


MINI-REVIEW

The close proximity between the human rectum and prostate: a functional-anatomic arrangement favoring prostate health

Vladimir Ajdžanović^{1,*}, Marko Miler¹, Branka Šošić-Jurjević¹, Branko Filipović¹

¹Department of Cytology, Institute for Biological Research "Siniša Stanković"—National Institute of Republic of Serbia, University of Belgrade, 11060 Belgrade, Serbia

***Correspondence**
avlada@ibiss.bg.ac.rs
(Vladimir Ajdžanović)

Abstract

Prostate health is related to the frequency of ejaculation and prostate drainage. Frequent, repetitive ejaculations theoretically may pose a prostate cancer risk due to ensuing high testosterone levels and loss of zinc. In line with this, the proximity of the human rectum and prostate is of diagnostic and therapeutic importance. We provide evidence to support the view that the proximity of the rectum and prostate in men enables lower bowel distention to compress the prostate's lateral side to facilitate drainage, which might lower cancer risk. This drainage mechanism is likely on-going and gradual, compared to rapid drainage following ejaculation. The physiological context suggests that these mechanisms of prostate drainage are complementary. Dietary content containing polyphenol- and fiber-rich meals, along with voluminous stool formation and increased gastrointestinal transit may all help improve prostate drainage. This may be important in voluntary abstinent men or other categories of sexually limited men. Recognizing that the anatomic relationship between the rectal area and prostate may facilitate prostate drainage, because of diet and gastro-intestinal activity, could be important to prostate health maintenance.

Keywords

Rectum; Defecation; Prostate drainage; Plant based diet; Polyphenols

1. Introduction

1.1 A brief overview of the anatomy and function of the human prostate

The human prostate is a pyramid-like gland, located beneath the urinary bladder and in front of the rectum [1, 2]. Geometrically speaking, the apex of the prostate contacts the urethra, it's base abuts the bladder and the prostate peripheral side remains adjacent to the anterior rectal wall [1, 3, 4]. According to McNeil's zonal anatomy scheme of the human prostate, derived from a large number of cadaver specimens, the gland is divided into an anterior fibromuscular stroma and three glandular zones [5]. The latter include: the central zone (25% of the glandular prostate tissue) surrounding the ejaculatory ducts, the transition zone (about 5% of the glandular prostate tissue) surrounding the urethra, and the peripheral zone surrounding both. This constitutes over 70% of the glandular prostate [1, 5, 6]. The transition zone is the site where benign prostatic hyperplasia (BPH) develops, while almost all prostate cancers arise in the peripheral zone [2, 5, 6]. Denonvilliers' fascia, medially fused with the fibromuscular stroma of the prostate, forms a barrier between prostate and rectum [4]. The epithelium of the human prostate gland is composed of acini (with an undulating to papillary appearance) and ducts lined

by luminal, basal and neuroendocrine cells. The specialized luminal cells secrete a variety of material which *inter alia* constitutes the seminal fluid [2]. Namely, the prostatic secretion, together with the fluids from seminal vesicles and bulbourethral glands, form the seminal fluid that promotes the survival and movement of spermatozoa. Proteolytic enzymes, citric acid, zinc, acid phosphatase and lipids represent the main constituents of prostatic secretion [7].

1.2 Health significance of prostate drainage

Frequency of ejaculation, actually the process of seminal fluid discharging (which includes prostate drainage), is linked with prostate health in several studies. Moderately frequent ejaculation (2–4 times per week) has been associated with a significantly decreased risk of prostate cancer [8]. Some authors suggest that frequent ejaculation seems to be protective from prostate cancer development [9], especially if practiced in early adult life [10]. The frequency of ejaculations/week in the fourth or fifth decade of life has been shown to have no significant impact on later prostate outcomes [10]. In line with this, a study using follow-up data on a significant number of US men (aged 46–81 years), suggests that ejaculation frequency is not related to increased risk of prostate cancer [11]. Keeping in mind the mediating role of androgen

