

## Original Article

# Recording a patient diet over the radical course of radiotherapy for prostate cancer using a diet diary: a feasibility study

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## Abstract

**Aims:** To obtain an estimate of dietary fibre and fluid intake in Australian men undergoing prostate radiotherapy and to establish feasibility and patient compliance with recording normal diet without intervention during the radical course of radiotherapy.

**Methods:** Eleven participants were enrolled and treated with 74–78 Gray (Gy) to the prostate over 8 weeks. Participants were instructed to record a diary of their food and fluid intake and bowel motions for the duration of treatment. Treating radiation therapists were instructed to initial the diet diary daily. Diet diaries were assessed for compliance by analysing the number of days over the treatment period and the number of diary pages submitted. The diet diaries were analysed for nutrient intake of fibre and fluids.

**Results:** A total of 10 of 11 participants submitted a diet record for the full duration of treatment with a median compliance of 100% (range 90.4–100%) of days recorded. The mean (standard deviation) of fibre and fluids recorded in the diaries were 21.5 g (5.5) and 2227.1 g (733.1), respectively.

**Conclusions:** It is feasible for patients to record a diet diary over a radical course of prostate radiotherapy. In this study, most patients were highly compliant with submitting a diet record for each day during treatment.

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## Keywords

Compliance; diet; diet diary; prostate cancer; radiotherapy

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## INTRODUCTION

In 2005, prostate cancer diagnosis was the most common of all cancers diagnosed in men in

Australia.<sup>1</sup> Many of these men undergo external beam radiotherapy (EBRT) for their treatment. Prostate motion during EBRT is known to be influenced by the filling of the bowel and bladder<sup>2</sup> with changes in rectal filling being the major cause of motion.<sup>3,4</sup> This has led to studies of dietary interventions aiming to reduce

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prostate motion by reducing the frequency of gas and faeces present in the bowel.<sup>5,6</sup> These studies have implemented anti-flatulent diets with a magnesium-based laxative, which in the study by Smitsmans et al. demonstrated a significant reduction in gas, faeces and moving gas.<sup>5</sup> Smitsmans et al., hypothesized that this reduction should correlate with a reduction in intra-fraction prostate motion, a result that was not supported by Nichol et al., who found that an anti-flatulent diet with milk of magnesia did not significantly reduce intra-fraction prostate motion on Cine-Magnetic Resonance Imaging (Cine-MRI).<sup>6</sup> Neither study did, however, assess compliance with the diet intervention. Compliance with a diet during radiation therapy may impact on the presence of moving gas which in turn may impact on intra-fraction prostate motion as recognised by Nichol et al.<sup>6</sup>

Diet diaries have demonstrated relatively good correlation to weighed food records, when compared to other recording methods.<sup>7</sup> This may make them useful in capturing compliance with diet interventions. However, most diet records are usually applied over a short term, such as in diet intervention and diet recording studies, capturing diet information for a few days to a week.<sup>8–11</sup> No previous studies were identified that assess the feasibility of utilising a diet diary to record diet intake in patients receiving radical prostate radiotherapy for the full course of treatment, which usually takes 8 weeks. Some weight loss studies have utilised diaries over a longer periods, which may limit their relevance to the present studies' population.<sup>12,13</sup> This study was conducted to establish feasibility and patient compliance with recording a normal diet without intervention for the full course of radical radiotherapy. The study also aimed to obtain an estimate of fibre and fluids intake of Australian men undergoing radiation therapy to the prostate.

## METHOD

### Participant recruitment

Eleven participants were recruited consecutively between February 2009 and May 2009 and informed consent was obtained verbally

after detailed information provision about the purpose and requirements of the study. This study was approved by the Peter MacCallum Cancer Centre (PMCC) Expedited Ethics Review committee.

Eligible participants had biopsy proven adenocarcinoma of the prostate and were eligible for radical radiotherapy to the intact organ. All participants were required to be implanted with gold seed fiducial markers and have no other prostheses in the pelvic region. Patients who had a history of irritable bowel syndrome, recent history of constipation or receiving opioid analgesics were deemed ineligible.

