

# Molecular epidemiology of smoking behaviors among smokers of cigarettes with different tar yields

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# Outline

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# Background

- **Smoking behavior is a comprehensive action**
  - ✓ Including puff frequency, puff volume, puff intervals and duration
  - ✓ Affected by sociological factors and cigarette itself
  
- **In China, tobacco industry usually reduces harmful compound emissions by reducing tar yields of cigarettes**
  - ✓ But it is not approved by the health authorities, for the reasons that smokers may smoke more cigarettes or take intense puffs

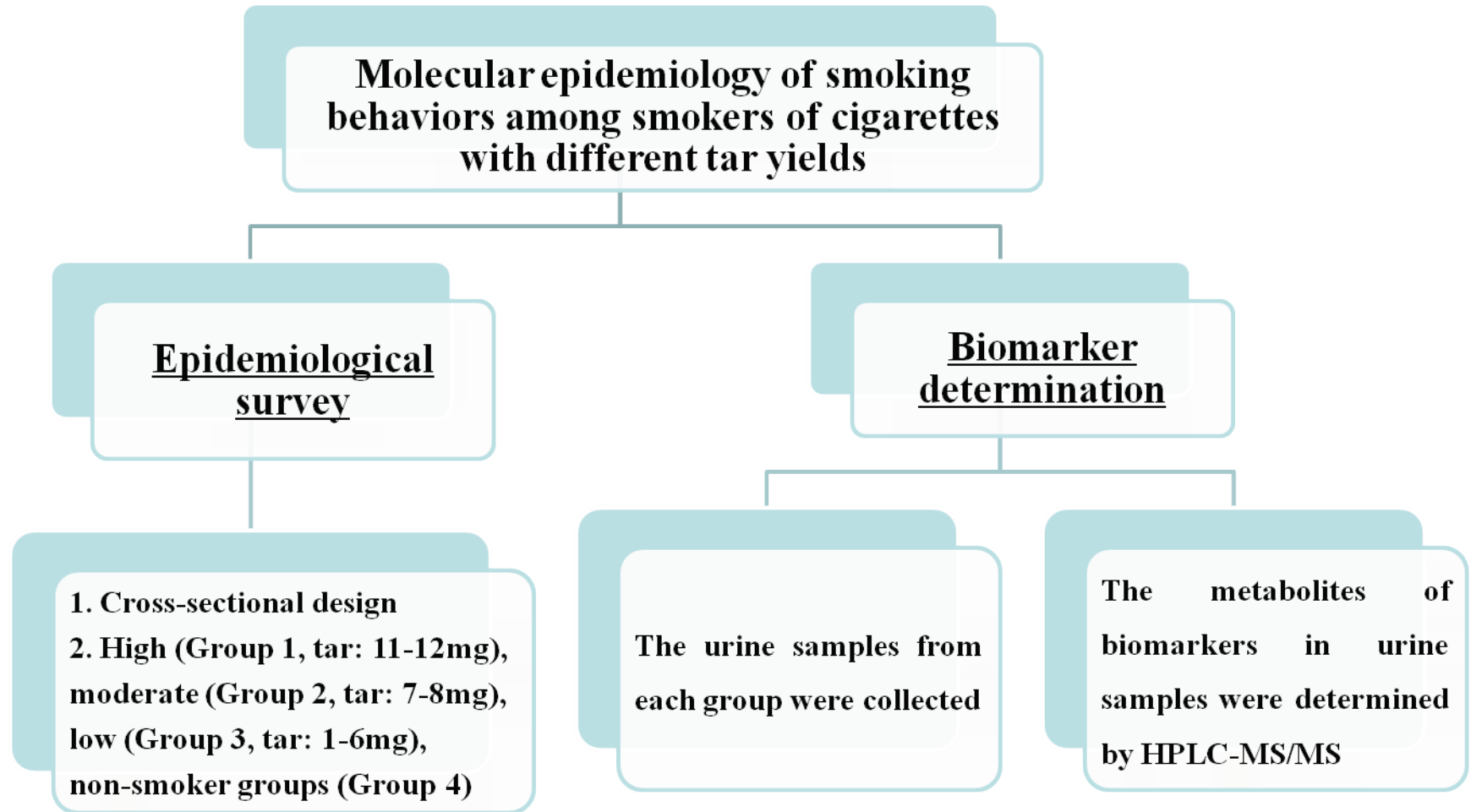
# Background

## ➤ Molecular epidemiology

- ✓ including epidemiological survey and biomarker determination, offer a new approach to addressing these challenges

