

## A STUDY ON INHALATION OF AIR POLLUTANT MATERIAL AND MOUTH BREATHING CORRELATION ON MOUTH BREATHING AND LIFE EXPECTANCY

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### Abstract

Breathing influenced by the surrounding environmental conditions including air pollutants with all material contents and how the best way for breathing. That is why breathing process include the air quality must be understood, by doing the right breathing process and keep better life. This study held to understanding the basic principles of nose breathing, air pollutant, and exercise to strengthen nose breathing muscle.

This study held by literature review about life expectancy related by job and qualitative method by observing, analyzing and describing of the aspects impact of the air pollutant and affecting the breathing process as the case study.

Lowest life expectancy related by people whose work using voice/speech (singer, musician, journalist) and using breathing power (sportsman, football player, manual hard worker). Intensity exercise before support performers or effort to achieve the target and good performer push this profession using mouth breathing besides nose breathing.

Awareness of the health problems related with mouth breathing need improvement by seeking treatment for how to maintain nose breathing. Suggestion routinely mouth and tongue exercise can help for establishing nose breathing.

**Keywords:** life expectancy, air pollutant, mouth breathing, nose breathing, exercise

### A. Introduction

Breathing process as a part of human body is very important. Sometimes we are not aware of this vital function. The ability to inhale and exhale is essential to human existence, begin from nose as gate entrance upper respiratory units into lower respiratory units within the lungs. The primary function of the lungs is gas exchange for transporting oxygen from the environment into the blood and eliminating carbon dioxide from the blood to meet the metabolic demands of the body. Nose is the natural gateway for the air entering the body. Although the resistance to airflow is lower when the respiration follows the oral route, most individuals are habitual nose breathers. Indeed, the nose is physiologically fit for priming the ambient air before it is conveyed to the distal respiratory tissues. It serves as an integrated

system for air filtering, heating and humidification. <sup>(3)</sup>. While breathing happen, influenced by the surrounding environmental conditions including temperature control, humidity setting and air pollutants with all material contents. That is why breathing process include the air quality must be understood, due by doing the right breathing process, we care our respiratory system and keep better life.

This study consider some previous research about achieving life expectancy related by occupation find that high-achieving life expectancy individuals tend to live longer than average, except for performers and athletes. Start from an analysis of 1,000 obituaries from *The New York Times* from 2009 – 2011, Richard Epstein and Catherine Epstein an Australian researcher in International Journal of Medicine finds the average age of death for notable people

varies depending upon their occupation. Athletes, performers, and creative types such as writers and artists died younger, on average, while people in business, politics, and the military hung on the longest. <sup>(3)</sup> Almost the same opinion comes from outlined researcher in Normal Breathing Journal that focus on why singers die early comes from data thousands of singers die earlier than the average life expectancy compared to other studied before according to life expectancy. <sup>(7)</sup>

This study, learning about the function of the human respiratory system, relates with environment especially air pollutant. First, study about air pollutant will able to provide information about its impact on human respiration system. Second, this study will ake precaution on introduction of anatomy – physiology of human respiratory system. This research will sudy about mechanism, how to obtain better air quality, exercise method to maintain nose breatthing during sleeping and not-sleeping condition. Finally, by combining the concepts of air pollutant, human anatomy and

physiology respiration system, basic understanding of the environment principles and priority nose breathing function will obtain.

The objective of this study are understanding the basic principles of nose breathing, air pollutant, and exercise to strengthen nose breathing muscle, with explanation as:

- Recognize the importance of health environmental in processes of the human body
- Understand the function and airflow of the human respiratory system
- Apply basic needed exercise to maintain nose breathing gain life expectancy rate life

**B. Methods**

Review Literature study and Qualitative method by observing, analyzing and describing of the aspects impact of the air pollutant and affecting the breathing process as the case study. Researchers Richard Epstein and Catherine Epstein said in their study, based on analyzing 1,000 New York Times obituaries from 2009-2011 compare the life expectancies for different types

Table 1. Mean age at death as a function of occupational grouping<sup>(3)</sup>

Occupation	N	Mean age
Performance/sports	221	77.2
Creatives/writers	290	78.5
Professional/academic/religious	232	81.66
Politics/business/military	183	82.95
Others	73	83.53

