

# **Can Smokeless Tobacco Reduce the Health Consequences of Smoking?**

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**Washington, D.C.**

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**“ Substituting this form of nicotine dependence for smoking leaves much to be desired and reminds me of the methadone cure for heroin addiction. The object of treatment is nondependency, not the lesser of two ills.”**

**Pfister A. Letter to the Editor Am J Med 1998; [vol]:184**

# Three Ideas About Smokeless Tobacco

- **Smokeless tobacco use is far less harmful to health than inhaling tobacco smoke**
- **Smokeless tobacco is a heterogeneous category – some varieties pose more risks than others**
- **Smokeless use in Sweden has resulted in substantial decreases in cigarette smoking and decreases in lung cancer and other smoking related diseases**

# Tobacco Consumption United States 1900-1999

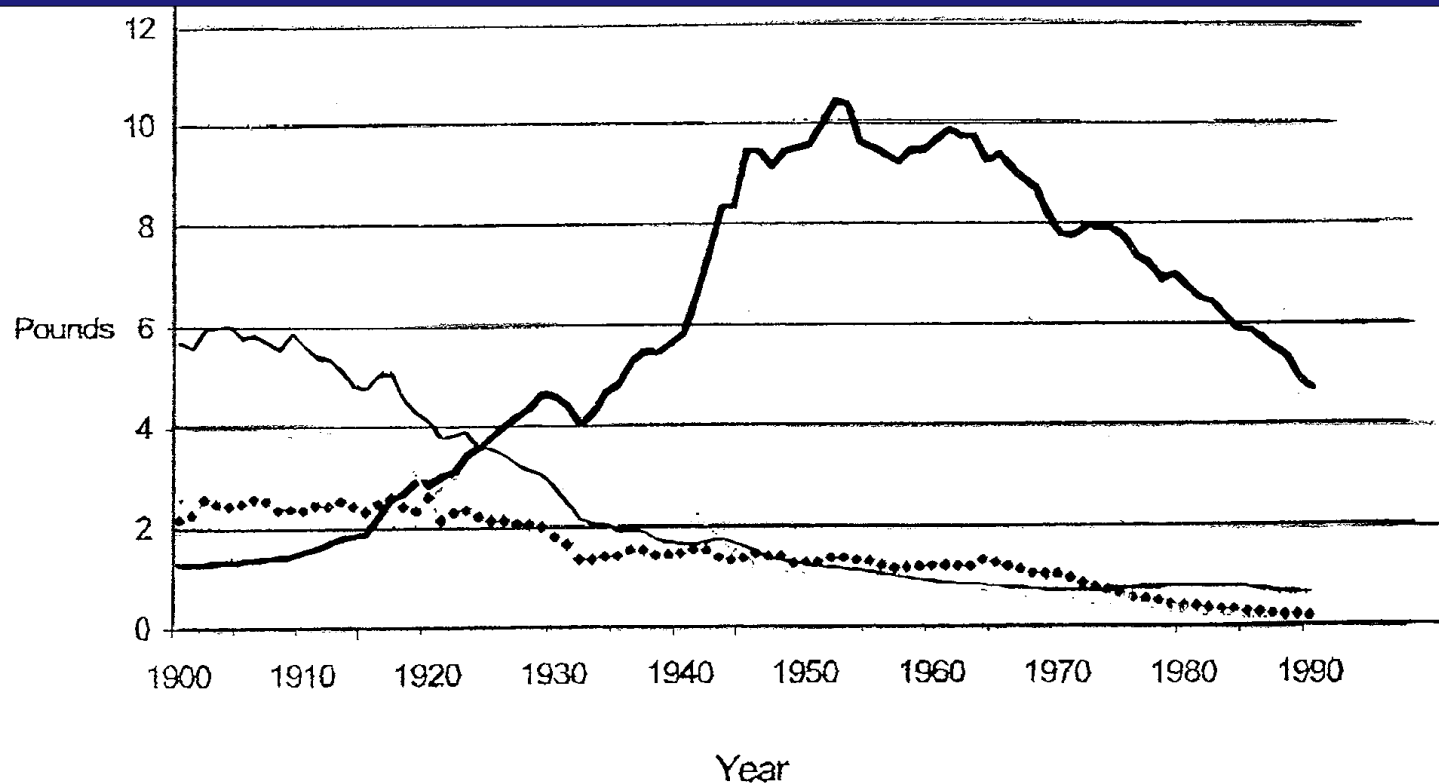
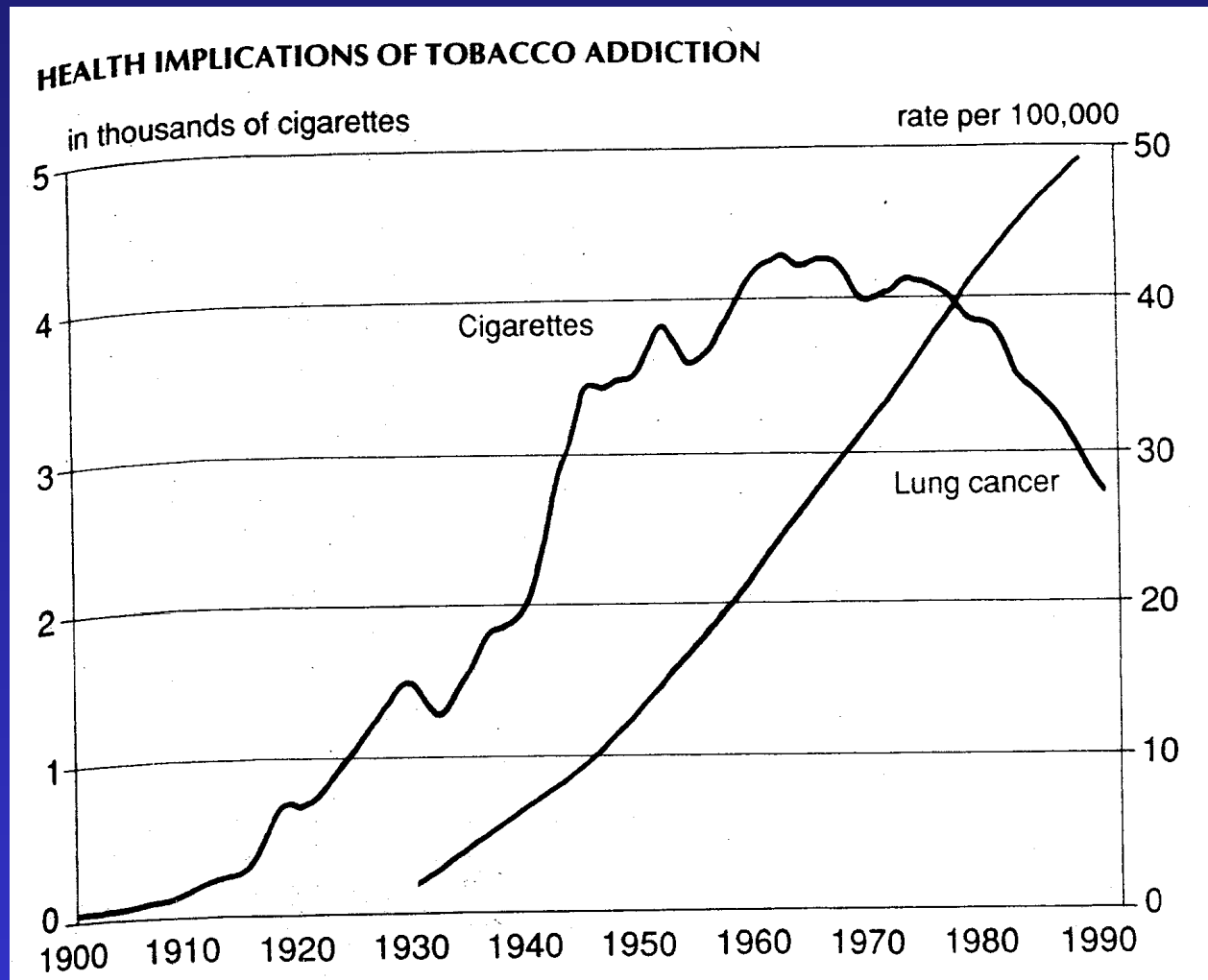


FIG. 5. Apparent per capita consumption (lb) by product type, United States: 1900-1990. Based upon the adjusted data of Creek *et al.* (1945-1990) [6] and the predicted values (1900-1944) obtained from inverse regression in which Creek *et al.*, [6] data were regressed the data of Milmore and Conover [5].

