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Original Research Article

Survey on cancer incidence around Chengannur, Kerala, with focus on major risk factors

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ABSTRACT

Background: Community awareness regarding the specific risk factors that enhance susceptibility to cancer is limited. This survey was undertaken to examine the prevalence of cancer cases in and around Chengannur, including the Alappuzha and Pathanamthitta districts of Kerala, with special attention to risk factors.
Methods: Cancer cases were identified through direct and indirect interviews with cancer patients and their relatives. Hospital records at the Government Hospital, Kozhencherry and the Health Centre, Chengannur, were also examined for data collection.
Results: A total of 285 cases were analysed with 26 cancer types recorded. The highest number of cases was observed with cancers of the breast (18.2%), followed by lungs (15.1%). Females comprised 52.6%, while males accounted for 47.4%. Chi-Square test ($p<0.001$) confirmed a significant association between cancer type and gender, with lungs, oral, brain and liver largely affecting males, while breast, cervix and ovary were female dominant. A peak of incidence of cancer was observed within the 40–60 years age group. Tobacco use was found to be the predominantly contributing risk factor (37.2%), followed by alcohol consumption (32.6%) and was strongly associated ($p<0.001$) with specific cancer types. Age, certain chemicals, family history, poor diet and certain hormones were also significant, comprising 17.5%, 16.8%, 14.7%, 12.6% and 10.9%, respectively.
Conclusions: The study provides valuable perspectives into cancer profiles of the Chengannur region, predominantly driven by lifestyle factors. Findings recommend community campaigns on cancer awareness focusing on midlife surges, gender-specific patterns and sustainable lifestyle shifts to reduce cancer risk.

Keywords: Alappuzha, Cancer statistics, Gender-specific, Lifestyle risk, Regional cancer burden

INTRODUCTION

Cancer is a major global health issue, as one in three individuals is likely to develop cancer in their lifetime. Over 19 million new cancer cases are reported annually worldwide. Cancer incidence and mortality are rapidly increasing in low- and middle-income countries, where 75% of global cancer deaths are projected to occur by 2030.[1] In India, cancer incidence exceeds 1.4 million new cases annually, with Kerala bearing a notably high burden. Cancer cases and deaths in Kerala are increasing every year.[2] Approximately 88,460 cases have been reported annually in Kerala, with 43,110 among males and 45,350 among females.[3,4] Carcinogens, such as tobacco, asbestos, arsenic, ionising radiation (e.g., gamma and X-rays), ultraviolet radiation and exhaust fumes, directly damage DNA and promote oncogenesis.[5,6] Immunosuppressive conditions, including HIV, further elevate cancer risk by impairing the body's defenses against infections and malignant transformation. Symptoms vary by tumour location, size and metastasis;

lumps in the breast or testicle, for instance, may signal malignancy.[7] Early detection of cancer, before metastasis, significantly enhances treatment success and the potential for cure. Physicians rely on patient symptoms and several other procedures to diagnose cancer. Advanced imaging techniques such as X-rays, CT scans, MRI scans, PET scans and ultrasound scans are used to detect tumour locations and assess affected organs.[8]

The precise reasons why one individual develops cancer and another does not often remain indefinable to physicians. However, research consistently identifies specific risk factors such as tobacco use, poor diet, obesity, infections, radiation and environmental exposures that enhance susceptibility to the disease.[9] Yet public awareness regarding the associated lifestyle risks and the critical signs that notify the onset of malignancy remains limited.

Over 70% of cancer cases in India are diagnosed at advanced stages. This late detection is worsened by uneven diagnostic and treatment practices, resulting in a significant economic burden and a lower survival rate.[10] In Alappuzha district, the number of cancer cases registered at the Government Medical College almost doubled compared to a decade ago.[11] In view of the limited awareness and the widespread rise in cancer occurrence, this survey was undertaken. The survey examines cancer prevalence in and around the Chengannur region, focusing on the most prevalent cancer types, symptoms and associated risk factors. The study is expected to throw light on emerging cancer trends, symptoms and associated risks specific to the region.

METHODS

Study design

The present survey was conducted in 2022–2023 and covered the areas surrounding Chengannur in the districts of Alappuzha and Pathanamthitta, Kerala, India. The study aimed to evaluate the prevalence of cancer and its associated risk factors among the local population.

