Original Article

Handicap status of exclusive narghile smokers compared to exclusive cigarette smokers: A case control-study

Ghazi Ben Hadj Mohamed a, Helmi Ben Saad a,b,c,*

a Laboratory of Physiology, Faculty of Medicine of Sousse, University of Sousse, Tunisia
b Department of Physiology and Functional Exploration, Farhat HACHED University Hospital of Sousse, Tunisia
c Research Laboratory N° LR14ES05: Interactions of the Cardiopulmonary System, Faculty of Medicine of Sousse, University of Sousse, Tunisia

Received 9 January 2016; accepted 17 January 2016
Available online 1 February 2016

Keywords
Tobacco control; Waterpipe; Cigarette smoking; Quality of life; Physical activity

Abstract
Objective: The aim of the present case–control study was to compare the quality-of-life (QOL) and physical-activity (PA) data of exclusive-narghile-smokers (ENS) with age- and tobacco quantity matched exclusive-cigarette-smokers (ECS).
Methods: Males aged ≥ 20 years who are ENS or ECS for more than 10 years were recruited to participate in this case–control study. Amounts of used tobacco (narghile-years (NY), pack-years (PY)) were determined. QOL (symptoms, activity, impacts and total scores) and PA (daily, sporting, leisure and PA scores) data were collected according the Saint-George’s-respiratory and the Voorrips PA questionnaires. Student t-test and Chi-2 test were used to compare the profiles of the two groups. Pearson correlation-coefficient (r) was used for evaluating the relationship between used quantity of tobacco and PA and QOL data.
Results: Two age (44 ± 9 vs. 45 ± 14 years) and quantity of used tobacco (30 ± 32 NY vs. 37 ± 34 PY) matched groups (63 ENS and 54 ECS) were compared. Compared to the ENS group, the ECS group has a worse QOL with significantly higher activities, impact and total scores (respectively, 22 ± 22 vs. 32 ± 25; 11 ± 12 vs. 23 ± 24 and 18 ± 14 vs. 28 ± 20), has significantly lower sporting and PA scores (respectively, 12 ± 8 vs. 8 ± 6 and 17 ± 8 vs. 14 ± 7). There were clear negative dose–effect relationships between sporting (r = −0.39), leisure (r = −0.38) or PA scores and QOL.

Abbreviations: CCQ, clinical-COPD-questionnaire; COPD, chronic-obstructive-pulmonary-disease; CS, cigarette-smokers; ECS, exclusive-cigarette-smokers; ENS, exclusive-narghile-smokers; HNS, healthy-non-smokers; HRQOL, health-related-quality-of-life; Non-S, non-smokers; NS, narghile-smokers; NY, narghile-years; PA, physical-activity; PAQ, physical-activity-questionnaire; PY, pack-years; QOL, quality-of-life; SD, standard-deviation; SEL, socio-economic-level; SF-36, short-form-health-survey; SGRQ, Saint-George’s-respiratory-questionnaire; SL, schooling-level; WHO, World-Health-Organization; 95% CI, 95% confidence-interval
* Corresponding author: Laboratory of Physiology, Faculty of Medicine of Sousse, Rue Mohamed KAROUI, Sousse 4000, Tunisia. Tel.: +216 98697024; fax: +216 73224899.
E-mail address: helmi.bensaad@rns.tn (H. Ben Saad).

Institution where the work was conducted: Department of Physiology and Functional Exploration, Farhat HACHED University Hospital of Sousse, Tunisia.

Peer review under responsibility of The Egyptian Society of Chest Diseases and Tuberculosis.

http://dx.doi.org/10.1016/j.ejcdt.2016.01.007
0422-7638 © 2016 The Egyptian Society of Chest Diseases and Tuberculosis. Production and hosting by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).
Introduction

The last years have seen the emergence of large-scale narghile-use [1,2]. This societal event has developed to a worrying extent [1–4] and has become well-established as a documented reason for chronic diseases, especially cardiorespiratory [1–12].