# Health Implications of Tobacco Addiction

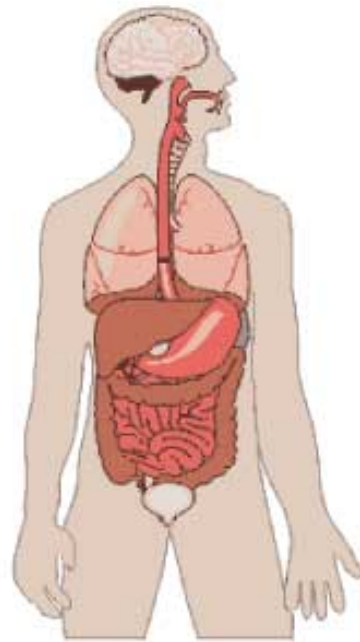


# Annual Smoking-Attributable Mortality (SAM), U.S. 1995-1999

<b>Cancers - Lip, oral cavity pharynx</b>	<b>5,137</b>
<b>Cancers - Esophagus, larynx, kidney, bladder, etc.</b>	<b>25,839</b>
<b>Cancers - Trachea, lung, bronchus</b>	<b>124,813</b>
<b>Cardiovascular diseases</b>	<b>148,605</b>
<b>Respiratory diseases</b>	<b>98,007</b>
<b>Pediatric diseases</b>	<b>1,007</b>
<b>Burns</b>	<b>966</b>
<b>Environmental tobacco smoke</b>	<b>38,053</b>
<b>TOTAL</b>	<b>442,398</b>

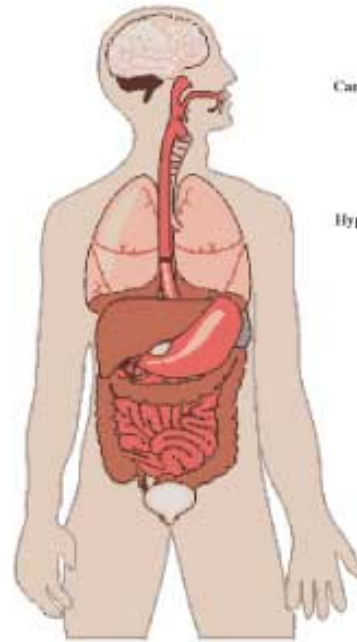
# Cigarettes vs. Smokeless Tobacco: A Comparison of Health Risks in the United States

## Male Risk of Cigarette-Attributed Mortality



Cerebrovascular Disease: 3.7x  
 Cancers, Lip, Oral Cavity, Pharynx: 27.5x  
 Cancer, Esophagus: 7.6x  
 Cancer, Larynx: 10.5x  
 Cancer, Bladder: 2.9x  
 Cancers, Trachea, Lung, Bronchus: 22.4x  
 Bronchitis, Emphysema: 9.7x  
 Chronic Airway Obstruction: 9.7x  
 Pneumonia, Influenza: 2.0x  
 Other Arterial Disease: 4.1x  
 Hypertensive Diseases: 1.9x  
 Atherosclerosis: 4.1x  
 Aortic Aneurysm: 4.1x  
 Ischemic Heart Disease: 2.8x

## Male Risk of Smokeless-Tobacco Attributed Mortality



Cancers, Oral: 8x  
 Hypertension: 7x

**Total Cigarette-Attributed Mortality: 442,000**

**Current Cigarette Smokers :  
Approx. 47 million**

**Total Smokeless Tobacco-Attributed Mortality: 6,000**

**Current Smokeless Tobacco Users:  
Approx. 12 million**

# Facts on Smoke

- **Cigarette smoke contains over 4000 compounds – 43 of these are toxic and / or carcinogenic**
- **Unlike combusted tobacco products, the major carcinogens in smokeless tobacco are the TSNAs – Tobacco Specific Nitrosamines**
- **“TSNAs are the major carcinogen in smokeless tobacco and snuff and are associated with cancer of the oral cavity of snuff dippers”**

*(Chemical Research in Toxicology, Vol. 14, No. 7, 2001)*

# **Tobacco Specific Nitrosamines (TSNAs)**

- **Leaf nitrates reduced to nitrites by bacterial activity and aging**
- **Nitrites and amines such as nicotine form nitrosamines – carcinogenic in animals and likely in humans**
- **NNN and NNK are of most concern**

# Tobacco in Smokeless Products

- **Mostly dark tobacco varieties**
  - **Air-cured**
  - **Fire-cured**
  
  - **Fermented**
  - **Non-fermented**
  - **Cooked**

# Smokeless Tobacco

- **Powdered**                      **nasal & oral snuff**
- **Ground**                        **nasal & oral snuff**
- **Cut & grated**                **chewing & oral snuff**
- **Stripped & packed**        **chewing tobacco**

# **Powdered Tobacco** *for Dry Snuff*

- **US dry snuff**
- **Indian dry snuff**

# US Dry Snuff

**PROCESSING / MANUFACTURING:** Tobacco is fire-cured, then fermented and processed into a dry, powdered form. The moisture content of the finished product is less than 10%. It is packaged and sold in small metal or glass containers.<sup>1</sup>



<sup>1</sup> Asma, S. (1998). Definitions of tobacco products. Unpublished Work.

