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Snuff Use and Smoking in Finnish Olympic Athletes

Abstract

This study aimed to assess the prevalence of smoking and snuff use in Finnish elite athletes. Of all the athletes (n = 494) financially supported by the National Olympic Committee, 446 completed a structured questionnaire (response rate 90.3%) in 2002. A control group (n = 1504, response rate 80.2%) comprised an age-matched sample from the population-based sample collected by the National Public Health Institute. Any smoking was reported by 11.4% of the athletes (3.6% daily and 7.8% occasionally) and by 38.3% of the controls (28.1% and 10.2%). After adjusting for age, sex, and education, OR (95% CI) for any smoking was highest 0.42 (0.23 – 0.77) for athletes in skill-based events and lowest 0.06 (0.02 – 0.17) for endurance athletes as compared with controls. Snuff use was reported by 24.6% of the athletes (9.6% daily and 15.0% occasionally) and by 3.7% of the controls (1.8% and 1.9%). The adjusted OR (95% CI) for any snuff use was highest 15.6 (9.55 – 25.6) for team-sport athletes and lowest 3.33 (1.54 – 7.21) for endurance athletes as compared with controls. Although snuff use in the general female population is rare, also female athletes did use snuff. Though prevalence of daily smoking among athletes was one-seventh of the respective figure for the general population, prevalence of daily snuff use was fivefold that of controls. Tobacco free elite athletes are valuable in health counselling because athletes are considered role models influencing their peers and the sport. Sport associations are challenged to ban all forms of tobacco.

Key words
Snuff · smoking · sports · elite athlete

Introduction

Physically active youth smoke cigarettes less than their less sport active peers [2, 7, 11, 22, 31]. However, higher frequencies of snuff use occur among high school athletes than among non-athletes [7, 20, 28, 34]. Oral tobacco products became more popular in the late 1970s first in the United States, but since the 1990s also in Europe [16]. Among adult athletes, smokeless tobacco (ST) use has been especially common among team-sport athletes. Of baseball players, 30 to 55%, and 40% of football players have reported use of ST [5, 9, 13]. Most of these studies have, however, included only male team-sport athletes. Thus, there are limited data concerning snuff use among participants in other sports events and among female athletes as compared with the general population.

Athletes consider oral forms of tobacco like snuff harmless or at least as having only a moderate effect on their sports performance. ST use is, however, associated with many adverse health effects [6]. Chronic use leads to gum recession, periodontal bone loss, risk for oral cancer. Acute effects are apparent mostly in the circulatory system. ST use elevates heart rate and systolic blood

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Table **1** Characteristics of study groups

	All athletes (n = 446)	*Speed and power events (n = 113)*	*Endurance events (n = 108)*	*Motor skills demanding events (n = 73)*	*Team sport events (n = 152)*	*Controls (n = 1504)*
Sex (men/women)	261/185	82/31	62/46	45/28	72/80	766/738
Mean (SD) age (years)	23.0 (4.5)	23.8 (4.1)	23.6 (4.0)	23.6 (6.5)	21.6 (3.6)	23.4 (3.5)
Mean (SD) duration of active sport career (years)	11.7 (4.3)	12.2 (3.7)	12.4 (4.6)	11.9 (5.0)	10.8 (4.1)	–
Mean (SD) training amount (hours per week)	15.4 (6.1)	15.5 (4.6)	17.3 (5.9)	15.1 (7.4)	14.1 (6.3)	–
Education						
– *high school; % (n)*	67.5 (301)	59.3 (67)	78.7 (85)	64.4 (47)	67.1 (102)	42.6 (641)
– *comprehensive school/ vocational school; % (n)*	32.5 (145)	40.7 (46)	21.3 (23)	35.6 (26)	32.9 (50)	57.4 (863)
Original sample size	494	127	119	89	159	1876
Response rate (%)	90.3	89.0	90.8	82.0	95.6	80.2

pressure both at rest and during exercise [8, 24, 26, 36]. No difference has, however, appeared in maximal heart rate, maximal oxygen consumption, or maximum lactic acid concentration during exercise to exhaustion in a group of ST users compared with levels in placebo controls [36]. However, increased lactic acid concentration and lowered stroke volume at rest and at 60 and 85% of maximal exercise have occurred during use of ST. Ksir et al. [24] found, after exercise by ST users, the apparent prolongation of recovery of heart rates [24]. Nicotine may promote the rupture of atherosclerotic plaques, formation of blood clots, and arterial thrombosis [4]. Tobacco use impairs the immune system, causing alterations in humoral and cellular immunity, which may then delay recovery from intensive physical performance and training [27]. Other physiological changes associated with ST use include: decreased peripheral circulation and increased levels of blood lipids, plasma glucose, glucagon, insulin, and cortisol [26].