Table 2. The related life expectancy by profession men and women <sup>(7)</sup>

Life Age verge During Time		1972-1976		2002-2005	
Non-manual	Examples of occupation	Men	Women	Men	Women
Professional	Doctors, accountants, qualified engineers	71.9	79.0	80.0	85.1
Managerial and technical/intermediate	Managers, journalists, teachers	71.9	77.1	79,4	83.2
Skilled non manual	Clerks, Cashiers, retail staff	69.5	78.3	78.4	82.4
<b>Manual</b>					
Skilled manual	Supervisors of manual workers, plumbers, electricians, goods vehicle drivers	70.0	75.2	76.5	80.5
Partly skilled	Warehousemen, security, guards, machine tools operators, care assistants, waiters	68.3	75.3	75.7	79.9
Untitled	Laborers, cleaners, messengers	66.5	74.2	72.7	78.1

of jobs, shown in Table 1, according to a new Australian study. 1). Business people and politicians live the longest, their average life expectancy was 82,95 year. 2). Historians, economists, and people in other academic jobs, like professors, live almost as long. They die at age 81.66 year. 3). Being creative seems to be hazardous to your health. Writers, composers and artists only live until 78.5 year. 4). Performers, like actors, athletes, singers and musicians die earliest, at 77.2 year. And they're the most likely to die of lung cancer. The researchers weren't sure if it was their lifestyle or the stress of being famous that caused them to die earlier. Their write that fame and achievement in performance-related careers may be earned at the cost of a shorter life expectancy, In such careers, smoking and other risk behavior may be either causes of effects of success and/or early death <sup>(3)</sup>.

Using data from Wikipedia, in list can be studied 110 footballers die in age 17 to 30. (years of death Jan 1889 to Nov 2014), and most causing of respiratory failure. For prevention by 2009 the Federation football and Association football implement preventive examination by medical checkup, ECG and ECHO examination for players in the Europe League 2011–12. Constant monitoring has been advised.

Some researchers suggested according to the reason why do singers die early? due singers have stressful lives, and being famous is a negative factor that makes them prone to chronic diseases, addictions, suicides, and poor health. They find that the most likely cause of poor health of singers lies in physical causes that relate to their professional work. Singers often spent up to 4-5 hours daily with incentive training during singing, and this produces a profound negative effect on their basal breathing patterns. There are dozens of studies testify that low O<sub>2</sub> in cells is the key cause for development of these diseases. Singing requires increased flow of air or ventilation. Hyperventilation minimizes alveolar carbon dioxide levels together with blood carbon dioxide quantity, becomes the crucial reason for lessened oxygen concentrations in body tissues. Obviously, low body O<sub>2</sub> also means low brain O<sub>2</sub>. Moreover, in conditions of hyperventilation, apart from lack of O<sub>2</sub>, the brain suffers from low CO<sub>2</sub> that is another crucial chemical for normal function of nerve cells. This effect takes place due to low arterial CO<sub>2</sub> levels. With reductions in brain CO<sub>2</sub>, nerve cells become over-excited. That leads to "spontaneous and asynchronous firing of neurons. In other words, low arterial CO<sub>2</sub> causes appearance of problems with sleep, mood swings,

Table 3. Life Expectancy of different Profession<sup>(10)</sup>

Profession	Life Age Average
Religious leaders	82
University professors and Politicians	79
Legal experts	78
Businesspeople	77
Senior government officials, artists and writers	74
Journalists	72
Athletes	69
Entertainers	65

Table 4. Outdoor Sources of Major Indoor Air Pollutant <sup>(1)</sup>

Pollutant	Percentage of emissions associated with industry	Percentage of emission associated with transport
Benzene	32	65
Carbon monoxide (CO)	3	90
Lead (Pb)	31	60
Oxides of Nitrogen (NO)	38	49
Particulates (PM10)	56	25
Sulphur Dioxide (SO <sub>2</sub> )	90	2
Volatile Organic Compounds (VOCs)	52	34
Ozone (O <sub>3</sub> )	Arises from atmospheric chemical reaction	

anxiety, panic, and addictions. With developing hyperventilation, people get reduced results for body oxygen test. This happens when this singer breathes over two times more than the medical norm. If body O<sub>2</sub> drops below 10 seconds, there is an immediate danger of heart attack, stroke, seizures, asthma attack, or some other severe exacerbation. With application of breathing techniques, it is possible to achieve normal minute ventilation and normal O<sub>2</sub> values in tissues. Furthermore, high body O<sub>2</sub> and CO<sub>2</sub> values profoundly improve quality of voice in singers due to relaxation and expansion of smooth muscles of airways.<sup>(7)</sup>

