

Prostate Cancer Characteristics and Associated Factors in Northern Cameroon

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How to cite this paper: Richard, T.S., Ahmadou, M., Hervé, N.K.A., Faustin, S.E.P., Myriam, B.E., Franklin, D.S. and Bruno, T.P. (2021) Prostate Cancer Characteristics and Associated Factors in Northern Cameroon. *Journal of Cancer Therapy*, 12, 289-301.

<https://doi.org/10.4236/jct.2021.125027>

Received: February 26, 2021

Accepted: May 25, 2021

Published: May 28, 2021

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Abstract

Background: The incidence of prostate cancer in Cameroon has been increasing in an alarming rate. The aim of this study is to characterize the form of prostate cancer and associated factors in patients from Cameroon Northern Regions. **Methods:** All patients with positive prostate biopsy (cancer+) from June 2018 to November 2019 were studied (n = 177). The followings were retrieved: digital rectal examination, standard clinical examinations, laboratory data such as serum prostate-specific antigen (PSA) level, and the Gleason score. Patients self-administered a questionnaire assessing prostate cancer's risk factors. **Results:** Patients were mainly from the Far North region (36.72%), and were either farmers or breeders (48.01%). Only prostate adenocarcinoma was present, with predominance of aggressive forms (Gleason score ≥ 7). Significant relationships were observed between Gleason score and 1) patients' age (P = 0.006), 2) history of urinary tract infections (P = 0.015) and of exposure to agricultural products (P = 0.049), 3) clinical signs (nycturia, pollakiuria, poor acute urine retention, and dysuria) (P = 0.019), 4) prostate weight, and 5) serum PSA levels (P < 0.0001). **Conclusion:** Aggressive forms of adenocarcinoma are the main prostate cancer in these regions, underlining the need for strategies aimed at raising prostate cancer awareness and early detection.

Keywords

Cancer, Prostate, Gleason Score, Risk Factors, Africa

1. Background

Prostate cancer is the second most common malignancy in males and the sixth leading cause of cancer mortality in men with a relatively higher death rate in men of African descent [1] [2]. The estimated mortality in 2018 was 4.03% worldwide and 12.04% in Cameroon, where it is the third leading cause of cancer death after breast and cervical cancer [3] [4]. Prostate cancer develops either in the epithelial or the connective components of prostate, resulting in either adenocarcinoma (more common) or sarcoma [5] [6].

When detected early and treated adequately, prostate cancer is curable in 95% of cases [1] [7]. Key diagnostic tools include the serum Prostate-Specific Antigen (PSA) level and the degree of histological differentiation evaluated by the Gleason score, a key element in the therapeutic decision and in the evaluation of the aggressiveness and evolution of the tumour [8] [9] [10]. The spread of use of diagnostic tools, such as the PSA level and the Digital rectal examination (DRE), for prostate cancer screening in Western countries increased the early detection of cases and improved the prognosis [3] [11]. On the other hand, in Cameroon as in most African countries, about 80% of cases are diagnosed at an advanced stage with death occurring within 12 months following diagnosis in most patients, due to: 1) the lack of hospitals with the right equipment and trained personnel for detecting and treating the disease; 2) the lack of awareness of the population about the disease and its risk factors; 3) the absence of national or local screening programmes; and 4) the costs of diagnostic that the majority of the population cannot afford [1] [2] [6] [12] [13] [14].

Fighting prostate cancer in Cameroon involves identifying the risk factors that are common in the country. The aim of the present study was to contribute to the primary prevention of prostate cancer by identifying the risk factors linked to the high incidence in northern Regions of Cameroon and to the secondary prevention by identifying the subtypes of prostate cancer present.

2. Materials and Methods

2.1. Participants and Ethical Considerations

The present retrospective, cross-sectional and descriptive study was performed using historical data from the Urology Department of Ngaoundere Islamic Hospital, Ngaoundere, Cameroon, obtained between June 2018 and November 2019. The study included all the patients whose biological assessment mentioned the performance of a prostate biopsy. Patients whose diagnosis after biopsy was a non-malignant prostate tumour were excluded. The data collected were anonymized to protect the privacy of participants.

