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Original Article

# Postoperative Hypoxemia and Oxygen Need in Bakers Compared with Cigarette and Water Pipe Smokers

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## Abstract

**Background:** Hypoxemia is a frequent complication after general anesthesia. It usually takes longer to recover in individuals with respiratory problems. Bakers may suffer from respiratory problems such as asthma. The objective of this study was to compare the occurrence of hypoxemia and duration of supplemental oxygen administration during recovery from general anesthesia in bakers and smokers.

**Methods:** One hundred and twenty patients (55-70 years) undergone elective eye surgeries were assigned to four groups (n=30 each) of cigarette smokers, water pipe smokers, bakers, and controls. Method of anesthesia was routine and the same in all groups. The rate of occurrence of hypoxemia in recovery room was assessed and the duration of supplemental $O_2$ to treat hypoxemia was measured in each group.

**Results** Arterial oxygen saturation ($SaO_2$) was above 92% before anesthesia in all groups. The rate of occurrence of hypoxemia was significantly higher in bakers (60%) compared to cigarette smokers (36.6%), water pipe smokers (40%) or controls (30%). Mean duration of supplemental $O_2$ administration was shorter in the control group (14±9 min) compared to those of cigarette smokers (30±16 min), water pipe smokers (28±14 min) or bakers (34±10 min).

**Conclusion** Bakers are more prone to the occurrence of postoperative hypoxemia than smokers or normal subjects. However, both bakers and smokers will need careful $SaO_2$ monitoring and longer duration of supplemental $O_2$ administration during recovery from general anesthesia if hypoxemia occurs.
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**Keywords** ● smoker ● baker ● Postoperative period ● hypoxemia ● oxygen therapy

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## Introduction

Smoking exposes body to over 4000 substances, some of which are harmful to smokers.[1] In the respiratory system, these substances produce chronic inflammation, narrowing of the airways and enzymatic digestion of the alveoli.[2] Such changes result in pulmonary emphysema, and reduce expiratory airflow to a degree sufficient to produce symptoms of respiratory limitations in approximately 15% of

smokers.[2] The ultimate consequences of such pathologic processes are interference with the uptake, transport, and delivery of oxygen to body tissues.[1]

Anesthesia is associated with ventilatory changes that start with the administration of premedications. Postoperative hypoxemia (POH) is the most obvious result of ventilatory changes during recovery.[3] It disappears rapidly in patients who do not have respiratory problems or are not smokers. But in elderly or in smokers, postoperative hypoxemia takes a longer period to fully recover.[3] Different types of smoking, including cigarette and water pipe exist. And their effects on POH have been studied.

Bakers, as their profession requires, mix flour, salt, yeasts, spices, sugar and other ingredients to prepare bread. They are exposed to various primary ingredients as well as fuel vapors and combustion products and may suffer from respiratory disorders such as allergic asthma.[4]

The objective of this study was to compare the occurrence of hypoxemia and duration of supplemental oxygen administration during recovery from general anesthesia in bakers and smokers.

## Patients and Methods

We enrolled 120 patients, who were candidates for elective eye surgeries to the study. Their age range was between 55 to 75 years and the operation would last less than one hour. The patients with asthma, chronic obstructive pulmonary disease, respiratory symptoms related to work, previous cardiothoracic operations, and those who had cardiovascular, renal, or liver diseases were excluded. We included those healthy individuals, cigarette smokers, water pipe smokers, and bakers to the study who did not have the exclusion criteria.

The study was approved by the Ethical Committee of Shiraz University of Medical Sciences.

Patients were assigned to one of the following groups (n=30 each): cigarette smokers (I), water pipe smokers (II),bakers (III) and controls (IV).The minimum requirement for allocation of patients in smoking groups were 10 pack-year history of cigarette smoking in group I, and 10 pack-year equivalent history of water pipe smoking in group II.[5] For bakers, a minimum of 10 years history of working in bakery for 6 hours a day and 6 days a week was considered. Finally, the individuals in group IV had no history of previous smoking or exposure to other inhalation.

*Methods*

Prior to induction of anesthesia, we recorded arterial oxygen saturation ($SaO_2$) in each patient using pulse oximetry (S 1600, Poyandegan Rah-Saadat, Iran). The minimum acceptable SaO2 to participate the study was 91%. Then, we induced anesthesia intravenously using midazolam (0.02-0.03 mg/kg), sodium thiopental (4-5 mg/kg) and cisatracurium (0.15 mg/kg).

A laryngeal mask airway (LMA) was used for assisting ventilation. Anesthesia was maintained using remifentanil (0.05-0.2 µg/kg/min) and propofol (50-100 µg/kg/min). After the operation, muscle relaxation was reversed, the sufficiency of which was determined clinically and by relaxometry. The patients transferred to the recovery room and the duration of recovery room stay was recorded.

We continuously monitored $SaO_2$ in the recovery room. The patients breathed room air unless $SaO_2$ decreased to less than 90%, which was defined as hypoxemia. Hypoxemic patients received oxygen via a face mask (6 l/min) for a maximum period of 15 minutes. Whenever $SaO_2$ exceeded 98% supplemental oxygen continued only for another 5 minutes (max 15 minutes). We continued $SaO_2$ monitoring for at least 30 minutes after discontinuing the supplemental oxygen.

