaining two received the advice from either the internet or family and/or acquaintances.

None of the patients were current smokers, however 10 patients (36%) reported to be former smokers. All 28 patients (100%) attended physical activity at "Pusterommet".

The majority of the men (71%) reported that someone else than themselves primarily cooked and prepared their food, whereas most of the women did this themselves. 10 patients (36%) currently consumed dietary supplementation whereas 18 (64%) did not, although two reported they had stopped when they were diagnosed.

**Table 1. Characteristics of the study population at “Pusterommet” based on self-reported data from the personal questionnaire.**

	Total	Gender	
		Male	Female
<b>Total, n</b>	28	14	14
<b>Age, mean (SD)</b>		72 (5)	55 (10)
<b>Living status, n</b>			
Alone	4	2	2
With partner and/or with children <18	23	11	12
<b>Currently living at Haukeland hotel, n</b>			
Yes	12	9	3
No	16	5	11
<b>Main responsibility for cooking, n</b>			
Me	9	2	7
Someone else	13	10	3
Even	6	2	4
<b>Main responsibility for shopping food, n</b>			
Me	9	3	6
Someone else	12	7	5
Even	6	3	3
<b>Type of cancer, n</b>			
Breast cancer	9	n.a.	9
Prostate cancer	11	11	n.a.
Other	7	2	5
<b>Type of current treatment, n</b>			
Chemotherapy	9	1	8
Radiation therapy	14	11	3
Treatment completed	5	2	3
<b>Weight in kg, mean (SD)</b>		89 (12)	69 (14)
<b>Weight change post diagnosis, n</b>			
Weight gain	8	4	4
Weight loss	9	3	6
No change	11	7	4
<b>Height in cm, mean (SD)</b>		180 (5)	166 (4)
<b>BMI, mean (SD)*</b>	26 (4)	27 (5)	25 (5)
<b>Smoking, n</b>			
Yes	0	0	0
No	18	9	9
Former	10	5	5
<b>Received dietary advice post diagnosis, n</b>			
Yes	4	1	3
No	24	13	11
<b>Dietary consumption post diagnosis, n</b>			
Consume less	4	0	4
Consume more	7	3	4
Unchanged	17	11	6
<b>Currently consume dietary supplementation, n</b>			
Yes, and also before diagnosis	8	5	3
Yes, began after diagnosis	2	0	2
No, consumed pre diagnosis, but stopped now	2	1	1
No, neither before diagnosis or now	16	8	8
<b>Type of supplement, n</b>			
Tran	8	4	4
Tran and others/or other(s)	4	2	2

Abbreviation: SD = standard deviation, n.a. = Not applicable

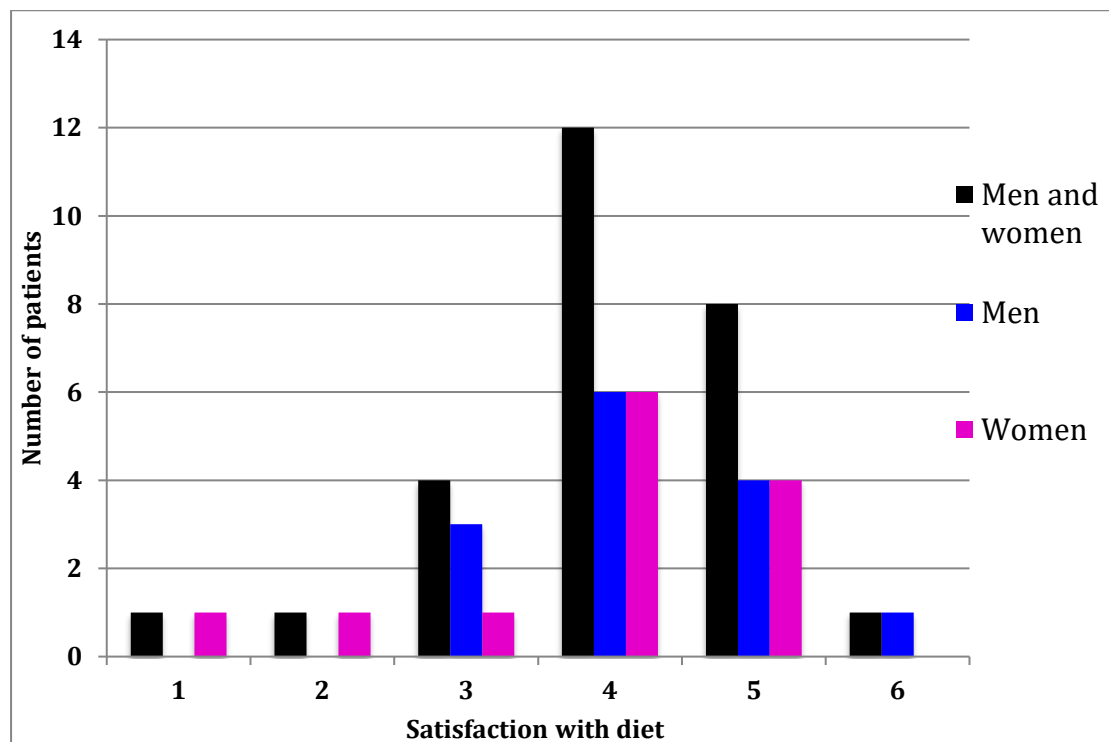
\* calculated from self-reported weight and height

### 5.2.1 Satisfaction with dietary behaviours

Of the 28 patients, 27 reported how satisfied they were with their current dietary behaviours, rating it from 1 to 6 (score 1 represents low satisfaction and score 6 represents high satisfaction) as illustrated below;



The results are shown in Figure 10. The black bar illustrates the results of all patients, and the two other bars represent each gender separately (women = pink, men = blue). The results show that most patients, self-scored their satisfaction as 3, 4 or 5 out of 6. The male patients reported to be more satisfied with their diet compared to the women, as two women gave them self a score of 1 and 2, whereas one man reported a score 6.



**Figure 10: Satisfaction with the current dietary behaviours. The genders are combined indicated by black bar, and the genders separated, indicated by blue and pink bar. Score 1 represents low satisfaction and score 6 represents high satisfaction. Total responders 27; 14 men and 13 women.**



Satisfaction with current dietary behaviours was further compared with BMI, age and the number of correct answers for the two rounds of the dietary questionnaire.

The results displayed in Table 2 show that those with higher satisfaction had lower BMI than those with medium satisfaction. The results further show that the more satisfied patients were older than the medium satisfied patients. Those who were more satisfied also had more correct answers in both rounds of the dietary questionnaires. Due to the low number of patients, the p-values have to be interpreted with caution. Only the difference in age achieved significance.

**Table 2: Satisfaction with diet compared with BMI, age, and number of correct answers round 1 and round 2**

	Satisfaction	n	Mean (SD)	P-value*
<b>BMI</b>	Medium	16	28.2 (4.1)	0.057
	High degree	9	24.7 (3.2)	
<b>Age</b>	Medium	16	62 (13)	0.001
	High degree	8	69 (7)	
<b>R1 score</b>	Medium	16	3.3	0.200
	High degree	9	4.0	
<b>R2 score</b>	Medium	15	4.7	0.067
	High degree	8	5.5	

\*P-value from conducting Mann Whitney U-test.

Medium= 3+4 dice, high degree = 5+6 dice.

R1 score is the number of correct answers from round 1 of dietary questionnaire.

R2 score is the number of correct answers from round 2 of dietary questionnaire.

### **5.2.2 Motivation to change dietary behaviours**

All the patients reported whether or not they wanted to change their current dietary behaviour. This variable was further used as a proxy to assess whether or not the patients were motivated to change their diet. The results shown in Table 3, illustrate that the majority of the study population (75%) reported they wanted to change their dietary behaviours. All the women and half of the men wanted to change.

Further analyses with respect to ‘wish to change diet’ have been dropped as this would mainly reflect the difference between men and women and as there was also huge differences in diagnoses and age among men and women, this analysis would not be valid.

The patients were further asked the reason why they wanted to change their dietary behaviour, and the most common reasons stated among the patients were;

- to eat healthier (n=9)
- to prevent recurrence (n=2)
- to prevent other lifestyle diseases (n=2)
- to lose or gain weight (n=4).