The study procedures were approved by the Department of Biomedical Sciences of the University of Ngaoundere and by the Institutional Review Board of Ngaoundere Islamic Hospital (Ref. No. 2019/105/UN/R/DFS/CD-SBM).

2.2. Procedures and Data Collection

Information on patients' socio-demographic characteristics and history, including exposure to prostate cancer's risk factors (history of urinary tract infections, tobacco consumption, alcohol and feeding habits...) was obtained using a questionnaire. Findings from digital rectal Examination (DRE) following clinical standard procedures (assessing the volume, consistency and regularity of the prostate) were also done, as well as other clinical data relevant for the study such as the PSA level and the Gleason score. The Urology Department of Ngaoundere Islamic Hospital determined the the aggressiveness of prostate cancers by applying standardized Gleason classification (2 to 5, 6, 3 + 4, 4 + 3, 8, and 9 to 10) [15] to the anatomopathological findings of H&E stained prostate biopsies. The weight of the prostate determined using ultrasound was also available.

2.3. Prostate Specific Antigen (PSA) Assay

Available data on the serum PSA level were obtained using the Chemiflex flexible assay protocol in the ARCHITECT i2000SR automatic immunoassay analyzer (Abbott Diagnostics, Lake Forest, IL, USA), as recommended by the manufacturer. Briefly, 75 uL of serum was pipetted and transferred to a microcentrifuge tube containing paramagnetic microparticles coated with anti-PSA antibodies. The tube was closed and shaken vigorously for 5 min with an agitator at room temperature to allow an optimal binding of the serum PSA to the anti-PSA coated microparticles. Then, after rinsing, 75 uL of acridinium-labelled anti-PSA antibody conjugate was added to the mixture and incubated at room temperature for 15 min. Subsequently the pre-activation and activation solutions were added to the reaction mixtures and the resulting chemiluminescent reaction was measured in relative units of URL light using ARCHITECT i2000SR.

2.4. Statistical Analysis

Data were collected, organized, and presented as frequency distributions. Data analysis was performed using XLStat Version 2019. The χ^2 test of independence was used to determine the existence of significant relationships between the Gleason score and: 1) socio-demographic factors; 2) patients' history of risk factors; 3) clinical and paraclinical factors. Statistical significance was set at $P < 0.05$.

3. Results

Of the 325 biopsies taken, 177 (54.46%) were malignant prostate tumour. They were included in the study

3.1. Socio-Demographic Characteristics

Table 1 shows the socio-demographic characteristics of prostatic cancer patients. Most patients were between [60 - 70] years with a frequency of 56.49% ($N = 100/177$) (**Table 1**). Of the three regions of Northern Cameroon, the Far

North region was the most represented with 36.72% (N = 65/177) of patients (**Table 1**). Most of the patients (92.69%; 164/177) were married. The Peulh tribe was predominant with a representativeness of 38.98%. Together, the farmers and breeders represented 48.02% (N = 85/177) of patients (**Table 1**).

Table 1. Socio-demographic characteristics of prostatic cancer patients.

Characteristics	N (/177)	%
Age (years)		
[50 - 60[	19	10.73
[60 - 70[	100	56.50
[70 - 80[	48	27.12
[80 - 90[	7	3.96
≥90	3	1.70
Region of origin		
Adamawa	53	29.94
Far North	65	36.72
North	59	33.33
Tribe		
Guisga	12	6.78
Kotoko	6	3.39
Mandara	6	3.39
Moundang	19	10.73
Peulh	69	38.98
Toupouri	12	6.78
Other	53	29.94
Marital status		
Single	0	0.00
Married	164	92.66
Divorced	3	1.69
Widower	10	5.65
Occupation		
Farmer	53	29.94
Trader	36	20.34
Breeder	32	18.08
Civil servant	48	27.12
Unemployed	8	4.52

3.2. Risk Factors' History

Table 2 presents the proportion of prostatic cancer patients exposed to known risk factors of the disease. Notably, 67.80% (N = 120/177) of patients had a history of regular dairy product consumption, 33.89% (N = 60/177) had a history of regular tobacco consumption, 23.16% (N = 41/177) had a history of urinary tract infection, and 20.90% (N = 37/177) had a history of regular alcohol consumption (**Table 2**).

