



Correlation between BMI and Oral Cancer: A Hospital-Based Case-Control Study

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ABSTRACT

Increased body mass index (BMI) is considered a significant factor in several malignancies of body. It also affects the prognosis of the management of malignancies. Its role in cancer of the oral cavity should also be evaluated as another risk factor other than tobacco, alcohol, virus etc. Therefore this study was conducted to evaluate the correlation between BMI and cancer of the oral cavity. A total of 160 patients (140 males, 20 females) with confirmed histopathologic diagnosis of oral squamous cell carcinoma (OSCC) and 200 healthy controls were enrolled. Height and weight of each study subject were measured. BMI was calculated by dividing the weight of the subject in kilograms with the square of the height in the square of metres. Chi-square test was used for evaluation of the level of significance. The number of those subjects with OSCC belonging to the overweight and obese group was 136 while the number of those healthy controls belonging to the overweight and obese group was 24. The statistical analysis revealed a significant correlation between BMI and oral cancer. There is a significant correlation between oral cancer and increased BMI. Increased BMI can also be considered as another critical risk factor for oral cancer because it has been found associated with other cancers of the oral cavity.

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INTRODUCTION

Cancer of the oral cavity is the most common cancer among males in India. It contributes about 50 to 70% of total deaths due to cancer in our country. It is believed to be the most frequent cancer in other countries of the Asian subcontinent ([Khandala et al.,](#)

[2006](#)). Globally it is considered as the sixth most frequent cancer. The most commonly affected parts of the oral cavity due to oral cancer include tongue followed by the floor of the mouth, buccal mucosa, alveolar mucosa and periodontium. It can involve every portion of the head and neck region. There is accepted the fact that the prevalence of oral cancer is different in different parts of the world. In western countries like the USA and various countries of Europe, oral cancer contributes about 5 to 10 % of all cancers ([Wynder et al., 1957](#)).

However, it is more commonly observed in South East Asian countries like India, some African countries and some eastern countries of Europe, including France. The difference in the prevalence of oral cancer in different countries of the world is due to differences in lifestyle of their population. The increased occurrence of cancer in countries of Eastern Europe and France has been attributed to the intake of a large amount of alcohol and excessive

cigarette smoking. In our country, the excessive use of non-smoked tobacco like betel quid, areca nut, khaini etc. is the reason for the increased incidence of oral cancer (Boring *et al.*, 1992).

It is generally believed that oral cancer is affected by the presence of several risk factors. Among them, the most common risk factors responsible for causing oral cancer include tobacco abuse, alcohol abuse, non-smoked tobacco like betel leaves, poor nutrition and infections caused by virus and bacteria. Chronic inflammations can also act as a potential risk factor for developing cancer (Ha and Califano, 2004). Among them is Lichen planus, which is an autoimmune disease characterised by chronic inflammation. It has a property to get converted into malignancy in 0.3 to 3% cases. Another example of such condition is Barrett's oesophagus. It is the chronic inflammation of GIT of which mainly the upper portion is commonly involved. It acts as a precancerous condition which has an increased tendency to get converted into adenocarcinomas. Infections caused by bacteria and virus are also believed to cause chronic inflammation which can further proceed to get converted into carcinoma (Mccoy, 1978).

The association between oral cancer and body mass index have also been explored. It has been found that increased BMI is related to several other cancers of the body. Some of these cancers include breast cancer, colon cancer, oesophagus cancer, and several other cancers of the body. Increased BMI can be due to several factors like altered lifestyle activities. It is believed to cause increased accumulation of fats and abnormal body metabolism. Besides, it is also associated with increased amounts of chemical substance adipokine. Such biochemical changes are responsible for increased production of cells, causing tumour formation. In the USA, it has been found that there is a simultaneous increase in the incidence of oral cancer along with the increase in the incidence of obesity. This may be suggestive of any association between increased BMI and oral cancer. It has also been found that increased BMI also affects the prognosis of different cancers like cancer of tongue (Kreimer, 2005).

It has been reported that despite controlling the significant risk factors for oral cancer like tobacco abuse, alcohol, viral infection, there has been no reduction in the occurrence of oral cancer. It means there is a need for identification of some other possible risk factors for oral cancer. Recent research has shown that BMI is a significant risk factor in various cancers of our body. Its role in oral cancer also need to be evaluated (Renehan *et al.*, 2008).

Therefore this study was conducted to evaluate the

correlation between increased BMI and oral cancer.