To better explore the chronic effects of narghile-use on health, it would be interesting to refer to the World-Health-Organization’s (WHO) latest categorization of the usual history of chronic diseases (http://www.who.int/classifications/icf/en/, Accessed January 9th 2016), which reports on three evolutionary stages: deficiency, incapacity and handicap. While the two first stages have already been extensively explored [5–12], to the best of the authors’ knowledge, only a few studies have raised the issue of the handicap (quality-of-life (QOL) and/or physical-activity (PA)) of narghile-smokers (NS) [12–15]. Their results are controversial.

In 2008, Nitzan Kaluski et al. [14] described the relationships between PA, lifestyle determinants and obesity in Middle-East schoolchildren aged 11–19 years. They found physical-inactivity to be powerfully linked to narghile-use [14]. In 2009, Tavafian et al. [15] investigated the relationships between narghile-use and health-related-QOL (HRQOL) [16] of people, aged more than 15 years, in the general population of Iran. They found statistically significant differences between NS (n = 172) and non-smokers (Non-S; n = 1486) on all scales except for the “role emotional” [15]. In addition, they noted that narghile-use was a risk factor for declining physical-component-summary and mental-component-summary scores [15]. In 2012, Joseph et al. [13] applied the clinical-chronic-obstructive-pulmonary-disease (COPD) questionnaire (CCQ) to describe the respiratory QOL in the Lebanese population aged more than 40 years, stressing on differences between smokers (NS and cigarette-smokers (CS)) and Non-S. They noted that previous and current CS vs. Non-S have significantly lower QOL in the same disease category and that previous and current NS vs. Non-S have similar QOL [13]. They also noted a clear dose–effect relationship for the effect of all types of smoking on QOL, with lower QOL scores in patients with heavier smoking cumulative doses. A result was even found for current NS [13]. In 2014, Ben Saad et al. [12] evaluated the PA [17] of Tunisian exclusive-NS (ENS), aged 20–60 years. They found that one fifth of male ENS were sedentary with a low total PA score [12]. They also found statistically significant differences between healthy-Non-S (HNS) group aged 40–60 years (n = 53) and an aged-matched subgroup of ENS (n = 25) on all scores (sporting activity, leisure activity and PA) except for daily activity score [12].

According to some guidelines [18,19], the aim of clinical control in patients with chronic disease includes HRQOL goals (improve QOL and increase physical and emotional participation in everyday activities) added to clinical goals. The usefulness of QOL measures is indisputable in the field of descriptive epidemiology [18]. In clinical practice, it can strengthen the doctor–patient relationship by emphasizing the interest that is attached to the consequences of the disease/symptoms on the subject’s daily life [18]. From a public health viewpoint, it is central to determine the level of PA in order to offer a hypothetical basis for the development of suitable policies and programs to improve health and avoid the many complications that attend physical inactivity [14]. The PA remains the best way to maintain body wellness, to ensure daily activities and to keep good cardiopulmonary function and thus daily PA.

It is clear that narghile-use still harbors many deficiencies. These were highlighted in the 2005-WHO advisory noted on narghile-use [20] and they need to be studied further [2]. Thus, the aim of the present case–control study was to compare the QOL and PA data, evaluated according to validated questionnaires [17,21,22], of ENS with age- and tobacco quantity matched exclusive-CS (ECS). The null hypothesis is that there is no divergence between mean values of their records.

Subjects and methods

Type of study

This was a case–control study spread over 2 months (December 2013–January 2014). It was conducted in several cafes in Sousse, Tunisia. The prevalence rates of smoking among males living in Sousse were 13% for narghile and 40% for cigarette (unpublished data). The study was conducted in agreement with the Declaration of Helsinki. Participants provided oral consent and the study procedure was accepted by the ethics committee of the local hospital (approval number 2208/2014).

Sample size

The null hypothesis was H0: m1 = m2 and the alternative hypothesis was Ha: m1 = m2 + d, where d is the difference between two means and n1 and n2 are the sample sizes for the ENS and ECS groups, such N = n1 + n2. The required sample size was estimated using a specific formula [23] (detailed in the Supplementary data section) to detect a difference between two means with a power of 85% and an α level of 5%. The total sample size for the study was 114 subjects (57 ENS and 57 ECS).