3.3. Clinical and Paraclinical Characteristics of Patients

The average duration of symptoms before patients arrived at the hospital was 6 months. The main reasons for consultation were disease complications, particularly acute urinary retention, and the most recurrent complaints of patients were pelvic pain, dysuria, pollakiuria, and local spreading features such as waist pain and legs' swelling.

Table 3 presents some clinical and paraclinical characteristics of prostatic cancer patients, notably the number of patients displaying nycturia, pollakiuria, acute urine retention (AUR), and dysuria, as well as the frequencies of patients in ranges of prostate weight, PSA levels, and Gleason score. About 59.89% (N = 106/177) of patients had dysuria, 42.37% (N = 75/177) had their prostate weight ranging between 25 and 50 g, 61.58% (N = 109/177) had a PSA level higher than 20 ng/mL. In addition, 44.63% of patients (N = 79/177) had a Gleason score ranging between 7 and 9 (**Table 3**).

3.4. Relationships of Factors with the Gleason Score

3.4.1. Relationships with Frequencies of Patients in Socio-Demographic Factor Groups

Table 4 shows the result of χ^2 test of independence assessing the relationships between the frequencies of patients in Gleason score ranges and frequencies of patients in groups of socio-demographic factors. There was a significant relationship (P = 0.006) between the frequencies of patients in Gleason score ranges and the frequencies of patients in age groups. Notably, 75.00%, 80.00%, and 82.69% of patients in age groups [50 - 60[, [60 - 70[, and [70 - 80[, respectively, had a Gleason score between 6 and 9 (**Table 4**). Gleason scores ≥ 9 were observed in 1.13% of patients aged [50 - 60[years, 1.70% aged [60 - 70[, 3.39% aged [70 - 80[, and 6.78% aged [80 - 90[(**Table 4**). Instead, there was not any clear relationship (P > 0.05) between the frequencies of patients in Gleason score and the frequencies of patients in groups of region of origin, tribes, or occupation (**Table 4**).

3.4.2. Relationships with Frequencies of Patients with History of Risk Factors

Table 5 shows the result of χ^2 test of independence assessing the relationships between the frequencies of patients in Gleason score ranges and frequencies of patients in groups with risk factors' history. There were significant relationships between the frequencies of patients in Gleason score ranges and: 1) frequencies

of patients with history of urinary tract infections ($P = 0.015$); 2) frequencies of patients with history of regular exposure to agricultural products ($P = 0.049$) (Table 5). The frequencies of patients in Gleason score ranges increased with frequencies of patients with history of urinary tract infections (1.13%, 4.52%, and 17.51% for scores $[2 - 6[$, $[6 - 7[$, and ≥ 7 , respectively) and with frequencies of patients with history of regular exposure to agricultural products (2.83%, 6.22%, and 16.95%) (Table 5).

Table 2. Patients' history of risk factors.

History of risk factors	N (/177)	%
History of urinary tract infections	41	23.16
History of regular exposure to agricultural products	25	14.12
History of regular tobacco consumption	60	33.90
History of regular alcohol consumption	37	20.90
History of regular fried food consumption	20	11.30
History of regular dairy product consumption	120	67.80
History of regular charcuterie consumption	33	18.64

Table 3. Some clinical and paraclinical characteristics of prostatic cancer patients.