receptors in prostate cancer initiation and progression [12, 13], as well as a significant link between higher levels of sexual activity and elevated testosterone [14–16], the existence of certain correlation between the frequent, repetitive ejaculations (followed by testosterone rise) and prostate cancer risk appears possible. In support of this, Parsons *et al.* [17] reported that higher levels of serum free testosterone are associated with an increased risk of prostate cancer. Conversely, it was suggested that prostate cancer is not observed in eunuchs and total androgen suppression by castration [18]. Further research is needed to shed light on this interesting question and important concern. Note that nocturnal emissions (“wet dreams”) may also participate in the process of prostate drainage. However, they are reported to be rather rare, with a frequency of about 0.3 per week in single men under thirty years old [19]. No association was observed between ejaculation frequency in early adulthood and subsequent lower urinary tract symptoms caused by BPH [20]. Interestingly, lions and dogs (hypercarnivores that exhibit seasonal mating) are known to spontaneously develop prostate cancer [21]. On the other hand, non-human primates (which also exhibit a distinct seasonal pattern of mating but have a mixed diet, predominantly based on plant foods) usually do not develop prostatic diseases, with the exception of rhesus macaques which can develop prostate cancer [22, 23]. The frequency of prostate discharge, through the act of mating in animals, appears to be less important for the potential development of prostate cancer than diet. As the development of malignant prostatic disease in men of advanced age actually may arise from an earlier lifestyle or diet [24, 25], it is useful to consider that prostate health may be affected by a gastrointestinal–rectal influence on prostate drainage.

2. Functional-anatomic specificity and clinical implications of the rectum and prostate close proximity

In humans, the rectum and anal canal form the last segment of the large intestine (actually of the gastrointestinal tract), so the syntagm “anorectal anatomy and physiology” is commonly used. The rectum, characteristically localized in the pelvis, is 12–18 cm long, possesses 2 or 3 curves within its lumen and begins at the level of the sacral promontory [26]. The lower one-third of the rectum, remaining without peritoneal covering, is enveloped by the Denonvilliers’ fascia that is between the prostate and rectum [4, 26]. It should be noted that the rectum and prostate share innervation; the pelvic plexus supplies the rectum with sympathetic and parasympathetic nerves and also forms the periprostatic plexus [26].

The close proximity between the human rectum and prostate is of diagnostic and therapeutic importance. Digital rectal examination (DRE) of the prostate, combined with free/total serum prostate-specific antigen (PSA) ratio measurements and ultrasound examination represents a common clinical approach for early prostate cancer detection in elderly men [27–29]. In parallel, DRE can be highly accurate in estimating the prostate volume in older patients with symptoms of BPH [30]. The approach implies careful and wide angle palpation of the prostate over the rectal mucosa, for its’ volume and any palpable nodules, masses or other abnormalities [31]. Repetitive

prostate massage represents an old tool for the urological praxis [32]. Prostate drainage technique, based upon such a massage, is applied in chronic prostatitis remediation [33].

3. Physiological and dietary aspect of beneficial rectum-prostate physical interaction

We support the view (through a detailed search of PubMed with appropriate keywords) that the anatomical linkage, that positions the rectum and prostate into such close proximity, normally facilitates gastrointestinal influence on prostate drainage and favors prostate health. In line with this, a plant-based diet, rich in polyphenols and fiber, is highlighted within the context of gut function as it relates to prostate health. Our narrative fulfills the good practice of scientific writing, given that some counter-arguments to our position are also provided, to ensure a balanced approach.

3.1 Physiological considerations

While fecal matter accumulates in the rectum, the anal canal regulates continence and defecation through complex interactions between sympathetic and parasympathetic nerves, striated and smooth muscles as well as other environmental factors [26]. Stretching of the intestinal lumen by a stool provides the stimulus for initiating defecation [26]. The inner rectal pressure, actually the pressure of fecal matter on the rectal walls, generated by defecation, compresses the prostate’s peripheral side and thereby aids prostate drainage (Fig. 1). There is a similarity between such physiological events in men and the pressure on perianal glands during defecation in dogs [34]. These sebaceous and serous glands are localized in the walls of dog anal sacs, open beside the anus and their product supposedly serves as a marker (Fig. 2) [34]. Normal emptying of the perianal glands that are a target tissue of sex steroid hormones [35] occurs as the stool passes over the glands and exerts radial pressure in the anal canal. Considering that the defecation mechanism in men includes contraction of the abdominal, recto-anal and pelvic floor muscles [36] it is expected that external compression of the rectum and prostate also occurs (Fig. 1). The net results of the described pressures during defecation likely cause prostate drainage independent of ejaculation-induced drainage, but complementary to this mechanism. Importantly, defecation-caused prostate drainage is not related to elevated testosterone levels that follow sexual activity and theoretically may increase the risk of prostate cancer [12–14, 37–39]. Occasionally, a warm water enema may be considered for hygienic purposes [40] as well as the efficacy of defecation-caused prostate drainage.