*Statistical analyses*

Data were presented as mean±SD. One way analyses of variance (ANOVA) and Chi-square test was used to compare the occurrence of hypoxemia, duration of treatment with supplemental oxygen, and duration of recovery room stay among four groups. $P<0.05$ was considered as statistically significant.

## Results

There were no significant differences between the age, sex, and body weight of the patients in the four groups, nor were any differences between the duration of smoking, or occupational exposure of the smokers and the bakers. Furthermore, the duration of anesthesia was not statistically different among all groups (Table 1).

**Table 1:** Mean±SD values of age, body weight (BW), duration of smoking (SMD) and anesthesia duration (AnD) of cigarette (I) and water pipe (II) smokers, bakers (III) and controls (IV), (n=30 for each group)

| Groups | Sex (F/M) | Age (yr) | BW (kg) | SMD* (yr) | AnD (min) |
|---|---|---|---|---|---|
| I | 14/16 | 67.1±7.8 | 64.8±10.9 | 26.4±8.1 | 63.1±20.4 |
| II | 15/15 | 67.0±6.5 | 64.6±11.4 | 28±8.7 | 69.1±18.2 |
| III | 16/14 | 66.8±7.7 | 65.2±11.0 | 27.6±7.6 | 66.5±21.2 |
| IV | 14/16 | 65.7±5.9 | 66.5±10.2 | 0 | 63.5±22.2 |

* Indicates statistically similar inhalation exposure history among the exposed groups but not the control group

Before the operations $SaO_2$ was above 92% in all patients. There were also no significant differences between the mean $SaO_2$ in the four groups at the time of arrival or leaving the recovery room (Table 2). Fifty out of 120 patients developed hypoxemia ($SaO_2$ <90%), mostly during the first 10 min in the recovery room. The incidence of hypoxemia was significantly higher in bakers (60%) than in cigarette smokers (37%), water pipe smoker (40%), and control (30%) groups. Smokers (both groups) and bakers required longer durations of supplementary oxygen as well as recovery room stay compared to that of the control group but their differences were not statistically significant (Table 3).

**Table 2:** Mean± SD values of arterial oxygen saturation ($SaO_2$) in percentile(%) at preoperative period (Pre-OP), recovery room arrival (RRA) and discharge from recovery room (DRR) of cigarette (I) and water pipe (II) smokers, bakers (III) and controls (IV), (n=30 for each group)

| | $SaO_2$ (%) | | |
|---|---|---|---|
| **Groups** | **Pre-Op** | **RRA** | **DRR** |
| I | 94.6±3.8 | 91.7±3.4 | 92.8±2.7 |
| II | 94.8±2.2 | 93.4±3.7 | 92.5±2.2 |
| III | 94.2±3.8 | 91.7±3.4 | 92 ± 1.9 |
| IV | 94.9±4.1 | 92.8±5.4 | 93 ± 2.2 |

No significant difference among the groups at the studied periods

**Table 3:** The mean±SD values of the durations of recovery room stay (RRS) and supplemental oxygen therapy (Sup-O2) of cigarette (I) and water pipe (II) smokers, bakers (III) and controls (IV), (n=30 for each group)

| | **I** | **II** | **III** | **IV** |
|---|---|---|---|---|
| RRS (min) | 63± 20* | 55± 13* | 64±13* | 42±11 |
| Sup-$O_2$ (min) | 30±17 | 28±14* | 34±10* | 14±9 |

* significantly difference from control group at p<0.05

## Discussion

Previous studies showed that early postoperative hypoxemia (POH) occurred in 35-70% of patients who generally anesthetized for elective surgeries.[6] Postoperative hypoxemia might be the extension of gas exchange disorder that had occurred during anesthesia.[7] Many other factors may also be involved in this event, however, the role of smoking in POH has not been established yet. Some studies have reported no association between hypoxemia and smoking.[8,9] Some other studies suggested that smokers were at an increased risk of developing POH.[10-12]

Bakers exposed to flour dust are at high risk of developing allergic respiratory diseases such as rhinitis, bronchitis, and asthma.

Bakers asthma is one of the most common forms of occupational asthma.[13,14] Its symptoms can be developed in about 10% of bakers after a latency period of months, years, or even after decades.[13,14] No previous studies have examined the occurrence of POH in healthy bakers. Therefore, the present study was designed to compare the occurrence of POH and the duration of supplementing O2 during recovery in healthy bakers with those of cigarette or water pipe smokers.

We found no association between smoking and the incidence of POH compared with the control group. This finding was similar to the results of other studies done by Murray, Daley and their collegues.[8,9] However, we found that when hypoxemia occurred, the patients in smoking groups would need longer durations of supplemental $O_2$ administration and recovery room stay.

In group III the incidence of POH, the duration of supplemental $O_2$ and recovery room stay were increased indicating that both baking and smoking prolong the altered episode of gas exchange. So, if POH occurs, these patients will require prolonged administration of supplemental $O_2$. Moreover, our findings indicate that baking, rather than smoking, can be considered as a risk factor for POH. It is interesting to mention that even those bakers who seem to be free of asthma might have unapparent respiratory problems which may increase the risk of respiratory disturbances and POH after general anesthesia.

## Conclusion

The results of this study suggest that special attention should be paid to bakers during the recovery room stay, because they are at a greater risk of developing postoperative hypoxemia.

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