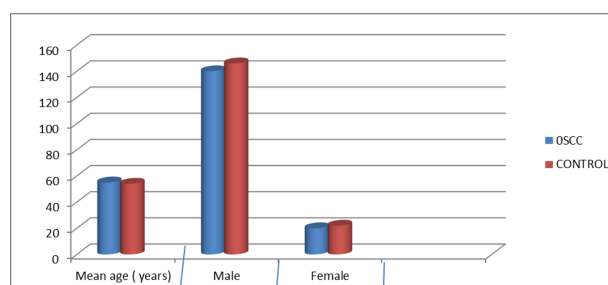
MATERIALS AND METHODS

The present study was conducted at Hamdard Institute of Medical Sciences and Research, New Delhi, for assessing the association between increased BMI and oral cancer. A total of 160 patients (140 males, 20 females) with confirmed histopathologic diagnosis of oral squamous cell carcinoma and 200 healthy controls were enrolled. Complete demographic details of all the subjects were recorded separately. Height and weight of each study subject were measured. BMI was calculated by dividing the weight of the subject in kilograms with the square of the height in the square of metres. The subjects were divided into four groups. Subjects with BMI less than 18.5 kg/m^2 were classified as underweight, those with BMI 18.5 to 23 kg/m^2 were classified as normal weight, those with 23 to 25 kg/m^2 were put as overweight, and those with BMI more than 25 kg/m^2 were classified as obese (Choi, 2011).

All the results were recorded in Microsoft excel sheet and were analysed with the help of SPSS software. Chi-square test was used for evaluation of the level of significance.

RESULTS

In the present study, a total of 160 patients with confirmed histopathologic diagnosis of oral squamous cell carcinoma and 200 healthy controls were enrolled. Mean age of patients of OSCC group and control group was 53.4 years and 51.7 years, respectively. There were 140 males and 20 females in OSCC group and 143 males and 17 females in the control group (Graph 1).



Graph 1: Demographic details

Table 1 shows the correlation between BMI and oral cancer in the subject's up to 50 years of age. Fifty-one subjects were found to be affected by oral squamous cell carcinoma. Out of these 09 subjects were less than 30 years old while 42 subjects were more than 30 years of age but not more than 50 years old.

Table 1: Association of BMI and OSCC in a subject's up to 50 years of age

Age Group (Years)	BMI (Body Mass Index)	OSCC Group	Control Group	p-value
Less than 30	Underweight (BMI <18.5 kg/m ²),	01	02	0.34
	Normal weight (BMI- 18.5 to 23 kg/m ²)	01	04	0.47
	Overweight:(BMI- 23 to 25 kg/m ²)	02	01	0.01*
	Obesity: (BMI 25 kg/m ²)	05	02	0.01*
30-50	Underweight (BMI <18.5 kg/m ²),	02	03	0.23
	Normal weight (BMI- 18.5 to 23 kg/m ²)	05	27	0.34
	Overweight:(BMI- 23 to 25 kg/m ²)	07	02	0.01*
	Obesity: (BMI 25 kg/m ²)	25	09	0.02*

*: Statistically significant

Table 2: Association of BMI and OSCC in subjects more than 50 years of age

Age Group (Years)	BMI (Body Mass Index)	OSCC Group	Control Group	p-value
50-70	Underweight (BMI <18.5 kg/m ²),	04	20	0.18
	Normal weight (BMI- 18.5 to 23 kg/m ²)	08	60	0.24
	Overweight:(BMI- 23 to 25 kg/m ²)	26	12	0.00*
	Obesity: (BMI 25 kg/m ²)	62	08	0.01*
≥70	Underweight (BMI <18.5 kg/m ²),	01	02	0.43
	Normal weight (BMI- 18.5 to 23 kg/m ²)	01	06	0.56
	Overweight:(BMI- 23 to 25 kg/m ²)	02	01	0.01*
	Obesity: (BMI 25 kg/m ²)	07	01	0.02*

*: Statistically significant

In subjects, less than 30-year-old age group the overweight subgroup consisted of 02 subjects in OSCC group and 01 subjects in the control group. The obese sub-group consisted of 5 subjects in OSCC group and 02 subjects in the control group. The underweight subgroup consisted of 01 subjects in OSCC group and 02 subjects in the control group. The normal weight sub-group consisted of 1 subject in OSCC group and 04 subjects in the control group.

In the category of 30 to 50 age group, the overweight subgroup consisted of 07 subjects in OSCC group and 02 subjects in the control group. The obese sub-group consisted of 25 subjects in OSCC group and 09 subjects in the control group. The underweight subgroup consisted of 02 subjects in OSCC group and 03 subjects in the control group. The normal weight sub-group consisted of 5 subjects in OSCC group and 27 subjects in the control group. While analysing statistically, it was seen that the presence of overweight and obese condition was a significant risk factor for the occurrence of OSCC.

Table 2 shows the correlation between BMI and oral cancer in subjects more than 50 years of age. 111

subjects were found to be affected by oral squamous cell carcinoma. Out of these 100 subjects were of 50-70 age groups while 11 subjects were more than 30 years of age but not more than 50 years old.