Dosage, quantity, and quality of tobacco product all influence the release of nicotine to the circulatory system and brain. Most popular brands of snuff in Finland are moist oral snuff containing a high quantity of nicotine leading to high blood concentrations. Generally, smoked cigarettes and snuff result in the same level of nicotine in the blood, but snuff usage leads to a prolonged high nicotine level in the central nervous system [3]. Among habitual snuff users and smokers, plasma peak nicotine concentrations on a day of normal snuff use or smoking, are similar, but with a tendency to higher cotine levels in the snuff users [19]. After quitting daily use of snuff nine out of ten report withdrawal symptoms [18].

The primary aim of the present study was to assess the frequency of smoking and snuff use in a large sample of Finnish elite athletes as compared with a representative sample of young adults of the same age. The secondary aim was to determine frequencies within different types of sport activities.

Methods

Study design for athletes

A cross-sectional survey was carried out in 2002. All athletes (n = 494) eligible for financial support from the National Olympic Committee comprised our source population for this study. They completed the questionnaire at their national team camps during the study period, and to those absent, the questionnaire was sent by mail. Of the 494 athletes, 446 (90.3%, 261 men and 185 women) completed this structured questionnaire anonymously (Table **1**). Mean of age was 23.0 years (SD 4.5 years). The athletes were divided into four groups according to type of sport: speed- and power-sport athletes (n = 113), endurance athletes (n = 108), athletes in skill-based events (n = 73), and team-sport athletes (n = 152). Track and field athletes (sprinters, jumpers, throwers, and decathletes, total n = 47) were the largest subgroup of speed- and power-sport athletes and cross-country skiing (n = 17) was the largest subgroup of endurance athletes. The largest subgroup of the athletes in skill-based events were shooters (n = 14) and of the team sport athletes ice-hockey players (total n = 82). Inclusion criteria and athlete subgroups are described previously in detail elsewhere [1].

Control subjects

The reference group comprised all those aged 18 – 29 years (n = 1894) from the Finnish National Health Survey Health 2000, coordinated by the National Public Health Institute. A nationally representative two-stage cluster sample was drawn, which consisted of 10 000 individuals and 80 regions (municipalities, or groups of municipalities with joint primary care). The sample included inhabitants of all the 15 largest cities and towns. The substudy of younger adults aged 18 to 29 included a computer-aided health interview – carried out in 2001. The final sample of those aged 18 to 29 numbered 1876, of whom 1504 (80.2%) participated in the health interview. Data were collected, stored, analysed, and reported anonymously according to the law on data protection in Finland.

Table **2** Reported smoking and snuff use status according to type of sport in athletes and controls; % (n)

	All athletes (n = 446)	*Speed and power events (n = 113)*	*Endurance events (n = 108)*	*Motor skills demanding events (n = 73)*	*Team sport events (n = 152)*	*Controls (n = 1504)*
Current smoking						
Daily smoker	3.6 (16)	1.8 (2)	0	13.7 (10)	2.6 (4)	28.1 (422)
Occasional smoker	7.8 (35)	5.3 (6)	2.8 (3)	5.5 (4)	14.5 (22)	10.2 (154)
Never smoker	77.6 (346)	80.5 (91)	91.7 (99)	74.0 (54)	67.1 (102)	44.1 (663)
Ex-smoker	11.0 (49)	12.4 (14)	5.6 (6)	6.8 (5)	15.8 (24)	17.6 (265)
Current snuff use						
Daily user	9.6 (43)	9.7 (11)	7.4 (8)	2.7 (2)	14.5 (22)	1.8 (27)
Occasional user	15.0 (67)	21.2 (24)	9.3 (10)	9.6 (7)	17.1 (26)	1.9 (29)
Not at all	75.3 (336)	69.0 (78)	83.3 (90)	87.7 (64)	68.4 (104)	96.3 (1448)