### Radiation therapy

Participants were treated to 74–78 Gy in 37–39 fractions over 8 weeks in the supine position using a combifix (Sinmed, Civco Medical Solutions, Reeuwijk, Netherlands) for pelvis immobilisation without the use of a thermoplastic drape. All participants had kilovoltage (kV) paired images at the beginning of treatment with an online correction protocol of matching to fiducial gold seeds with a 0 mm tolerance. All participants followed the standard instructions for bladder and bowel preparation of 750 mL of water 30 min prior to treatment for a comfortably full bladder and to empty their bowel before treatment. Participants were advised to take Fybogel (Reckitt Benckiser, West Ryde, Australia) if needed to promote regular bowel motion.

### Recording and assessment of the diet diary

Participants met with the dietitian and/or principle investigator prior to the treatment planning appointment for instructions on recording the diet diary and provision of materials. The diet diary provided was a folder with instructions and pro-forma A4 looseleaf diary pages to be completed. Participants were instructed to complete a new page each day, recording the time and place that food or drink was consumed. Each ingredient of food or drink item, if known, was to be listed separately with the cooking method and brand, as well as the estimate of weight or volume. Each diary

page also had a space to list the times a participant had a bowel motion in the day.

A subjective global nutritional assessment<sup>14,15</sup> was performed at either the pre-study meeting or first week of treatment, and again in the last week of treatment to assess any changes in nutritional health. The participants were encouraged to maintain and record their normal dietary intake and bowel motions. None required additional dietary education due to special nutritional needs.

Patients were instructed to present their diet diary at each of the daily treatments where a treating radiation therapist initialed the record to assess compliance. The participants also met with investigators weekly throughout the course of treatment for systematic questioning about their progress with recording their diet, to discuss any issues with the diet diary and to record their weight. During the final meeting, participants were given the chance to offer suggestions for improvement of the diet diary as a consumer.

The diet diary was assessed for missing data points to evaluate compliance. The data points assessed were the number of diary pages compared to total days over the treatment period, the number of days bowel motions were recorded and the number of days radiation therapists' initials were recorded. Dietary records were de-identified and entered by the principal investigator into Foodworks 2007, version 5, SP1 (Xyris Software, Highgate Hill, Australia) to assess the diet for intake of fibre and fluids. For foods where the quantity was not estimated, the 'unspecified serve' amount in Foodworks was entered. The water content was reported according to the calculation by Foodworks as the total water in the diet from foods and fluids consumed.

### Statistical analyses

Frequency analyses were carried out to obtain the median (ranges) number of days recorded in the diet diary. Mean ( $\pm$  Standard Deviation (SD)) of the daily intake of fibre and fluids were assessed. All statistical analyses were car-

ried out using Microsoft Excel 2003 (Microsoft Corporation, Redmond, WA, USA).

## RESULTS

Thirteen patients were approached for this study during the recruitment period. One patient declined due to personal reasons and availability. One patient was approached but later deemed ineligible due to receiving radiotherapy following prostatectomy. The demographics for the 11 participants who successfully enrolled in the study are shown in Table 1. A total of 10 of the 11 recruited participants submitted a diet diary, which spanned the duration of their treatment. One participant withdrew from the study due to personal reasons. Another patient became ineligible while on study due to requiring opioid analgesics for an extended period for sciatica pain. However, he was keen to continue his participation and the investigators considered that it would only impact his bowel motion frequency, so he was allowed to continue on study.

With 10 of 11 enrolled participants completing the study requirements, the feasibility of recording a diet diary for the full course of radiotherapy in prostate cancer patients was 90.9%. Whereas all eligible patients approached for the study are accounted for the feasibility

**Table 1.** Demographic characteristics of prostate cancer patients participating in a diet diary and bowel motion compliance study (total  $N = 11$ )

	<i>n/N (%)</i>
Age (years) (mean 71.8, SD 7.25)	
50–59	1/11 (9)
60–69	3/11 (27)
70–79	5/11 (46)
80+	2/11 (18)
Stage (TNM)	
T2	6/11 (55)
T3	5/11 (45)
PSA (ng/mL)	
0–10	1/11 (9)
10.1–20	10/11 (91)

Note:  $n$  = number of participants;  $N$  = total number of participants; TNM = TNM Classification of malignant tumours, 6th Ed.; SD = standard deviation; PSA = prostate-specific antigen.