There is another study written by the Telegraph on 25 Oct 2007, about how occupation is the attainment life expectation related by job. According to a 2011 a study in U.S., the gap in life expectancy at age 25, by education, with a bachelor's degree or higher. Middle-class professionals such as doctors and accountants are outliving builders and cleaners by as much as eight years, according to official figures. The study looked at people from five social classes in 1972-1976 and 2002-2005. Skilled workers have a greater increase in life expectancy and at the age of 65 than those in manual occupations. In professional occupations can expect live to 80, almost eight years longer than those in unskilled jobs, whose life expectancy is 72.7. Men in managerial and technical occupations such as journalists and teachers have slightly shorter life expectancy at 79.4, while unskilled workers such as laborers and cleaners have the shortest life expectancy as shown in Table 2. In this situation the figures showed the differences between social groups were growing. Those who have a lower life expectancy have it because of a range of factors, they may live in housing which is damp and has poor heating, or near busy roads which means more air pollution. There is also evidence that people on low incomes have higher smoking rates and their diets tend to be worse because high fat, high sugar diets are cheaper. The study shown people who working in a healthy environment, not in a rush, thinker, have longer life expectancy than people work by manual in an unpredictable environment.<sup>(7)</sup>

Based on research from Wonkwang University, Prof Kim Jong-In who analyzed newspaper obituaries and data from statistics Korea between 2001 and 2010 and derived the average life span of different professions.<sup>(10)</sup> Find that Clergy have the longest life expectancy and entertainers the shortest, according to that study. Show business is the only career where average life expectancy is growing shorter. Religious leaders lived an average of 82 years, which was the longest, followed by university professors and politicians (79), legal experts (78), businesspeople (77), senior government officials, artists and writers (74). But journalists (72), athletes (69) and entertainers (65) died relatively young, shown in Table 3.

This data, compare several prior research about life expectancy related job profession and life age average. According to the lowest life expectancy related job expectancy include singers, sportsman, journalist, clerks, cashiers, retail staff and hard manual worker like laborers, cleaners, messengers assumed that this profession using breathing mechanism process supporting their job and work environment condition impact their life. Hard intensity training for singers, sportsman and others profession give bad impact if using mouth breathing to support their breathing process to get their target and focus. Air pollution go into airflow process breathing airflow without filtering by nose give bad impact to this profession in their life. Need to know good breathing process by nose breathing and how is the effort practicing not to use mouth breathing.

### C. Result and discussion

According to the study data above it appears that human life expectancy related by job, affected by work environment and health environment air quality, and self-awareness in avoiding mouth breathing by maintain nose breathing

#### C.1 How air pollutant related with respiration system

Now days, the air quality in the indoor environment has a significant impact on human

health and comfort. Because most people spend most of their time in indoor, poor indoor air quality can lead to discomfort, ill health, absenteeism, and low productivity. Good indoor air quality safeguards the health of indoor occupants and contributes to their comfort and well-being. Indoor air pollution has received little attention in past compared with the outdoor air pollution. It is now become main topic of increasing public concern, prompted partly by the isolation of the indoor environment from the natural outdoor environment in tight-sealed commercial building. (see Table 4)

There is growing public awareness regarding the risk associated with poor indoor air quality in the home and workplace. Because Americans spend approximately 22 hours every day indoors, susceptible individuals are at much greater risk of adverse health effects from chronic low levels of exposure to indoor air pollutants over time. Along with particulate matter, gases such as ozone, nitrogen dioxide, carbon monoxide, and sulfur dioxide; microbial and chemical volatile organic compounds; passive smoke; and outdoor ambient air are the most common types of air pollutants encountered indoors, and from their study find indoor pollutants act as respiratory irritants, toxicants and adjuvants or carriers of allergens.<sup>(10)</sup> The health effects by poor indoor air quality are dependent on several factors such as the effect of each air contaminant, concentration, duration of exposure, and individual sensitivity. Until recently, the health effects of indoor air pollution have received relatively little attention from the scientific community. Along with particulate matter (PM), gases such as ozone (O<sub>3</sub>), nitrogen dioxide (NO<sub>2</sub>), carbon monoxide (CO), and sulfur dioxide (SO<sub>2</sub>); microbial and chemical volatile organic compounds (VOCs); and passive smoke are the most common types of air pollutants encountered indoors.<sup>(1)</sup>

