

# Smoking Behavior and Smoke Exposure of Roll-Your-Own (RYO) Cigarette Smokers in the UK

LION SHAHAB<sup>a</sup>, ROBERT WEST<sup>a</sup>, DAVID HAMMOND<sup>b</sup>, RICHARD J. O'CONNOR<sup>c</sup> and ANN MCNEILL<sup>d</sup>

<sup>a</sup>University College London, UK <sup>b</sup>University of Waterloo, Canada <sup>c</sup>Roswell Park Cancer Institute, USA

<sup>d</sup>University of Nottingham, UK



## BACKGROUND

- RYO cigarettes are becoming increasingly popular due to higher taxation levied on manufactured cigarettes<sup>1</sup>
- Despite the fact that over a quarter of smokers in the UK now smoke RYO<sup>2</sup>, relatively little is known about smoking behavior of this group compared with manufactured cigarette (MC) smokers
- This study aimed to:
  - (1) Characterise RYO smokers
  - (2) Compare RYO and MC smokers on
    - (i) feasibility of using a topography device
    - (ii) puffing behavior determined by it
    - (iii) smoke exposure

## METHODS

### Participants

- Smokers were recruited by ads in newspapers, flyers, emails and posters
- Participants were included if they exclusively smoked 5+ RYO or MC cigarettes per day, were not pregnant, 18-60 years old, had no heart or lung disease

### Procedure

- Smokers visited a lab twice 24h apart
- Demographic and smoking characteristics were recorded and breath and saliva samples collected

- At the end of Visit 1 participants were shown how to use a smoking topography device (Figure 1) and asked to smoke with this machine until Visit 2

### Analysis

- Reliability was assessed with intraclass correlation coefficients and group differences with ANOVA, t- or  $\chi^2$ -tests

**Table 1: Characteristics of the sample by cigarette type**

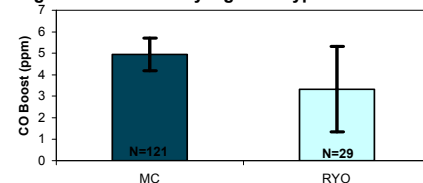
	All smokers (N=160)	MC (N=131)	RYO (N=29)
<i>Anthropometric data</i>			
Mean (SD) age	31.7 (10.7)	31.4 (10.4)	33.1 (12.2)
Percent (N) male	56.3 (90)	51.1 (67)	79.3 (23)**
Mean (SD) BMI	23.9 (4.0)	24.0 (4.1)	23.3 (3.4)
<i>Smoking data</i>			
Mean (SD) cigarettes per day	13.8 (5.9)	13.4 (5.7)	15.9 (6.4)
Mean (SD) length of time of smoking in years	14.3 (11.1)	14.1 (10.7)	15.6 (13.0)
Mean (SD) HSI	2.4 (1.5)	2.3 (1.4)	2.7 (1.8)
Percent (N) smoking marijuana	36.9 (59)	36.6 (48)	37.9 (11)
Percent (N) quit attempt in last year	56.3 (90)	57.3 (75)	51.7 (15)
Mean (SD) intention to quit in the next month	2.8 (1.6)	2.9 (1.6)	2.5 (1.7)

\*\*p<.01

**Table 3: Measure reliability by cigarette type**

CReSS puffing parameters	Intraclass correlation coefficient (95% CI)	
	MC (124)	RYO (24)
Number of puffs	.885 (.850-.914)	.861 (.749-.932)
Interpuff interval	.772 (.702-.830)	.700 (.464-.854)
Puff duration	.933 (.912-.950)	.947 (.904-.974)
Puff volume	.924 (.897-.945)	.927 (.867-.965)
Average Puff flow	.932 (.905-.952)	.891 (.803-.947)
Peak puff flow	.934 (.901-.955)	.899 (.817-.951)

**Figure 2: CO Boost by cigarette type#**

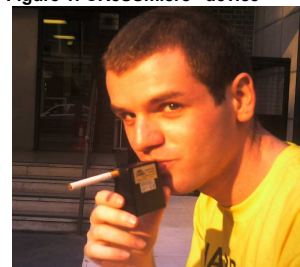


\*Controlling for sex, age, HSI, baseline CO

**Table 2: RYO descriptives**

Mean (SD) Weight, mg	Mean (SD) $\phi$ , mm	Percent (N) Filter	Percent (N) Tapered
512 (95)	5.8 (0.67)	69.5 (19)	48.3 (14)