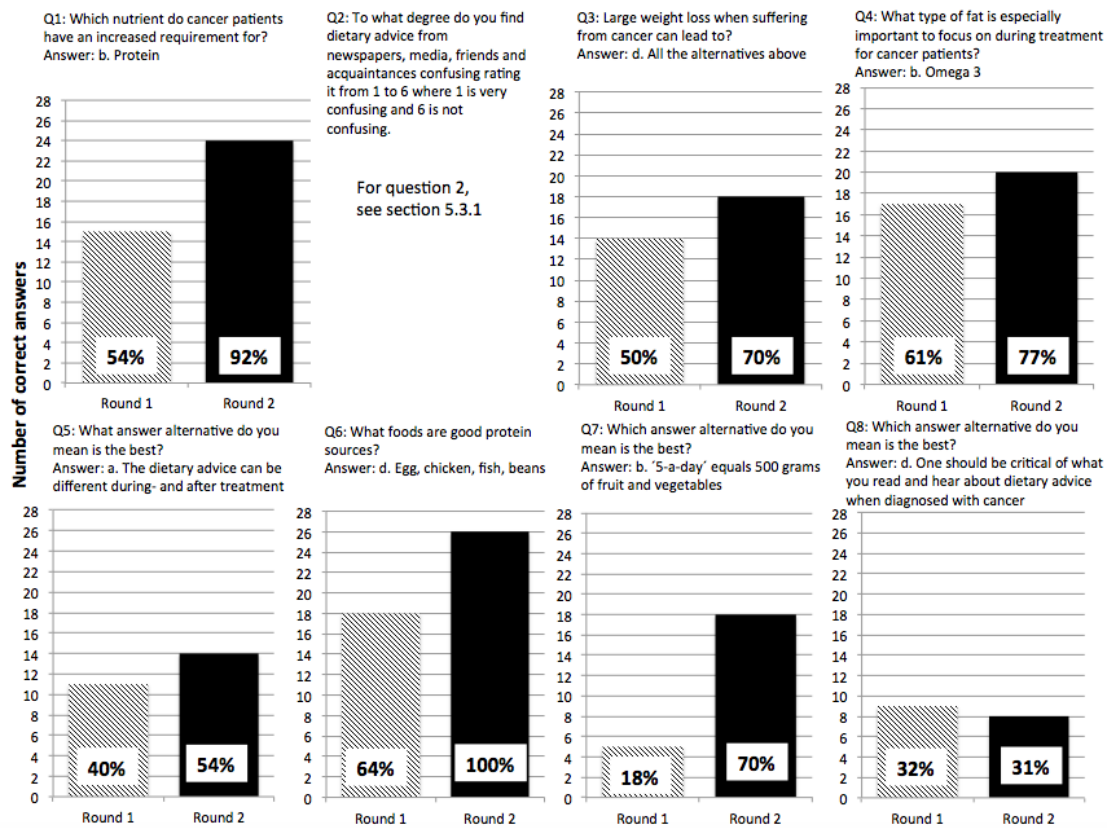
**Table 3: Wish to change dietary habits in the study population**

Wish to change dietary habits, n	Total	Men	Women
Yes	21	7	14
No	7	7	0

### 5.3 Dietary knowledge

28 patients completed the dietary questionnaire before the one-day nutrition course and 26 patients completed the questionnaire after attending the course. Figure 11 illustrates the 7 questions and correct answers for those questions that contained answer options. Results for questions 2, which did not contain answer options, are shown in 5.3.1. The results from Figure 11 illustrates how many of the 28 and 26 patients, round 1 and 2 respectively, that answered correctly on each of the questions.

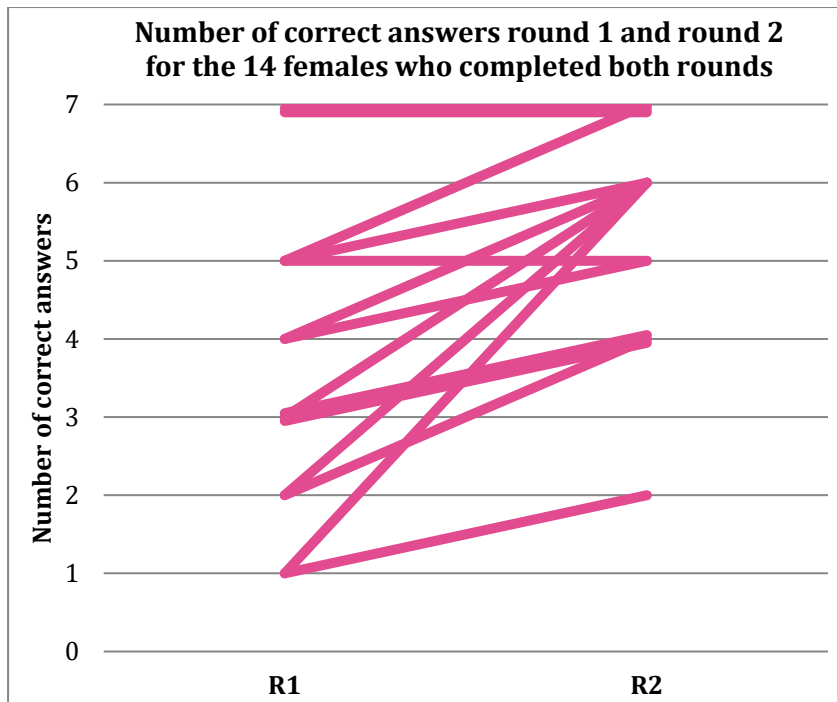
The number of correct answers increased in round two and 6 out of 7 questions resulted in more correct answers in round 2. This illustrates that the majority of the patients had more correct answers after attending the course. Question 1, 6 and 7, in particular, had a large increase in the number of correct answers after attendance. Question 3, 4 and 5 had a slight increase in the number of correct answers, however question 8 had a minor decline in the number of patients who answered correctly.



**Figure 11: Questions and number of correct answers round 1 and round 2 from the dietary questionnaires. The percentages represent the total correct answers from each round. Maximal number of correct answers was 28 round 1 and 26 round 2.**

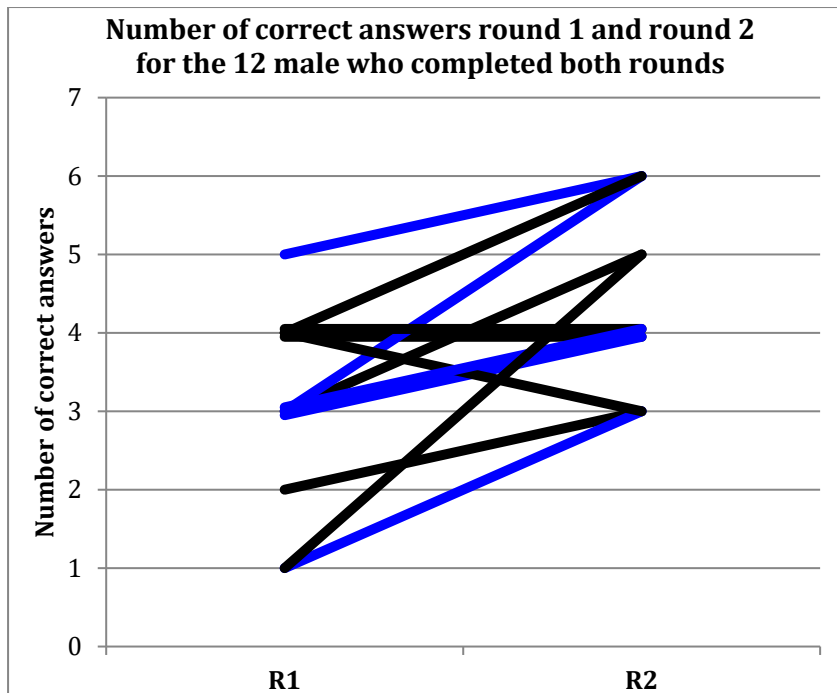
Figure 12 and Figure 13 show the direct link between the total score round 1 (R1) and round 2 (R2), for each individual female (n=14), and male (n=12). Out of the 26 patients who completed both questionnaires, 20 had a better score and 5 maintained their score after attending the course. The maximal score was 7 both rounds.