As zinc accumulates in the prostate [41, 42], frequent ejaculations may reduce its levels and adversely affect prostate homeostasis and general immunity [41–44]. In the light of recent pandemic, it should be noted that most risk groups for COVID-19 are associated with zinc deficiency [45]. Also, serum testosterone level rises drastically at the moment of ejaculation [46]. Obviously, temperance in sexual activity, which minimizes high circulating testosterone levels and zinc loss, appears to be beneficial for prostate health, which cor-

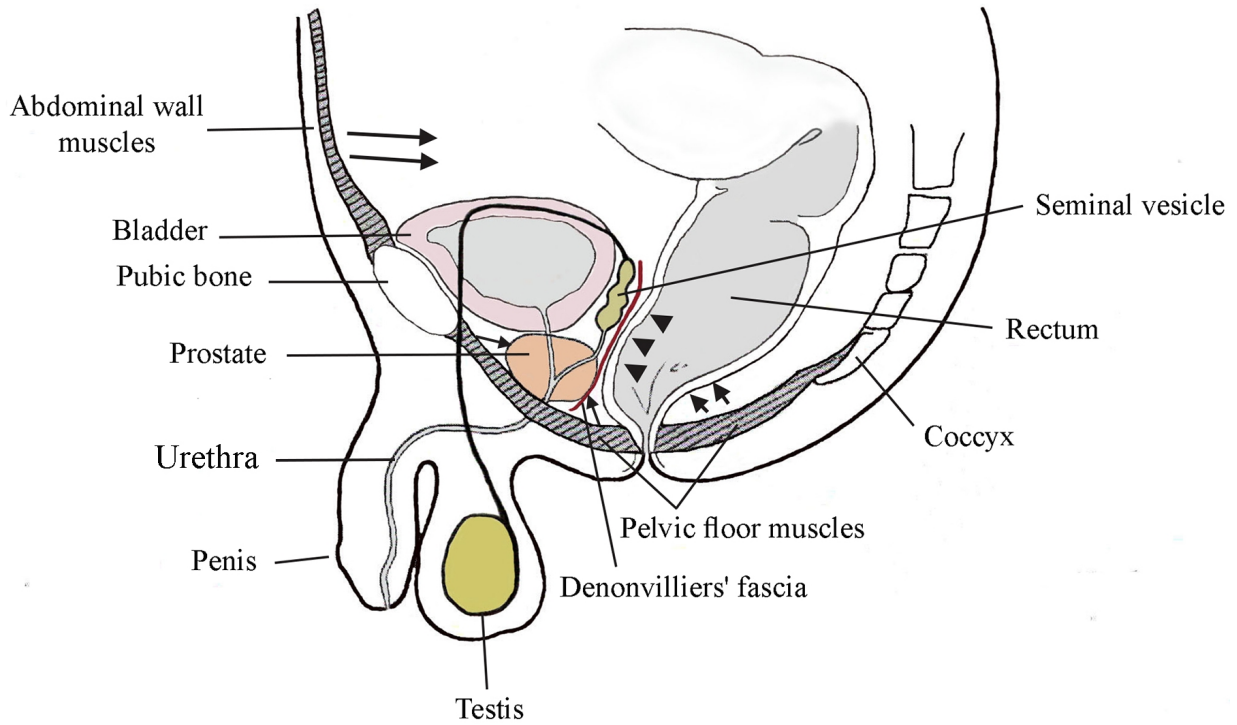


FIGURE 1. Functional-anatomic arrangement of the human rectum and prostate that enables defecation-caused prostate drainage. Arrowheads, the inner rectal pressure generated by transiting fecal matter; Arrow, external compression of the rectum and prostate, due to contraction of the abdominal wall and pelvic floor muscles.