Data source

Primary data were collected through direct and indirect oral interviews with the cancer patients and their relatives. Based on the existing literature, a structured questionnaire was prepared for use in the survey's detailed case studies. Variables, including age, sex, occupation, symptoms, risk factors, treatment methods and treatment centres, were systematically organised for comprehensive data collection. Secondary data were obtained from hospital records. Government Hospital, Kozhencherry, was visited and, with the hospital authorities' cooperation, patient records were analysed for confirmed cancer cases. Data were also obtained from records at the Health Centre, Mulakuzha, Chengannur. Relevant details of each case were systematically documented in separate questionnaires.

Study population and sampling

The study population comprised confirmed cancer cases identified through interviews and hospital records. Convenience sampling was employed, focusing on accessible patients and records and no formal sample size calculation was specified.

Inclusion criteria

Only confirmed cancer cases diagnosed during 2022–2023 and individuals willing to participate were included in the study.

Exclusion criteria

Cases with incomplete records, non-residents of study districts, unconfirmed diagnoses and those who were not willing to participate in the interviews were excluded.

Data analysis

Data were entered into Excel spreadsheets and analysed using SPSS version 27.0. Descriptive statistics, such as frequencies, percentages and cross-tabulations, were used to summarise the data by sex, age groups and risk factors. Inferential analyses comprised Chi-square tests of independence and Fisher's exact tests to assess associations between categorical variables. A p-value of less than 0.05 was considered statistically significant.

Ethical considerations

Verbal consent was obtained from all participants prior to interviews. Confidentiality was maintained by anonymising data, securely storing records and excluding personal identifiers. No incentives were provided. Permissions were obtained from the respective healthcare institutions before accessing patient records. Permission from the Institutional Ethics Committee was obtained prior to study commencement.

RESULTS

A total of 285 cases (n=285) were analysed in the study. The highest number of cases was observed with cancers of the breast (18.2%), followed by lungs (15.1%) (Table 1). Intermediate frequencies were noted for oral cavity (9.8%), blood (8.4%), liver (6.0%), brain (6.0%) and cervical (3.9%) cancers. Cancers of the breast, lung, oral, blood, liver and brain together accounted for about 63.5% of the total cancer burden. The throat, uterus, bone, stomach, ovary, oesophagus and kidney each showed between 8 and 10 cases. Tongue, intestine and skin accounted for 4-7 cases each, while thyroid, rectum, urinary bladder and pancreas contributed about 2–3 cases

each. The maxilla, parotid gland, larynx, gall bladder and vagina accounted for only isolated cases.

The gender distribution indicated a significant predominance of cancer cases among females. Females comprised 52.6% (n=150), while males accounted for 47.4% (n=135) (Table 1). In females, breast cancer predominated (34%), with cervix (8%), lungs (8%) and oral (8%) following. Among males, lung cancer was the most prevalent (23.7%), followed by the cancer of the brain (12.6%), oral (11.9%), blood (11.1%) and liver (10.4%). The Pearson Chi-Square test ($\chi^2(16)=130.642$, $p<0.001$) and Likelihood ratio test ($\chi^2(16)=166.225$, $p<0.001$) both confirm a highly significant association between cancer type and gender distributions (N=281 valid cases) (Table 2). Cancers of the breast, cervix and ovary are female-dominant, whereas those of the lungs, oral, brain and liver are male-dominant (Figure 1). Fisher's exact test confirmed a significant association between cancer type and gender ($p<0.001$), consistent with the chi-square results despite small expected cell counts.

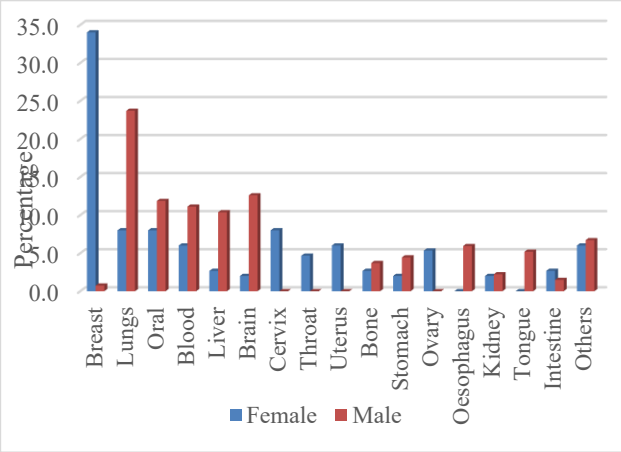

Figure 1: Gender-specific cancer sites.