<sup>2</sup> Substance Abuse and Mental Health Services Administration. Summary of Findings from the 2000 National Household Survey on Drug Abuse. Office of Applied Studies, NHSDA Series H-13, DHHS Publication No. (SMA) 01-3549. Rockville, MD, 2001.

# **Ground Tobacco** *for Moist Snuff*

- **US oral snuff**
- **Scandinavian oral snus**
- **Indian Pan Masala**
- **Sudanese Toombak**

# US Moist Snuff

**PROCESSING / MANUFACTURING:** The **tobacco** is either air- or fire-cured, then processed into fine particles (“fine cut”) or strips (“long cut”). Tobacco stems and seeds are not removed. Moisture content of the final product is up to 50%. The tobacco is sold either loose (in such products as Skoal, Copenhagen and Kodiak), or packaged in small, ready-to-use pouches called *packets* or *sachets* (in such products as Skoal Bandits). Nicotine is released more rapidly from the fine cut form due to the greater surface area. Moist snuff is the most commonly used form of tobacco in the United States.<sup>1</sup>

Short cut



Long cut



Long cut flavored



<sup>1</sup> Asma, S. (1998). Definitions of tobacco products. Unpublished Work.

# Toombak

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**GEOGRAPHIC LOCATION OF USE:** Sudan

**PRODUCT CONSTITUENTS:** tobacco, sodium bicarbonate

**PROCESSING / MANUFACTURING:** Tobacco leaves are harvested and left in a field for uniform drying. The leaves are then tied into bundles, sprinkled with water, and stored for a couple of weeks at 30 to 45°C to allow fermentation. The leaves are then ground up and aged for up to a year.



# US Moist Plug

**PROCESSING / MANUFACTURING:** Commercially manufactured. **Enriched tobacco leaves** (Burley and bright tobacco or cigar tobacco) or fragments are wrapped in **fine tobacco** and pressed into bricks. Moist plug tobacco has at least 15% moisture. Most plug tobacco is flavored and sweetened with **licorice**. Plus tobacco is packaged as a compressed brick or flat block wrapped inside natural tobacco leaves. Typically weighs 7 to 13 ounces.<sup>1</sup> Sugar content is approximately 24%.<sup>3</sup>



<sup>1</sup> Asma, S. (1998). Definitions of tobacco products. Unpublished Work.

# **Stripped and Threshed Tobacco** *for Chewing Tobacco*

- **US twist and plug chew**
- **US loose leaf chew**

# US Loose Leaf Chew

**PROCESSING / MANUFACTURING:** Commercially manufactured. Loose **cigar tobacco leaves** are air-cured, then stemmed, cut or granulated and loosely packed to form small strips of shredded tobacco. Most brands are sweetened and flavored with **licorice**. Typically sold in pouches weighing about 3 ounces.<sup>1</sup> Loose-leaf tobacco has a high average sugar content (approximately 35%).<sup>3</sup>



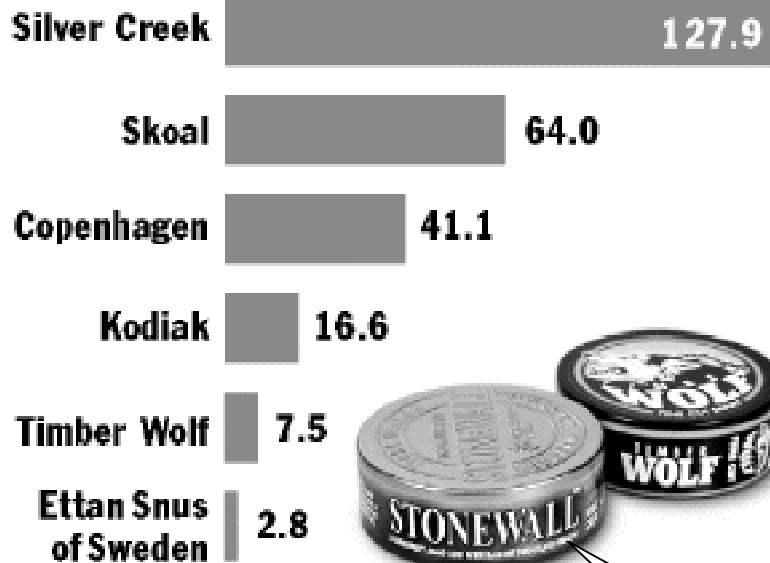
<sup>1</sup> Asma, S. (1998). Definitions of tobacco products. Unpublished Work