Figure 12 illustrates how all women either maintained (21%) or increased (79%) their knowledge after attending the course. 2 women scored the maximal score in both rounds, and further 1 woman maintained her score of 5 correct answers.



**Figure 12: Individual results of the nutrition score in women R1 means round 1, and R2 means round 2. Each of the female participants is represented by a line (n=14). Maximal score was 7.**

Figure 13 shows each individual's difference in score for the male patients (n=12). The blue lines represent those men who indicated in the questionnaire that they wanted to change their diet (n=5), and the black lines represent those who did not want to change their diet (n=7). The overall results for the male patients show that 9 out of 12 men (75%) increased their score, 2 showed no change in the score (17%), and one showed a reduction in the score by scoring one less correct answer round 2. Out of all the men who were motivated to change their dietary behaviour (n=5), 100% of them increased their score after attending the course. Out of those who reported not to be motivated to change their diet (n=7), 57% of them showed an increase in knowledge and the remaining 43% showed no change or a reduction in knowledge. However, neither of them was significant (Table 4), also when only tested in men (0,067,  $\chi^2$  test).



**Figure 13: Individual results of the nutrition score in men R1 means round 1, and R2 means round 2. Each of the male participants is represented by a line (n=12). Maximal score was 7.**

Blue = want to change dietary intake. Black = does not want to change dietary intake. Two male patients excluded from this Figure due to lost to follow up R2.

**Table 4: Difference in knowledge score for those patients who were motivated to change diet and those who were not motivated to change diet**

	Want to change diet (% of total population)	Mean (SD) score in knowledge	P-value *
Round 1	No (25%)	3.1 ± 1.2	0.800
	Yes (75%)	3.5 ± 1.7	
Round 2	No (25%)	4.3 ± 1.1	0.135
	Yes (75%)	5.2 ± 1.4	

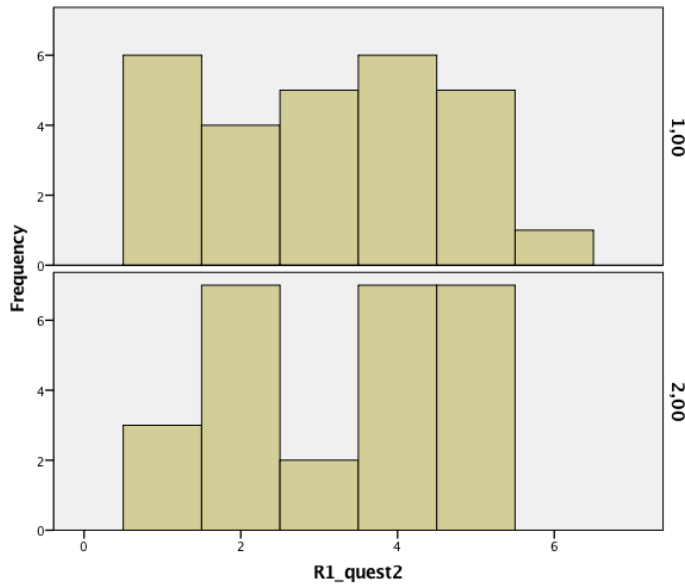
\*p-value conducted using Mann-Whitney U-test

### 5.3.1 Confusion regarding dietary advice

Question 2 in the dietary questionnaire had the purpose to assess how confusing the patients found nutrition advice from different sources (newspapers, media, friends, and acquaintances), rating it from 1 to 6 where 1 was 'very confusing' and 6 was 'not confusing' as shown below;

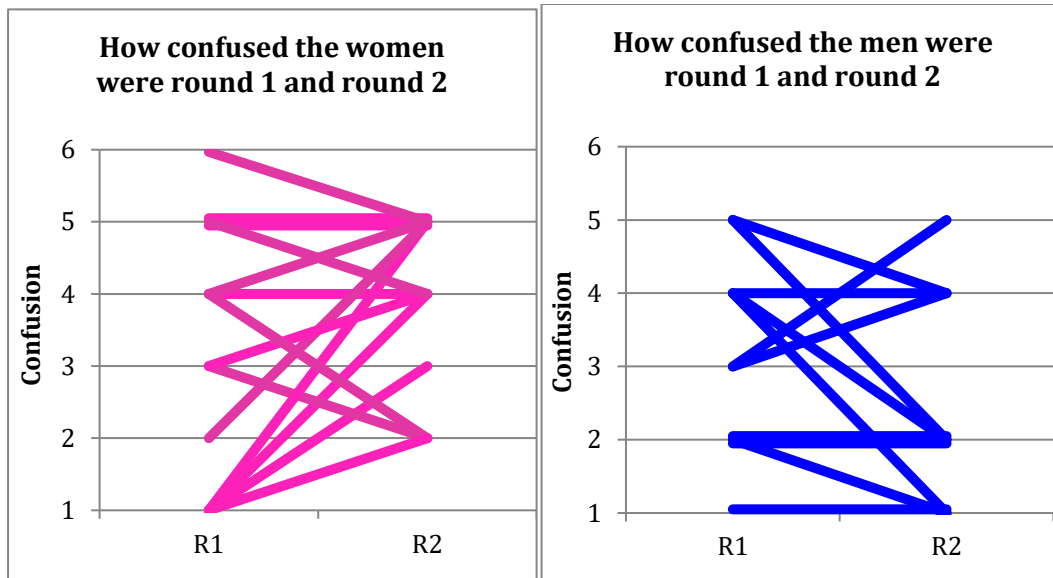


Figure 14 shows the distribution of the results before the nutrition course (the columns on top), and the distribution of the results after attending the course (the columns on the bottom). This figure illustrates a shift to the right after attending the course, meaning more answered they found dietary advice less confusing.



**Figure 14: How confused the patients found dietary advice from different sources before (1,00) and after (2,00) the nutrition course. Lowest score was 1, which represented very confused and highest score was 6, which represented not confused. R1 n=28, R2 n=26.**

Figure 15 shows how confused each individual felt before and after the course. The results from the women show that 7 were less confused, 3 felt no difference, and 4 were more confused after attending the course. The results for the men show that 2 men were less confused, 4 scored the same, and 5 men were more confused after attending the course. When comparing the results between the two genders, Figure 15 illustrates that most of the women scored their confusion to dietary advice closer to ‘not confusing’ (mostly 4 and 5) round 2, compared to the men as most of them scored their confusion closer to ‘very confusing’ (mostly 1 and 2).



**Figure 15: How confused each individual female (pink / left), and male (blue / right) felt in regards to receiving dietary advice before and after the nutrition course.**

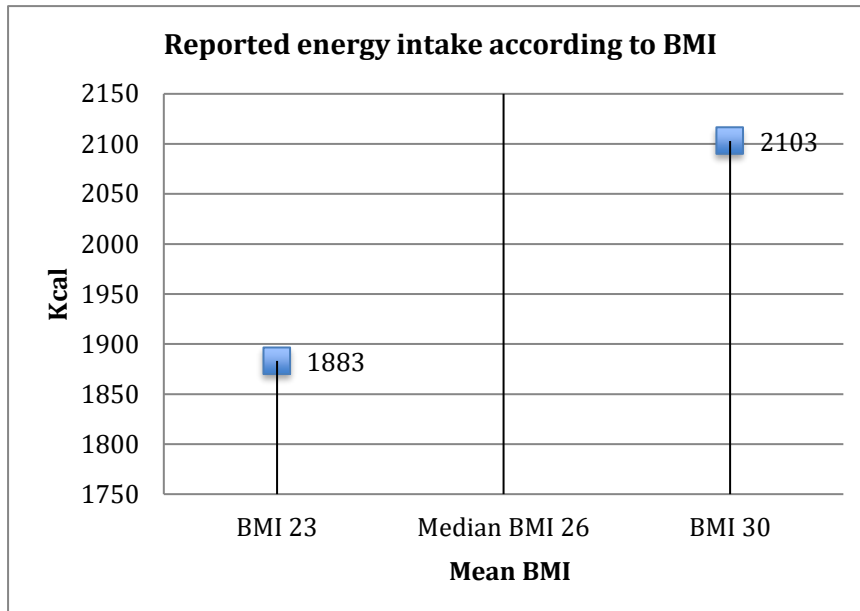
#### 5.4 Dietary intake

Dietary changes were measured through nutrient intake registered in the 3-day food diaries. The results from the patient's 3-day food diary are presented in Table 5. The results show mean data from all patients, and stratified by gender. As 18 patients filled out 3-day food diary before the one-day nutrition course, and only 14 of them filled out 3-day food diary after the course, the results from the food diaries before the course have been divided into two sections; the first section includes data from all food diaries (n=18), and the second section (n=14) have excluded the data from those 4 patients who did not complete round 2.

