

A Systematic Review of Plant-Based Diet and Bladder Cancer: A Call for Further Research

✉ [Jacob Taylor](#)¹, [Natasha Gupta](#)^{1,2}, [Jaime Blanck](#)³, [Stacy Loeb](#)^{1,2}

¹Department of Urology, New York University Langone Health, New York, United States ²Department of Population Health, New York University Langone Health and Manhattan Veteran Affairs, New York, United States ³Johns Hopkins Welch Medical Library, Johns Hopkins University, Baltimore, United States

Abstract

The relationship between plant-based dietary patterns and bladder cancer has not been extensively studied. Our objective was to perform a systematic review of the relationship between plant-based diets and bladder cancer risk and/or outcomes. We searched the literature for all relevant papers published before October 2020. Of 74 identified records, only 2 references were included in the final qualitative analysis. These publications found that vegetarian diets are associated with a lower risk of bladder cancer diagnosis. We did not identify any studies investigating the impact of plant-based dietary patterns on outcomes for individuals diagnosed with bladder cancer, which represents an important area for further study.

Introduction

Previous studies have examined the relationship between specific foods and bladder cancer risk. A systematic review of modifiable risk factors for bladder cancer reported that consuming more fruits and vegetables was associated with a decreased risk, whereas the consumption of processed meat was associated with an increased risk of bladder cancer[1].

Nutritional epidemiology is shifting toward evaluation of dietary patterns[2]. A previous systematic review suggested that the Mediterranean diet is associated with lower bladder cancer risk, while the Western diet is associated with increased risk[3]. Plant-based diets have become increasingly popular, but relatively little is known about their relationship to bladder cancer risk and/or outcomes. Therefore, our objective was to perform a systematic review of the relationship between plant-based diets (eg, vegetarian or vegan) and bladder cancer risk and/or outcomes.

Materials and Methods

The systematic review was conducted according to the European Association of Urology methodology, beginning with formulating the research question and writing the protocol, which was registered with PROSPERO (ID CRD42020214023). We then conducted a search of PubMed, Embase, Cochrane, Scopus, Web of Science, and AMED for all relevant publications up to October 2020. The search terms were vegetarian or vegan diets and MeSH term variations for bladder cancer or urothelial carcinoma (see appendix for details). Of 74 identified records, 34 were screened after duplicates were removed (Figure 1). Only 2 references were included in the final qualitative analysis.

The quality of evidence was assessed using the criteria outlined by Hawker et al.[4], which use 9 question domains with scores ranging from “very poor” (1) to “good” (4), with 36 being the highest score. If multiple publications come from a single study, a composite score is reported including information from all publications.