In subjects of 50-70 years, age group, the overweight sub-group consisted of 26 subjects in OSCC group and 12 subjects in the control group. The obese sub-group consisted of 62 subjects in the OSCC group and 08 subjects in the control group. The underweight subgroup consisted of 04 subjects in OSCC group and 20 subjects in the control group. The normal weight sub-group consisted of 08 subjects in OSCC group and 60 subjects in the control group. While analysing statistically, it was seen that the presence of overweight and obese condition was a significant risk factor for the occurrence of OSCC.

In subjects of more than 70 years, age group, the overweight sub-group consisted of 02 subjects in OSCC group and 01 subjects in the control group. The obese sub-group consisted of 07 subjects in OSCC group and 01 subjects in the control group. The underweight subgroup consisted of 01 subjects in OSCC group and 02 subjects in the control group.

The normal weight sub-group consisted of 01 subjects in OSCC group and 06 subjects in the control group. While analysing statistically, it was seen that the presence of overweight and obese condition was a significant risk factor for the occurrence of OSCC.

DISCUSSION

It is vital to follow the principle of eating for survival but never survive for eating, as this thinking is gaining a lot of acceptance in modern life. This is because obesity has been growing at a rapid rate. An interesting fact to note is that risk factors for poor oral health and oral cancer are the same. It includes abnormalities in diet, genetic setup, social and economic conditions along with various lifestyle carelessness. Obesity has got worldwide spread, and it is responsible for serious health issues like diabetes, hypertension, osteoporosis and several heart diseases.

Hence it has become a significant enemy to normal health. The major reasons for worldwide distribution of obesity include changes in lifestyle like increase in physical inactivity, unhealthy habits of eating, and changes in the social conditions. Obesity has also been found to be associated with several cancers of our body like breast cancer, colon cancer and some others ([Kaul et al., 2018](#); [Ram et al., 2011](#)).

Oral cancer is being considered as the most common cancer in our country. There is more than 50% mortality rate of the malignancy of the oral cavity. The prognosis of this cancer has not improved in the last five years. However, there has been a marked improvement in the prognosis of other cancers of the body ([Cali and Caprio, 2008](#)). It is significantly more common in the males and old age group. The more common site for oral cancer includes tongue followed by buccal mucosa, alveolar mucosa and others. There is a marked effect on the quality of life of patients as there is difficulty in speech, mastication, burning sensation etc. ([Morrison and Petersen, 2003](#)).

Generally, several risk factors are involved in the pathogenesis of oral cancer. Among them, tobacco, alcohol, viral infection are being considered as most important. But it has been found that despite controlling these risk factors, the incidence of oral cancer has not declined. It means that there are other possible risk factors. Increased BMI can also be considered as another critical risk factor for oral cancer because it has been found associated with other cancers of the oral cavity ([Iyengar et al., 2014](#)).

In our study, a total of 160 patients of OSCC were included out of 140 were males and 20 were females.

It has been found that more patients were male, and they were more 50 years old. In the category of 30 to 50 age group, the overweight subgroup consisted of 07 subjects in OSCC group and 02 subjects in the control group. The obese sub-group consisted of 25 subjects in OSCC group and 09 subjects in the control group. The underweight subgroup consisted of 02 subjects in OSCC group and 03 subjects in the control group. The normal weight sub-group consisted of 5 subjects in OSCC group and 27 subjects in the control group. While analysing statistically, it was seen that the presence of overweight and obese condition was a significant risk factor for the occurrence of OSCC.

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The results of our study are similar to some previous studies showing a significant association between oral cancer and increased BMI. [Kabat et al.](#) in 1994, conducted a study and found a direct relationship between increased BMI and oral cancer ([Kabat et al., 1994](#)).

Similarly, [Franceschi et al.](#) in 2001 performed research and concluded that there is a correlation between increased BMI and oral cancer ([Franceschi et al., 2001](#)). [Choi et al.](#) in 2011 conducted a study in Korea which demonstrated a significant association between obesity and oral cancer in females younger than 50 years of age ([Choi, 2011](#)). Our data also suggest that obesity may be another risk factor for oral cancer. [Nieto et al.](#) in 2003 conducted a study to evaluate the influence of body mass index on oral cancer in 375 cases. They found that there is an increased correlation between oral cancer and increased BMI ([Nieto et al., 2003](#)). A higher BMI was associated with increased risk of oral cancer among females, and non-smokers males as shown by a study carried out in Japan in 2005 ([Kuriyama et al., 2005](#)). [Iyengar et al.](#) in 2014 conducted a study to evaluate the role of obesity in the outcome of the management of oral cancer. It was concluded that the prognosis of oral cancer was not fair in patients with increased BMI ([Iyengar et al., 2014](#); [Wynder et al., 1957](#)).

CONCLUSION

From the above results, the authors concluded that a strong association exists between BMI and the occurrence of oral cancer. However, more research should be carried out to establish the fact that increased BMI is significantly correlated with oral cancer. Increased BMI can also be considered as another important risk factor for oral cancer because it has been found associated with other cancers of the oral cavity.

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Conflict of Interest

The authors declare that there is no conflict of interest for this study.

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