Clinical and paraclinical characteristics	N (/177)	%
Clinical signs		
Nycturia	13	7.35
Pollakiuria	15	8.48
AUR [^]	43	24.29
Dysuria	106	59.89
Prostate weight(g)		
Absent	12	6.78
$[25 - 50[$	75	42.37
$[50 - 75[$	52	29.38
$[75 - 100]$	38	21.47
PSA^{^^} levels (ng/mL)		
0	12	6.78
<4	3	1.70
$[4 - 20]$	53	29.94
>20	109	61.58
Gleason score ranges		
$[2 - 6[$	24	13.56
$[6 - 7[$	51	28.81
$[7 - 9[$	79	44.63
$[9 - 10]$	23	12.99

AUR[^]: acute urine retention. PSA^{^^}: Prostate-Specific Antigen.

Table 4. Relationships of frequencies of patients in Gleason score ranges with frequencies of patients in socio-demographic factor groups.

Characteristics	Gleason Score (%)				Total (%)	P-value
	[2 - 6[	[6 - 7[	[7 - 9[	[9 - 10]	
Age (years)						
[50 - 60[0.565	1.695	3.390	1.130	6.780	0.006***
[60 - 70[	6.780	19.774	14.124	1.695	42.373
[70 - 80[	1.695	3.955	20.339	3.390	29.379
[80 - 90[	4.520	3.390	6.780	6.780	21.469
≥90	0.565	1.695	3.390	1.130	6.780	
Region of origin						
Adamawa	2.825	11.199	11.864	3.955	29.944	0.386
Far North	5.085	11.299	15.819	4.520	36.723	
North	5.650	6.215	16.949	4.520	33.333	
Tribe						
Guisga	1.130	1.130	3.955	0.565	6.780	0.324
Kotoko	0.000	1.130	0.565	1.695	3.390	
Mandara	0.000	0.565	2.825	0.000	3.390	
Moundang	2.260	2.260	4.520	1.695	10.734	
Peulh	4.520	11.299	18.079	5.085	38.983	
Toupouri	0.000	2.260	3.955	0.565	6.780	
Other	5.650	10.169	10.734	3.390	29.944	
Occupation						
Farmer	3.390	9.040	14.124	3.390	29.944	0.808
Trader	2.260	5.085	9.040	3.955	20.339	
Breeder	1.695	5.085	10.169	1.130	18.079	
Civil servant	5.085	7.910	10.169	3.955	27.119	
Unemployed	1.130	1.695	1.130	0.565	4.520	

***P < 0.001, χ^2 test of independence.**Table 5.** Relationships of frequencies of patients in Gleason score ranges with frequencies of patients with prostatic cancer risk factors.

Prostatic cancer risk factors	Gleason Score (%)				Total (%)	P-value
	[2 - 6[	[6 - 7[	[7 - 9[	[9 - 10]		
History of urinary tract infections	1.13	4.52	11.86	5.65	23.16	0.015*
HRC [^] of alcohol	5.09	7.35	15.82	5.65	33.90	0.427
HRC of tobacco	3.39	4.52	10.17	2.83	20.90	0.738
HRE ^{^^} to agricultural products	2.83	6.22	11.30	5.65	25.99	0.049*
HRC of fried foods	2.26	2.83	2.83	3.39	11.30	0.211
HRC of dairy products	10.73	20.34	26.55	10.17	67.80	0.154
HRC of charcuterie	2.83	2.83	8.48	4.52	18.64	0.083

[^]HRC: History of regular consumption. ^{^^}HRE: History of regular exposure. *P < 0.05, χ^2 test of independence.

No significant relationship was observed between the frequencies of patients in Gleason score ranges and the frequencies of patients in with history of other risk factors, which are history of regular consumption of tobacco, alcohol, fried foods, dairy products, and charcuterie (**Table 5**).