Population

Several special cafes, which NS and CS frequented in Sousse city, were visited for this investigation. Only males aged 20 years and above, with a smoking history of more than ten years, were included. In each café, approximately five to ten smokers were approached and studied. The ECS and ENS were
selected randomly. Firstly, the individual data of every subject (age, smoking type, duration and daily amount of tobacco smoked) were documented with their oral consent. Then the Voorrips’ PA-questionnaire (PAQ) [17] and the Saint-Georges-respiratory-questionnaire (SGRQ) [21,22] were fulfilled.

**Collected data**

The following data were collected: subject characteristics (age, occupation and education level); amount of used tobacco (narghile-years (NY) and pack-years (PY)); type of narghile tobacco smoked (Tabanel and/or Tombac and/or Jurak); PAQ scores (daily, sporting, leisure and PA) and status (low (non-active), moderate and high (active)); SGRQ scores (symptoms, activity, impacts and total scores).

**Applied questionnaires**

After consenting to participate, each smoker was given three questionnaires to complete and was instructed to ask the researcher (GBHIM) to clarify questions, which might have appeared vague. Questionnaire responses were anonymous. The three applied questionnaires were as follows:

A basic questionnaire for age, socioeconomic and schooling levels (respectively, SEL and SL) and smoking status and habits. Two (low and high) SL and SEL were defined [24]. Narghile-use, type of narghile tobacco used and cigarette consumption were self-reported. The smoking histories were defined as NY for ENS (number of narghile smoked a day × total number of smoking years) and PY for ECS (number of packs smoked a day × total number of smoking years). Three types of used narghile tobacco were evaluated: Moassel and/or Tombac and/or Jurak [25].

An Arabic translated version of the Voorrips PAQ [17] was filled out by each smoker. The questionnaire is divided into three parts, evaluating each with different scores, three types of PAs: daily, sporting and leisure activities. The three scores' sum yields a total PA score [17]. This PAQ is used to classify subjects in three categories according to the total PA score: low (score < 9.4, showing a non-active lifestyle); moderate (9.4 < score < 16.5) and high (score ≥ 16.5) levels. According to the total PA score, two groups of subjects were arbitrarily defined [non-active (score < 9.4); active (score ≥ 9.4)] [12].

An Arabic translated version of the SGRQ [21,22] was filled out by each smoker. The SGRQ is a standardized self-administrated airway disease-specific questionnaire divided into three subscales: “symptoms”, “activity” and “impacts” (respectively, 8, 16 and 26 items). For each subscale and for the overall questionnaire, scores range from 0 (no impairment) to 100 (maximum impairment). A total score was calculated by adding all the answers to the questionnaire and expressing the result as a percentage of the maximum possible for the entire questionnaire. The maximum possible scores for “symptoms”, “activity”, “impacts” are, respectively, 662.5, 1209.1 and 2117.8 with a total maximum score of 3989.4. More information about the SGRQ is included in the Supplementary data section.

**Statistical analysis**

Age, amounts of used tobacco, PAQ and SGRQ data distributions were normal and outcomes were expressed as mean ± standard-deviation (SD) and 95% confidence-interval (95% CI). SL, SEL and PA status are expressed as a number (%). For PA and QOL data, a percentage of change was calculated [=(ENS value – ECS value)/ENS value]. Student’s t-test was used to compare means of quantitative data and Chi-2 test was used to compare the profiles of the two groups. The Pearson correlation-coefficient (r) was used to evaluate the relationship between used quantity of tobacco and PAQ [17] and SGRQ [21,22] data (dose–effect). All statistical procedures were performed using Statistica software (Statistica Kernel version 6; Stat Software, France). Significance was set at the 0.05 level.

**Results**

One hundred seventeen subjects were included (63 ENS and 54 ECS).