Further data comparison and analysis will mainly be based on the results from those who filled out food diaries both before (n=14) and after attending the nutrition course, however before that, one comparison which includes energy intake data and BMI values from 18 patients round 1 will be shown.

Figure 16 shows the results of the dietary intake in round 1 (n=18) and round 2 (n=14) according to BMI. The average energy intake of those with BMI<26 was 1883 kcal (SD±526) (both R1 (n=9) and R2 (n=7) combined), and for those with BMI>26 the result was 2103 kcal (SD ±322) (both R1 (n=9) and R2 (n=7) combined). The gender

distribution for each BMI group round 1 was 6 females and 3 males in the BMI group <26, and 3 females and 6 males in the BMI group >26. The gender distribution for round 2 was 6 females and 1 males in the BMI group <26, and 2 females and 5 males in the BMI group >26.



**Figure 16: Reported energy intake compared to BMI groups. Median BMI of 18 patients.**

BMI 23 = is the mean BMI those patients with a BMI<26.

BMI 30 = is mean BMI of those patients with a BMI>26.

Energy intake (kcal) is calculated by mean intake (both R1 and R2) of all 3-day food diaries for those with a BMI<26 and BMI>26.



**Table 5: Dietary intake presented as mean  $\pm$  SD of 3-day food diaries.**

	All patients			Men			Women		
	Before course	Before course *	After course	Before course	Before course*	After course	Before course	Before course*	After course
<b>Total, n</b>	18	14	14	9	6	6	9	8	8
<b>Kcal</b>	2165 $\pm$ 455	2176 $\pm$ 497	1822 $\pm$ 428	2358 $\pm$ 387	2492 $\pm$ 344	1915 $\pm$ 312	1972 $\pm$ 454	1939 $\pm$ 474	1752 $\pm$ 508
<b>Protein (g)</b>	103 $\pm$ 30	105 $\pm$ 34	91 $\pm$ 20	121 $\pm$ 28	132 $\pm$ 30	103 $\pm$ 14	86 $\pm$ 21	85 $\pm$ 22	82 $\pm$ 19
<b>CH (g)</b>	248 $\pm$ 59	249 $\pm$ 63	226 $\pm$ 48	267 $\pm$ 47	268 $\pm$ 55	237 $\pm$ 44	228 $\pm$ 66	234 $\pm$ 67	218 $\pm$ 51
<b>Fibre (g)</b>	25 $\pm$ 7	26 $\pm$ 7	26 $\pm$ 6	26 $\pm$ 6	27 $\pm$ 7	27 $\pm$ 34	24 $\pm$ 7	25 $\pm$ 7	25 $\pm$ 8
<b>Fat (g)</b>	85 $\pm$ 26	88 $\pm$ 27	68 $\pm$ 27	92 $\pm$ 28	102 $\pm$ 24	68 $\pm$ 24	78 $\pm$ 24	78 $\pm$ 26	67 $\pm$ 30
Saturated fatty acids (g)	32 $\pm$ 11	33 $\pm$ 11	23 $\pm$ 9	36 $\pm$ 11	39 $\pm$ 7	22 $\pm$ 9	28 $\pm$ 11	28 $\pm$ 12	24 $\pm$ 10
N-3 fatty acids (g)	3.0 $\pm$ 1.7	3.3 $\pm$ 1.7	3.7 $\pm$ 1.9	3.4 $\pm$ 1.5	3.8 $\pm$ 1.5	5.0 $\pm$ 1.6	2.7 $\pm$ 1.9	2.9 $\pm$ 1.9	2.8 $\pm$ 1.5
<b>Protein E%</b>	19 $\pm$ 3	19 $\pm$ 3	20 $\pm$ 3	21 $\pm$ 3	21 $\pm$ 2	22 $\pm$ 3	18 $\pm$ 3	18 $\pm$ 3	19 $\pm$ 3
<b>CH TE%</b>	45 $\pm$ 8	44 $\pm$ 8	47 $\pm$ 6	44 $\pm$ 8	42 $\pm$ 8	47 $\pm$ 7	46 $\pm$ 8	46 $\pm$ 8	48 $\pm$ 6
<b>Fat TE%</b>	36 $\pm$ 6	36 $\pm$ 6	33 $\pm$ 6	35 $\pm$ 7	37 $\pm$ 7	31 $\pm$ 7	36 $\pm$ 6	36 $\pm$ 6	33 $\pm$ 6
Saturated fatty acids TE%	13 $\pm$ 3	13 $\pm$ 3	11 $\pm$ 3	14 $\pm$ 3	14 $\pm$ 3	10 $\pm$ 3	13 $\pm$ 3	13 $\pm$ 3	12 $\pm$ 4

Abbreviation: SD = standard deviation, Kcal = kilocalories, g = gram, CH = carbohydrates, including fibre, TE% = total energy percentage, N-3 fatty acids.

\* Those participants who completed both round 1 and round 2 of food diaries.

## **Energy**

Furthermore, comparing only those 14 patients who filled out 3-day food diary both rounds, as Table 5 illustrates, mean energy intake was 2176 kcal (SD  $\pm$  497) before the one-day nutrition course and 1,822 kcal (SD  $\pm$  428) after attendance to the course. Reported energy intakes before and after the course were almost within the recommendations from ESPEN guidelines calculated;

Mean kg BW (79 kg) x 25-30 kcal/ day/kg BW = 1975-2370 kcal per day.

The energy intake was higher for the male patients in both rounds, with a mean intake of 2204 kcal (SD  $\pm$  328), compared to female patients, with a mean total energy intake of 1845 (SD  $\pm$  491) as seen in Table 5. The reduction in energy intake after attending the course was higher for the men, 577 kcal (SD  $\pm$ 32), than for the women, 187 (SD  $\pm$ 34). Furthermore, 8 of 14 patients, mainly men (88%), lived at Haukeland hotel in round 1. This had a significant impact on the energy intake as those who lived at the hotel in round 1 reported significantly lower energy intake in round 2, when none of the patients lived at Haukeland hotel round 2 (data not shown). No formal test was possible as dietary intake was only available for 2 men NOT living at the hotel round 1 (and 7 living at the hotel). For the females, it was the other way round, as 7 did not live at Haukeland hotel, and 2 lived at the hotel round 1.

## **Protein**

The reported protein intake in gram was very close to the recommendations from ESPEN guidelines for cancer patients (1.2 g protein/kg BW/day) both before and after the course as seen in Table 5;

Daily protein recommendation for the women: 69 kg x 1.2-2.0 g/kg BW = 83-138 g protein.

Daily protein recommendation for the men: 89 kg x 1.2-2.0 g/kg BW = 107-178 g protein.

The male patients had an average reduction in protein consumption of 29 $\pm$ 16 gram, after attendance, which is on average 4 gram under the recommended intake by ESPEN. However, the contribution of protein on the total energy intake increased by 1% for both genders after attending the course. The higher energy contribution from

protein is also seen by an increased energy-adjusted protein intake ( $47.9 \pm 7.7$  to  $50.4 \pm 7.7$  g protein / 1000 kcal), as seen in Table 7.

### **Fat**

Table 5 shows that there was a reduction in fat intake from R1 to R2. The reduction in energy intake was mainly due to a reduced fat intake. The men, in particular, reported a large reduction in fat intake, with a total of fat reduction of 34 g, after the course, where 17 g of this was from saturated fatty acids. The contribution of fat to total energy intake decreased with almost 4%, displayed in Table 6. The percentage of total energy intake derived from saturated fatty acids decreased from 13.4% in round 1 to 11.1% round 2, but this change was not statistically significant ( $p=0.54$ ). A further in-depth analysis by sex revealed that the decrease was significant in men only ( $p=0.027$ ).

Monounsaturated fatty acids and polyunsaturated fatty acids were excluded from the results due to limited nutritional values present on food labels that were manually registered in 'Kostholdsplanleggeren'.