The others air pollutant is indoor particulate matter. The adverse effects of indoor particulate matter are dependent on deposition in the respiratory system and the ability of the respiratory tree to remove them, which is directly related to particle size and chemical

composition. For example, coarse particulate matter generated indoors (2.5-10 μm) tends to deposit in the nasal, pharyngeal, and laryngeal regions of the respiratory system, whereas fine (0.1-2.5 μm) and ultrafine (<0.1 μm) particulate matter generated indoors and outdoors tends to deposit in the trachea bronchial region and alveoli. Organic pollutants can adsorb onto the surface of these particles, contributing to important adverse health effects. Indoor particulate matter can also be classified according to its sources, which include cooking, heating, consumer products, building materials, house dust, particle re suspension from human activity such as vacuuming and foot traffic, outdoor particle infiltration, and secondary organic aerosol. Indoor particulate matter has been associated with increased respiratory symptoms.

The best standard environment indoor air quality, support by control procedure. standard. Their 3 primary considerations in improving indoor air quality are (1) Evaluation of construction failures that allow moisture into the walls of a building, (2) Poor ventilation causing excessive humidity and accumulation of gaseous and/or chemical exposure from materials in the living space, and (3) Poorly designed or HVAC systems that contribute to poor air circulation. Building a healthy home should take into account costs versus energy savings and improved health outcomes.<sup>(10)</sup>

### C.2 Breathing Process

From the standpoint of respiratory deposition, the respiratory system can be divided into three regions. The regions differ markedly in structure, airflow pattern, function and sensitivity to deposit particles. The first is the head region which includes the nose, mouth, pharynx, and larynx. Inhaled air is warmed and humidified in this region. In this region nose as the main function. The second is the tracheobronchial region, include the airways from larynx to the terminal bronchioles. This region resembles an inverted tree with a single trunk, the trachea, subdividing into smaller and smaller branches. Finally, beyond the terminal

bronchioles is the pulmonary or alveolar region, where gas exchange takes place. The respiratory system of normal adult processes 10-20 m<sup>3</sup> (12-24 kg) of air per day. The gas exchange area of the lungs is about 30 m<sup>2</sup> and is perfused with over 200 km of capillaries. At rest, about 700 mL of tidal is inhaled and exhaled with each breath. During heavy work, tidal volume may be three times this amount. A resting adult breathes about 12 times a minute and this rate triples during heavy work.

Once deposited, particles are retained in the lung depending on their chemical properties, their location within the lung and the type of clearance mechanism involved. The airway surfaces of the first two respiratory regions are covered with layer mucous that is slowly propelled by ciliary action to the pharynx, swallowed to the gastrointestinal tract. This *mucociliary* escalator transports deposits particles out of the respiratory system in matter of hours. Soluble particles pass through the thin alveolar membrane into the bloodstream. Solid particles may dissolve slowly by phagocytic cells and dissolve or transported to the *mucocilliary* escalator, *Fibrogenic* dusts as silica interfere with this clearance mechanism and cause gradual scarring of fibrosis of the alveolar region <sup>(4)</sup>.

Normal nasal breathing has two major advantages function that can not find in mouth breathing: 1. filtration function by the *ciliair* hairs, and 2. humidity function of inspired gas. Mouth breathing at bedtime is not good because do not have filtration by the *ciliair* hairs, no humidification of inspired gas, salivary glands going to slow down and cause the throat and mouth becomes dry.

### C.3 Mouth Breathing Effect

Enhance the comprehension explanation above, mouth breathing can cause major health problems. The nose breathing route provides more resistance for respiratory muscles as compared to mouth breathing (the route for mouth breathing is shorter and it has a greater cross sectional area). Nose breathing has the filtration apparatus, warming and humidifies function that can filtering the deposit air.

