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The "Canone Inverso": when tobacco was not so bad. A look back at the primordial debate on the tobacco effects in the occupational medicine

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Summary. *Aim:* The article provides an overview on the beginning and evolutions of medical observations on tobacco induced diseases between Eighteenth and Nineteenth century. *Methods:* By searching for historical medical literature, first studies on tobacco-induced diseases focused on production risks rather than on adverse effects that the use of tobacco has for the human health. *Results:* The approach induced first eighteenth-century authors to define this substance as a non-pathogenic and, consequently, not to consider tobacco factories dangerous for health workers. In those years, tobacco was employed in therapy as a stimulant treatment and it was considered harmless and even healthy and preventive of several acute diseases. *Conclusions:* Authors will show that studies on pathogenic effects of smoking will only start around late nineteenth century, when the idea of the healthiness of tobacco industry was already supported. (www.actabiomedica.it)

Key words: tobacco, occupational medicine, public health

Introduction

Tobacco is a plant, native of the North and South American territories, belonging to the genus of Nicotiana Tabacum. This plant has started to be known in the rest of the world, after the half of the XV century when Cristoforo Colombo was back from his expedition to the Americas (1). Tobacco has been defined among the most dangerous plant that humans decide to use for personal purpouses (2). Every year, in fact, tobacco smoking and chewing cause bilions of deaths worldwide (3). Although the hazardous nature of tobacco is today a clear and unanimous opinion, we cannot say the same when we compare the current studies with those ones from the past. In fact, first studies on tobacco-induced diseases focused on production risks rather than on adverse effects that the use of tobacco has for the human health.

In Europe tobacco quickly finds wide use by humans in everyday life as a pleasant substance to chew and inhale. Starting from Seventeenth Century tobacco is used for several aims in medicine. For example, it was noted that, in case of pathological status, tobacco was used as a sneeze-inducing substance to reactivate the nervous and interior "motions", especially in the respiratory apparatus through sneezing. According to the medical doctrine of the time, these pathological statuses were attributed to a slowdown of fluids motion of the body with the consequent alteration of the functions of the organs.

Tobacco was also considered as a stimulant active drug to the nervous system and it is used to resuscitate of the dying, especially of the drowned (4). In Literature it is well documented its use in resuscitating "apparently" dead. In fact, we found that fumigation machines were created to inject tobacco smoke in the

intestines in the purpose to energize and reactivate the internal organs due to its irritant properties (5).

In the same period some description of pathological effects of tobacco on smokers appears in medical literature reporting autopsy data, though basically they act only as occasional notes and are not formalized at all.

Among authors studying the pathogenicity of smoking and of consumption due to inhaled tobacco, it is noteworthy Theophile Bonet (1620-1689), first author reporting a systematic study on this (6). Although Bonet describes in his paper lungs and brain injuries, the debate on smoking pathogenicity is still far from a comprehensive discussion, which will develop only starting from mid-nineteenth century. Until that period, in fact, denounces of tobacco-induced damages will remain limited to the different interpretations on its therapeutic use and adverse effects of high doses, whithout a real medical nosology.

Taking into consideration the scientific background, the present paper provides an historical overview on the beginning and evolutions of medical observations about the use of tobacco, including tobacco-induced diseases, between the Eighteen and Ninetheen Century. The article shows how the discussion on tobacco disease mainly will develop from the birth of the occupational medicine, where primordial considerations on tobacco worker's disease, including related poisoning risks, were made.

Discussion

Ramazzini and tobacco-induced diseases in industrial medicine

The discussion about Tobacco met great interest from several scientists and academics of the Seventeeth Century. One of the most important author studying the effects of tobacco on human health is Bernardino Ramazzini (1633-1714), whose theories will be followed for over a century.

Ramazzini was an Italian doctor, scientist and academic, who dedicated his entire life to the study of physics and meteorology, associated to the medicine, and to the research related to Epidemiology of diseases, including their clinic management (7, 8). Considered as the father of the occupational medicine, he introduced for the first time in the medical science literature the systematic study of workers' diseases and social protection within working environments (9, 10).

As for the matter of tobacco, Bernardini focused his research not on the damages that the use (or abuse) of this substance may have on human health, but rather on the effects that its manipulation has on workers. In fact, in his most important study, *De morbis artificum diatribe,* detailed considerations about the pathogenicity of the tobacco processing are reported. Paying specific attention to certain steps of the production cycle, as the opening of bales and the pulverization of tobacco leaves, he described stomach and head problems connected to the tobacco (11). In particular, Ramazzini believed that the use of tobacco was responsible to cause nausea, sneezes, dizzines, headache and breating difficulties. Similarly to Ramazzini, also Bonet reported that the use of tobacco may cause among workers lung and brain lesions.