### **Fibre**

The patients consumed sufficient fibre in both rounds comparing to the national guidelines for healthy adults (25 gram - 35 gram) seen in Table 6. There was no change in fibre intake in absolute numbers (Table 5). After adjusting for energy intake, the fibre intake increased with 2.2g per 1000 kcal ( $12.3 \pm 3.3$  to  $14.5 \pm 3.7$ ), was statistically significant ( $p < 0.05$ , Table 7).

**Table 6: Results from the 3-day food diary from the 14 patients that completed both rounds of food registrations compared with the National guidelines for healthy adults.**

	Mean $\pm$ SD	National guidelines	Sig. (2-tailed), R1 vs. R2
Kcal, R1	2176 $\pm$ 497		
Kcal, R2	1822 $\pm$ 428		
Protein E%, R1	19.3 $\pm$ 3.1	10-20%	0.264
Protein E%, R2	20.1 $\pm$ 3.2		
CH E%, R1	44.4 $\pm$ 8.0	45-60 %	0.235
CH E%, R2	47.4 $\pm$ 6.0		
Fat E%, R1	36.4 $\pm$ 6.2	25-40 %	0.129
Fat E%, R2	32.6 $\pm$ 6.2		
Saturated fatty acids E%, R1	13.4 $\pm$ 2.6	<10 %	0.054*
Saturated fatty acids E%, R2	11.1 $\pm$ 3.4		
Fiber gram, R1	25.7 $\pm$ 6.7	25-35 g	0.965
Fiber gram, R2	25.6 $\pm$ 6.0		

\* P-value conducted from paired sample t-test. Tested R1 vs R2.

R1= round 1, R2= round 2.

**Table 7: Energy adjusted intake of protein and fibre (mean and SD, g per 1000 kcal for the 14 patients that completed both rounds)**

	Round	N	Mean (SD)	Sig. (2-tailed)
Gram protein /1000 kcal	1	14	47.9 (7.7)	0.149 U test
	2	14	50.4 (7.7)	
Gram fibre /1000 kcal	1	14	12.3 (3.3)	0.038 U test
	2	14	14.5 (3.7)	

Note: U test = nonparametric test for related samples =Wilcoxon U test

## 6. DISCUSSION

The aim of this study was to evaluate the efficacy of the one-day nutrition course, which is part of the rehabilitation program for cancer patients at HUS, and to evaluate short-term changes in dietary knowledge and dietary intake in cancer patients. As diet is a major factor in both cancer prevention and highly relevant during cancer treatment, dietary behaviour can have a major impact on health outcomes related to cancer. The main result is that the one-day nutrition course was effective in increasing specific dietary knowledge. Furthermore, the course had moderate effects on dietary behaviour, resulting in moderate changes in intake of dietary fibre, protein and saturated fatty acids, measured by a 3-day self-reported food diary.

The results are based on registration of the patient's dietary knowledge and individual dietary assessment before and after attending the one-day nutrition course. The results are promising, however, they have to be discussed in light of the existing literature and possible limitations of this evaluation.

The discussion will be divided into three sections. The first section will discuss the main findings of this study. The second section will identify potential sources of bias and discuss the strengths and limitations of the study design and methods used in this study. The third section will discuss the clinical implications and the demand for similar nutrition courses during rehabilitation of cancer patients and directed to cancer survivors and give recommendations for future research.

### 6.1 Main findings

#### 6.1.1 Dietary knowledge

The results suggest that the course is effective to improve nutritional knowledge of cancer patients, as shown in the increased scores in round 2 in cancer patients who attended the one-day nutrition course. The questions that show the largest increase in the number of correct answers were on the following topics; 1) increased protein requirement, 2) foods that are good protein sources, and 3) "5-a-day" equals 500 grams of fruits and vegetables. The patients also seemed more confident in making dietary choices after attending the one-day nutrition course measured through question 2 about 'dietary advice confusion'.

As there is hardly any other comparable study on cancer patients and the assessment of the increase in nutritional knowledge through a dietary questionnaire, similar studies in students will be the basis for comparison. The results of the study conducted at KOR correspond to the first part of the hypothesis ‘The one-day nutrition course will result in increase in nutritional knowledge measured by a dietary questionnaire’, and is supported by findings from similar studies that have been performed to check the quality of nutrition education programs for second, third and high school students (52-54). These studies, in similarity with the present study, used multiple-choice questionnaires (identical pre and post the course) to assess nutritional knowledge before and after the nutrition course.

Several factors are believed to play a major role in the increase in knowledge about nutrition for cancer patients. It is plausible that one main factor is how KOR arrange the one-day nutrition course. There is only a small group of patients attending each course making space for more interactive learning and time for personal and specified questions about nutrition and cancer. Furthermore, due to the number of qualified health professionals surrounding this group of patients, information given is science-based and is regarded as reliable by the patients. In addition, patients can feel safe and talk to people in the same situation. This is supported by the findings of the studies among students, who were also in a safe learning environment resulting in an increase in knowledge (52-54). The teaching methods used throughout the nutrition course day at KOR, referring to 2.1, combine theoretical information and practical tasks, is believed to have been an important factor for the increase in knowledge, because the questions which had the largest increase in number of correct answers, 1) protein requirement, 2) protein sources, and 3) “5-a-day”, they were all taught through the combination of these teaching strategies. In addition, it has been shown in health education programs that a variety of different methods is most effective when it comes to patient education (55).

Another point is how the motivation for learning and wanting to change dietary behaviour is believed to have an impact on the results of the nutritional questionnaires. First, it is likely that attendance to the course illustrates the fact that the patients are motivated to learn. Secondly, the results show that 100% of the women and 50% of the men wanted to change dietary behaviour. These findings are

supported by other studies that have assessed motivation for dietary promotion programs and found that younger and female respondents expressed higher interest than older and male respondents (14). Even considering this, a proportion of 50% of men who want to change their diet can be regarded as a high proportion, thus creating a positive environment for change. Lastly, the results from the present quality control study illustrate that while almost all of those who wanted to change their diet increased their score in the nutrition test, this was only the case in 57% of those who did not want to change their diet. This indicates that motivation for changing dietary behaviour had a positive effect on the increase in the patients' dietary knowledge, and also that the teaching methods at KOR still managed to increase the knowledge of the patients who were not motivated.

The findings are very encouraging as it shows that the course has an effect. The patients gained relevant knowledge in regards to their health situation, as the questions used in the dietary questionnaire was based on scientific literature in terms of diet and cancer, referring to section 1.3. Although the test was only repeated once and only after a relatively short period of time, this result is encouraging.

#### **6.1.2 Dietary change**

The initial hypothesis was that although some increase in knowledge was expected, this would not translate into dietary change. It was indeed a challenge to test this part of the hypothesis. This is reflected by the lower number of participants, and the higher drop out rate compared to the nutrition questionnaire. This makes it more difficult to draw conclusions on the observed changes.

Indeed, dietary knowledge alone will not result in improved health, and therefore individual dietary intake was measured. The main results illustrate an increase in protein intake per 1000 kcal, and a statistical significant ( $p=0.05$ ) increase in dietary fibre per 1000 kcal, next to a reduction in saturated fatty acids of total energy intake. Although the analysis was focused on nutrients rather on food groups, it was estimated that the increase in fibre intake in round 2 was due to an increase in consumption fruits and vegetables. This correlates with what the patients learned during the one-day nutrition course. Furthermore, patients chose more reduced fat products in round two, which also reflects the course content. These findings are

supported by similar nutrition education courses in students, where the dietary behaviour results also reflected the study's course content; including an increase in fruit and vegetable consumption, increase in the number of students consuming breakfast, and an increase in servings of milk per day among the students (52-54). These results indicate that the course taught at KOR was well prepared and easy for the patients to adapt to. The results from the dietary assessments are encouraging in regards to changes in nutrient intake. Clearly, patients learned from the course and used the obtained knowledge to make dietary changes, although not all these changes were statistically significant. The dietary changes were in line with recommendations to healthy adults, to cancer prevention and to cancer patients. The reduction in the percentage of saturated fatty acids means the patients are closer to the national guidelines to promote public health and prevent disease (<10% saturated fatty acids of the total energy intake) (30). The increase in dietary fibre is according to WCRF protective for the development of certain cancers (24), and sufficient protein intake for cancer patients are according to the ESPEN guidelines, recommended to enhance clinical outcome and preserve loss of lean body mass (17). This means these results can be positive for their clinical outcome and help prevent or minimize the risk of future diseases. Thus, the second part of the hypothesis must be rejected, and it has been shown that even a one-day course can cause at least short-term nutritional changes.