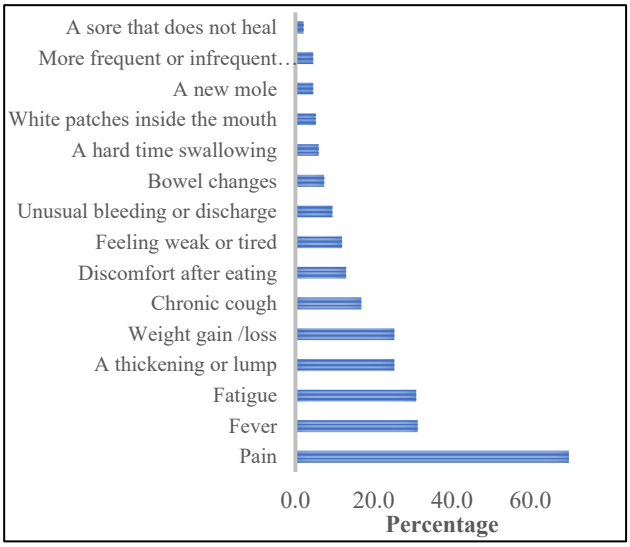

Figure 2: Prevalence of common cancer symptoms.

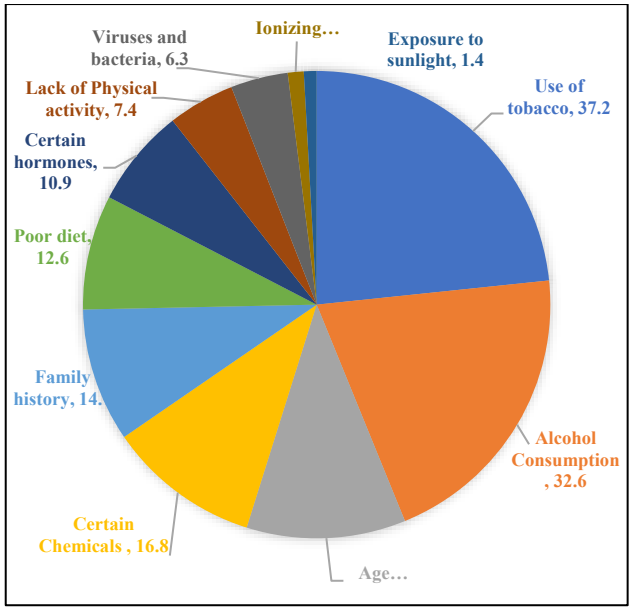

Figure 3: Leading cancer risk factors by attributable percentage.

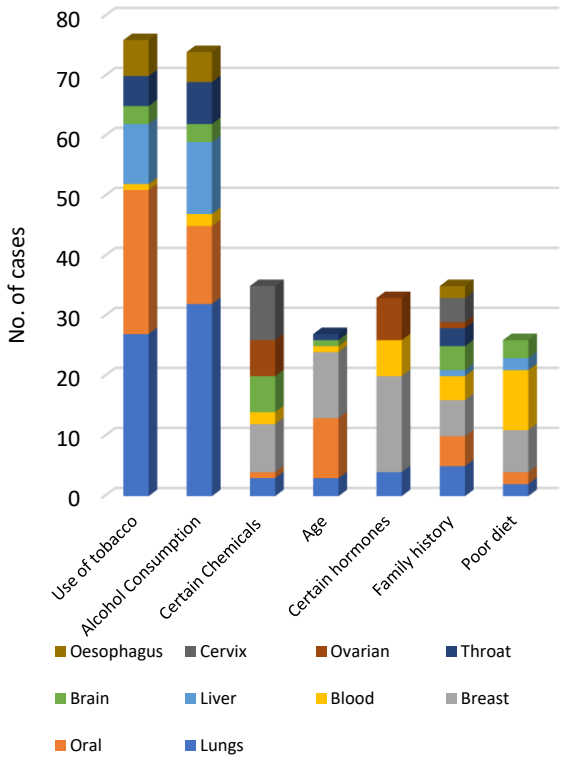

Figure 4: The top ten risk factor influenced cancers.