Because tobacco has narcotic effects, Ramazzini held that it was responsible to cause also the loss of appetite. According to Helmontiana theories, in fact, the narcotic effect of tobacco prevented the acid fermentation of stomach, determining the torpidity of animals spirits. According to the authors of that period, substances passing through the body may interact with all the constituent parts of fluids, causing a sort of a chemical transformation. This chemical transformation interferes with natural motions of fluids and parts. The blood was defined as a substance full of animal spirits that gives life to every part of body; the transformation of its mas and motion causes statuses of morbid alteration.

Ramazzini also highlighted that the fine dust widening in the air during the tobacco processing was responsible for the injuries of lung and trachea. That is why workers were required, for precautionary purposes, to cover mouth and nose (so preventing flying atoms to be penetrated), to go in outdoor place to breathe clear air and wash often the face with cold water.

The use of water and vinegar-based beverages, that generally work as emetics, neutralized particles

that penetrate into the throat and stomach. An additional pathogenic factor was due at the insalubrity of tobacco processing workplaces where the humidity was responsible of causing headache and nausea. According to Ramazzini, the pathogenicity degree of tobacco must be calculated on the basis of smell intensity that it releases: more the smell is intense and penetrating, more a substance can violently act on the animal machine.

The Nineteenth Century: the healthness of tobacco industries

The debate over the adverse effects of Tobacco continues to widespread in many countries of the European continent also in the Nineteenth Century. In those years in fact, the awareness of how important is a clean and safe working enviroment increases along with policies with the aim to protect health workers'. It was noted, for example, that in the first decades of Nineteen Century, in many countries as France, England and Germany, it starts to appear tobacco industries employing doctors. These doctors were in charge to draft registers and reports on workers' health conditions (12). The widespread of the debates over tobacco effects was falicitated, especially in France, by the study on tobacco effects on the workers' health, provided in 1829 by A.J.B. Parent-Duchâtelet (1790-1835) and J.P.J. d'Arcet (1777-1844). Parent-Duchâtelet and d'Arcet were important exponents of the French hygienist movement. Data presented in the study were taken from the analysis performed on ten tobacco factories located in France.

The study was based also on the analysis of pathogenic effects described by Ramazzini years before and on the A.-F. Fourcroy's edition, dated on 1777, thought with the addition of new observations on the pathogenicity of the tobacco processing (13). It is important to underline that in the later edition, issued by P. Patissier in 1882, the consideration described in it do not differ from those ones presented some years before by Ramazzini (14).

In the same years F.V. Mérat (1780-1851) showed in the "Dictionnaire des sciences médicales" that tobacco workers suffer vomit, abdominal cramping, acute and chronic diseases of respiratory system, dizziness, asthma, muscles pain, trepidation, acute chest diseases, that in certain cases lead even to death (15).

Although all authors described pathogenic effects ascribable to tobacco, they arrive at conclusions relatively different from Ramazzini's tradition.

The authors visit Paris factory, entering into direct contact with workers, and using medical reports of the factories of the other nine french cities (Le Havre, lille, Strasbourg, Lyon, Marseille, Toulouse, Tonneins, Bordeaux, Morlaix). The intersection of data obtained from the results of workers' medical examination lead Parent-Duchatelet and d'Arcet to exclude any serious illness related to the processing of tobacco, which mostly causes temporary upsets.

Indeed, the worst effects of the manufacturing processes would be generated by the release during the demolition of the plant masses and the drying practices. This would result in a disturbance lasting up to three months, calling into question the real existence of diseases attributable to tobacco processing.

Hence, it is denied that tobacco causes damage to the nervous system and brain. Rather several authors call living conditions into question as determinants of typical diseases of the poorer segments of the population - while the tobacco factories, as much for the safety of the substance as for the type of work carried out there, are referred to as healthy places when compared to others (16).

In 1843, F. Mélier (1798-1866), personal physician of the Emperor Napoleon II, member of the Imperial Academy of Medicine and Inspector general of health services in France, presented at the Royal Academy of Medicine of Paris the report on the health status of tobacco manufacturing workers (17).

The report – that was based on the annual reports drawn up by doctors working for tobacco factories – shows the frequency of widespread diseases in the overall population, not statistically correlated to the work in tobacco factories: pneumonitis, fever, gastroenteritis, rheumatism, with transitory and not serious clinical consequences.

Mélier visits several times Paris factory, observing the production cycle, tasks and environmental conditions of workers: this allows him to identify as a pathogenic factor the stage of leaves fermentation, from which flow gases, ammonia, acetic acid and nicotine.

Mélier considers the latter one a poisonous substance, as indeed evidenced by tests conducted on animals to which he administered it in liquid form.

Workmen that comes into contact with tobacco in the fermentation or pulverization phase and in all the moments in which the processing releases heat - which promotes the volatility of the "invisible" particles - are exposed to increased risk.