**Table 2.** Compliance with recording diet diary, bowel motions and for radiation therapists initialing diet diaries. Submitted pages indicating the recording frequency on pages submitted to investigators, total treatment days indicating recording frequency over the total treatment duration (total  $N = 10$ )

	Median (%)	Range (%)
Compliance for submitting daily page	100	90.4–100
Bowel motions (submitted pages)	97.3	42–100
Bowel motions (total treatment days)	95.5	39.6–100
Radiation therapists' initial (submitted pages)	79.3	20–100
Radiation therapists' initial (total treatment days)	77.2	18.9–100

Note:  $N$  = total number of participants.

**Table 3.** The weight (mean  $\pm$  SD) and range of fibre and water recorded in participant diets during RT for prostate cancer

	Mean ( $\pm$ SD)	Range
Fibre (g)	21.5 ( $\pm$ 5.5)	15–32.4
Water (g)	2227.1 ( $\pm$ 733.1)	1409–3462

Note: SD = standard deviation; g = grams.

was 83.3% (10/12). Seven out of the ten participants who completed the study requirements submitted a fully compliant diet record. However, only three of those had daily entries in the bowel motion section of the record for their full duration of treatment. The participants' compliance with the diet diary, recording bowel motions and for the treating radiation therapists who initialed the diary pages is reported in Table 2. The median compliance for recording bowel motions and for radiation therapists initialing the diary pages is reported both for the number of submitted diary pages and for the total number of treatment days, which includes days were participants failed to submit a diary page.

The mean of the recorded averages for the total number of daily dietary fibre and water intake is reported in Table 3. The dietary water content is reported in grams as per the report from Foodworks. Each gram of water equates to approximately 1 mL.<sup>16</sup> The duration of the diet diary recording varied by a small number of days among participants (mean 53.9 and SD 3.6). Since the average fibre and fluids of participants was only minimally affected by the

duration of recording, each participant was given an equal 'weight' when calculating the group mean.

Only three participants submitted a complete record of bowel motions. There were five other participants who had sufficient data (above 90% compliance) to perform a frequency analysis of bowel motions (total of 14 missing data points) after the poor recording participant, the withdrawn participant and the participant who received opioid analgesics were excluded. This offered 378 of 392 possible data points for analysis. These eight participants saw an increase of their mean daily bowel motions from 1.72 per day in week one to 2.39 per day in week seven (Figure 1).

Participant weight was recorded fortnightly with assessable results available for 10 participants. All had a stable weight over the 7–8 weeks of treatment. The mean weight change was a 0.53 kg gain, median 0.55 kg gain (range  $-1.2$ – $2$  kg). This represented a mean weight gain of 0.6% bodyweight (range  $-1.7$ – $2.3$ %).

## DISCUSSION

This study demonstrates that patient-initiated recording of a diet diary for the complete duration of radical prostate radiotherapy is feasible. Compliance with recording the diet diary was very high with a median of 100% (range 90.4–100 %) of days recorded during the treatment period. One participant who returned the least number of sheets did not realise that he