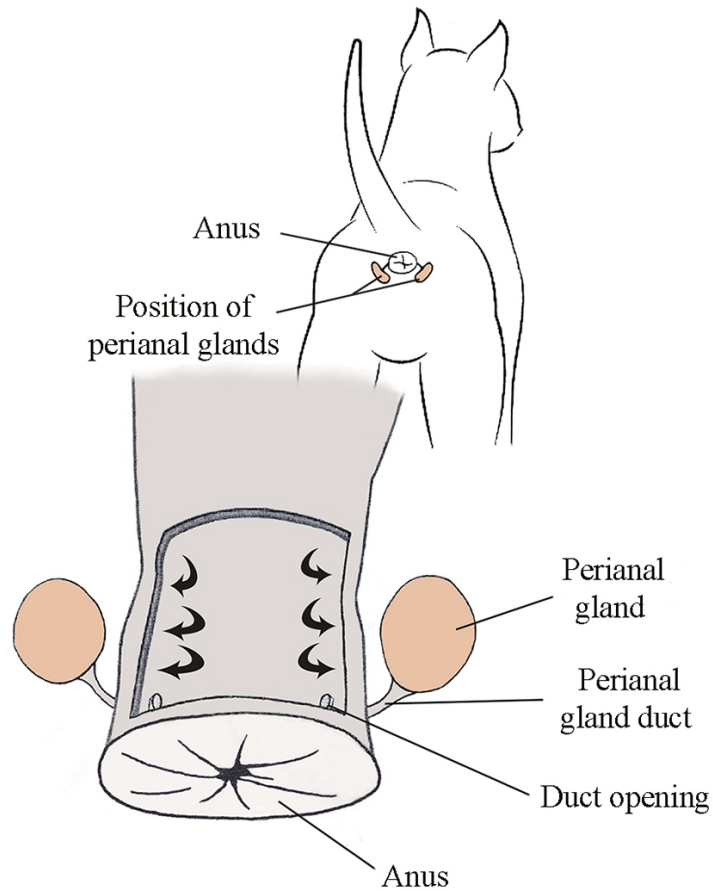


FIGURE 2. Schematic representation of perianal glands in dogs. Curved arrows, stool radial pressure in the anal canal, which causes emptying of the perianal glands.

responds to the Ancient Greek maxim “Nothing in excess”, inscribed on Apollo’s temple in Delphi. In support of this, the study performed on a large cohort of Catholic priests in New York State linked celibacy with significantly reduced prostate cancer mortality [47]. Interestingly, the protective effect of celibacy in nuns for cancer of the cervix is even more pronounced [48]. Given that prostate cancer and cervical cancer have different etiology and pathology, this parallel, however, has no mechanistic dimension. The rate of colorectal cancer mortality in the priests was also less than that of the general noncelibate male population [47]. A zinc loss upon prostate drainage related to defecation is only speculative at this level of knowledge, so further monitoring studies are needed in this respect.

3.2 Dietary considerations

A combination of physical activity, sufficient fluid intake and adequate diet (all affecting the stool formation/defecation) [49] are needed for a beneficial rectum-prostate physical interaction and subsequent prostate drainage. A broader dietary aspect is of particular interest in this context.

Various classes of dietary polyphenols (soy isoflavones, flavonols from onion, flavanols from green tea, *etc.*) represent secondary metabolites of plants having protective effects against the development of prostate diseases as well as having a significant role in slowing the progression of prostate cancer [13, 24, 50]. Polyphenols *inter alia* may modulate various signaling pathways, downregulate prostate cancer cell androgen receptors, reverse the epithelial to mesenchymal transition of these cells, decrease the expression of prostate-specific antigen and matrix metalloproteinase, contribute to epigenetic changes associated with the fate of cancer cells, affect microRNA expression as well as suppress the angiogenesis that follows prostate cancer growth [13, 51]. There is a bi-directional relationship between ingested polyphenols and the gut microbiota. Polyphenols may impact composition of the gut microbiota and improve digestion, while gut bacteria metabolize polyphenols into bioactive forms that provide health benefits [52, 53].