**These products differ widely in  
constituents of concern**

# TSNAs in Smokeless Tobacco

## What's in Smokeless Tobacco

Levels of total tobacco-specific nitrosamines in five domestic and one Swedish moist snuff brands, in micrograms per gram of dried tobacco



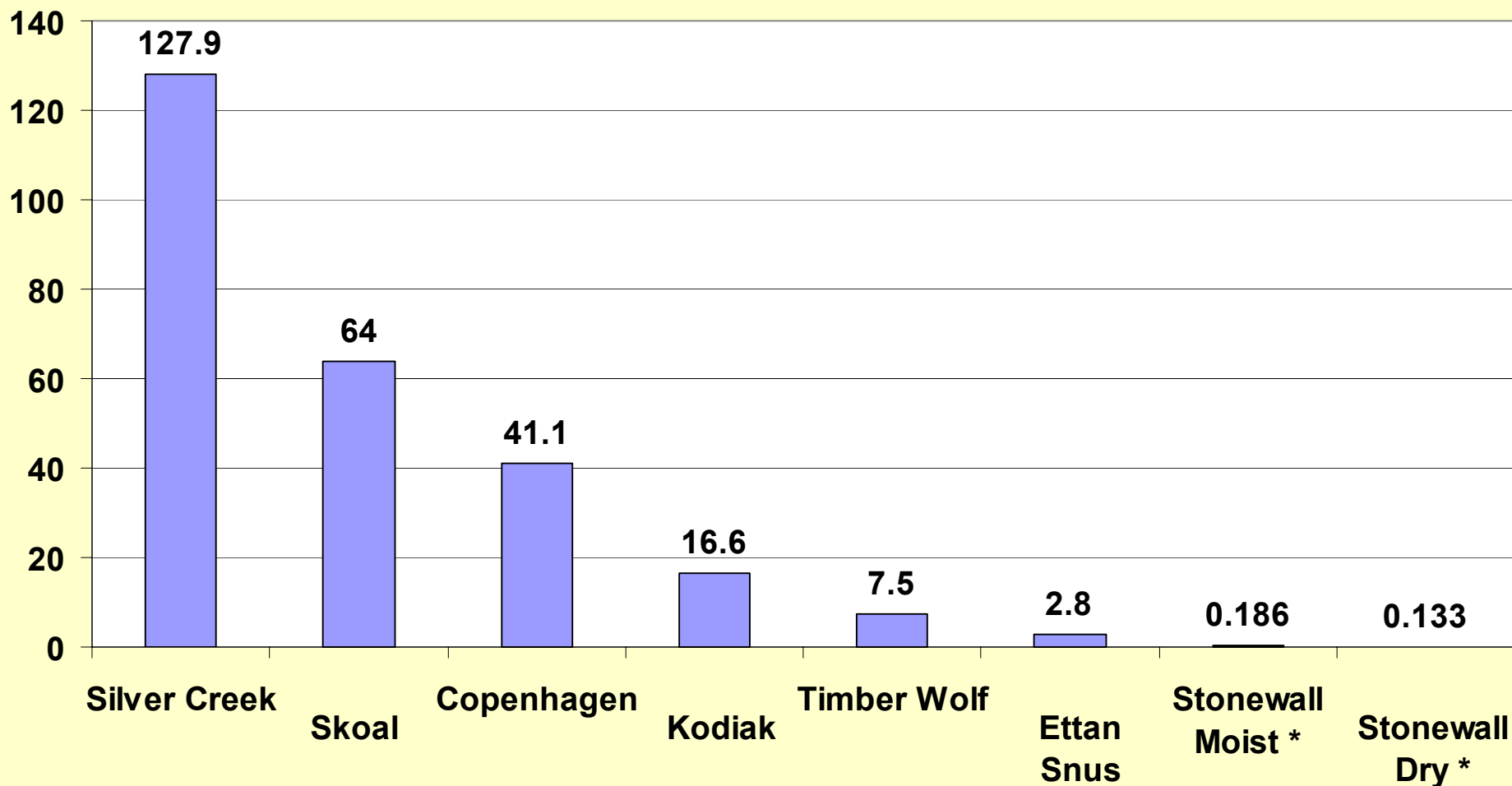
Source: study commissioned by Massachusetts Health Department

