# The Impact of Cigarette Smoking on Antenatal Growth Scan And Neonatal Outcome

Thesis
Submitted for Partial Fulfillment of Master Degree
**In Obstetrics and Gynecology**

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# INTRODUCTION

Maternal smoking during pregnancy is known to be associated with fetal growth defects, increased risk of low birth weight, prematurity, spontaneous abortion, perinatal mortality, ectopic pregnancy, impaired fetal growth from gestational age ٢٠ weeks onwards, infants born to smoking mothers are on average ٢٠٠ grams lighter and ١,٤ cm shorter than infants of non smokers ***(Jeanty ١٩٨٧; Newnham et al, ١٩٩٠)***.

Women who smoked at least a pack a day had children with twice the rate of extreme behavior problems, the more cigarettes a mother smoked during pregnancy, the greater the likelihood that her child would demonstrate severe behavior problems as the child became older ***(Andrews et al, ٢٠٠٠)***.

Smoking-induced blood vessel constriction can also cause growth restriction in the fetus. This can be detected during pregnancy when ultrasound measurements note that the baby's bone lengths, abdominal circumference and head

circumference lag behind expected measurements ***(Carmichael et al. ٢٠١٠)***.

The nicotine in cigarette smoke acts as a neuroteratogen that interferes with the developing nervous system in utero, mothers of "hyperkinetic" children were found to smoke an average of ١٤ cigarettes during pregnancy compared to only ٦ cigarettes smoked on average for mothers of "normal" children ***(Guo et al., ٢٠١٠)***.

The blood concentrations of nickel and cadmium and their metabolites were elevated in smoker females and suggested high correlation with adverse pregnancy outcomes although they were detected in minimal amounts in those females' placentae ***(Guo et al., ٢٠١٠)***.

A pilot study included ١٠٠ women attending ANC chosen without prior selection at Al-agouza police hospital revealed a number of ٦٠٪ passive smokers, ١٠٪ active smokers, so it was observed that the numbers of smoker women among officers' wives is high.

# AIM OF THE WORK

The aim of this study is to evaluate the impact of maternal cigarette smoking on fetal biometric parameters during the second half of pregnancy with neonatal outcome assessment.

# History of tobacco smoking

Tobacco is produced by different Nicotiana species; among all, Nicotiana tabacum is the most widely planted, characterized by short viscid-glandular hairs exuding a yellow secretion containing nicotine. Nicotine is produced as a defense against predatory insects. Indeed, nicotine was used as pesticide throughout the world (including in the United States) until the mid-١٩٦٠s, when it was banned **(Slotkin, ١٩٩٩).**

It is worthwhile noting that only one insect, the Manduca sextans (the tobacco horn worm), escapes the ill effects of nicotine. Its system of defense against nicotine consists both in carrying an altered amino acid sequence of the receptor, which limits the affinity of nicotine for its own receptors, and in possessing a functional equivalent to a blood-brain barrier **(Eastham et al, ١٩٩٨).**

Thus, the astrocytes that wrap neurons express nicotine-binding proteins, functioning as a scavenger and releasing nicotine back into the surrounding hemolymph protecting the neurons **(Banerjee and Bhat, ٢٠٠٧).**

It is generally accepted that tobacco began growing in the Americas around ٦٠٠٠ BCE **(Pearsall, ١٩٩٢).** However, the first archaeological sample came from a clay tobacco pipe from the Banda region of Ghana in West Africa, dating to the ١٩th century BCE, as supported by gas chromatography/mass spectrometry (GC–MS) of the pipe residues, which found peaks identical to those observed with samples of pure nicotine **(Rafferty, ٢٠٠٢).**

Sometime during the first millennium of the Common Era, Native Americans started to use tobacco in religious ceremonies and medicinal practices. The Mayan peoples used tobacco for recreational, ceremonial (ritual), and medicinal purposes, as shown by sculptures depicting high-ranking persons smoking cigars and priests blowing tobacco smoke over human sacrifices. The importance of the tobacco ritual derived from its symbolic role as an intermediary between the people and the gods. The smoke was used as a vehicle for the offerings, transporting up blood soaked in paper and burned **(Pearsall, ١٩٩٢).**

Subsequently, the Toltecs, who built the Aztec

empire, inherited the smoking custom from the Mayas. The Mayans who settled in the Mississippi Valley extended the use of tobacco to the neighboring tribes, who tailored tobacco smoking to their own religion. They believed that their god, Manitou, revealed himself in the rising smoke. A Huron myth tells how in ancient times, when the land was barren and the people were starving, the Great Spirit sent forth a woman to save humanity. As she traveled over the world, everywhere her right hand touched the soil, there grew potatoes. And everywhere her left hand touched the soil, there grew corn. And when the world was rich and fertile, she sat down and rested. When she arose, there grew tobacco **(Pearsall, ١٩٩٢).**