Considering the results and the most common cancer types of the study population, breast- and prostate cancer, the positive changes in dietary intake can be considered specifically important for these patients. Especially since the majority of these patient groups receive endocrine treatment five to ten years post diagnosis, which increases the risk of unfavourable weight gain in the years after diagnosis (10, 11, 15). As gain in body fat, both during and after (main) treatment, is associated with reduced prognosis, and greater risk of cancer recurrence and comorbidities, it can be particularly vital that breast- and prostate cancer patients adapt to a healthier lifestyle and healthy dietary behaviours. This is important not only for their current situation but mostly for their future health. It is also important when considering prevention of or minimizing late sequelae for these patient groups, as the 5-year survival rates are high.



Factors that seem to be essential for the changes in dietary behaviour in the present study are both subjective and objective factors. Subjective factors include 1) motivation for change, 2) type of cancer and 3) the desire to improve their health.

### **Motivation for dietary change**

As previously mentioned, all the female patients and 50% of the male patients responded that they wanted to change dietary behaviours. Some patients stated reasons for wanting to change dietary behaviour including if changes would benefit their health, and reduce the risk of other lifestyle diseases. As elaborated in 1.5.5 motivation, in addition to knowledge, is an important individual determinant that can influence health behaviour.

It will be difficult to conclude from these numbers to the motivation of all cancer patients. Cancer patients attending the KOR had already shown motivation by signing up and attending a rehabilitation program. Indeed, an American study assessed motivation for diet-related programs among cancer patients and survivors. They found that a total of 54% of cancer patients and survivors (n=978) reported being “very” or “extremely” interested in this type of program (14). These results support the findings in the present study that most of the patients are motivated for information and diet-related programs. High motivation among cancer patient is further supported by another Norwegian study that assessed interest for lifestyle intervention during chemotherapy for cancer patients, where 96% reported interest (56). However, when the researchers recruited for an actual intervention, 161 eligible patients who received chemotherapy were offered a 12-months comprehensive, individualized lifestyle intervention, only 100 patients (62%) agreed to participate, and further 61 patients completed the intervention. These studies together with the present study indicate a high level of motivation for health and diet related information and programs among cancer patients. However, there is limited or no information provided by the Norwegian health care services to cancer patients in regards to rehabilitation programs in Norway, and further uncertainties in regards the availability or offer on nutritional guidance from clinical dietitians at the rehabilitation sites (16). This is unfortunate because there are rehabilitation programs and courses available for cancer patients, however, there are not enough clinical dietitians in the healthcare system,

and information might not reach the patients due to lack of communication between the healthcare services and the patients.

### **Type of cancer and the desire to improve their health**

The fact that the patients participating in this study are a relatively healthy cancer patient group (outpatient, good prognosis) is believed to be an important factor for the changes in dietary intake. Most of these patients are able to go to grocery stores and prepare their own food, compared to cancer patients more critically affected by their disease. Also, the patients have the desire to strengthen and improve their health, which is illustrated by the fact that they had already signed up and joined the rehabilitation program.

Research that aims to assess individual determinants for behavioural changes often builds on theories, including the SCT, TPB, HBM and the Transtheoretical model. According to theories from the Transtheoretical model, the patients in the present study are already in the process of making behavioural changes, as they attend physical activities lessons at “Pusterommet”. Assessing the stages in the Transtheoretical model, the patients are in the ‘action’ or ‘maintenance’ phase in terms of physical activity. Furthermore, the results show that 25% of the patients report they do not want to change dietary behaviour, however, they still attended the one-day nutrition course, and according to theories from the Transtheoretical model, information can be a very important factor in the ‘pre-contemplation’ and ‘contemplation’ phase. Although these patients were not motivated to make dietary changes, they chose to attend the one-day nutrition course, and the results show that 57% of them increased their knowledge through obtaining information, which can, according to the Transtheoretical model, increase the chance of behavioural changes.

Objective factors that can have resulted in dietary changes include the nutrition course having an individual approach although it was group based, helping the individuals to identify themselves in regards to the information provided. The teaching techniques included visual demonstrations as a learning aid, which made it easier for the patients to relate to the topic that was taught. The demonstrations showed how theory could be carried out in praxis, e.g. awareness in regards to percentage of fat stated on dairy products, and estimating the weight of one serving of fruit or vegetable that is part of

the “5-a-day” concept. These examples can be linked to the results that show an increase in dietary fibre intake, and a reduced intake of saturated fatty acids.

The results from this pilot study indicate that environmental and individual determinants have played substantial roles in the results of the increase in nutritional knowledge. Furthermore, the results show positive changes in dietary intake, which indicates that the course had a positive effect on dietary intake among this group of patients. The resource of a clinical dietitian is needed during rehabilitation for cancer patients.

## **6.2 Methodological considerations**

### **Study design**

This quality control study has only used quantitative data and carried out quantitative data analysis. Reliability and validity are two terms important to define before establishing the credibility and truthfulness of the findings.

Validity in quantitative research is defined as “*the extent to which a concept is accurately measured in a study*” (57). Reliability in quantitative research refers to “*exact replicability of the process and the results*” (58).

Several aspects have to be considered when looking at the internal and external validity of the present evaluation, including choice of patients, choice of methods and generalizability.

#### **6.2.1 Bias**

The study was subject to bias in patient selection as it represents a highly selected group of patients. Furthermore, 57% of the patients lived in Haukeland hotel round one but not round two of food diary registration.

Reasons for selection bias include;

- 1) KOT patients are among the healthiest of cancer patients, and few types of cancers were represented in the results (patients with high of 5-year survival rates), and
- 2) KOR recruits cancer patients who are already motivated to adapt to healthy lifestyle behaviours by taking part in different activities, thus attending KOR. The limited selection of patients means that the results only represent a subset of cancer patients and give a weak basis for generalization, and thus have an impact on the validity of the study.

The results from the 3-day food diary before and after attending the one-day nutrition course illustrate a mean reduction in energy intake of 345 kcal/day. The reliability of the data may be compromised by the fact that 57% of the patients lived in the patients' hotel during round one, which may have affected their food choice. 25% of them reported to consume more after diagnosis and stated this was due to very tempting, good and available food at the hotel. Indicating that the results might have been different if these patients would have stayed at home during round one as well as round two. This makes the results from this group of patients slightly less comparable and hereby biased the outcome, next to weakening the validity of the study.

Furthermore, studies that use dietary assessment methods are to some degree often affected by information bias, which can have impacted the validity of the results because participants might not report the whole truth (59). 3-day food diary method was considered alongside with dietary assessment methods including repeated 24-hour dietary recall, which was excluded as an alternative due to three main reasons;

- 1) it is a time-consuming method for the researcher in charge;
- 2) the patients did not always attend planned activities or meetings at KOR due to a reduced state because of disease or treatment, and
- 3) it requires individuals to be able to recall their intake, and cancer patients receiving treatment can experience cognitive impairment, as a side-effect from antitumor treatments.

Therefore, 3-day food diary was chosen as the most exact method with possibilities, still self-reporting bias may be have reduced the reliability of the dietary assessment method and further impacted the validity and reliability of the results. Furthermore, 86% of the patients who completed food diaries reported currently receiving treatments. This means their dietary intake may have been affected by factors including treatment and its side effects, food availability, and the dependency of others to prepare their meals. These are factors that are difficult to control, and as the patients were asked to complete food diaries independent of the type of treatment, treatment phase, and in different stages of their disease, these are factors that need to be taken into consideration when reviewing the results.

A weakness/possible information bias with the personal questionnaire is that it was all self-reported, including anthropometric measures, and body weight change during disease period, which means the patients can appear slimmer than what they are, or the individuals can have interpreted “weight change” differently.

### **6.2.2 Limitations**

There are some limitations to this study, including a limited number of participants, large dropout rate, no control group, and limitations regarding the dietary questionnaire.