0.15\*

K. D. Brunnemann, J. Qi and D. Hoffmann: Aging of Oral Moist Snuff and the Yields of Tobacco-Specific N-Nitrosamines (TSNA), AHF, Valhalla, N.Y. 10595, June 22, 2001

\* Stonewall was tested separately

# TSNA Levels in Selected Brands of Smokeless Tobacco (ug/g – parts per million)



K. D. Brunnemann, J. Qi and D. Hoffmann: Aging of Oral Moist Snuff and the Yields of Tobacco-Specific N-Nitrosamines (TSNA), AHF, Valhalla, N.Y. 10595, June 22, 2001

\* Stonewall Moist and Dry were tested separately

# Toombak

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**GEOGRAPHIC LOCATION OF USE:** Sudan

**PRODUCT CONSTITUENTS:** tobacco, sodium bicarbonate

**PROCESSING / MANUFACTURING:** Tobacco leaves are harvested and left in a field for uniform drying. The leaves are then tied into bundles, sprinkled with water, and stored for a couple of weeks at 30 to 45°C to allow fermentation. The leaves are then ground up and aged for up to a year.



# TSNAs in Tobacco Snuff

		<b>Average (ppm)</b>	<b>Maximum (ppm)</b>
<b>Sudan</b>	<b>Idris et al, 1998</b>	<b>1020.0</b>	<b>9710.0</b>
	<b>Idris et al, 1991</b>	<b>3440.0</b>	<b>10950.0</b>
<b>USA</b>	<b>Brunnemann et al, 2002</b>	<b>4.6</b>	<b>37.6</b>
	<b>Wall Street Journal, 2001</b>	<b>51.4</b>	<b>127.9</b>
	<b>Hoffmann &amp; Djordjevic, 1997</b>	<b>7.3</b>	<b>8.5</b>
	<b>Hoffmann et al., 1987</b>	<b>27.9</b>	
<b>Sweden</b>	<b>Idris et al., 1998</b>	<b>6.0</b>	<b>11.0</b>
	<b>Brunnemann &amp; Hoffmann, 1982</b>	<b>4.2</b>	

**Worldwide, carcinogenic TSNAs in  
smokeless tobacco may vary by  
more than one thousand-fold**

**In the developed world they vary by several  
hundred-fold**

# **The Swedish Story**

**The use of snus – oral smokeless tobacco (moist snuff) is traditional in Sweden.**

**Currently about 20% of men and 2 to 3% women use snus**

**Over the past 25 years, the use of snus had increased and the rate of cigarette smoking has decreased.**

**The rate for men is now about 15% in Sweden, 10% in northern Sweden – the lowest rate in the developed world.**

# The Swedish Story

- **For about 20 years Swedish Match has prevented high TSNA levels in “snus” (Swedish snuff)**
- **This was accomplished by a combination of selection of tobacco leaf, pasteurization and refrigerated storage**

## **The Swedish Story** (Cont'd)

- **Swedish data provide indirect evidence that reducing TSNA's reduces risk of oral pathology**
- **Several recent case control studies have shown no significant increases in mouth cancer among snus users**
- **These same studies did find elevated risk of mouth cancer among smokers and heavy drinkers**

## **The Swedish Story (Cont'd)**

**Swedish researchers have postulated that the absence of elevated mouth cancer risk among snuff users is a result of avoiding the high TSNAs typical of smokeless tobacco in the U.S., Africa and Asia**

# The IMM Study

- **IMM**
  - **Institute of Environmental Medicine**
  - **The Karolinska Institute**
  - **University of Stockholm, Sweden**
- **IMM Study**
  - **Commissioned and published by Swedish National Board of Health and Welfare**

## **Conclusions of IMM Study**

- **Long term use of snuff does not alter risk factors for cardiovascular disease**
- **Case-control studies do not support the conclusion that snuff use increases the risk for cancer - but there is not sufficient evidence for excluding such a risk**

## **Additional Observations**

- **Since the 1960s, snuff use in Sweden is several-fold higher than snuff use in Canada, Denmark, France, or USA**
- **Nevertheless, the death rate in Sweden for oral cancers is lower than in all of these countries**

# Daily Smoking Rates in Sweden

**Ranstrum, 1999:**

- **In Sweden, mortality for smoking related diseases among men is lowest in any Western country**
- **Mortality for females is not unique**
- **Men with history of snus use had a higher rate of quitting cigarettes**