Polyphenolic extracts increased gastrointestinal transit in rats [54]. Cocoa polyphenols improved stool consistency in mice, and a prune polyphenol-laxative effect was also proposed in humans [55, 56]. Dietary fibers, present in plant-based diets together with polyphenols, were demonstrated to increase stool weight, frequency of defecation and gastrointestinal transit in healthy men [57]. Importantly, no association was reported between a vegan diet and serum total and free testosterone levels [58]. It appears that plant based, polyphenol- and fiber-rich diets and resulting bulk stool formation, as well as efficient defecation, may positively affect prostate drainage as noted herein. Although rare, BPH can cause acute colonic obstruction [59], indicating some possible negative consequences of the functional-anatomic arrangement we highlight in this work. Finally, it should be noted that zinc supplementation is strongly suggested for prostate health preservation [44]. Adherence to a healthy lifestyle agenda, and care of gastro-intestinal function based on data herein should be considered for a healthy prostate gland.

4. Conclusions

Drainage represents an important determinant of prostate health. It is accomplished *via* ejaculation, being the main route of prostate drainage, but may also be influenced by the process of defecation when considering the functional-anatomic arrangement between the prostate and peri-anal structures. Drainage by repetitive ejaculation may be associated with elevated testosterone levels and zinc loss. Rapid ejaculation-induced drainage is intermittent whereas drainage *via* prostate compression in the prostate-rectal area, especially during defecation, may be an on-going process of lesser intensity compared with ejaculation. The physiological context suggests that these two mechanisms of prostate drainage are complementary. The role of defecation-induced prostate drainage may be especially important in some men including those who are voluntarily abstinent or in sexually isolated men such as soldiers, prisoners, *etc.* In line with this, it was observed that celibate lifestyles coincide with decreased rates of prostate and colorectal cancer. Dietary habits would be expected to be a major variable that reflects the intensity of the gastrointestinal role in prostate drainage. Further clinical studies are needed to shed additional light on the potential significance of defecation-caused prostate drainage for prostate health.

AVAILABILITY OF DATA AND MATERIALS

Not applicable.

AUTHOR CONTRIBUTIONS

VA—conceptualization (lead), investigation (lead), writing-original draft (lead), revision (lead). MM—conceptualization (supporting), investigation (supporting), resources (lead). BŠJ—funding acquisition (lead), writing-original draft (supporting), visualization (supporting), revision (supporting). BF—project administration (lead), supervision (lead), investigation (supporting), visualization (lead). All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

ACKNOWLEDGMENT

Our work is realized as a part of the scientific program, which is planned within Institute for Biological Research “Siniša Stanković”—National Institute of Republic of Serbia. We wish to express our gratitude to Walter Severs (College of Medicine, Pennsylvania State University, Hershey, PA, USA) for the valuable expert assistance during manuscript preparation. We are also grateful to Steve Quarrie (Newcastle University, UK; Faculty of Biology, University of Belgrade, Serbia; European Training Academy EUTA, Belgrade, Serbia), an English language professional, for his help in proofreading the

manuscript.

FUNDING

Our work was supported by the Ministry of Science, Technological Development and Innovations of the Republic of Serbia, *via* direct financing of our Institute (contract number: 451-03-47/2023-01/200007). Ministry is engaged only in the research and preparation of the article funding.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