The two groups were age-, SL- and SEL matched and their means of used tobacco amounts were similar (Table 1). The two most smoked types of narghile-tobacco were Tombac and Moassel, respectively, in 41.3% and in 25.4% of subjects. Almost one fourth of subjects smoked a mixture of narghile tobacco (Table 1). Fig. 1 displays the used quantities of tobacco by each group divided by age ranges. Fewer smokers were included in the age ranges [20–30] years and ≥ 60 years, respectively, 14 and 13 subjects. The amounts of used tobacco were similar for the two groups regardless of age range.

Table 2 displays the PA scores and status of the two groups. Compared to the ENS group, the ECS group has significantly lower sporting and PA activity scores (percentage changes were, respectively, +45% and +25%). However, they have similar leisure and daily activity scores and include similar percentages of non-active and active smokers.

Table 3 displays the QOL data of the two groups. Compared to the ENS group, the ECS one has significantly higher activities”, “impact” and “total” scores (percentage changes were, respectively, −45%, −115% and −56%). However, they have similar “symptoms” scores.

Table 4 displays the “r” between used quantities of tobacco and PAQ and SGRQ data (dose–effect) for the two groups. There were clear, negative dose–effect relationships between sporting, leisure and PAs scores and quantity of smoked cigarettes (the higher the dose of cigarette smoking was, the lower the PAs scores were). No significant relationship was found between quantity of used narghile and QOL or PAQ data.

**Discussion**

Two age-, SL-, SEL- and quantity of used tobacco- matched groups were compared: 63 ENS and 54 ECS. Compared to the ENS group, the ECS one has a worse QOL with significantly higher “activities”, “impact” and “total” scores, has significantly lower sporting and PA scores, but includes similar percentages of non-active subjects. Therefore, the null hypothesis, that there is no divergence between the QOL and/or PA scores of the two groups, is discarded. There were clear negative dose–effect relationships between sporting, leisure and PAs scores and quantity of cigarettes smoked (the higher the dose of cigarettes, the lower the PAs scores). However, no significant relationship was found between quantity of narghile usage and QOL or PA data.
The damaging effects of narghile-usage on QOL and PA data highlighted in the present study are part of a more universal phenomenon [1,2,4,25]. Studies analyzing ENS QOL and/or PA data are scarce, totaling only four [12–15]. Their characteristics and results are displayed in Tables 1S and 2S in the Supplementary data section. In the 2015 systematic review of health effects associated with narghile-use [1], the authors stated that "narghile-smoking was linked with lower overall HRQOL in a cross-sectional study of 1675, past adjusting for cigarette smoking and other parameters [15]" and concluded that "the findings of these single reports require further verification".

Study designs

Unlike the four published studies [12–15], the present study is case–controlled. In their cross-sectional study, including 70 ENS, Ben Saad et al. [12] have compared data of a subgroup of 40–60-Y-old ENS (n = 25) with those of an age-matched HNS group (n = 53). Case–control studies are somewhat economical and can be carried out by small groups in single conveniences. However, their results may be perplexed by a variety of affective factors to the extent that they can give answers different to those given in other studies.

Sample size

The present case–control study sample size (n = 117; 63 ENS) is estimated to be satisfactory. It is higher than that of Ben Saad et al. [12] (n = 78; 25 ENS) and lower than those of the three other published cross-sectional studies (Tables 1S and 2S). However, as done in another study [12], the present one sample size was calculated according to a predictive equation [23].

Applied questionnaires

Some other questionnaires were applied in similar studies (Tables 1S and 2S). For QOL evaluation, an Arabic version of the CCQ [26] and a Persian version of the short-form-health-survey (SF-36) [27] were applied (Table 2S). The SGRQ is a self-reported disease-specific HRQOL questionnaire [21,22]. It was developed originally to measure the impact of COPD and asthma on a person’s life and health, but has also been studied and applied to non-COPD pulmonary populations [21,22]. For the PA status evaluation, an Arabic version of the Voorrips PAQ [17] and the MABAT youth questionnaires [28] were previously applied (Table 1S). The Voorrips PAQ [17] is validated for applying in "free living" and apparently well being people. It gives a consistent and valid method for categorizing subjects into classes of high, medium, and low PA [17].