**Ranstrum concludes that the use of snuff  
“helps keep smoking rates low rather than  
promoting smoking”**

# Composition of Swedish Snus

- **Air cured tobacco only**
- **No fermentation**
- **Rapid cooking to virtual sterility**
- **Low nitrosamines**
- **Safe additives and flavors**
- **Stored cold until sold**

# **Common Ingredients of Smokeless Tobacco**

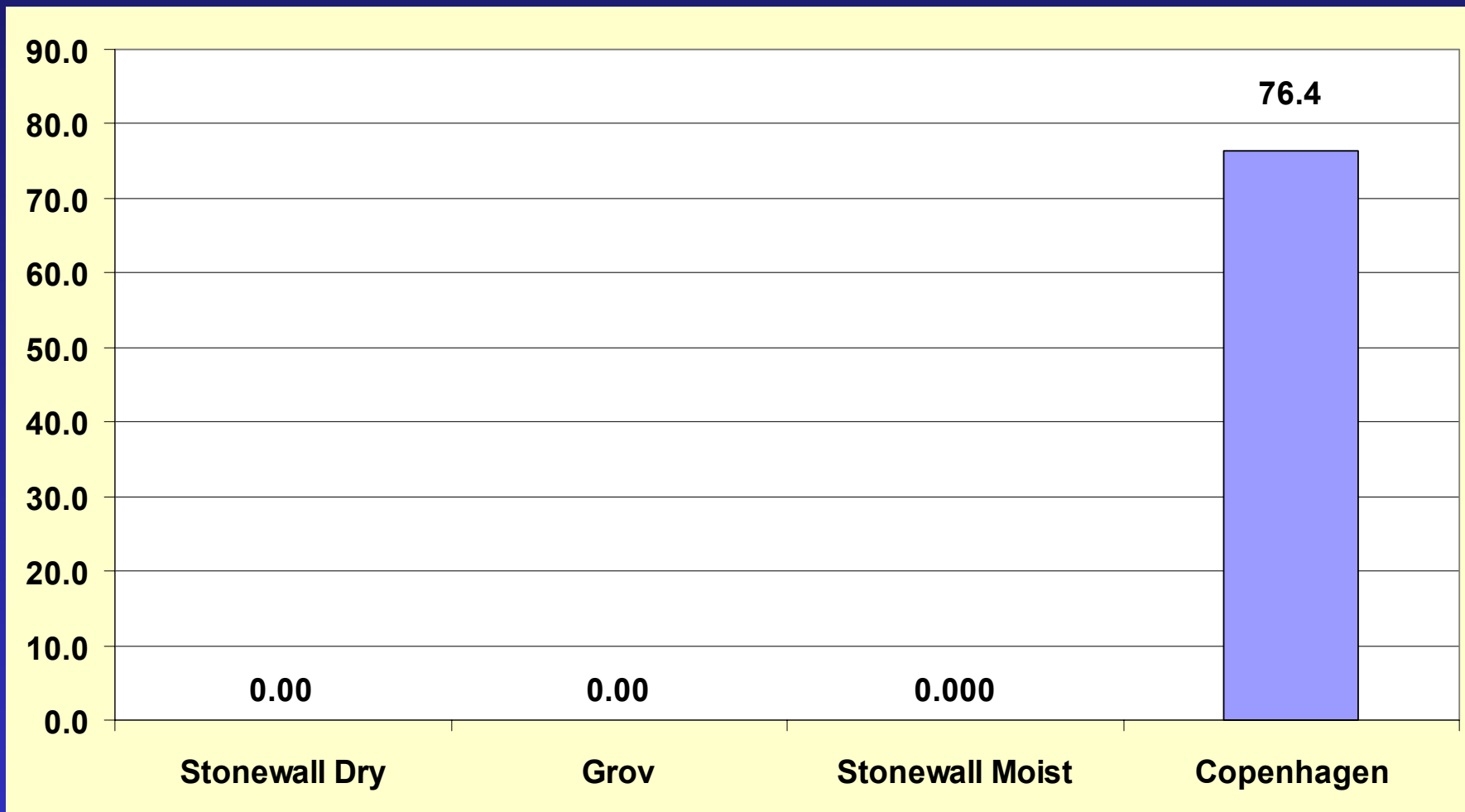
## *North America & Europe*

- **Air-cured & fire-cured tobacco (N. tabacum)**
- **Sucrose, Fructose, Sorbitol, Molasses, Dried fruit**
- **Water, Sodium bicarbonate**
- **Sodium chloride, Ammonium chloride**
- **Licorice, Anise, Menthol, Wintergreen, Eucalyptus**
- **Paraffin oil, Glycerol**