3.4.3. Relationships with Frequencies of Patients with Clinical and Paraclinical Signs

Table 6 shows the result of χ^2 test of independence assessing the relationships between the frequencies of patients in Gleason score ranges and frequencies of patients in groups with clinical and paraclinical signs. There was a significant relationship between the frequencies of patients in Gleason score ranges and the frequencies of patients with clinical signs (nycturia, pollakiuria, poor acute urine retention, and dysuria) ($P = 0.019$). The frequencies of patients with clinical signs increased with Gleason scores, that is (respectively for scores [2 - 6[, [6 - 7[, and ≥ 7): 0.00%, 2.26%, and 6.22% for pollakiuria; 5.09%, 7.91%, and 11.30% for poor acute urine retention; and 5.65%, 16.95%, and 37.29% for dysuria; with the exception of nycturia where comparable frequencies were observed (2.83%, 1.70%, 2.83%) (**Table 6**).

Table 6. Relationships of frequencies of patients in Gleason score ranges with frequencies of patients with clinical and paraclinical signs.

Characteristics	Gleason Score (%)				Total (%)	P-value
	[2 - 6[	[6 - 7[	[7 - 9[	[9 - 10]	
Clinical signs						
Nycturia	2.825	1.695	2.825	0.000	7.345	0.019*
Pollakiuria	0.000	2.260	4.520	1.695	8.475	
AUR [^]	5.085	7.910	10.734	0.565	24.294	
Dysuria	5.650	16.949	26.554	10.734	59.887	
Prostate weight						
Absent	0.565	1.695	3.390	1.130	6.780	<0.0001***
[25 - 50[	6.780	19.774	14.124	1.695	42.373
[50 - 75[	1.695	3.955	20.339	3.390	29.379
[75 - 100]	4.520	3.390	6.780	6.780	21.469	
PSA^{^^}levels (ng/mL)						
0	2.260	0.000	2.825	1.695	6.780	<0.0001***
<4	0.000	0.565	0.565	0.565	1.695	
[4 - 20]	6.780	14.124	7.910	1.130	29.944	
>20	4.520	14.124	33.333	9.605	61.582	

[^]AUR: acute urine retention. ^{^^}PSA: Prostate-Specific Antigen. * $P < 0.05$, *** $P < 0.001$, χ^2 test of independence.

There was a significant relationship between the frequencies of patients in Gleason score ranges and the frequencies of patients in prostate weight groups ($P < 0.0001$) (**Table 6**). Overall, the frequencies in Gleason score ranges increased with frequencies in increasingly high prostate weight groups (for scores [2 - 6], [6 - 7], and ≥ 7 , respectively): 6.78%, 19.77%, and 15.82% for [25 - 50[g; 1.70%, 3.96%, and 23.73% for [50 - 75[g; and 4.52%, 3.39%, and 13.56% for [75 - 100] g (**Table 6**).

There was also a significant relationship between the frequencies of patients in Gleason score ranges and the frequencies of patients in serum PSA level groups ($P < 0.0001$) (**Table 6**). Overall, the frequencies in Gleason score ranges increased with frequencies in groups with increasingly high PSA levels (for scores [2 - 6], [6 - 7], and ≥ 7 , respectively): 2.26%, 0.00%, and 4.52% for 0 ng/mL; 0.00%, 0.57%, and 1.13% for < 4 ng/mL; 6.78%, 14.12%, and 9.04% for [4 - 20] ng/mL; and 4.52%, 14.12%, and 42.94% for > 20 ng/mL (**Table 6**).

4. Discussion

The findings of the present study suggest that the risk factors shared by most prostate cancer patients in North Cameroon were: 1) an advanced age; 2) a history of urinary tract infections; 3) a history of regular exposure to agricultural products; 4) the presence of clinical signs, such as nycturia, pollakiuria, poor acute urine retention, and dysuria; 5) high prostate weight; and 6) high serum PSA levels. Adenocarcinoma was the only prostate cancer type found in all patients in this study, which is in agreement with studies in other regions of Cameroon [13] [14] and in many other sub-Saharan African countries where adenocarcinoma was the predominant histological type with a range of more than 95% [1] [11].