A complex system of religious and political rites also developed around tobacco in Central America. Thus, for thousands of years tobacco had a sacred purpose for many Native American tribes. Tobacco was used for prayer, to show respect, to heal, and to provide spiritual protection. Tobacco was never meant to be abused, and it was never used for recreational intent **(Pearsall, ١٩٩٢).**

## Early European Tobacco Use and Prohibitions

The English word tobacco arises from the Spanish tabaco, and it is supposed to derive from a word in the Arawakan language, taino, which referred either to a roll of tobacco leaves, or to the tabago, a kind of Y-shaped pipe for sniffing tobacco smoke However, similar words in Spanish and Italian were used since at least ١٤١٠ to define medicinal herbs, originating from the Arabic tabbaq, a word supposedly dating from the ninth century, as the name of various herbs **(Pearsall, ١٩٩٢).**

The history of tobacco started officially when, on October ١٢, ١٤٩٢, Christopher Columbus arrived in Hispaniola. The natives that he encountered offered him dried tobacco leaves as a gift. The men who escorted Columbus (Rodrigo de Jerez and Luis de Torres) met several users of tobacco, but the first European explorers paid slight attention to the plant itself, until they became aware that tobacco might be used to treat diseases. Even so, Rodrigo de Jerez became a confirmed formal smoker, and he is considered the first man who smoked outside of the

Americas. He brought the tobacco habit back to his hometown of Ayamonte. In ١٥١٨, Fernando Cortez brought tobacco to Spain, as requested by Ramon Pane. When in ١٥١٩ Cortez conquered Tenochtitlan, the capital of the Aztec empire, he found the natives smoking perfumed red cigarettes. Indeed, one of the oldest recognized hints of the use of tobacco is a stone statue of the Aztec god Xochiplii, the "Prince of Flowers" decorated with sacred and psychoactive flowers including tobacco (Nicotiana tabacum) (**Mirahmadizadeh and Nakhaee, ٢٠٠٨)**

Eventually, in the mid-١٦th century, tobacco was introduced more widely into Europe. In ١٥٣٥, the French explorer Jacques Cartier met some natives (St. Lawrence Iroquois) on the island of Montreal who used tobacco. He wrote the first definitive account of early testing of tobacco by Europeans. Tobacco continued to spread throughout Europe due to the French Ambassador to Portugal, Jean Nicot deVillemain. He introduced the queen consort and regent of France, Catherine de Medicis, to tobacco. Initially Nicot sent snuff to treat her son Francis II's

migraine headaches. The queen later named tobacco "Herba Regina" or "Herba Medicea." (There is confusion in sources: some claim it cured Catherine's own headaches, by making her sneeze.) It was in homage to Nicot that the name of the botanical species became Nicotiana and its product nicotine **(Henningfield et al., ١٩٩٣).**

In ١٥٨٨, Thomas Harriet in Virginia promoted the smoking of tobacco as a feasible way to get one's daily dose. Regrettably, he died of nose cancer (it was popular at that time to breathe the smoke out through the nose).This was the first time that some of the dangerous effects of tobacco smoking started to be realized, opening the great debate over tobacco danger and the fights for its ban. In ١٦٠٤, James I of England issued his Counterblast to Tobacco, conceivably the most well-known early condemnation of the tobacco habit. Some years later, Sir Francis Bacon noted that trying to quit the bad habit of smoking was quite hard; this is probably the first written account of tobacco addiction. Restrictions on tobacco use

also began during this period. The first tobacco ban was effected in ١٥٧٥, making it illegal to smoke in any public place of worship in the Roman Catholic Church of the Spanish Colonies. In ١٦٢٤, Pope Urban VIII threatened snuff users with excommunication, since sneezing was thought too close to sexual ecstasy **(Henningfield et al., ١٩٩٣).**

Then, in ١٦٣٤, the Greek Church declared that it was the tobacco smoke that intoxicated Noah after the deluge and consequently banned its use**.** Nevertheless, from this time on, tobacco use spread all over the world **(Mirahmadizadeh and Nakhaee, ٢٠٠٨)**

# Nicotine

## Nicotine and Related Alkaloids in Tobacco Products

Nicotine is a natural ingredient acting as a botanical insecticide in tobacco leaves. It is the principal tobacco alkaloid, occurring to the extent of about ١,٥٪ by weight in commercial cigarette tobacco and comprising about ٩٥٪ of the total alkaloid content. Oral snuff and pipe tobacco contain concentrations of nicotine similar to cigarette tobacco, whereas cigar and chewing tobacco have only about half the nicotine concentration of cigarette tobacco. An average tobacco rod contains ١٠–١٤ mg of nicotine and on average about ١–١,٥ mg of nicotine is absorbed systemically during smoking **(Kozlowski et al. ١٩٩٨).**

Nicotine in tobacco is largely the levorotary (S)-isomer; only ٠,١–٠,٦٪ of total nicotine content is (R)-nicotine **(Armstrong et al. ١٩٩٨).**