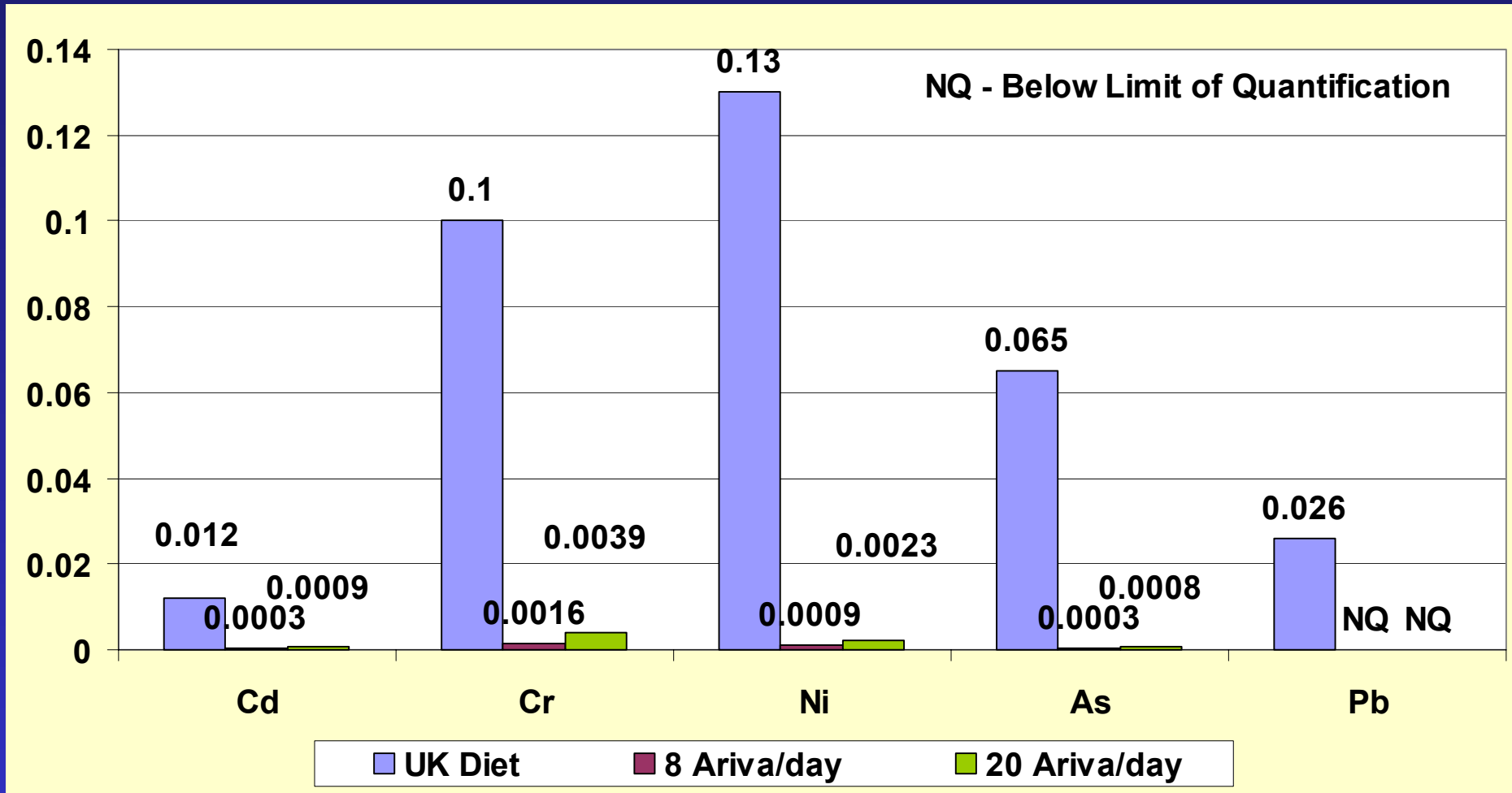
# Other Components of Concern in Smokeless Tobacco

- PAH – Benzo[a]pyrene
- Formaldehyde
- Generic Nitrosamines
- Metals – As, Ni, Cd
- Polonium<sup>210</sup>

# Benzo[a]pyrene Content of Smokeless Tobacco



# Trace Metal Levels in Average UK Diet Compared to Exposure from 8 and 20 Cigaretts/day (mg/day)



# Conclusion

**We should not dismiss the implications of the Swedish experience for reducing the adverse health consequences of tobacco smoking**