Key Words

Urinary bladder neoplasm, diet, vegetarian, systematic review

Competing Interests

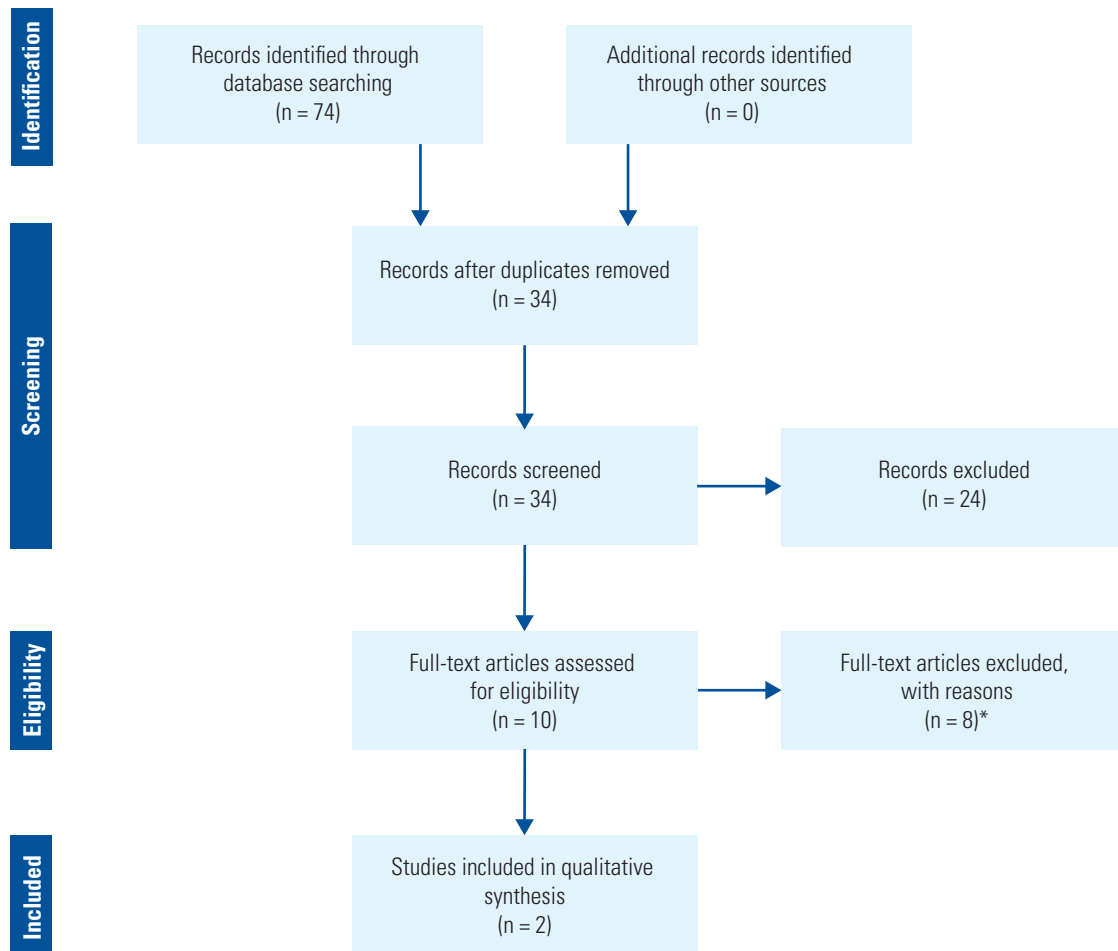
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FIGURE 1.
PRISMA flow chart



*Texts excluded due to lack of dietary or outcome data.

Results

The first publication by Key et al. reported on a large prospective cohort study of 61 566 British men and women[5]. Participants completed semi-quantitative food frequency questionnaires and were followed for an average of 12.2 years and were divided into 3 categories: meat eaters, fish eaters (did not eat meat but did eat fish), and vegetarians (did not eat meat or fish). The study population included > 20 000 vegetarians. Multivariable models were performed to examine cancer risk after adjustment for potential confounders such as smoking and physical activity. Compared with meat eaters, fish eaters had no difference in risk of bladder cancer (RR 0.81; 95% CI 0.36–1.81), but vegetarians had a significantly lower risk of bladder cancer (RR 0.47; 95% CI 0.25–0.89). A follow-up analysis by Key et al. similarly found a significantly lower risk of bladder cancer among vegetarians compared with meat eaters

(RR 0.62; 95% CI 0.38–0.99), although this was attenuated after adjustment for body mass index[6]. Overall, the composite quality rating from both publications was 36, a high-quality rating.

Discussion

Overall, our systematic review identified only 2 publications from a single prospective UK cohort study that specifically evaluated plant-based dietary patterns and bladder cancer. The limited available evidence suggests a vegetarian diet might be protective against bladder cancer. These findings are not surprising in light of previous studies suggesting an association between higher fruit and vegetable consumption and lower bladder cancer risk, whereas consumption of meat products has been linked with higher risk[1,7]. We did not identify any studies that examined plant-based diets with outcomes among patients diagnosed

with bladder cancer, representing an important area for future research. Although the quantity of evidence is quite small, the quality of evidence that does exist is high based on these 2 publications.