**To investigate the smoking behaviors of smokers of different tar yield cigarettes, molecular epidemiology were adopted to study smoking behaviors and their influencing factors**

# Study Design



# Materials and methods-Epidemiological survey

- The study was approved by Ethics Committee
- Subjects: Wuhou and Chenghua district, Chengdu, Sichuan Province
- Inclusion criteria: 18 - 65 years old, smoking at least 5 cigarettes per day for the last six months, in stable and generally good health, no taking medicines
- Groups: high (9-11mg), moderate (7-8mg), low (1-6mg) tar cigarette smokers and nonsmokers
- Subject numbers: total 435 persons, 207, 70, 51, 107 for high, moderate, low tar cigarette smokers and nonsmokers



# Materials and methods-questionnaire

## ➤ Contents

- ✓ **Subject demographics:** gender、age、degree of education、marital status、career、income、Body Mass Index (BMI) , etc
- ✓ **Smoking behavior:** cigarette smoking、puff interval、nicotine dependence 、cigarette change, etc

## ➤ Quality control

- ✓ Advice from experts, supervisors were trained
- ✓ All questionnaires were entered by trained data-entry personnel. double data entry procedures

## ➤ Data analysis

- ✓ T-test, Chi-squared-test, One-way analysis of variance

# Materials and methods–biomarker determination

## ➤ Sample collection

- ✓ 24 h urine were recorded

## ➤ Samples storage

- ✓ Transferred into tubes
- ✓ Transport by air
- ✓ Stored refrigerated at -40 °C until sample analysis

## ➤ Biomarker determination: The metabolites of biomarkers in urine samples were determined by HPLC-MS/MS.



# Materials and methods–biomarker determination

## ➤ Biomarker including:

- ✓ Nicotine
- ✓ TSNAs
- ✓ PAHs (Polycyclic Aromatic Hydrocarbons)
- ✓ VOCs (Volatile Organic Compounds)
  - 1, 3-butadiene
  - Benzene
  - Acrylonitrile
- ✓ Volatile-carbonyl-compounds
  - Caracrolein
  - Crotonaldehyde

## ➤ Data analysis: One-way analysis of variance

# Results and Discussion-questionnaire

The characteristics of the subjects					
	high-tar group	moderate-tar group	low-tar group	non-smoker group	<i>p</i>
Age, Mean (SD)	43.5(12.0)	40.8(13.1)	38.4(13.3)	41.8(12.1)	0.043
Sex, N%					0.001
Men	204(98.6)	69(98.6)	46(90.2)	94(87.8)	
Women	3(1.4)	1(1.4)	5(9.8)	13(12.1)	
Education, N (%)					0.001
Junior school	92(44.4)	29(41.4)	14(27.5)	34(31.8)	
high school graduates	71(34.3)	15(21.4)	13(25.5)	19(17.8)	
Graduate	42(20.3)	24(34.3)	22(43.1)	40(37.4)	
Post-Graduate	2(1.0)	2(2.9)	2(3.9)	14(13.1)	
Marital status, N (%)					0.071
unmarried	28(13.5)	12(17.1)	15(29.4)	12(11.2)	
Married	174(84.1)	55(78.6)	36(70.6)	95(88.8)	
divorce	6(1.9)	2(2.9)	0(0)	0(0)	
widowed	2(0.5)	1(1.4)	0(0)	0(0)	