Determining smoking

All subjects were asked about their smoking habits: Question 1. "Have you smoked 100 or more cigars or cigarettes in your life?" 2. "What is your current smoking status (a) daily smoker, (b) occasional smoker, (c) non-smoker?" and 3. "When was the last time you smoked (a) today or yesterday, (b) 2 days to 1 month ago, (c) over 1 month to 6 months ago, (d) over 6 months to 1 year ago, (e) over 1 year to 5 years ago, (f) over 5 years to 10 years ago, (g) over 10 years ago?" Subjects who had smoked less than 100 cigars/cigarettes during their lifetime were considered never smokers. If subjects had smoked over 100 cigars/cigarettes and had smoked for the last time more than one month ago, they were considered ex-smokers. If subjects answered positively to question number (1) and answered daily or occasional smoker to question number (2), they were considered current smokers. Current smokers were further classified as daily or occasional smokers.

Determining snuff use

All subjects were asked (Question 4.) "How many times have you used snuff during your lifetime (a) never, (b) once, (c) 2 to 50 times, (d) over 50 times?" and 5. "Do you use snuff currently (a) daily, (b) occasionally, (c) not at all?" Subjects were also asked 6. "Have you ever used snuff daily?" Subjects who had used snuff less than 50 times during their lifetime were considered never users. If subjects answered daily or occasionally to question number (5), they were considered current users. If subjects had used snuff over 50 times and answered not at all to question number (5), they were considered ex-users.

Statistical methods

Odds ratios (ORs) for smoking and snuff use and their 95% confidence intervals (95% CIs) for the athlete groups as compared with controls were estimated by a logistic regression model (SPSS 10.0 software). Age, sex, educational level, and type of sport were included in the analysis as independent covariates.

Results

Smoking

Of the athletes, 3.6% (16 of 446) reported daily smoking and 7.8% (35 of 446) occasional smoking, whereas among controls, 28.1% (422 of 1504) were daily smokers and 10.2% (154 of 1504) occasional smokers (Table **2**). After adjusting for age, sex, and education, daily or occasional smoking was significantly lower among athletes than among controls (OR, 0.23; 95% CI, 0.17 – 0.32). Of the athlete subgroups, smoking was most common among those in skill-based events (Table **2**). None of the endurance athletes reported daily smoking. Age-, sex-, and education-adjusted ORs (95% CI) for daily or occasional smoking were significantly lower in all athlete subgroups than in controls (Table **3**).

Among controls, men were smokers more often than women, but among athletes no statistical difference existed between sexes. Lower education was significantly associated with smoking in both groups (Table **3**). In contrast with controls, OR for smoking increased significantly with age in athletes. Sex- and education-adjusted ORs (95% CI) for smoking were 1.81 (0.80 – 4.10) and 2.72 (1.26 – 5.86) for 21 – 24-year-old and over 24-year-old athletes, respectively, as compared with under 21-year-old athletes. There was evidence of an interaction effect on smoking between age and type of sport. In the youngest age group, all athlete subgroups smoked significantly less than controls of the same age (Fig. **1**). However, athletes in team-sport and skill-based events showed a clear tendency with age to increase their smoking level compared to that of controls. At the two oldest age groups these two athlete subgroups did not differ statistically significantly from controls.

Snuff use

Of all the athletes, 24.6% reported snuff use. Of these, 9.6% were daily snuff users and 15.0% occasional users. Of the controls, 3.7% reported snuff use (1.8% daily and 1.9% occasionally). After adjusting for age, sex, and education, OR (95% CI) for daily or occasional snuff use was significantly higher among athletes than among controls (OR, 8.32; 95% CI 5.77 – 12.01). Of the athlete subgroups, team-sport athletes were the most frequent snuff users (Table **2**). After adjusting for age, sex, and education, OR

Table **3** Age-, sex-, and education-adjusted logistic regression model for current smoking and snuff use in athletes as compared with controls