The single long-term symptom, however, prevalent only in the tobacco manufacturing workers, is the gray color that, in Mélier's view, indicates a change in the blood, i.e. a sort of intoxication.

Examinations of the blood and urine of the workers did not provide in any case satisfactory results in order to detect any traces of substances, which may have altered the composition of biological fluids.

To examine the effects of exposure to tobacco during fermentation, plants, live rabbits and live birds, were left in warehouses. As a result, they haven't shown obvious damage resulting from their exposure to the tobacco processing.

According to a leit-motif of the era, the author imputes the harmlessness of the tobacco processing to the great industry progress that reduced risks for workers.

This attitude is coherent with the pre-positivist thinking, praising the technological progress as a factor of development for the whole society and element of progress of peoples. Doctors who deal with industrial hygiene on one hand denounce the risks of disease produced by labor, on the other hand they highlight how technology can assist and improve working conditions preventing the onset of disease.

This kind of approach allows the author to not enter into conflict with the authoritative reference of Ramazzini (who exhibited his theories at a time when there were not yet preventive measures, safe machines and industrial production systems), simply affirming that any pathogens effects of tobacco have been reduced by new processing techniques. He believes that tobacco fumes are even preventive from contamination of certain diseases, and healing, especially for rheumatic pains, sporadic fevers, scabies, constipation and some epidemic diseases.

The debate that developed in France on damaging or harmless feature of tobacco production is prevalent also in Italy, where tobacco factories are among the most developed ones, especially in the northern regions.

Risks and benefits of Tobacco in the Italian medicine during the XVII and XVIII Centuries

The medical foreign literature on tobacco received great interests also among Italian researchers, thus the debate over tobacco effects fastly found fertile ground also in Italy. In those years, Italy was one of the countries with the most developed and organized tobacco factories (18). For example, Berruti (1796-1870), who was an experimental physiology Professor at the University of Turin and author of a famous report on cholera for the Piedmontese regia commission and several naturalist researches, resuming Parent-du-Chatelet's work and F. Melier's Inquiry on the workers' health status dated on 1842, analyzes in his work entitled "*Sull'uso del tabacco e sulla sanità degli operai che lavorano nelle fabbriche di tabacco*" how diseases are linked to the tobacco processing (19).

The goal of this author was to underline the main damages induced by the tobacco processing and, thus to debunk the Ramazzini's thesis on the pathogenic risks. According to Berutti, in fact, the major part of diseases affecting tobacco industries workers depends on the structural unhealthiness of factories. To confirm this, the author suggests to use preventive medicine measures adopted in France and Piedmont, where doctors working in factories have the duty to supervise daily the workers' health conditions (15).

Accordingly to his theory in fact, diseases that medical tradition referred to the use of tobacco (apoplexy, nervous disorders, delirium, paralysis, irritation of mouth and bronchi, polyps, nose and mouth ulcers, respiratory inflammation) could not be linked to tobacco as a pathogenic agent, provided that a few important symptoms of poisoning (such as nausea and abdominal cramping) are away and that generally workers have nonspecific symptoms and symptoms that overlap with those ones reported by other categories of workers. Rather, these symptoms are linked to inappropriate fatigue, mandatory inactivity, poor housing, poor diet, unhealthness of dark and crowded workplaces; all these factors lead to understand why

workers are thin and also have a bad skin tone. The Berutti's observations provided on the tobacco factories located in Piedmont, are supported by French coeval literature.

Differently from other authors, Berutti provided a detailed gender classification of tasks, including the related risk exposure of men and women. The storage of dehydrated leaves in indoor location and the fermentation of them are described as responsible for occupational diseases and, thus, the preventive action to improve locations architecturally and hygienically are the only measures to reduce significantly the risk exposure.

Berutti concludes that there is any risk linked to the tobacco substance. Diseases that have been highlighted as a consequence of tobacco manipulation or inhalation are actually simply connected to the change in season and rather tobacco factories are healthy places in which the staying is useful for the treatment of pulmonary tuberculosis.

The Reception of Berutti's Work during the XIX Century

The Berutti's work finds clearly wide use and reply in Literature, as shown by the report of the Imperial Society of Medicine written by J.B. Ygonin in 1866 focusing on diseases of processing tobacco workers (20). In this report the author recalls the Berutti's apologia focusing on the main benefits that the technological and industrial progress has brought to society and Public health. The advances of production cycles and work processes make the tobacco manufacturing industries harmless when compared with the past, though few cases of Cachexia, dysentery, insomnia, nausea, loss of appetite, dull skin tone are even reported after years of work and, in any case, with weaken symptoms.

In fact, thanks to the advances mentioned above, workers are protected against direct contact with tobacco. Therefore, in order to improve working conditions it is necessary to air working places. Similarly to Berutti, Ygogin attributes serious diseases to living and working conditions, malnutrition and poverty.