The age-specific distribution of cancer cases revealed a peak of incidence within the 40–50 years age group, followed by 50-60 (Table 3). 31.2% of cases fell within the 40-50 age group and 22.1% within the 50-60 age group. Males exhibited the highest number of cases (40%) in the 40-50 age bracket, followed by females (23.3%), indicating a midlife surge in malignancy.

Females showed a higher number of cases in the 50-60 age bracket (25.3%), followed by males (18.5%). Females and males showed notable cases in the 60-70 and 30-40 age groups as well. Chi-square test results indicate no statistically significant association between age-wise distribution of cancer and gender ($\chi^2(8) = 11.223$, $p=0.189$) (Table 4). Peak incidence remains consistent (40-60 years) for both, supporting uniform age-related risk across genders. Among the symptoms, pain emerged as the predominant symptom reported in 69.8% of the cancer cases analysed. Fatigue and fever ranked second (30.9%). Weight gain or loss and a thickening or lump, were reported in 25.3% of cases. Chronic cough, discomfort after eating and feeling weak or tired affected 16.8, 13 and 11.9% of cases, respectively. Unusual bleeding or discharge, bowel changes, difficulty in swallowing, white patches inside the mouth, new mole, infrequent urination, sore that does not heal, etc., were the least common symptoms, each noted in less than 10% of patients (Figure 2).

Among the assessed cancer risk factors, tobacco use was found to be the predominant contributor (37.2%), followed by alcohol consumption (32.6%) (Figure 3). Age, certain chemicals, family history, poor diet and certain hormones were also significant, comprising 17.5%, 16.8%, 14.7%, 12.6% and 10.9%, respectively. Lack of physical activity; viruses and bacteria were involved in 6-7% of cases. Exposure to sunlight and ionising radiation represented progressively smaller proportions. Chi-square analysis revealed significant associations between several risk factors and cancer types. Tobacco use ($\chi^2=44.91$, $p<0.001$), alcohol consumption ($\chi^2=38.66$, $p<0.001$) and exposure to chemicals ($\chi^2=45.70$, $p<0.001$) showed strong associations (Table 5).

Tobacco uses and alcohol consumption were strongly associated with lung, oral and liver cancers (Figure 4). Certain chemicals were associated with breast and cervical cancers. Age ($\chi^2=16.16$, $p=0.006$), poor diet ($\chi^2=20.40$, $p=0.001$) and lack of physical activity ($\chi^2=12.16$, $p=0.033$) were also significantly associated. However, hormonal factors, family history and infections did not show statistically significant associations ($p>0.05$). Some variables, including ionizing radiation and sunlight exposure, could not be reliably tested due to sparse data. Of the 285 cancer cases studied, 55% resulted in survival, while 45% were non-surviving. This narrow margin highlights a near-equal chance of recovery.

Table 1: Survey-based cancer cases in the Chengannur region.

Cancer site	Total		Females		Males	
	No. of cases, n=285	%	No. of cases n=150	%	No. of cases n=135	%
Breast	52	18.2	51	34.0	1	0.7
Lungs	43	15.1	12	8.0	32	23.7
Oral	28	9.8	12	8.0	16	11.9
Blood	24	8.4	9	6.0	15	11.1
Liver	17	6.0	4	2.7	14	10.4
Brain	17	6.0	3	2.0	17	12.6
Cervix	11	3.9	12	8.0	-	-
Throat	10	3.5	7	4.7	-	-
Uterus	9	3.2	9	6.0	-	-
Bone	9	3.2	4	2.7	5	3.7
Stomach	9	3.2	3	2.0	6	4.4
Ovary	8	2.8	8	5.3	-	-
Oesophagus	8	2.8	-	-	8	5.9
Kidney	8	2.8	3	2.0	3	2.2
Tongue	7	2.5	-	-	7	5.2
Intestine	6	2.1	4	2.7	2	1.5
Skin	4	1.4	1	0.7	2	1.5
Thyroid	3	1.1	2	1.3	1	0.7
Rectum	3	1.1	1	0.7	2	1.5
Urinary Bladder	2	0.7	2	1.3	-	-
Pancreas	2	0.7	1	0.7	1	0.7
Maxilla	1	0.4	-	-	1	0.7
Parotid gland	1	0.4	-	-	1	0.7
Larynx	1	0.4	-	-	1	0.7
Gall bladder	1	0.4	1	0.7	-	-
Vagina	1	0.4	1	0.7	-	-
Total	285	100.0	150	100.0	135	100.0

Table 2: Chi-square test results for cancer type by gender.