- [1] Paner G. Prostate gland and seminal vesicle. In Amin MB, Tickoo SK (eds.) *Diagnostic pathology: genitourinary* (pp. 536–724). 1st edn. Amirsys Inc.: Salt Lake City, Utah. 2010.
- [2] Ittmann M. *Anatomy and histology of the human and murine prostate*. Cold Spring Harbor Perspectives in Medicine. 2018; 8: a030346.
- [3] Ben-Josef E, Han S, Tobi M, Shaw LM, Bonner HS, Vargas BJ, *et al.* A pilot study of topical intrarectal application of amifostine for prevention of late radiation rectal injury. *International Journal of Radiation Oncology, Biology, Physics*. 2002; 53: 1160–1164.
- [4] Raychaudhuri B, Cahill D. Pelvic fasciae in urology. *The Annals of the Royal College of Surgeons of England*. 2008; 90: 633–637.
- [5] McNeal JE. The zonal anatomy of the prostate. *The Prostate*. 1981; 2: 35–49.
- [6] Henry GH, Malewska A, Joseph DB, Malladi VS, Lee J, Torrealba J, *et al.* A cellular anatomy of the normal adult human prostate and prostatic urethra. *Cell Reports*. 2018; 25: 3530–3542.e5.
- [7] Mann T. *The Biochemistry of Semen*. 1st edn. Methuen & Co: London; John Wiley & Sons: New York. 1954.
- [8] Jian Z, Ye D, Chen Y, Li H, Wang K. Sexual activity and risk of prostate cancer: a dose—response meta-analysis. *The Journal of Sexual Medicine*. 2018; 15: 1300–1309.
- [9] Kotb AF, Beltagy A, Ismail AM, Hashad MM. Sexual activity and the risk of prostate cancer: review article. *Archives of Italian Urology and Andrology*. 2015; 87: 214–215.
- [10] Giles GG, Severi G, English DR, McCredie MR, Borland R, Boyle P, *et al.* Sexual factors and prostate cancer. *BJU International*. 2003; 92: 211–216.
- [11] Leitzmann MF, Platz EA, Stampfer MJ, Willett WC, Giovannucci E. Ejaculation frequency and subsequent risk of prostate cancer. *JAMA*. 2004; 291: 1578–1586.
- [12] Cunha GR, Ricke W, Thomson A, Marker PC, Risbridger G, Hayward SW, *et al.* Hormonal, cellular, and molecular regulation of normal and neoplastic prostatic development. *The Journal of Steroid Biochemistry and Molecular Biology*. 2004; 92: 221–236.
- [13] Ajdžanović V, Filipović B, Miljić D, Mijatović S, Maksimović-Ivanić D, Miler M, *et al.* Prostate cancer metastasis and soy isoflavones: a dogfight over a bone. *EXCLI Journal*. 2019; 18: 106–126.
- [14] Tsitouras PD, Martin CE, Harman SM. Relationship of serum testosterone to sexual activity in healthy elderly men. *Journal of Gerontology*. 1982; 37: 288–293.
- [15] van Anders SM, Watson NV. Social neuroendocrinology: effects of social contexts and behaviors on sex steroids in humans. *Human Nature*. 2006; 17: 212–237.
- [16] Escasa MJ, Casey JF, Gray PB. Salivary testosterone levels in men at a U.S. sex club. *Archives of Sexual Behavior*. 2011; 40: 921–926.
- [17] Parsons JK, Carter HB, Platz EA, Wright EJ, Landis P, Metter EJ. Serum testosterone and the risk of prostate cancer: potential implications for testosterone therapy. *Cancer Epidemiology, Biomarkers & Prevention*. 2005; 14: 2257–2260.
- [18] Yassin A, AlRumaihi K, Alzubaidi R, Alkadhhi S, Al Ansari A. Testosterone, testosterone therapy and prostate cancer. *The Aging Male*. 2019; 22: 219–227.
- [19] Kinsey AC, Pomeroy WB, Martin CE. *Sexual behavior in the human male*. 1st edn. Indiana University Press: Bloomington. 1948.
- [20] Sutcliffe S, Giovannucci E, De Marzo AM, Willett WC, Platz EA. Sexually transmitted infections, prostatitis, ejaculation frequency, and the odds of lower urinary tract symptoms. *American Journal of Epidemiology*. 2005; 162: 898–906.
- [21] Mubiru JN, Hubbard GB, Dick EJ, Furman J, Troyer DA, Rogers J. Nonhuman primates as models for studies of prostate specific antigen and prostatic diseases. *The Prostate*. 2008; 68: 1546–1554.