### Table 1

Characteristics of the two groups of exclusive-narghile-smokers (ENS) and exclusive-cigarette-smokers (ECS).

<table>
<thead>
<tr>
<th></th>
<th>ENS (n = 63)</th>
<th>ECS (n = 54)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Years)</td>
<td>44.35 ± 9.35 (41.99–46.70)</td>
<td>44.76 ± 14.47 (40.81–48.72)</td>
</tr>
<tr>
<td>Tobacco-years (PY or NY)</td>
<td>30 ± 32 (22–38)</td>
<td>37 ± 34 (28–47)</td>
</tr>
<tr>
<td>Schooling-level</td>
<td>Low 44 (69.8)</td>
<td>31 (57.4)</td>
</tr>
<tr>
<td></td>
<td>High 19 (30.1)</td>
<td>23 (42.6)</td>
</tr>
<tr>
<td>Socioeconomic-level</td>
<td>Low 42 (66.7)</td>
<td>29 (53.7)</td>
</tr>
<tr>
<td></td>
<td>High 21 (33.3)</td>
<td>25 (46.3)</td>
</tr>
<tr>
<td>Narghile tobacco</td>
<td>Tombac 26 (41.3)</td>
<td>Moassel 16 (25.4)</td>
</tr>
<tr>
<td></td>
<td>Jurak 9 (14.3)</td>
<td>Tombac and Moassel 5 (7.9)</td>
</tr>
<tr>
<td></td>
<td>Tombac and Jurak 3 (4.8)</td>
<td>Moassel and Jurak 2 (3.2)</td>
</tr>
<tr>
<td></td>
<td>Three types 2 (3.2)</td>
<td></td>
</tr>
</tbody>
</table>

Age and tobacco data are mean ± SD (95% confidence interval). Schooling and socioeconomic levels and narghile tobacco data are numbers (%). *p < 0.05 (t-test): ENS vs. ECS. **p < 0.05 (Chi-2): ENS vs. ECS. ns: not significant. ENS: ◻, ECS: △.
Handicap status of exclusive narghile smokers

Table 2  Physical activity scores and status of the two groups of exclusive-narghile-smokers (ENS) and exclusive-cigarette-smokers (ECS).

<table>
<thead>
<tr>
<th>Activities scores</th>
<th>ENS (n = 63)</th>
<th>ECS (n = 54)</th>
<th>Percentage change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sporting</td>
<td>12.20 ± 7.61</td>
<td>8.44 ± 5.69</td>
<td>+45$^*$</td>
</tr>
<tr>
<td>Leisure</td>
<td>3.16 ± 2.13</td>
<td>3.57 ± 2.34</td>
<td>–11</td>
</tr>
<tr>
<td></td>
<td>(2.63–3.70)</td>
<td>(2.93–4.21)</td>
<td></td>
</tr>
<tr>
<td>Daily</td>
<td>1.74 ± 0.56</td>
<td>1.70 ± 0.56</td>
<td>+2</td>
</tr>
<tr>
<td></td>
<td>(1.60–1.88)</td>
<td>(1.54–1.85)</td>
<td></td>
</tr>
<tr>
<td>Physical</td>
<td>17.11 ± 8.46</td>
<td>13.71 ± 6.99</td>
<td>+25$^*$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Physical activity status</th>
<th>ENS (n = 63)</th>
<th>ECS (n = 54)</th>
<th>Percentage change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (non-active)</td>
<td>13 (20.6)</td>
<td>15 (27.8)</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>13 (20.6)</td>
<td>22 (40.7)</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>37 (58.8)</td>
<td>17 (31.5)</td>
<td></td>
</tr>
<tr>
<td>Moderate and high (active)</td>
<td>50 (79.4)</td>
<td>39 (72.2)</td>
<td></td>
</tr>
</tbody>
</table>

Sporting, leisure, daily and physical activities scores data are mean ± SD (95% confidence-interval). Percentage change = (ENS value – ECS value)/ENS value.