**Figure 1: CReSSmicro® device\***



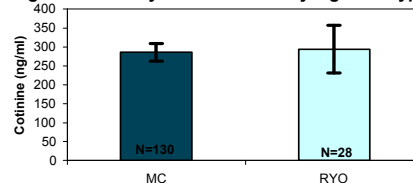
\*Flowshare Technologies, Inc. Baltimore, Maryland

**Table 4: Puffing measures by cigarette type**

CReSS puffing parameters#	Total (N=159)	MC (N=130)	RYO (N=29)
	Mean (SD)		
Number of cigarette puffs	14.7 (4.9)	14.1 (4.8)	17.6 (4.9)*
Interpuff interval in seconds	23.8 (9.7)	24.5 (9.6)	20.6 (9.8)
Puff duration in seconds	1.6 (0.5)	1.5 (0.5)	1.8 (0.5)*
Puff volume in ml	54.5 (14.3)	54.5 (14.0)	54.4 (14.2)
Average Puff flow in ml/s	36.9 (8.1)	37.8 (8.0)	33.3 (8.1)**
Peak puff flow in ml/s	54.1 (14.5)	55.6 (14.3)	47.4 (14.5)**
Cigarette smoke volume in ml	777 (262)	743 (250)	927 (254)*

\*Controlling for sex; \*\*p<.05; \*\*\*p<.01

**Figure 3: Salivary cotinine levels by cigarette type#**



\*Controlling for sex, age, HSI, BMI

## Measures

- **Demographic, anthropometric & smoking characteristics:** Age, sex, body mass index (BMI), and cigarette consumption to determine nicotine dependence<sup>3</sup>
- **Puffing behaviour:** Determined by battery-operated, hand-held portable topography device that measures and electronically stores a full complement of puffing variables
- **Smoke intake:** Saliva was collected with a dental roll and assayed for cotinine, a reliable measure and metabolite of nicotine, using a well-known technique<sup>4</sup>; Breath carbon-monoxide (CO) was measured with a standard monitor both before and after participants smoked a cigarette and the difference used to estimate CO boost

## RESULTS

- (1) There were more male RYO than MC smokers but no differences on any other measure including marijuana use (Table 1); smokers put in about 0.5 g tobacco per RYO-the majority used filters (Table 2)
- (2.i) The majority of MC (82%) and RYO (76%) smokers said the CReSSmicro was easy to use and measures were equally reliable in both groups (Table 3); however, more RYO (17%) than MC (5%) smokers had missing data ( $\chi^2(1)=4.8, p=.03$ )
- (2.ii) Table 4 shows discrepancy between RYO and MC smokers in recorded puffing: RYO took more and longer puffs and had a higher smoke volume per cigarette while MC smokers had a higher peak and average puff flow thus inhaling more quickly
- (2.iii) Despite these disparities in puffing behavior, MC and RYO smokers did not differ markedly in CO boost or salivary cotinine levels (Figures 2 & 3)

## CONCLUSIONS

- As previously shown<sup>5</sup> comparatively more men than women smoked RYO but otherwise RYO and MC smokers were broadly comparable
- Using a topography device to assess RYO puffing appeared feasible but more research is needed
- Disparities in puffing parameters but not smoke exposure may be due to physical differences in MC and RYO cigarettes that result in varied smoke yield concentrations per RYO and MC puff

## REFERENCES

- 1 Oddoux K, Melihan-Cheinin P (2001). France: rolling round the curbs. *Tab Control*, 10, 6.
- 2 Young D, Borland R, Hammond D, Cummings KM, Devlin E, Yong HH, O'Connor RJ (2006). Prevalence and attributes of roll-your-own smokers in the International Tobacco Control (ITC) Four Country Survey. *Tab Control*, 15, iii76-iii82.
- 3 Heatherton TF, Kozlowski LT, Frecker RC, Fagerstrom KO (1991). The Fagerstrom Test for Nicotine Dependence: a revision of the Fagerstrom Tolerance Questionnaire. *Br J Addict*, 86, 1119-27.
- 4 Feyerabend C, Russell MA (1990). A rapid gas-liquid chromatographic method for the determination of cotinine and nicotine in biological fluids. *J Pharm Pharmacol*, 42, 450-452.
- 5 Goddard E, Green H (2005). *General Household Survey 2004. Smoking and Drinking among Adults, 2004*. London: Office of National Statistics.



For more details contact:  
lion.shahab@ucl.ac.uk