Starting from the second half of Nineteenth Century, with the first experimental studies and thanks to data observed during autopsy, it begins to investigate tobacco-induced damages and to denounce their dangerousness. Nonetheless it continues to debate over the tobacco effects on tobacco processing health workers', even at the beginning of the Nineteenth Century. To this purpose, we recall Gaetano Pieraccini (1864-1957), doctor interested in diseases of working population, member of Parliament from 1909 to 1913 and exponent of the Italian Socialist Party, who promoted a campaign to guarantee employee and social insurances to tobacco workers (21). In fact, in his treatise of Occupational Medicine the author recalls the debate over effects of tobacco processing, trying to conciliate the past different oppure diverging considerations about its pathogenicity.

Furthermore, Pieraccini observes and describes the incidence of various techniques to manufacture tobacco depending on the type of the product to be wrapped (cigars, cigarettes, or snuff tobacco), similarly to the other authors. The result was a detailed description of production cycles and hierarchical classification of the exposure risk of workers in regard to their tasks.

In order to confute the opposite theories, Pieraccini decided to visit the tobacco factories located in Florence, highlighting the more dangerous element in the manufacturing process of tobacco, with particular reference to the fermentation process. On the basis of the analysis conducted, in fact, he found that nicotine, ammonia and carbonic acid – that are moreover same substances inhaling together the smoke and that intoxicate the atmosphere – are emanated from the process of fermentation. These substances cause chronic and acute disturbs. If it is true that people who inhale tobacco powder are at risk of respiratory mechanical effects, it is also true that the exposure of tobacco inhalations may be responsible for intoxications. Indeed, during wash and maceration steps toxic substances can pass through respiratory tract as well as through the skin. Among newly recruited female workers, mostly employed for the tobacco maceration and fermentation, it has been observed symptoms of severe intoxication with nausea, dizzinesses and vomit; also among male workers employing to accumulate tobacco, it has been observed burning sensation behind the sternum, cough, sternutation, lacrimation and irritation of he conjunctiva.

While all the authors of that time agree on the existence of tobacco-induced acute disease, there isn't

at international level an unanimous consensus on how long it will take to cure tobacco diseases.

To this purpose, Pieraccini made the difference between the concept of toxicity (or of innocuity) and addiction. Although according to this author the addiction entails the disappearance of symptoms (or attenuation) until acute phenomena vanishes, there isn't any element in his theories that led us to exclude the toxicity of tobacco and the dangerousness of the related diseases.

Contrary to the assertions made by previous authors, Pieraccini believes that workers's diseases can not be attributed to their living conditions but rather to the tobacco manufacturing process itself. Although acute deseases from tobacco (and thus transitory) have long been identified, there are still divergences on the existence and severity of chronic ones.

According to this author, nervous system, cardiovascular and respiratory systems diseases and the diseases caused by tobacco processing are chronic.

In order to reduce pathogenic risks in tobacco factories, Pieraccini suggests continuous ventilation systems, larger rooms, good heating, special clothing, wash basins, dining halls, appropriate workbenches, separation of the different operating areas – that is positioning of fermentation spaces away from laboratories and distance between the latter ones and the drying environments. According to him, these measures may avoid that in the factories there is excessive air pollution.

Conclusions

The debate on the healthiness of tobacco workers and on risks of tobacco-induced disease first develops in the primordial occupational medicine, with the analysis of illnesses that affect the tobacco workers.

Precisely, only in the second half of the nineteenth century, studies on smoking pathogenicity begin along with the development of organic chemistry. Thanks to this discipline, tobacco properties and the burning substances that cigars gives off are analyzed with particular reference to the effects that cause to organs and the physiological alterations. The triumph and the systematization of pathological anatomy leads to the first observations on the correlation between diseases of the respiratory system and smoking. Nevertheless, studies are sporadic and primordial until the late nineteenth century.

Therefore, up to this moment, authors analyse on a large scale the potential harmful effects of tobacco within industrial hygiene and occupational medicine.

As mentioned above, Ramazzini denounces the pathogenic risks of tobacco processing. Then in the nineteenth century technological progress, with new production systems in the industrial era, makes the work less burdensome and more harmless, so that the tobacco industries are referred to as the least unhealthy industries and tobacco as a healing substance rather than a damaging one.

The *longue durée* of this concept is even found in the practice of homeopathy (which has developed on XIX century), where tabacum is today still used to treat few symptons such as dizziness, vomit and motion sickness. It is no coincidence that homeopathy uses tobacco to treat same simptons that first occupational physicians found on tobacco workers, that eneterd into contact and inhaled of dusts.

The positive conclusions of the analysis of the effects of tobacco on those who work on it, and the idea of its healing and preservative power for acute diseases, are perhaps the cause of the stall of thoughts on smoking pathogenicity?

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