The study is limited due to the limited size of the study population, which is a result of the study period and attendance to the one-day nutrition courses. Although no formal power calculation of sample size was performed prior to the study, the aim was 25-60 participants. However, the population size ended up at 28, which was 97% of the eligible patients. A large dropout of participants (22%) who did not complete the second round of food diary further limits the study.

However, this quality control study was not able to assess whether there was a correlation between motivation for change and actual change. This was mostly due to small samples size and 75% of the total population responded to be motivated.

The study is also limited by the lack of control group. Due to limited time, no control group was recruited. This makes it impossible to establish any causal effect of the observed changes in dietary knowledge and dietary intake. The optimal control group could be cancer patients attending KOR, but not attending the one-day nutrition day course. Alternatively, control groups could be outpatients including cancer patients at HUS, which do not attend KOR, or patients affected by lifestyle diseases such as coronary heart disease, where dietary changes are often an advantage to their health.

There are some factors that can have reduced the reliability of the method used to assess dietary knowledge. This includes patients coordinating responses, or “cheat” with the answers to appear smarter. Although the order of the questions was at random in order to minimize the learning effect, it can still be considered a limitation.

The dietary analysis program ‘Kostholdsplanleggeren’ was the best choice with possibilities, but it has a limited selection of foods. Therefore, a program with more foods available would be preferable, but is not available for Norway.

### **6.2.2 Strengths**

Despite the limitations, this study has some strengths. The questions were pre-tested, which allowed for some adjustments. The patients were provided with clearly understandable questionnaires that reduce the risk of subjective interpretations. The patients had the opportunity to ask the researcher in charge, which was always present during completion of the questionnaires, in case of doubt about the meaning of the questions, which increased the reliability of the answers next to avoiding any cheating by the use of Google or talking with each other.

There are also examples of factors that confirm the validity of the results from the 3-day food diaries. With the aim to achieve honesty and detailed information from the patients, and avoid over- or underreporting, or self-reporting bias, the patients were only partly informed of the purpose of the study as described in 4.5. The fact that it was made clear to the patients that there were no expectations to their dietary intake, however that honesty was very relevant for the analysis and in order for them to receive accurate feedback, is believed to have strengthened the validity of the dietary intake results. Furthermore, the researcher tried to clarify uncertainties with the collection of each individual food diary to avoid inaccuracy.

### **6.3 Clinical implications and the demand for similar nutrition courses**

The findings of this quality control study indicate that the one-day nutrition course results in health beneficial changes in dietary intake among cancer patients. The need for such programs are also supported by a report presented by the Norwegian Government in April 2018 “National Cancer Strategy” (60). The report states that there is a need to increase awareness and competence regarding actions that can promote a healthy lifestyle and healthy lifestyle behaviours. Actions should focus on cancer prevention and already established cancer cases, as lifestyle choices can affect treatment, quality of life and the risk of recurrence of cancer (60).

The high prevalence of cancer patients and the increase in the number of cancer survivors should be paid attention to. Both the disease itself and cancer treatment

methods can lead to current and future health issues. It is therefore important that evidence-based dietary advice reaches out to the cancer patients and cancer survivors, so individuals can make changes to dietary intake, which can further promote their current and future health. Although the Norwegian Directorate of Health states that there is little documentation on the effect of rehabilitation programs for cancer patients, the nutrition course at KOR, HUS, has now been formally evaluated, and results show that the patients increased their dietary knowledge and made changes in dietary intake after attending the course. This further validates the important knowledge and work of a clinical dietitian as part of interdisciplinary teamwork.

Although the pilot study was successful, only a subset of cancer patients at HUS attended the one-day nutrition course, despite this being a low threshold rehabilitation offer. One reason might be that information about the rehabilitation program does not reach out to all the cancer patients. If nutrition education programs were to be integrated as part of cancer treatment, at least for those patients healthy enough to attend, more patients could benefit. Most of the cancer resources are currently being spent on medical research and medical care. It is recommended that more resources should be spent on similar nutrition education programs, as it seems to have a positive effect on dietary behaviour, which can be vital for these patients' current and future health to prevent late sequelae and comorbidities.

#### **6.4 Further research**

There are a very limited number of similar studies on cancer patients, if any. This indicates the need for more and larger studies to evaluate the efficacy of nutrition courses on cancer patients as part of a rehabilitation program. Recommendations for improvement in future research would be longer periods of data collection, larger sample sizes, greater varieties of cancer types and having the participants live under the same household conditions during two or more rounds of food diary registration. It would also be recommended to use a control group, to establish any causal effect. Furthermore, it would also be beneficial to assess long-term adherence to dietary changes and assess factors that can help maintain positive changes in dietary intake, as for example follow up courses, as the present study only assessed short-term changes in dietary intake. This recommendation is supported by Schiavon, et al.

(2015) who states that long-term adherence to a dietary pattern is a challenge in studies on diet and disease, and therefore teaching methods are being assessed and evaluated (21).

#### **6.5 Conclusion of the quality control study**

Through this study, the one-day nutrition course at KOR has now been evaluated by a formal quality control study. The results of the pilot study are very positive and;

- show an increase in dietary knowledge and beneficial changes in short-term dietary intake among cancer patients who attend the one-day nutrition course as part of the rehabilitation program at KOR, HUS
- show the value of the nutritional knowledge and work of clinical dietitians, as the change in dietary knowledge and positive changes in dietary intake reflect the course content
- confirm that the resources spent on the one-day nutrition course are beneficial for cancer patients.

The results showing positive changes in dietary intake are encouraging because they can possibly have a major impact on cancer patients' present health status and quality of life, and also prevent or minimize the risk of development of cancer recurrence, second malignancies, comorbidities, and late sequelae. In addition to benefit the health and quality of life for cancer patients and cancer survivors, these positive dietary changes can potentially result in major socioeconomic savings in the long term.



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## **8. Appendix**

1. Personal questionnaire
2. Dietary questionnaire round 1
3. Dietary questionnaire round 2
4. Information on how to fill in the 3-day food diary
5. 3-day food diary registration form

## 8.1 Appendix 1: Personal questionnaire

### Kartlegging av kosthold

Forklaring: Fyll ut det som stemmer med:  Noter der det er merket \_\_\_\_\_

ID: \_\_\_\_\_

Dato: \_\_\_\_\_

Alder: \_\_\_\_\_

Kjønn: Mann  Kvinne

Boforhold: Alene  Med partner  Med barn (under 18 år)

Bor du for tiden på Haukeland hotell? Ja  Nei

Hvem lager hovedsakelig mat hjemme?: Jeg  En annen person

Hvem handler hovedsakelig mat?: Jeg  En annen person

Hvilke type kreft har du?: \_\_\_\_\_

Hvilke behandlingsfase er du i?: Cellegift  Stråling  Avsluttet behandling

Nåværende vekt: \_\_\_\_\_ kg

Har vekten din endret seg siden du fikk diagnosen?:

Ja, har opplevd vektøkning  Ja, har opplevd vektreduksjon  Nei

Nåværende høyde: \_\_\_\_\_ cm

Røyker du?: Ja  Nei  Tidligere  men sluttet i \_\_\_\_\_ (årstall)

Deltar du på fysisk aktivitet på Pusterommet?: Ja  Nei

Har du fått kostråd etter diagnosen?: Ja  Nei

I så fall av hvem: Klinisk ernæringsfysiolog  Annet helsepersonell

Internett  Bekjente/Familie  Andre

Hvis du sammenligner spisevaner med tiden før diagnosen, spiser du:

Mindre enn før  Mer enn før  Uendret

Hvis endring, hvorfor? \_\_\_\_\_

Tar du kosttilskudd?: Ja, jeg tok også før diagnosen

I så fall hva: \_\_\_\_\_

Ja, jeg begynte å ta etter at jeg fikk diagnosen

I så fall hva: \_\_\_\_\_

Hva er grunnen til at du begynte å ta kosttilskudd etter at du fikk diagnosen?

\_\_\_\_\_

Nei, jeg tok kosttilskudd før diagnosen, men har stoppet nå

I så fall hva pleide du å ta?: \_\_\_\_\_

Hvorfor stoppet du?: \_\_\_\_\_

Nei, tok ikke før diagnosen, og tar ikke nå

Er du fornøyd med spisevanene dine nå? Gi spisevanene dine et terningkast (ring rundt terning):

Ikke fornøyd       Veldig fornøyd

Ønsker du å endre spisevanene dine?: Ja  Nei

Hvorfor/hvorfor ikke: \_\_\_\_\_

## 8.2 Appendix 2: Dietary questionnaire round 1

ID: \_\_\_\_\_ Forklaring: Ring rundt det ENE svaralternativet du mener er best.