Tanaka, Japanese researcher in their study about assessment nasal function in control breathing, discovered that end-tidal-CO<sub>2</sub> concentrations were higher during nose breathing than during oral breathing. This research study revealed that a group of healthy volunteers had an average CO<sub>2</sub> of about 43.7 mm Hg for nose breathing and only around 40.6 mm Hg for oral breathing. Hence, mouth breathing reduces oxygenation of the whole body.<sup>(12)</sup> A short summary of immediate negative biochemical effects of mouth breathing related to CO<sub>2</sub> are: (1) Reduced CO<sub>2</sub> content in alveoli of the lungs (*hypocapnia*), (2) *Hypocapnia vasoconstriction* (constrictions of blood vessels due to CO<sub>2</sub> deficiency), (3) Reduced oxygenation of cells and tissues of all vital organs of the human body, (4) Biochemical stress due to dirty air (viruses, bacteria, toxic and harmful chemicals) entering into the lungs, (5) Possible infections due to absence of the self-immunization effect

Mouth breathing starts when body cannot get enough air through the nose, so the mouth takes over. This forces to breathe through the mouth out of sheer necessity, and this can become a life-long habit if not corrected. It is perfectly natural to breathe through mouth at certain times, such as when lifting a heavy load or exercising, but breathing through the mouth most of the time, however, can cause health problems. It is important to realize that mouth breathing and having an open mouth are really the same thing, and are equally detrimental to your health. Using the mouth for breathing disrupts our natural body mechanics. The root of the problem in many cases is oxygen deprivation, which can affect a number of body functions and lead to symptoms such as gingivitis and gum disease, bad breathe, poor sleep leading to chronic fatigue. In adults, poor oxygen concentration in the bloodstream has been associated with high blood pressure, heart problems, sleep apnea and other medical issues.<sup>(11,17)</sup>

Mouth breathing changes the way of tongue works and where it rests in the mouth. The tongue is made up of muscles covered by mucous membranes. These muscles are attached

to the lower jaw and to the hyoid bone (a small, U-shaped bone, which lies deep in the muscles at the back of the tongue) above the larynx. The tongue also aids in the formation of sounds of speech and coordinates its movements to aid in swallowing. Naturally tongue rest in the top of mouth, when mouth open it rests in the bottom. This leads to underdeveloped oral muscle, and can cause breathing, speech, swallowing, and chewing problem. When tongue rests low in the mouth, push forward to swallow as a tongue thrust. A tongue thrust and mouth breathing always go hand in hand it means if using mouth breathing, have a tongue thrust swallowing pattern. When the tongue is in the wrong

position, the head tends to rest forward, causing the shoulders to slump. Human body unknown how to breathe normally, and the muscles of the face and mouth have compensated and learned to work correctly. Need exercise to help retrain muscles and to stop mouth breathing.

#### C.4. Nose Breathing Maintenance

Mouth breathing may seem like an easy habit to change, just close the mouth. Unfortunately, for people who struggle with nose breathing, changing mouth breathing habit it is not easy. There are several way offered to maintain nose breathing as:

- (1) Make an effort not to open mouth to

<b>Exercise 1</b>	Slowly open and close your mouth to its full extent, making sure the lips meet when closing.
<b>Exercise 2</b>	Pucker your lips (as if about to kiss). Hold for a count of 10. Relax.
<b>Exercise 3</b>	Spread your lips into a big, exaggerated smile. Hold. Relax.
<b>Exercise 4</b>	Mix Exercises 2 & 3: Pucker-Hold-Smile-Hold.
<b>Exercise 5</b>	Try to pucker with your mouth wide open, without closing your jaws together. Hold & relax.
<b>Exercise 6</b>	Close your lips and press them tightly together.
<b>Exercise 7</b>	Close your lips firmly, then make a "slurping" noise, as if sipping a drink.
<b>Exercise 8</b>	Open your mouth and stick out your tongue. Be sure your tongue comes straight out of your mouth and doesn't go off the side. Hold, relax and repeat several times. Work toward sticking your tongue out farther each day, but still pointing straight ahead.
<b>Exercise 9</b>	Stick out your tongue and try to reach your chin with the tongue tip. Hold at the farthest extension.
<b>Exercise 10</b>	Touch your nose with the tongue tip. Hold at farthest extension.
<b>Exercise 11</b>	Stick out your tongue. Hold a spoon upright against the tip of your extended tongue and try to push it away while your hand holds the spoon in place.
<b>Exercise 12</b>	Repeatedly stick your tongue in and out as fast as you can.
<b>Exercise 13</b>	Flick your tongue from corner to corner as quickly as you can.
<b>Exercise 14</b>	Move tongue all around your lips in a circle as quickly as you can, making sure you stay in constant contact.
<b>Exercise 15</b>	Open and close mouth as quickly as you can, making sure your lips close each time.
<b>Exercise 16</b>	Say "Ma-Ma-Ma-Ma" as quickly as possible, ensuring there's an "em" and an "ah" sound each time.
<b>Exercise 17</b>	Repeat with "La-La-La-La."
<b>Exercise 18</b>	Repeat with "Ka-Ka-Ka-Ka" as quickly and accurately as you can.
<b>Exercise 19</b>	Repeat with "Kala-Kala-Kala-Kala"
<b>Exercise 20</b>	Gargle loudly with warm water.
<b>Exercise 21</b>	Say the vowel sounds (A-E-I-O-U) as loud as you can.

Adapted from: combine methods that teach how train mouth and tongue muscle to improve breathing performance.

breath. The first rule is to breathe through nose breathe and awareness of healthy life encourage to close the mouth and use nose breathing.

(2) Whose suffer from mouth breathing during sleep time, learn the medical technique tape the mouth for stopping mouth breathing during sleep. For most people who still learn to stop mouth breathing, if they sleep on their back at night, try to sleep on side.

(3) A routine exercise to make strong tongue and jaw muscle can be train. The various muscles of respiration aid in both inspiration and expiration, which require changes in the pressure within the thoracic cavity. Diaphragm muscle, external intercostal and interchondral part of the internal intercostal muscles are big part of respiration muscle. At the neck muscles, the sternocleidomastoid (elevated sternum) and the scalene muscles considered accessory muscles of breathing. The involvement of these muscles seems to depend on the respiratory activity. Apart from these neck muscles, the following muscles have also been observed contributing to the breathing: *serratus anterior, pectoralis major & minor, upper trapezius, latissimus dorsi, erector spinae (thoracic), iliocostalis lumborum, quadratus lumborum, serratus posterior superior and inferior, levatores costarum, transversus thoracis, subclavius*<sup>(13)</sup>. The technique is based on the neuromuscular re-education or re-patterning of the oral and facial muscles, tongue exercise and behavior modification techniques to promote proper tongue position, improved breathing, chewing and swallowing<sup>(14)</sup>. Modification technique with short method exercise and long method exercise can be combined.

The first is combination 4 steps exercise using mouth and tongue exercise A - I - O - Beh to strengthen muscle tongue and be expected to improve nose breathing habit can be done 3 minutes two times every day.<sup>(10)</sup>

The second is combination 21 steps *oropharyngeal* exercise included exercises for the soft palate, tongue, facial muscles and mouth practiced 60 minutes daily and divided by 2 steps each for 30 minutes for one month than can be review for convenience.<sup>(9)</sup>

(4) Use the right pillow. Choose design pillow with a groove that cradles your head so you can lie comfortably on your controlled side sleep posture. Make sure the pillow align head, neck and shoulders for more relaxing and restful sleep, elevate upper body and align body spine so that airways are not blocked.

#### D. Conclusion

1. Lowest life expectancy related by people whose work using voice talent (singer, musician, journalist) and using breathing power (sportsman, football player, manual hard worker).
2. Intensity exercise before support performers or effort to achieve the target and good performer push this profession using mouth breathing besides nose breathing.
3. Establish nose breathing come from how to be able to breathe clean air with a minimum of airborne particles by review home environment or work environment. Beside that establish easier nose breathing can be in a smoke free environment and awareness to using nose breathing
4. According to get better life age expectancy, the nature of people's jobs also has a defect, but they have autonomy and control over what they do, tend to be in a better health. At this time, many people even health care professionals are not aware of the health problems associated with mouth breathing. Seeking treatment for mouth breathing can significantly improve quality of life, and can be a part of the solution.
5. Suggestion routinely mouth and tongue exercise can help for establishing nasal breathing.

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