$^*$ p < 0.05 (test-t): ENS vs. ECS.

Limitations of the study

The results in the present study are subject to some limitations. The first limitation concerns the convenience sampling whose main disadvantages are the risk that the sample might not represent the population as a whole, and the results might suggest a bias in the responses from volunteers [9]. The second limitation concerns lack of information about any data concerning subjects’ chronic diseases. In practice, when comparing NS and CS and analyzing the divergences between them, one should keep in mind that CS might demonstrate a higher frequency of chronic diseases in comparison to NS [15], and this results in poorer QOL. The third limitation, as seen in a similar study [14], concerns self-reporting data. This is topic to misreporting of socially desirability bias. The last limitation concerns the non evaluation of other criteria (eg.; heating a house by diesel fuel or by hot air, passive smoking, occupational environment) that could influence the results.

Physical activity of ENS

Compared to the ENS group, the ECS group has significantly lower sporting and PA scores but includes similar percentages of active and non-active subjects (Table 2). The negative impact of cigarette smoking on PA among adults is well documented [29,30] and only two studies have evaluated the effect of narghile-use on PA of children [14] and adults [12] – and these have produced controversial results. In Nitzan Kaluski et al. study [14], narghile-use, but not cigarette smoking, was found to be connected with less optimal intensity of PA among boys, although it was important merely among non-Jewish boys. Jewish and non-Jewish NS boys were found to be 0.78 and 0.64 times less likely to be optimally active compared with their Non-NS counterparts. Nevertheless, this relationship disappeared among Jewish boys and just failed to be significant among non-Jewish boys (odds-ratio = 0.59) when adjusted for all other parameters included in the regression model. Lack of relationship between cigarette smoking and PA might be due to the low occurrence of cigarette smoking or the higher dose of nicotine in narghile as compared to cigarettes, or other confusing factors, for example, the use of supplementary drugs such as hashish [14,31]. In Ben Saad et al. study [12], one fifth of the 70 ENS were sedentary. Their “leisure activity” median (1st–3rd quartiles) was four (3–6) and their “daily activity” and “PA” scores mean ± SD were, respectively, 1 ± 1; 9 ± 6 and 16 ± 7. These data are generally lower than the present study ENS scores (Table 1), and could be explained by a higher amount of narghile tobacco consumed (Table 1S). In the previous study, authors [12] compared PA scores of a subgroup of ENS (n = 25) with those of a HNS group (n = 53): the ENS was found to have significantly lower “sporting”, “leisure” and “PA” activities, but a similar, “daily” activity score (Table 1S). PAQ data were negatively correlated only with quantity of used cigarettes: the higher the dose of cigarette smoking the lower were some PA scores (Table 4). Lack of correlation between the PAQ data and quantity of narghile used is surprising, since in a previous study [12], a higher quantity of narghile resulted in a lower 6-min walk-distance, a parameter reflecting objectively PA data [24]. However, in 104 HNS Tunisian men aged 40 years and above, the 6-min walk-distance was not significantly correlated with the PA score [24].

Quality-of-life

Narghile-use is associated significantly with poorer health perception. However, compared to the ENS group, the ECS
**Table 4** Correlation-coefficient between used quantity of tobacco and physical activities or quality-of-life scores of the two groups of exclusive-narghile-smokers (ENS) and exclusive-cigarette-smokers (ECS).

<table>
<thead>
<tr>
<th></th>
<th>ENS (n = 63)</th>
<th>ECS (n = 54)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Physical activities scores</td>
<td></td>
</tr>
<tr>
<td>Sporting</td>
<td>0.02</td>
<td>−0.39*</td>
</tr>
<tr>
<td>Leisure</td>
<td>0.18</td>
<td>−0.38*</td>
</tr>
<tr>
<td>Daily</td>
<td>−0.13</td>
<td>−0.18</td>
</tr>
<tr>
<td>Physical</td>
<td>0.05</td>
<td>−0.46</td>
</tr>
<tr>
<td></td>
<td>Quality-of-life scores</td>
<td></td>
</tr>
<tr>
<td>Symptoms</td>
<td>−0.11</td>
<td>−0.02</td>
</tr>
<tr>
<td>Activity</td>
<td>0.19</td>
<td>0.02</td>
</tr>
<tr>
<td>Impacts</td>
<td>0.11</td>
<td>−0.05</td>
</tr>
<tr>
<td>Total</td>
<td>0.12</td>
<td>−0.03</td>
</tr>
</tbody>
</table>

* p < 0.05.