- [22] Gordon TP. Reproductive behavior in the rhesus monkey: social and endocrine variables. *American Zoologist*. 1981; 21: 185–195.
- [23] Waters DJ, Sakr WA, Hayden DW, Lang CM, McKinney L, Murphy GP, *et al.* Workgroup 4: spontaneous prostate carcinoma in dogs and nonhuman primates. *The Prostate*. 1998; 36: 64–67.
- [24] Patel VH. Nutrition and prostate cancer: an overview. *Expert Review of Anticancer Therapy*. 2014; 14: 1295–1304.
- [25] Wilson KM, Mucci LA. Diet and lifestyle in prostate cancer. *Advances in Experimental Medicine and Biology*. 2019; 1210: 1–27.
- [26] Barleben A, Mills S. Anorectal anatomy and physiology. *Surgical Clinics of North America*. 2010; 90: 1–15.
- [27] De Visschere P, Oosterlinck W, De Meerleer G, Villeirs G. Clinical and imaging tools in the early diagnosis of prostate cancer, a review. *Journal of the Belgian Society of Radiology*. 2010; 93: 62–70.
- [28] Walsh AL, Considine SW, Thomas AZ, Lynch TH, Manecksha RP. Digital rectal examination in primary care is important for early detection of prostate cancer: a retrospective cohort analysis study. *British Journal of General Practice*. 2014; 64: e783–e787.
- [29] Catalona WJ, Richie JP, Ahmann FR, Hudson MA, Scardino PT, Flanigan RC, *et al.* Comparison of digital rectal examination and serum prostate specific antigen in the early detection of prostate cancer: results of a multicenter clinical trial of 6,630 men. *The Journal of Urology*. 2017; 197: S200–S207.
- [30] Yamamoto T, Fukuta F, Masumori N. Does digital rectal examination predict prostate volume greater than 30 mL? *International Journal of Urology*. 2017; 24: 373–376.
- [31] Pokorny CS. Digital rectal examination: indications and technique. *The Medical Journal of Australia*. 2017; 207: 147–148.
- [32] Nickel JC, Alexander R, Anderson R, Krieger J, Moon T, Neal D, *et al.* Prostatitis unplugged? Prostatic massage revisited. *Techniques in Urology*. 1999; 5: 1–7.
- [33] Gus'kov AR. Prostatic drainage technique in obstructive chronic prostatitis using rectal pneumovibromassager PVM-R-01. *Urologiia*. 1999; 4: 32–36.
- [34] Dyce KM, Sack WO, Wensing CJG. *Textbook of veterinary anatomy*. 4th edn. Saunders, Elsevier Inc.: St. Louis, Missouri. 2010.
- [35] Atoji Y, Yamamoto Y, Komatsu T, Suzuki Y, Tsubota T. Circumanal glands of the dog: a new classification and cell degeneration. *The Anatomical Record*. 1998; 250: 251–267.
- [36] Sharma A, Rao S. Constipation: pathophysiology and current therapeutic approaches. *Gastrointestinal Pharmacology*. 2017; 239: 59–74.
- [37] Dabbs JM, Mohammed S. Male and female salivary testosterone concentrations before and after sexual activity. *Physiology & Behavior*. 1992; 52: 195–197.
- [38] Parsons JK, Carter HB, Platz EA, Wright EJ, Landis P, Metter EJ. Serum testosterone and the risk of prostate cancer: potential implications for testosterone therapy. *Cancer Epidemiology, Biomarkers & Prevention*. 2005; 14: 2257–2260.
- [39] Goldey KL, van Anders SM. Sexual modulation of testosterone: insights for humans from across species. *Adaptive Human Behavior and Physiology*. 2015; 1: 93–123.
- [40] Mounsey A, Raleigh M, Wilson A. Management of constipation in older adults. *American Family Physician*. 2015; 92: 500–504.
- [41] Dissanayake D, Wijesinghe P, Ratnasooriya W, Wimalasena S. Relationship between seminal plasma zinc and semen quality in a subfertile population. *Journal of Human Reproductive Sciences*. 2010; 3: 124–128.
- [42] Christudoss P, Selvakumar R, Fleming JJ, Gopalakrishnan G. Zinc status of patients with benign prostatic hyperplasia and prostate carcinoma. *Indian Journal of Urology*. 2011; 27: 14–18.