Value		df	Asymptotic significance (2-sided)
Pearson chi-square	130.642	16	<0.001
Likelihood ratio	166.225	16	<0.001
N of valid cases	281		

Table 3: Age-wise distribution of cancer cases in the Chengannur region.

Age group	Total		Females		Males	
	No. of cases n=285	%	No. of cases n=150	%	No. of cases n=135	%
0-10	1	0.4	1	0.7	0	0.0
10-20	11	3.9	9	6.0	2	1.5
20-30	15	5.3	8	5.3	7	5.2
30-40	42	14.7	23	15.3	19	14.1
40-50	89	31.2	35	23.3	54	40.0
50-60	63	22.1	38	25.3	25	18.5
60-70	46	16.1	28	18.7	18	13.3
70-80	15	5.3	7	4.7	8	5.9
80-90	3	1.1	1	0.7	2	1.5
90-100	0	0.0	0	0.0	0	0.0
Total	285	100.00	150	100.0	135	100.0

Table 4: Chi-square test results for age-wise distribution of cancer by gender.

Value		df	Asymptotic significance (2-sided)
Pearson chi-square	11.223	8	0.189
Likelihood ratio	12.066	8	0.148
N of valid cases	199		

Table 5: Chi-square test results for risk factors Vs cancer types.

Risk factor	χ^2 value	df	P value
Use of tobacco	44.91	5	<0.001
Alcohol consumption	38.66	5	<0.001
Certain chemicals	45.70	5	<0.001
Age	16.16	5	0.006
Certain hormones	8.80	5	0.118
Family history	3.70	5	0.594
Poor diet	20.40	5	0.001
Viruses and bacteria	8.78	5	0.118
Lack of physical activity	12.16	5	0.033

DISCUSSION

This local survey-based investigation offers critical insights into the cancer types, symptoms and risk factors prevalent in the Chengannur area and its premises. Among the 285 analysed cases, diverse malignancies were documented, including breast, lung, oral, blood, liver, brain, cervix, throat, uterus, bone, stomach, ovary, oesophagus, kidney, tongue, intestine, skin, thyroid, rectum, urinary bladder, pancreas, maxillary, parotid gland, laryngeal, gall bladder and vaginal cancers.

Breast cancer emerged as the leading type (18.2%), closely followed by lung cancer (15.1%). Breast, lung, oral, blood, liver and brain cancers collectively comprised approximately 63.5% of the total cancer burden. Gender distribution analysis revealed a slight female predominance in cancer cases over males. Breast cancer predominated in females, trailed by cervix, lung, oral and uterus. Lung cancer topped male cases, followed by brain, oral, blood and liver. Breast cancer predominance among females and lung cancer among males are consistent with the demographic and clinical profiles of cancer patients registered at the Hospital-Based Cancer Registry of Malabar Cancer Centre in the northern region of Kerala.[12]

The study aligns with Kerala's rising breast cancers amid improved diagnostics and longevity. A recent study conducted at Niranam panchayat of Pathanamthitta district, Kerala, reported breast cancer as the most prevalent type of cancer, with 37.3% of occurrences.[13] Breast cancer is, in fact, considered the most common form of cancer and the principal cause of death from cancer among women worldwide.[14] The increase in lung cancer cases lines up with Kerala's reported cancer trends from hospital-based registries in Thalassery (26.2%), Kochi (12.1%), Thiruvananthapuram (13%) and Kollam (18.2%).[15] This is higher than the world average (14.5%) and the Indian average (6.9%).[16,17] The female skew reported in the study contrasts with national trends, where cases are more common among males. Sex-linked tumour variations suggest the involvement of hormonal or reproductive factors. The occurrence of breast and cervical malignancies in female cases highlights targeted screening needs.