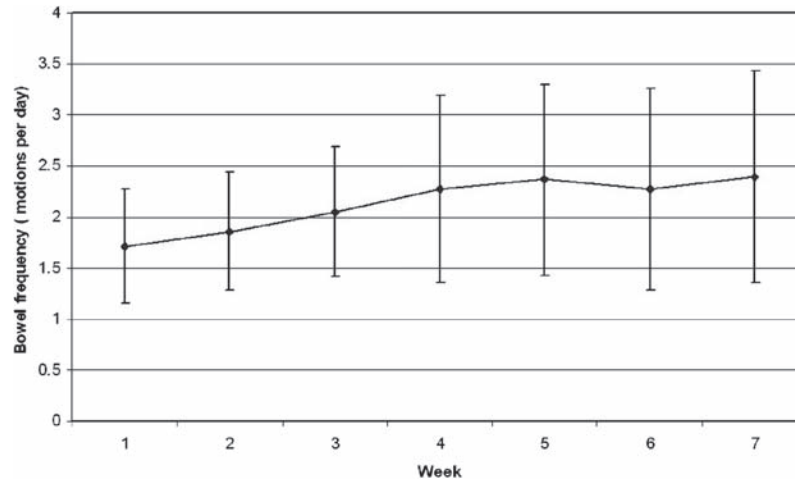


Figure 1. Average frequency of bowel motions per day over radical radiotherapy for eight participants. Error bars represent the standard deviations (1 SD), that is the variation in bowel motion frequency in these participants.

needed to record his diet diary over the week-end for the first week, which explained some of his missing pages. Participants generally responded at weekly review that it was not much of a burden to record their diary. Most recorded it at each meal, or caught up at the following meal if they had skipped recording the diary at the time of a meal. A subjective assessment would suggest the submitted pages were almost entirely complete with only two pages potentially missing a meal at the end of the day. This was indicated by only two main meals being recorded for the day, however, on those days the participant may not have had a meal at the end of the day. This was not questioned during weekly review and is a weakness in the diary recording.

One participant in this study withdrew because he felt the diet recording was too onerous given his personal circumstances. Due to the small number of participants in this study, it is hard to suggest how many participants may typically be unable to comply with recording diet records over several weeks. In the breast cancer nutrition adjuvant study, a study investigating the feasibility of reducing dietary fat intake as a component of treatment regimens for patients with resected breast cancer, two of 59 participants were excluded from the study due to inability to complete the four-day food

records which were to be completed at baseline in the 'run in' period.<sup>8</sup> The reasons for inability were not discussed. In a diet intervention and exercise study among healthy male participants with risk factors for coronary heart disease by Naslund et al.,<sup>9</sup> 88% (104 of 118) of participants returned completed seven-day diet records. Those results are similar to ours with an approximately 10% dropout rate.

In weight loss programmes where diet diaries are used for self-monitoring over even longer periods, the reported levels of compliance with completing the diet diaries are lower. In a study comparing hardcopy diet diaries versus Personal Digital Assistant (PDA) entered diaries, the rates of compliance were around 57% ( $n = 93$ ) and 52% ( $n = 57$ ), respectively, over a period of 24 weeks.<sup>12</sup> Other authors have reported comparable rates of compliance using an internet self-monitoring system.<sup>13</sup> In the present study, the far greater level of compliance could be due to shorter recording periods, the diet records being signed off by treatment staff frequently during treatment and repeated, regular contact with clinical and research staff. The higher rate of compliance may also be due to the fact that participants had cancer and were more likely to participate in trials than people participating in weight loss or less traumatic studies.

In their study comparing a 3-day food record to a food frequency questionnaire (FFQ) in a similar aged cohort, Schaefer et al.<sup>10</sup> found that only 17 of the 57 (29.8%) participants submitted completed food records. In contrast, 7 of the 10 (70%) of those who completed the present study submitted entire food records over the whole period. However, when using the same definitions of what constitutes a complete record, our study would likely fall below 50% as many records had some foods where the type or portion was not specifically entered. For example, participants may have recorded the measurement of a serving of soup as 'bowl' rather than an estimate in millilitres or may have failed to estimate the size of a piece of fruit. In the study by Schaefer et al.<sup>10</sup> the participants were eating known portions of prescribed diets, whereas in our study the diet was unrestricted and estimates of portions were allowed. In reporting dietary intake over a long period, it is not unreasonable to suggest that the occasional omission of specific food weight still offers a complete record.