# Results and Discussion-questionnaire

**Table 1: The characteristics of the subjects**

	high-tar group	moderate-tar group	low-tar group	non-smoker group	<i>p</i>
Occupation, N(%)					0.001
Manager	18(50.0)	4(11.1)	3(8.3)	11(30.6)	
professionals & technical	19(26.4)	11(15.3)	7(9.7)	35(48.6)	
Staff	18(50.0)	6(16.7)	2(9.7)	10(27.8)	
Skilled worker	13(35.1)	9(24.3)	7(18.9)	8(21.7)	
attendant	33(56.9)	13(22.4)	6(10.3)	6(10.3)	
unskilled worker	23(63.9)	4(11.1)	2(5.5)	7(19.4)	
Student	4(20.0)	4(20.0)	10(50.0)	2(10.0)	
Else	79(56.4)	19(13.6)	14(10.0)	28(20.0)	
monthly income, N(%)					0.007
<2000	47(50.0)	14(14.9)	13(13.8)	20(21.3)	
2000—2999	64(54.2)	22(18.7)	12(10.2)	20(16.9)	
3000—3999	46(51.9)	13(14.6)	14(15.7)	16(16.8)	
≥4000	50(37.3)	21(15.7)	12(9.0)	51(38.0)	
BMI, Mean(SD)	24.1(3.5)	23.7(3.7)	23.2(3.7)	24.2(3.4)	0.267

# Results and Discussion-questionnaire

## Compare with different groups:

- **Statistically significant( $P<0.05$ ):** age, gender, education, occupation
- **No statistical significance ( $P>0.05$ ):** marriage status, BMI(body mass index)

# Results and Discussion-Self-reported smoking habits

## Self-reported smoking habits

Group	low-tar group	moderate-tar group	high-tar group	<i>P</i>
puffing interval, N(%)				0.443
<10s	17(33.3)	32(47.1)	65(31.9)	
10—19s	21(41.2)	22(32.4)	78(38.2)	
20—29s	7(13.7)	8(11.8)	33(16.2)	
≥30s	6(11.8)	6(8.8)	28(13.7)	
depth of inhalation N(%)				0.934
oral cavity	5(9.8)	8(11.4)	27(13.2)	
laryngeal	13(25.5)	19(27.1)	58(28.3)	
lung	33(64.7)	43(61.4)	120(58.5)	
butt length, N(%)				0.854
<+5mm	16(31.4)	26(37.1)	82(40.0)	
5mm—9mm	22(43.1)	27(38.6)	76(37.1)	
≥10mm	13(25.5)	17(24.3)	47(22.9)	
cigarette number, (cigarette/day), Mean(SD)	15.4(12.5)	15.7(8.4)	16.7(8.2)	0.572
The Fagerstrom Test for Nicotine Dependence(FTND)	2.6(2.1)	3.4(2.4)	3.2(2.5)	0.149