The association between diet and risk of cancer has been explored in almost every cancer type. For instance, Vieira et al., in a 2017 systematic review, found a 12% increased risk of colorectal cancer for each 100g/day consumption of red and processed meat[8]. There are many potential explanations for this association, including the generation of oxidative stress from heme iron and the carcinogenic effect of N-nitroso compounds and heterocyclic amines[9]. These same compounds may incite the development of bladder cancer, and decreasing the consumption and formation of these toxic compounds could decrease the dwell time of these carcinogens in the urine. A plant-based diet may provide greater antioxidant protection against free radi-

cal damage[10]. For instance, selenium, a known antioxidant, was found to be inversely related to bladder cancer risk in a meta-analysis of 7 studies[11]. Additional prospective studies are warranted to further explore the impact of plant-based dietary patterns in bladder cancer.

Conclusion

Given the importance of identifying modifiable factors that can affect bladder cancer risk and outcomes, our study highlights a great need for more research into the impact of plant-based diets. Most previous studies have focused on individual dietary components rather than dietary patterns. Observational data suggest that vegetarian diets may be associated with a lower risk of bladder cancer; however, we did not identify any studies investigating the impact of plant-based dietary patterns on oncologic or functional outcomes for individuals already diagnosed with bladder cancer, which represents an important area for further study.

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APPENDIX 1.

Search term strategy

Search Summary

Embase	26
PubMed	10
Cochrane	2
Scopus	24
Web of Science	12
AMED	2
<hr/>	
Total found	74
Duplicates	40
Grand Total	34

Embase

26 citations

(“bladder cancer”/exp OR “bladder adenocarcinoma” OR “bladder adenocarcinoma” OR “bladder cancerogenesis” OR “bladder carcinogenesis” OR “bladder carcinoma” OR “bladder diverticulum carcinoma” OR “bladder metastasis” OR “bladder cancer” OR “transitional cell cancer” OR “bladder carcinogen” OR “urinary bladder metastasis” OR “urothelial cancer” OR “urothelial carcinoma” OR “vesical cancer” OR “vesical carcinomanesis” OR “vesical carcinomatosis” OR “Bladder Neoplasm” OR “Bladder Neoplasms” OR “Bladder Tumors” OR “Bladder Tumor” OR “Malignant Tumor of Urinary Bladder” OR “Cancer of the Bladder” OR “Bladder Cancers” OR “transitional cell carcinoma”/exp OR “transitional cell cancer” OR “transitional cell cancers” OR “transitional cell carcinoma” OR “transitional cell carcinomas” OR “transitional cell tumor” OR “transitional cell tumors” OR “transitional cell tumour” OR “transitional cell tumours” OR “urothelial cancer” OR “urothelial cancers” OR “urothelial carcinoma” OR “urothelial carcinomas” OR “urothelial cell cancer” OR “urothelial cell cancers” OR “urothelial cell carcinoma” OR “urothelial cell carcinomas”) AND (“vegetarian”/de OR “lactoovovegetarian”/exp OR “lactovegetarian”/exp OR “vegan”/exp OR “vegetarian diet”/de OR “fruitarian diet”/exp OR “lactovegetarian diet”/exp OR “ovovegetarian diet”/exp OR “vegan diet”/exp OR “plant based” OR “plant-based” OR “vegan” OR “veganism” OR “vegans” OR “vegetable based” OR “vegetarian” OR “vegetarianism” OR “vegetarians” OR lactoovovegetarian* OR lactovegetarian*)