In this study, the average age of the patients was 59.43 ± 8.98 years, the youngest patient was 54, and the age group with the highest number of patients was 60 to 70 years. This observation is in agreement with other studies in Cameroon and other African countries [1] [2] [14] [16]. The emergence of prostate cancer at an advanced age has been linked to many ageing factors, including marked DNA damages, alterations in the biosynthesis of androgenic hormones and in the control of the cell cycle [11] [17] [18].

Farmers and breeders were the most affected (48.01%) and there was a significant relationship between the frequencies of patients in Gleason score ranges and frequencies of patients with history of regular exposure to agricultural products. This finding is in agreement with various studies that have shown that occupations requiring the use of insecticides, pesticides and disinfectants are associated with higher risk for cancer [19] [20]. Notably, dairy products were consumed by almost all patients and there was a relationship between these foods and the Gleason score. This is also in agreement with previous reports showing that milk consumption increases the risk of prostate cancer at least partly due to high calcium content that may increase prostate carcinogenesis by lowering se-

rum 1,25-dihydroxyvitamin D concentrations, [9] [21]. It was also hypothesized that oestrogens and insulin-like growth factor-1 (IGF-1) contained in cow milk may stimulate the growth of tumours, particularly in sensitive breast and prostate tissues [22].

On the same hand, the Peulh tribe whose occupation is mainly animal husbandry, constituted 36.72% of the patients. Patients of this tribe come to hospitals only at prostate cancer advanced stage because to them pathologies affecting the urogenital system are taboo. Overall, in our study, most patients visited the hospital more than 6 months after the onset of symptoms and the main reason for consultation was disease complications, particularly acute urinary retention. Not surprisingly, 61.58% of patients already had high PSA levels (>20 ng/ml) and 86.44% a Gleason score of 6 or higher. In addition to cultural considerations, this finding may be explained by poverty in this area of Cameroon where people depend on small farms often on an ingrate land. This corroborates previous reports showing that late presentation of patients in African hospitals is due at least partly to the lack of financial resources to afford a consultation, to poor knowledge on the signs and symptoms of prostate cancer, and to the lack of national screening strategies [2] [6] [23]. Cameroonian health Authorities should devise and implement a national strategy to raise awareness about prostate cancer, signs and risk factors, to make early detection of cases possible, instead of current late stage detections whose treatment is often associated with poor prognosis [1] [2] [8] [12] [14] [23].

Moreover, most of the patients in the study were married (92.69%), in a geographical area where the culture encourages men to have more wives, indicating that these patients were sexually active. Data on the role of sexuality in prostate carcinogenesis are controversial [24] [25] [26]. However, it was reported that the risk for developing prostate cancer increases with the number of sexual partners [27], suggesting that intense sexual activity may also be a risk factor in North Cameroon. Other established risk factors worth noticing [7] [10] [16] [18] [28] [29] included history of urinary tract infections, history of regular tobacco and alcohol consumption (23.16%, 33.89% and 20.20% of patients, respectively).

5. Conclusion

In the present study, advanced age history of urinary tract infections and of regular exposure to agricultural products, the presence of nycturia, pollakiuria, poor acute urine retention, and dysuria, high prostate weight; and high serum PSA levels were the most common risk factors of prostate cancer in patients from Northern Regions of Cameroon, with significant relationships with the Gleason score. Gleason scores higher than 7, reflecting aggressive cancer and poor prognosis were observed in more than 50% of the patients, strongly suggesting that aggressive forms of prostate cancer are common in Cameroon Northern Regions. Strategies to raise prostate cancer awareness and for early detection of cases are highly needed in these Regions.

Acknowledgements

The authors thank the medical professionals who provided their support in the clinical part of the study and in data analysis, in particular those of the Urology Department of Ngaoundere Islamic Hospital, Ngaoundere, Cameroon.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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