Chemical reagents and pharmaceutical formulations of (S)-nicotine have a similar content of (R)-nicotine (٠,١–١,٢٪) as impurity since plant-derived nicotine is used for

their manufacture. In most tobacco strains, nornicotine and anatabine are the most abundant of minor alkaloids, followed by anabasine. This order of abundance is the same in cigarette tobacco and oral snuff, chewing, pipe, and cigar tobacco. However, nornicotine levels are highest in cigar tobacco, anatabine levels are lowest in chewing tobacco and oral snuff, and anabasine levels are lowest in chewing tobacco **(Jacob et al., ١٩٩٩).**

Small amounts of the N′- methyl derivatives of anabasine and anatabine are found in tobacco and tobacco smoke. Several of the minor alkaloids are thought to arise by bacterial action or oxidation during tobacco processing rather than by biosynthetic processes in the living plant. These include myosmine, N′-methylmyosmine, cotinine, nicotyrine, nornicotyrine, nicotine N′-oxide, ٢, ٣′-bipyridyl, and metanicotine. Myosmine is found not only in tobacco but also in a variety of foods including nuts, cereals, milk, and potatoes **(Tyroller et al. ٢٠٠٢).**

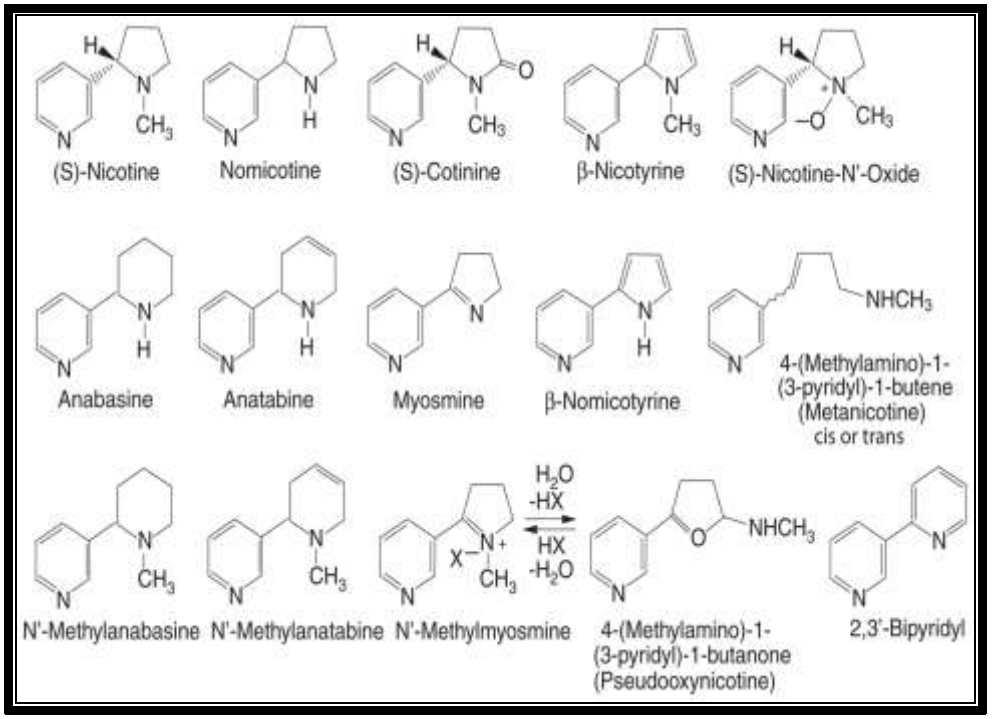


Figure (١): Structures of tobacco alkaloids **(Armstrong et al. ١٩٩٨).**

Also, nicotine is found in low levels in vegetables such as potatoes, tomatoes, and eggplants **(Siegmund et al. ١٩٩٩).**

## Absorption of Nicotine

Nicotine is distilled from burning tobacco and carried proximally on tar droplets (also called particulate matter), which are inhaled. Absorption of nicotine across biological membranes depends on pH. Nicotine is a weak base with a pKa of ٨,٠. In its ionized state, such as in acidic

environments, nicotine does not rapidly cross membranes. The pH of smoke from flue-cured tobaccos, found in most cigarettes, is acidic (pH ٥,٥–٦,٠). At this pH, nicotine is primarily ionized. As a consequence, there is little buccal absorption of nicotine from flue-cured tobacco smoke, even when it is held in the mouth **(Pankow ٢٠٠١).**

Smoke from air-cured tobaccos, the predominant tobacco used in pipes, cigars, and some European cigarettes, is more alkaline (pH ٦,٥ or higher) and, considerable nicotine is unionized. Smoke from these products is well absorbed through the mouth. It has recently been proposed that the pH of cigarette smoke particulate matter is higher than previously thought, and thus, a larger portion of nicotine would be in the unionized form, facilitating rapid pulmonary absorption **(Pankow ٢٠٠١).**

When tobacco smoke reaches the small airways and alveoli of the lung, nicotine is rapidly absorbed. Blood concentrations of nicotine rise quickly during a smoke and peak at the completion of smoking. The rapid absorption of