PubMed

10 citations

(“Urinary Bladder Neoplasms”[MeSH] OR “bladder adenocarcinoma” OR “bladder adenocarcinoma” OR “bladder cancerogenesis” OR “bladder carcinogenesis” OR “bladder carcinoma” OR “bladder diverticulum carcinoma” OR “bladder metastasis” OR “bladder cancer” OR “transitional cell cancer” OR “bladder carcinogen” OR “urinary bladder metastasis” OR “urothelial cancer” OR “urothelial carcinoma” OR “vesical cancer” OR “vesical carcinomanesis” OR “vesical carcinomatosis” OR “Bladder Neoplasm” OR “Bladder Neoplasms” OR “Bladder Tumors” OR “Bladder Tumor” OR “Malignant Tumor of Urinary Bladder” OR “Cancer of the Bladder” OR “Bladder Cancers” OR “Carcinoma, Transitional Cell”[MeSH] OR “transitional cell cancer” OR “transitional cell cancers” OR “transitional cell carcinoma” OR “transitional cell carcinomas” OR “transitional cell tumor” OR “transitional cell tumors” OR “transitional cell tumour” OR “transitional cell tumours” OR “urothelial cancer” OR “urothelial cancers” OR “urothelial carcinoma” OR “urothelial carcinomas” OR “urothelial cell cancer” OR “urothelial cell cancers” OR “urothelial cell carcinoma” OR “urothelial cell carcinomas”) AND (“Vegetarians”[MeSH] OR “Diet, Vegetarian”[MeSH] OR “Vegans”[MeSH] OR “Diet, Vegan”[MeSH] OR “plant based”[tw] OR “plant-based”[tw] OR “vegan”[tw] OR “veganism”[tw] OR “vegans”[tw] OR “vegans”[tw] OR “vegetable based”[tw] OR “vegetarian”[tw] OR “vegetarianism”[tw] OR “vegetarians”[tw] OR lactoovovegetarian*[tw] OR lactovegetarian*[tw])

Cochrane

2 results

([mh “Urinary Bladder Neoplasms”] OR “bladder adenocarcinoma” OR “bladder adenocarcinoma” OR “bladder cancerogenesis” OR “bladder carcinogenesis” OR “bladder carcinoma” OR “bladder diverticulum carcinoma” OR “bladder metastasis” OR “bladder cancer” OR “transitional cell cancer” OR “bladder carcinogen” OR “urinary bladder metastasis” OR “urothelial cancer” OR “urothelial carcinoma” OR “vesical cancer” OR “vesical carcinomanesis” OR “vesical carcinomatosis” OR “Bladder Neoplasm” OR “Bladder Neoplasms” OR “Bladder Tumors” OR “Bladder Tumor” OR “Malignant Tumor of Urinary Bladder” OR “Cancer of the Bladder” OR “Bladder Cancers” OR [mh “Carcinoma, Transitional Cell”] OR

“transitional cell cancer” OR “transitional cell cancers” OR “transitional cell carcinoma” OR “transitional cell carcinomas” OR “transitional cell tumor” OR “transitional cell tumors” OR “transitional cell tumour” OR “transitional cell tumours” OR “urothelial cancer” OR “urothelial cancers” OR “urothelial carcinoma” OR “urothelial carcinomas” OR “urothelial cell cancer” OR “urothelial cell cancers” OR “urothelial cell carcinoma” OR “urothelial cell carcinomas”) AND ([mh “Vegetarians”] OR [mh “Diet, Vegetarian”] OR [mh “Vegans”] OR [mh “Diet, Vegan”] OR “plant based” OR “plant-based” OR “vegan” OR “veganism” OR “vegans” OR “vegans” OR “vegetable based” OR “vegetarian” OR “vegetarianism” OR “vegetarians” OR lactoovovegetarian* OR lactovegetarian*)

Scopus

24 results

TITLE-ABS-KEY((“bladder adenocarcinoma” OR “bladder adenocarcinoma” OR “bladder cancerogenesis” OR “bladder carcinogenesis” OR “bladder carcinoma” OR “bladder diverticulum carcinoma” OR “bladder metastasis” OR “bladder cancer” OR “transitional cell cancer” OR “bladder carcinogen” OR “urinary bladder metastasis” OR “urothelial cancer” OR “urothelial carcinoma” OR “vesical cancer” OR “vesical carcinomanesis” OR “vesical carcinomatosis” OR “Bladder Neoplasm” OR “Bladder Neoplasms” OR “Bladder Tumors” OR “Bladder Tumor” OR “Malignant Tumor of Urinary Bladder” OR “Cancer of the Bladder” OR “Bladder Cancers” OR “transitional cell cancer” OR “transitional cell cancers” OR “transitional cell carcinoma” OR “transitional cell carcinomas” OR “transitional cell tumor” OR “transitional cell tumors” OR “transitional cell tumour” OR “transitional cell tumours” OR “urothelial cancer” OR “urothelial cancers” OR “urothelial carcinoma” OR “urothelial carcinomas” OR “urothelial cell cancer” OR “urothelial cell cancers” OR “urothelial cell carcinoma” OR “urothelial cell carcinomas”) AND (“plant based” OR “plant-based” OR “vegan” OR “veganism” OR “vegans” OR “vegans” OR “vegetable based” OR “vegetarian” OR “vegetarianism” OR “vegetarians” OR lactoovovegetarian* OR lactovegetarian*))