	Smoking		*Snuff use*	
Characteristic	***OR***	***95% CI***	***OR***	***95% CI***
Age (years)				
– *under 21*	1		1	
– *21–24*	1.22	0.94–1.58	1.33	0.85–2.07
– *over 25*	0.96	0.74–1.24	0.95	0.59–1.51
Sex				
– *women*	1		1	
– *men*	1.45	1.18–1.77	6.52	4.07–10.4
Education				
– *high school*	1		1	
– *comprehensive school/vocational school*	1.96	1.59–2.41	0.95	0.65–1.37
Type of sports				
– *none (controls)*	1		1	
– *speed and power athletes*	0.12	0.06–0.25	9.13	5.51–15.1
– *endurance athletes*	0.06	0.02–0.17	4.94	2.70–9.06
– *skill-based events*	0.42	0.23–0.77	3.33	1.54–7.21
– *team-sport athletes*	0.39	0.25–0.60	15.63	9.55–25.6

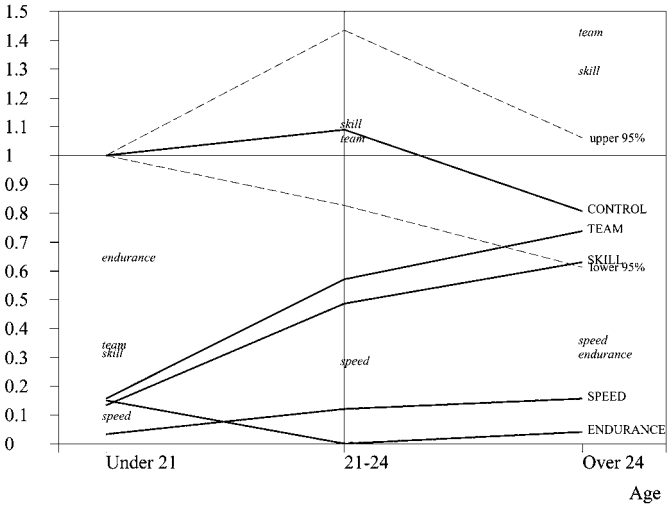

Fig. **1** Predicted sex- and education-adjusted odds ratios (OR) for smoking by age and type of sport as compared with under 21-year-old controls. The 95% confidence interval (CI) for controls (n = 1504) is shown with a dotted line. Italic letters refer to the upper limits of the 95% CI in sport subgroups. The athletes (n = 446) are divided into speed and power athletes (speed), endurance athletes (endurance), team-sport athletes (team), and those in skill-based events (skill) according to the type of sport.

(95% CI) for snuff use was significantly higher among all athlete subgroups than among controls (Table **3**).

After adjusting for age and education, OR (95% CI) for snuff use was significantly higher among men than among women (Table **3**). Of the male athletes, 33.3% (87 of 261) reported snuff use. Of these, 14.9% (39 of 261) were daily snuff users and 18.4% (48 of 261) occasional users. Of the controls, 7.0% (54 of 766) reported snuff use (3.5% daily and 3.5% occasionally). Male athletes were significantly more often snuff users than were male controls (OR, 6.59; 95% CI, 4.43–9.81 after adjusting for age and education). Female controls reported virtually no snuff use (none daily and 0.3% occasionally), but a total of 12.5% of all the female athletes reported daily or occasional snuff use. Of female athletes, those in team-sport events were most frequently snuff users (3.8%; 3 of 80 daily, and 15.0%; 12 of 80 occasionally).

Discussion

The main finding of the study was that snuff use plays a more important role among athletes than does smoking, though retail sale of snuff is forbidden in Finland. In this study, 4% of non-athletes reported any use of snuff and 25% of athletes. Tobacco use was influenced by type of sport. Smoking was most frequent among athletes in skill-based events and snuff use among team-sport athletes. Though snuff use in the general female population is rare, the use among female athletes was surprisingly frequent.

Response rate was high from both in athletes and in controls. Selective response is therefore not likely to explain the results. Control data came from a stratified population sample drawn from the population registry. In the population studies, non-respondents are more likely smokers than respondents [25], but potential bias due to selective response should be small. The outcome variables smoking and snuff use were based on questions used by the National Public Health Institute. Smoking prevalence in our general population sample and that of earlier studies was comparable [17]. Validity of self-reported tobacco surveys has been good in Finland [37].