In assessing the completeness of dietary records, Thorogood et al.<sup>11</sup> used a formula of 1.2 basal metabolic rate as the minimum energy required to be healthy. They found that 147 of the 186 (79%) dietary records in their study had sufficient energy recorded to be considered complete. In this study using the same formula we found that 7 of the 10 (70%) dietary records were complete, indicating that three participants underreported their dietary intake. This formula does not take into account the level of daily activity for each participant though, which means that some will require more or less energy each day. Therefore, it would be reasonable to suggest that there was under-reporting of diet intake in the present study. This suggestion is supported by the fact that all patients had a stable weight over the course of treatment.

The mean fibre and fluid intakes reported in this study are below the National Health and Medical Research Council (NHMRC) Australian guidelines for recommended dietary intake.<sup>17</sup> The NHMRC recommends 30 g of fibre per day for males in this age category.<sup>17</sup>

The figures reported in this study may be below their true value due to the underreporting by some participants. However, the 1995 National Nutrition Survey found the average fibre intake in this age category to be around 24–26.3 g of fibre per day,<sup>18</sup> indicating that most males will not achieve the recommended daily intake of fibre.

The NHMRC recommendation for total water intake is 3.4 L, including 2.6 L drinking fluids.<sup>17</sup> Most in this study did not achieve the recommended total water intake; however, some drinking fluids were likely to be omitted. It appears that the most frequent omission of fluid intake was water consumed on treatment days for bladder preparation. It is also possible that males undergoing prostate radiotherapy may reduce fluid intake due to urinary frequency and retention toxicities, which may explain this observation.

It is possible that participant compliance with bowel motion recording was higher than the result presented here due to inadequate recording instructions. The recording space may have been left blank if no motion was passed in a day. Some participants were diligent in recording days when they had no motion, however others may not have been. It was also observed in this study that daily bowel motions increased over the course of treatment; however, the exact increase cannot be confirmed due to some missing data points.

The requirement for treating radiation therapists to initial the diet diary each day achieved the lowest score of compliance. The rotation of staff to and from the treatment machine may have been responsible for periods of low compliance with initialing diet records. The study, with information about staff requirements, was initially presented at voluntary staff in service and infrequently during the treatment team meetings throughout the study; hence, staff may not have clearly understood their role. It is not clear if initialing the diet diary by radiation therapist impacts on participant compliance with recording the diary, although it may benefit some participants to have frequent reminders.

This study had several limitations which potentially could be remedied. The diet diary was not sensitive to participants skipping a meal at the end of the day and this was not part of the weekly review questioning. The diary format and instructions to participants were also not sensitive to days when patients did not have a bowel motion. A recommendation for future applications is for patients to record 'nil' when a bowel motion is not passed during the day and any blank records for bowel motions or meals are questioned at weekly review. Improved information provision to the staff involved through more frequent presentations and electing staff members to 'champion' the requirements to other staff may be a method of improving compliance with staff initialing the diet diaries. Importantly, the sample size was small and the application of the diet diary in a larger population could yield different outcomes.

This study indicates that a diet diary may be a useful tool for recording dietary intake over a course of radical prostate radiotherapy. Such a tool may be useful for recording compliance with diet interventions, which a lack of compliance has potentially impacted the results of previous studies.<sup>5,6</sup> We intend to use this tool for future diet intervention studies which will aim to test if dietary intake can reduce organ motion during radical prostate cancer radiotherapy. Measuring compliance with an intervention will strengthen the study design, establish rates of compliance and improve the applicability of results. The validation of this tool to monitor dietary intake for use in clinical practice is beyond the scope of the present study and will require further studies using larger patient populations.

In conclusion, based on our small sample it is feasible for prostate cancer patients to record a diet diary over the full course of radical radiotherapy to the prostate of approximately 8 weeks. In our study, most patients were highly compliant with submitting a record of their diet and bowel motions for each day during that time period. To further improve compliance the treating radiation therapists could undergo further education to ensure that they

check the record daily. The results suggest that diet diaries can be implemented to investigate the effects of gas and faeces on prostate motion during radiation therapy studies. Such practices may support the development of improved treatment protocols for patients with prostate cancer.

## ACKNOWLEDGEMENT

The authors would like to thank the staff at the Bendigo Radiotherapy Centre for their support.

## Declaration of interest

None of the authors have a conflict of interest.

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