A group has a significantly worse QOL with differences between the two groups higher than the minimally-clinically-important-difference (MCID = 4) [22] (Table 3). The present study results are not surprising since the SGRQ is a respiratory disease-specific questionnaire [22] and chronic ENS has less undesirable effects on respiratory function tests than chronic ECS [9]. Comparison of plethysmographic data of two, age and height matched groups (36 ENS and 106 ECS of more than 10 NY or 10 PY) found that the ECS group had lower flows and volumes and higher frequencies of subjects with obstructive-ventilatory-defect or with lung-hyperinflation. The present study results are similar to that previously shown by an Iranian population-based study [15], and are opposite to those reported by a Lebanese study [13]. The Iraqi study [15] showed that the SF-36 mean scores of NS, for seven out of eight dimensions, were lower than those of Non-S, signifying that NS had a considerably worse health status than Non-S in all scales except for “role limitations due to emotional problems” scale (Table 2). The scores for each decreased scale of NS compared to Non-S decreased by more than five points, and this is clinically significant [15]. The Lebanese study [13] showed that the previous and current CS vs. Non-S have significantly lower QOL (evaluated via the CCQ [27]) in the same disease category, however, previous and current NS vs. Non-S have similar QOL. Since earlier studies have established that socio-demographic characteristics could impact HRQOL [32–34], it was argued that observed disparities between NS and CS might be due to existing divergences in their socio-demographic characteristics [13]. This hypothesis could not be retained in the present study, since the two groups were SL- and SEL-matched (Table 1). However, to correctly answer this question, multivariate logistic regression analysis was necessary [15]. Tavafian et al. [15] have verified the interactions between narghile-use and other independent variables, including age, sex, SL, occupational status, marital status, and cigarette smoking status, and they have shown that narghile-use could increase the risk of both physical and mental impairment, independent of other socio-demographic characteristics. No significant relationship was found between QOL data and quantity of consumed narghile or cigarettes (Table 4). The present result is opposite to that of Joseph et al. [13] where positive dose–effect relationships were found between different smoking types cumulative doses and QOL score (Table 25). In addition, cumulative cigarette and narghile doses were found to be a predictor of respiratory QOL of a sample of healthy, COPD and chronic bronchitis subjects [13].

In conclusion, chronic exclusive narghile-use is less detrimental to PA and QOL than chronic exclusive cigarette smoking.

**Recommendations**

Smoking (including narghile-use) needs to be discouraged for causes of universal health encouragement [4,25] and because it reduces physical fitness [12]. As done by Tavafian et al. [15], the authors also recommend research to test the social desirability bias, and this should be done by taking a subsample and comparing a subjective fitness measurement (questionnaires) with objective measures of exercise tolerance. This can be done by means of pedometers to measure the level of the activity over a particular episode of time [35]. Therefore, given the harmful effects of narghile-use on PA and QOL, more research in different target populations, with larger target populations and larger samples are needed to confirm these results.

**Authors’ contributions**

GBHM and BSH conceived the study, participated in its design, collected questionnaire data, performed the statistical analysis, coordinated the study, helped to draft the manuscript and approved the final version; The two authors read and approved the final manuscript.

**Conflict of interest**

The authors have disclosed no conflicts of interest.

**Acknowledgements**

Authors wish to thank Professors **Mohamed TURKI ZAIRI** and **Rogger LEDSHAM** from the Sohar University (Oman) for their invaluable contribution in the improvement of the quality of the writing in the present paper.

**Appendix A. Supplementary data**

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.ejcdt.2016.01.007.

**References**