- [43] Kotsirilios V, Vitetta L, Sali A. In: A guide to evidence-based integrative and complementary medicine. 1st edn. Churchill Livingstone: Sydney, Australia. 2011.
- [44] Costello LC, Franklin RB. A comprehensive review of the role of zinc in normal prostate function and metabolism; and its implications in prostate cancer. *Archives of Biochemistry and Biophysics*. 2016; 611: 100–112.
- [45] Wessels I, Rolles B, Rink L. The potential impact of zinc supplementation on COVID-19 pathogenesis. *Frontiers in Immunology*. 2020; 11: 1712.
- [46] Kobori Y, Osaka A, Iwahata T, Okada H. Serum testosterone level rises drastically at the moment of ejaculation. *Fertility and Sterility*. 2020; 114: E391.
- [47] Michalek AM, Mettlin C, Priore RL. Prostate cancer mortality among catholic priests. *Journal of Surgical Oncology*. 1981; 17: 129–133.
- [48] Fraumeni JF Jr, Lloyd JW, Smith EM, Wagoner JK. Cancer mortality among nuns: role of marital status and etiology of neoplastic disease in women. *Journal of the National Cancer Institute*. 1969; 42: 455–468.
- [49] Yurtdaş G, Acar-Tek N, Akbulut G, Cemali Ö, Arslan N, Beyaz Coşkun A, *et al.* Risk factors for constipation in adults: a cross-sectional study. *Journal of the American College of Nutrition*. 2020; 39: 713–719.
- [50] Pejčić T, Tosti T, Džamić Z, Gašić U, Vuksanović A, Dolićanin Z, *et al.* The polyphenols as potential agents in prevention and therapy of prostate diseases. *Molecules*. 2019; 24: 3982.
- [51] Lall RK, Syed DN, Adhami VM, Khan MI, Mukhtar H. Dietary polyphenols in prevention and treatment of prostate cancer. *International Journal of Molecular Sciences*. 2015; 16: 3350–3376.
- [52] Fraga CG, Croft KD, Kennedy DO, Tomás-Barberán FA. The effects of polyphenols and other bioactives on human health. *Food & Function*. 2019; 10: 514–528.
- [53] Danneskiold-Samsøe NB, Dias de Freitas Queiroz Barros H, Santos R, Bicas JL, Cazarin CBB, Madsen L, *et al.* Interplay between food and gut microbiota in health and disease. *Food Research International*. 2019; 115: 23–31.
- [54] Bayer SB, Gearry RB, Drummond LN. Putative mechanisms of kiwifruit on maintenance of normal gastrointestinal function. *Critical Reviews in Food Science and Nutrition*. 2018; 58: 2432–2452.
- [55] Attaluri A, Donahoe R, Valestin J, Brown K, Rao SS. Randomised clinical trial: dried plums (prunes) vs. psyllium for constipation. *Alimentary Pharmacology & Therapeutics*. 2011; 33: 822–828.
- [56] Martin DA, Bolling BW. A review of the efficacy of dietary polyphenols in experimental models of inflammatory bowel diseases. *Food & Function*. 2015; 6: 1773–1786.
- [57] Beyer PL, Flynn MA. Effects of high- and low-fiber diets on human feces. *Journal of the American Dietetic Association*. 1978; 72: 271–277.
- [58] La J, Roberts NH, Yafi FA. Diet and men's sexual health. *Sexual Medicine Reviews*. 2018; 6: 54–68.
- [59] Mac Giobuin S, Kavanagh DO, Ryan R, Kinsella A, Myers E, Evoy D, *et al.* Acute colonic obstruction due to benign prostatic hypertrophy. *Irish Medical Journal*. 2009; 102: 52–53.

How to cite this article: Vladimir Ajdžanović, Marko Miler, Branka Šošić-Jurjević, Branko Filipović. The close proximity between the human rectum and prostate: a functional-anatomic arrangement favoring prostate health. *Journal of Men's Health*. 2023; 19(10): 1-6. doi: 10.22514/jomh.2023.094.