Tobacco uses and alcohol consumption emerged as the leading risk factors in this study (37% and 33%, respectively), highlighting their dominant role in driving the observed cancer burden. The use of tobacco or alcohol was found to be more associated with lung, oral and liver cancer. These findings align with Kerala's epidemiology, where use of tobacco, including smoking and chewing, fuels lung cancers.[18] According to the Indian Council of Medical Research's Hospital-Based Cancer Registry, tobacco consumption drives 33.3% of all cancers in India, accounting for 48.7% of cases in males and 16.5% in females.[19] Alcohol synergises these risks via hepatic and digestive tract damage. A study by Moreo-Lopez et al, has shown that the most important risk factor for developing oral cancer is tobacco consumption, followed by alcohol consumption.[20] According to previous workers, among various risk factors of cancer, tobacco is the most important avoidable risk factor of cancer of the oral cavity, lungs, oesophagus, stomach, liver, pancreas, kidney, bladder, cervix.[21] Passive exposure to environmental tobacco smoke at home or at work has been associated with lung cancer risk among never-smoking women.[22]

Age, certain chemicals, family history, poor diet and hormones were among the next highest attributable percentage risk factors in the present study. Risk factors of cancer, such as age and family history, are well established. Cancer risk increases with age and certain modifiable risk factors, including overweight and physical inactivity. Age was prominently linked to breast and oral cancer, echoing midlife peaks (40-50 years) in females and chemicals affecting breast and cervical cases, possibly from occupational or environmental exposures in the region. Family history was frequently observed in many cases of lung, breast, oral, blood and brain tumours. Poor diet was observed in many cases of blood cancer and in a few cases of breast cancer and brain tumour. According to Thorling, moderate exercise for prolonged periods evidently reduces the risk of some cancers.[23] Tominaga suggests that diet, exercise and stress, which play an important role in the aetiology of cancer, are also manageable risk factors of cancer.[21] The age-specific analysis identified a peak incidence of cancer in the 40-60 years group, followed by 60-70, signaling a midlife vulnerability that warrants scrutiny. Notable early cases in the 30-40 age group highlight premature onsets. The occurrence of cancer at comparatively younger ages requires further age-specific and community-based analysis of the causes and risk factors involved. In the susceptible age group of males aged 50-60, use of tobacco or alcohol was the major risk factor. In a previous study, the majority of oral cancer patients reported exposure to the major risk factors of tobacco and alcohol even at a younger age.[24] The majority of the cases analysed in the present study were found to be surviving. It emphasises that early detection cures many types of cancer. Pain was the most frequently reported symptom in 70% of cases, stressing its role as a symbol of advanced malignancies, often signaling tumour invasion. Fatigue and fever followed, reflecting systemic inflammatory responses common in cancers like lung and blood types prevalent here. Weight changes and lumps were also identified as indicators of tumour growth. Chronic cough and postprandial discomfort suggest respiratory and gastrointestinal involvement, which can lead to lung, oral and stomach malignancies. These patterns emphasise the need for multi-symptom screening for cancer. Symptoms such as intermittent fever, fatigue, chronic cough, weight gain or loss, etc., should not be taken lightly as they may indicate the onset of malignancy. Rare symptoms like new moles, bowel alterations, bleeding/discharge or urinary issues potentially indicate early-stage cancers such as skin, rectal or bladder cases.

One limitation of the present study is that the data were collected from a limited geographical area and a relatively small sample. This may restrict the generalisation of the findings beyond the study population. Further, the study relied largely on patient-reported information on lifestyle habits and risk factors, which may be subject to recall and reporting bias. In addition, the cross-sectional design limits the establishment of causal relationships between the identified risk factors and specific cancer types. Despite these limitations, the study provides valuable preliminary information regarding cancer incidence patterns and associated risk factors in the study area.

CONCLUSION

The study, conducted in and around Chengannur, provides valuable perspectives into cancer profiles amid Kerala's escalating incidence, predominantly driven by lifestyle factors. Tobacco use and alcohol consumption dominated, followed by age, chemical exposures, poor diet, hormones and physical inactivity. Among the cancers reported, breast cancer topped the list, closely followed by lung cancer. Most risk factors are modifiable through lifestyle shifts such as quitting tobacco,

moderating alcohol intake, adopting a good diet rich in fruits and vegetables, low in red meat and fats and engaging in routine exercise. Such interventions have the potential to prevent 40-50% of cancers. Targeted awareness campaigns focusing on midlife surges (40-60 years), gender-specific patterns (lung, brain and oral cancers in males; breast and cervical cancers in females) and rising regional burdens, as evidenced by the study, can help reduce cancer risk. Chengannur-centric findings emphasise the need for local education on sustainable lifestyle shifts, early screening policies and public health strategies to mitigate the projected rise in cancer cases by 2030.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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