As found earlier, snuff use was strongly associated with male gender [17]. Because snuff sales have been prohibited in Finland since 1995, snuff usage has developed subcultures, where unofficial supply chain, like sport team, is part of trait in consumption. Older athletes act as role models and suppliers creating the snuff positive culture. The belief, that team mates and baseball players in general use ST, has been reported to be a risk of snuff use [38]. Also in Sweden, where snuff is sold in stores, some team-sports, like ice-hockey, have a higher proportion of snuff users than has the general population [32]. Some sports associations and funding organizations have been unwilling to implement the task of tobacco-free sport. There are, however, good examples of introducing tobacco-free sport in funding and sponsorship criteria and suspension from competitions when snuff is used during sport events. The Finnish Floorball Federation bans all use of tobacco in games and training.

There were just a few snuff users among non-athlete women, but 12% of athlete women used snuff either daily or occasionally. Female athletes in team sport events favoured the use of snuff equally to men. Their reasons for use of tobacco might be similar to those of men. This is supported by a study looking at the motivation and performance in sportsmanship without major gender differences [29].

Kujala et al. [23] reported that 15.7% of former world-class athletes and 26.1% of their age-matched controls were current smokers [23]. In accordance with our findings, current smoking was least frequent among endurance athletes (11.4%) when compared with mixed sport athletes (15.2%) and power-sport athletes (17.9%). It has to be taken into account that the training of top athletes has changed over time, and the training of those currently participating regularly and actively in recreational sports may be similar, in many respects, to the training of former top athletes.

Endurance events require high respiratory capacity. That none of the endurance athletes in the present study was a daily smoker may be due to awareness of the detrimental effects of smoking on lung function. In the events which require respiratory capacity snuff use is more common than smoking. Respiratory capacity is not a major performance limiting factor in skill-based events. This may explain why smoking was most common among these athletes. Also many athletes and their coaches believe that ST enhances their athletic performance by preventing their mouths from drying out, improving their reaction time, and producing a desirable arousal-attentional set. Furthermore, baseball players have reported improved ability to concentrate for extended periods, such as during the slower periods of a baseball game [5]. However, no improvement has been reported in reactivity as a result of ST [8,10,21,26]. Escher et al. [10] reported that ST may detrimentally influence maximum voluntary force [10]. Athletes may misinterpret the positive feedback from relieving withdrawal symptoms of nicotine as performance enhancing effects of snuff.

Top-level sport requires high quality nutrition and psychological support and optimal physical circumstances. The health hazards of smoking are well documented [35], but research on health hazards of snuff use is scarce, because consumption is limited to only a few countries. This may explain athletes' current poor awareness of the influence of snuff on sporting performance. The large body of evidence on the health consequences of nicotine can be applied to the physical effects of snuff.

Smokeless tobacco may act as a gateway to smoking [12,14,15]. The addiction to nicotine from regular snuff use equals levels reached with smoked cigarettes [16], and therefore switching to cigarettes causes no side-effects. Given that ST use may be a more acceptable form of nicotine administration within the social milieu of some adolescents, it is possible that many young athletes start to use first snuff and will later progress to cigarette smoking as adults when social constraints regarding smoking decrease [15] and supply of snuff becomes more burdensome. In this study, the increasing number of smokers among older athletes supports this hypothesis. In contrast, Gingiss and Gottlieb [13] found no evidence that ST would act as a gateway drug for smoking in a small sample (n = 284) of college baseball players [13]. Whether athletes retiring from sports switch snuff to smoking is not clear, but in one study ice-hockey players still initiated tobacco use until age 19 [33], while in the general population smoking cessation rate increases from age 15 years [30].

The aim of sport is to gain physical and mental well being. Tobacco use among athletes raises need for implementing tobacco-free target in sports at all levels: training, competing, and funding. The culture of team sports supporting snuff use among both men and women needs to be taken seriously. The trends of tobacco use should be followed both among athletes and general population. More detailed studies are needed in developing sustainable interventions for athletes. Several researchers have proposed that ST use serves as a gateway drug for cigarette smoking [12,14,15]. Given that the negative health effects of cigarette smoking are even more dramatic than those associated with ST use, examining the potential gateway effect of ST among athletes is also an important area of research.

In conclusion, athletes smoked significantly less, than their age-matched controls. Although athletes smoke less, their top-level sport performance is endangered by any use of tobacco as snuff use among athletes is unfortunately frequent. Tobacco free elite athletes are valuable in health counselling because athletes are considered role models influencing their peers and the sport. Sport associations are challenged to ban all forms of tobacco.

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