1. Hvilket næringsstoff har kreftpasienter et høyere behov for?:

- Karbohydrater
- Proteiner
- Fett
- Vitamin C

2. I hvilken grad syntes du det er forvirrende med kostråd fra aviser, media, venner og bekjente?

Ring rundt en terning.



Svært forvirrende

Ikke forvirrende

3. Stort vekttap ved kreftsykdom kan føre til:

- Dårligere toleranse for kreftbehandlingen
- Større risiko for komplikasjoner
- Dårligere immunforsvar
- Alle alternativene over

4. Hvilken type fett er det spesielt viktig for kreftpasienter å fokusere på under behandling?:

- Mettet fett
- Omega 3 fett
- Omega 6 fett
- Det viktigste er at kreftpasienter får i seg fett

5. Hvilket svaralternativ mener du er best?:

- Kostholdsrådene (hva du bør spise) kan være forskjellige under og etter behandling
- Kostholdsrådene (hva du bør spise) er de samme under og etter behandling
- Det er svært gunstig for antitumorbehandlingen å unngå alle typer sukker i behandlingsperioden
- Det er viktig med ekstra tilskudd av antioksidanter under behandlingsperioden

6. Hvilke matvarer er gode proteinkilder?:

- Kål, spinat, brokkoli, rosenkål
- Olivener, avokado, blåbær, majones
- Grovbrød, poteter, ris, fullkornspasta
- Egg, kylling, fisk, bønner

7. Hvilket svaralternativ mener du er best?:

- Det er viktig å spise ferske grønnsaker ettersom frosne grønnsaker er mye mindre næringsrike
- '5 om dagen' tilsvarer 500 gram frukt og grønt per dag.
- Bær, spesielt blåbær er det viktigste å få i seg av frukt og grønt ved kreftsykdom.
- Økt inntak av frukt og grønt, og 'juicing' (lage juice av frukt og grønt) har vist seg å være svært god støttebehandling ved kreftsykdom

8. Hvilket svaralternativ mener du er best?:

- Kostholdsrådene (hva du bør spise) oppdateres stadig, og det er derfor viktig å holde seg oppdatert på hva media anbefaler
- Det er viktig å gjøre kostholdsendringer ved kreftsykdom, og derfor lurt å ta til seg de rådene man kan få
- Det er kun fastlegen sin man skal forhøre seg med når det gjelder kostråd ved kreftsykdom
- Man skal være kritisk til det man leser og hører om kosthold ved kreftsykdom

### 8.3 Appendix 3: Dietary questionnaire round 2

ID: \_\_\_\_\_ Forklaring: Ring rundt det ENE svaralternativet du mener er best.

1. Hvilken type fett er det spesielt viktig for kreftpasienter å fokusere på under behandling?:

- e. Mettet fett
- f. Omega 3 fett
- g. Omega 6 fett
- h. Det viktigste er at kreftpasienter får i seg fett

2. I hvilken grad syntes du det er forvirrende med kostråd fra aviser, media, venner og bekjente?

Ring rundt en terning.



Svært forvirrende

Ikke forvirrende

3. Hvilke matvarer er gode proteinkilder?:

- e. Kål, spinat, brokkoli, rosenkål
- f. Olivenolje, avokado, blåbær, majones
- g. Grovbrød, poteter, ris, fullkornspasta
- h. Egg, kylling, fisk, bønner

4. Hvilket svaralternativ mener du er best?:

- e. Det er viktig å spise ferske grønnsaker ettersom frosne grønnsaker er mye mindre næringsrike
- f. '5 om dagen' tilsvarer 500 gram frukt og grønt per dag.
- g. Bær, spesielt blåbær er det viktigste å få i seg av frukt og grønt ved kreftsykdom.
- h. Økt inntak av frukt og grønt, og 'juicing' (lage juice av frukt og grønt) har vist seg å være svært god støttebehandling ved kreftsykdom

5. Hvilket næringsstoff har kreftpasienter et høyere behov for?:

- e. Karbohydrater
- f. Proteiner
- g. Fett
- h. Vitamin C

6. Hvilket svaralternativ mener du er best?:

- e. Kostholdsrådene (hva du bør spise) oppdateres stadig, og det er derfor viktig å holde seg oppdatert på hva media anbefaler
- f. Det er viktig å gjøre kostholdsendringer ved kreftsykdom, og derfor lurt å ta til seg de rådene man kan få
- g. Det er kun fastlegen sin man skal forhøre seg med når det gjelder kostråd ved kreftsykdom
- h. Man skal være kritisk til det man leser og hører om kosthold ved kreftsykdom

7. Hvilket svaralternativ mener du er best?:

- e. Kostholdsrådene (hva du bør spise) kan være forskjellige under og etter behandling
- f. Kostholdsrådene (hva du bør spise) er de samme under og etter behandling
- g. Det er svært gunstig for antitumorbehandlingen å unngå alle typer sukker i behandlingsperioden
- h. Det er viktig med ekstra tilskudd av antioksidanter under behandlingsperioden

8. Stort vekttap ved kreftsykdom kan føre til:

- e. Dårligere toleranse for kreftbehandlingen
- f. Større risiko for komplikasjoner
- g. Dårligere immunforsvar
- h. Alle alternativene over



## 8.4 Appendix 4: Information on how to fill in the 3-day food diary

### OPPLYSNINGER OM KOSTHOLDET

- Beskriv kostholdet ditt så nøye som mulig slik det er nå.
- Det skal totalt være 3 dager; 2 ukedager og en helgedag, se skjemaene nedenfor.
- Skriv ned alle matvarer og drikkevarer, husk også mat og drikke du spiser mellom hovedmåltider. Eksempel: en håndfull valnøtter, 12 mandler, 1 Coca Cola boks.
- Beskriv maten så nøyaktig som mulig:
- Eksempler:
  - Type brød: kneip, loff, grovbrød. Gjerne noter ned brødmerket om du har det ('sportsbrød' eller 'Xtra Grovbrød').
  - 'Lett ost' istedenfor 'ost'. Gjerne med merket (f.eks. Norvegia) om du vet merket.
  - Skummet melk/lett melk/hel melk istedenfor melk.
  - 'Laksefilet' istedenfor fisk.
- Hvis ingrediensene er blandet, skriv hvilke ingredienser som er i maten, for eksempel ved en gryterett, eller i en salat.
- Dersom mengden gram/dl/liter er kjent, skriv det ned. Dersom det ikke er kjent, skriv ned mengden som for eksempel: et stykke brød, en kopp te, en spiseskje olivenolje, en filet av laks, en håndfull nøtter, en skive salami osv.
- Husk også å notere ned det du drikker. For eksempel en kaffe med skummet melk med ca 1 spiseskje (ss) skummet melk, og 1 teskje (ts) sukker.

### Eksempel:

Tidspunkt	Mat og drikke	Mengde
7.30	Grovbrød (Bakehuset, havre fullkorn) Smør (Bremykt lett) Gulost (Norvegia) Jordbær syltetøy (Lerum, uten tilsatt sukker, 80% bær) Kokt pålegg skinke Kaffe (svart) Banan	2 skiver Tynt lag x 2 2 skiver På 1 skive 3 skiver 1 kopp ½
17.30	Kyllingfilet stekt i rapsolje Ris  Salat (tomat, agurk, mais, rucola salat, rød paprika) Vann  Vanilje is (Creme, Hennig Olsen)	1 filet, 1 ss olje Ca 4 toppede spiseskjeer ferdigkokt ris 1/3 middags-tallerken 2 glass  2 is kuler
	Kosttilskudd? Hvis, ja, hvilke(t) og mengde: Tran (Møllers), 1 spiseskje.	

### 8.5 Appendix 5: 3-day food diary registration form

Example from 1 day only. They were all the same except;

"DAG 1", "DAG 2" and "DAG 3".

#### DAG 1

Tidspunkt	Mat og drikke	Menge
	Kosttilskudd? Hvis, ja, hvilke(t) og mængde:	