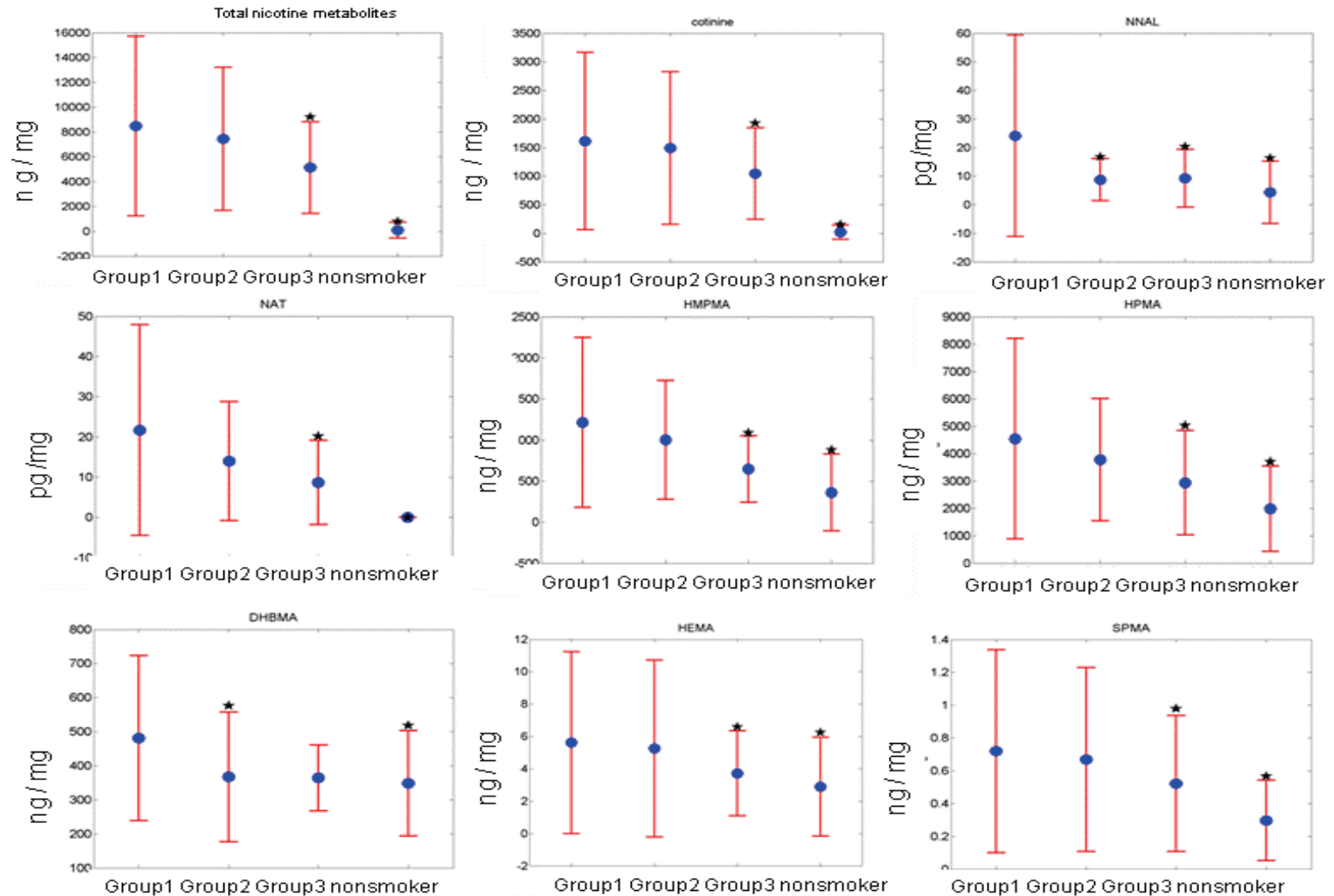
# Results and Discussion-Self-reported smoking habits

- There were **no significant differences** in following contents among different tar groups.
  - ✓ Cigarette number ( $P=0.572, >0.05$ ),
  - ✓ Puffing interval ( $P=0.443, >0.05$ ),
  - ✓ Depth of inhalation ( $P=0.934, >0.05$ ),
  - ✓ Butt length ( $P=0.854, >0.05$ ),
  - ✓ Nicotine dependence ( $P=0.149, >0.05$ )

**No smoking behavior difference between different tar level smokers.**

# Results and Discussion-biomarker determination

Biomarker analysis results in urines of different tar level cigarette smokers and nonsmokers.



# Results and Discussion-biomarker determination

- The metabolite levels of nicotine, TSNAs, VOCs (Volatile Organic Compounds), Volatile-carbonyl-compounds (HMPMA, HPMA) in the urine of smokers **in low-tar groups were significantly ( $P<0.05$ ) lower than that in high-tar groups**
- The metabolite levels of PAHs did **not differ significantly ( $P>0.05$ )** among different tar groups

**The exposure level of smokers of low tar yield cigarettes to hazardous compounds is lower than that of high tar yield cigarettes**



# Conclusion

We adopted molecular epidemiology to study smoking behaviors and their influencing factors

- Smoking behaviors were affected by the factors, age, gender, education, occupation and income
- The tar yield of cigarette was not a main influencing factor of smoking behaviors
- Smoking low tar cigarette can indeed decrease harmful compounds exposures

*Thanks !*