Web of Science

12 results

TS=(“bladder adenocarcinoma” OR “bladder adenocarcinoma” OR “bladder cancerogenesis” OR “bladder carcinogenesis” OR “bladder carcinoma” OR “bladder diverticulum carcinoma” OR “bladder metastasis” OR “bladder cancer” OR “transitional

cell cancer” OR “bladder carcinogen” OR “urinary bladder metastasis” OR “urothelial cancer” OR “urothelial carcinoma” OR “vesical cancer” OR “vesical carcinomanesis” OR “vesical carcinomatosis” OR “Bladder Neoplasm” OR “Bladder Neoplasms” OR “Bladder Tumors” OR “Bladder Tumor” OR “Malignant Tumor of Urinary Bladder” OR “Cancer of the Bladder” OR “Bladder Cancers” OR “transitional cell cancer” OR “transitional cell cancers” OR “transitional cell carcinoma” OR “transitional cell carcinomas” OR “transitional cell tumor” OR “transitional cell tumors” OR “transitional cell tumour” OR “transitional cell tumours” OR “urothelial cancer” OR “urothelial cancers” OR “urothelial carcinoma” OR “urothelial carcinomas” OR “urothelial cell cancer” OR “urothelial cell cancers” OR “urothelial cell carcinoma” OR “urothelial cell carcinomas”) AND TS=(“plant based” OR “plant-based” OR “vegan” OR “veganism” OR “vegans” OR “vegans” OR “vegetable based” OR “vegetarian” OR “vegetarianism” OR “vegetarians” OR lactoovovegetarian* OR lactovegetarian*)

AMED

No results found

(Bladder neoplasms/ OR “bladder adenocarcinoma” OR “bladder adenocarcinoma” OR “bladder cancerogenesis” OR “bladder carcinogenesis” OR “bladder carcinoma” OR “bladder diverticulum carcinoma” OR “bladder metastasis” OR “bladder cancer” OR “transitional cell cancer” OR “bladder carcinogen” OR “urinary bladder metastasis” OR “urothelial cancer” OR “urothelial carcinoma” OR “vesical cancer” OR “vesical carcinomanesis” OR “vesical carcinomatosis” OR “Bladder Neoplasm” OR “Bladder Neoplasms” OR “Bladder Tumors” OR “Bladder Tumor” OR “Malignant Tumor of Urinary Bladder” OR “Cancer of the Bladder” OR “Bladder Cancers” OR “transitional cell cancer” OR “transitional cell cancers” OR “transitional cell carcinoma” OR “transitional cell carcinomas” OR “transitional cell tumor” OR “transitional cell tumors” OR “transitional cell tumour” OR “transitional cell tumours” OR “urothelial cancer” OR “urothelial cancers” OR “urothelial carcinoma” OR “urothelial carcinomas” OR “urothelial cell cancer” OR “urothelial cell cancers” OR “urothelial cell carcinoma” OR “urothelial cell carcinomas”) AND (Vegetarianism/ OR Diet vegetarian/ OR “plant based” OR “plant-based” OR “vegan” OR “veganism” OR “vegans” OR “vegans” OR “vegetable based” OR “vegetarian” OR “vegetarianism” OR “vegetarians” OR lactoovovegetarian* OR lactovegetarian*)