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Physiology

EFFECT OF LONG TERM SMOKING ON MANUAL DEXTERITY – AN OBSERVATIONAL STUDY ON CHRONIC SMOKERS BETWEEN THE AGES OF 25 TO 60 YEARS

Dr. Shivani Agarwal — Assistant Professor Dept of Physiology GGMC & JJ Hospital, Mumbai

Dr Sharad Patel* — Associate Professor Dept of Physiology GSMC & KEM Hospital, Mumbai
*Corresponding Author

ABSTRACT

Background: Cigarette smoking remains one of the major health problems worldwide, a prime factor in major medical illnesses, and contributing to cancer of many organs. It has also been associated with neurocognitive deficit. This study evaluates the effect of smoking on the manual dexterity of chronic smokers between the ages of 25 to 60 years.

Methods: 100 healthy subjects were divided in 2 groups: Group A (Smokers) & Group B (Non smokers). Manual dexterity was assessed using the O'Connor Finger Dexterity Test. For statistical analysis, GraphPad InStat DTCG was used. Student's unpaired t-test was applied to compare the results.

Results : The performance of smokers was found to be inferior to non smokers, as the mean time taken for completing the test was more for smokers.

Conclusion : The results of this study indicate that even 5 years of smoking can contribute to a significant deficit in manual dexterity, emphasizing its negative impact on many aspects of day to day life, professional skills, and ultimately the quality of life.

KEYWORDS :

INTRODUCTION

Cigarette smoking is one of the major worldwide health problems and one of the largest preventable causes of disease and premature death. As per World health Organization [WHO], about a third of the male adult global population smokes and it is estimated that the global prevalence of smoking will be 22.7% by 2020 and 22.0% by 2030[1]. Indian studies have recognized tobacco use as a major health hazard [2,3]. According to the national cross-sectional household survey, India has over 200 million tobacco consumers, and increasing, especially among women [4].

Long term smoking has proved to be a prime factor in heart disease, stroke and chronic lung disease, and a contributor to cancer of many organs [7].Tobacco smoking has also been associated with negative effects on several types of neurocognitive functions [8]. Previous cross-sectional studies with cohorts in 30–60 year age range indicated chronic smokers performed more poorly than non-smokers on several measures of neurocognition [9, 11, 12, 14, 16]. Higher pack years was related to lower global cognitive functioning [17].

AIM:

To study and compare the effect of chronic cigarette smoking on the manual dexterity of smokers and non smokers between the age group of 25-60 years and to assess the impact of Chronicity of smoking on the manual dexterity in smokers.

METHODOLOGY:

This is an observational, prospective, pilot study for an Indian population. 100 participants between the ages of 25 to 60 years who are age and sex matched were divided in 2 groups; Group A [n=50] consisting of individuals who have been smoking for 5 years or more, and Group B[n=50] consisting of non-exposed controls.

INCLUSION AND EXCLUSION CRITERIA:

Group 1

Inclusion criteria:

Smoking participants were required to be actively smoking at the time of assessment, smoke at least 10 cigarettes per day for 5 years or more, with no periods of smoking cessation greater than 1month in the 5-years prior to enrollment.

Exclusion criteria:

1. Participants were screened for conditions known or suspected to influence brain neurobiology and there should be no history of any;
   - Neurologic disorder [e.g., seizure disorder, neurodegenerative disorder, demyelinating disorder, closed head trauma with loss of consciousness].
   - General medical disorder [e.g., hypertension, myocardial infarction, Type-1 or 2 diabetes, cerebrovascular accident].
   - Psychiatric disorders [mood thought, anxiety, substance/alcohol use disorders].
2. No smoking participant should be engaged in any pharma cological/behavioral smoking nicotine cessation program or used other forms of tobacco at the time of study.
3. No participant should have consumed alcohol for at least 24 hours prior to the study.

Group 2:

Inclusion criteria:

1. Non-smoking participants were required:
   - to have smoked less than 20 cigarettes in their lifetime, and
   - no cigarette use in the 10 years prior to study, and
   - no history of use of other tobacco products.

Exclusion criteria:

1. Participants were screened for conditions known or suspected to influence brain neurobiology. They should not have had any history of:
   - Neurologic disorders [e.g., seizure disorder, neurodegenerative disorder, demyelinating disorder, closed head trauma with loss of consciousness].
   - General medical disorders [e.g., hypertension, myocardial infarction, Type-1 or 2 diabetes, cerebrovascular accident].
   - Psychiatric disorders [mood, thought, anxiety, substance/alcohol use disorders].
2. No participant should have consumed alcohol for at least 24 hours prior to the study.

EQUIPMENT:

- O'Connor Finger Dexterity Test [Model 32021]
- Stop watch

Subjects were invited to take part in the study, from among the staff at a Tertiary Healthcare Centre of the Municipal Corporation of Greater Mumbai. They were asked to report in the morning with light breakfast without tea or coffee. After explaining the nature and purpose of the study in their colloquial language, written informed consent was taken. Some basic information regarding name, age, sex, address etc and some anthropometric data like height and weight was taken.

The participant was seated comfortably at a table 30 inches in height, with hands resting comfortably on the table or on their sides. Before starting the test, the participant was explained the procedure and correct way of performing the test followed by a demonstration.

O'Connor Finger Dexterity Test: The testing board consists of 100 holes about 3/16 inches in diameter. The holes are arranged in ten rows and spaced ½ inch apart. Each pin is 1 inch long and each hole will accommodate 3 of the pins. Above the holes is a shallow well holding 300 pins. It is a timed test of both manual and fine dexterity. Participants are asked to pick up 3 pins simultaneously using the fingers of their dominant hand and then to place them in each of the 100 holes, starting from the farthest corner, filling every row one after the other in a 'Z' pattern, moving towards the participant. The time required in minutes, to fill the 100 holes, is the basis for the score. The lesser the time required, higher is the score.

ANALYSIS:

- Data was presented as mean ± Standard Deviations.
- Statistical analysis between smokers and non smokers was done using Student t-test.

VARIABLE	GROUP A [n= 50] ($\bar{x}$ ± SD)	GROUP B [n=50] ($\bar{x}$ ± SD)
Age (in years)	40.72 ± 7.75	39.48 ± 8.75
Cigarettes/day	13.2 ± 4.7	NA
Pack years	14.5 ± 9.5	NA

- The results were said to be significant if the value of p obtained is <0.05, moderately significant if p<0.01and highly significant if p<0.001.

OUTCOME:

Table 1. Demographic and clinical measures.**VARIABLEGROUP A [n= 50] ($\bar{x}$ ± SD)GROUP B [n=50] ($\bar{x}$ ± SD)**Age (in years)40.72 ± 7.7539.48 ± 8.75Cigarettes/day13.2 ± 4.7NAPack years14.5 ± 9.5NA

$\bar{x}$ = Mean
SD = Standard deviation

Pack years: The pack-year is a unit for measuring the amount a person has smoked over a long period of time. It is calculated by multiplying the number of packs of cigarettes smoked per day by the number of years the person has smoked. For example, 1 pack-year is equal to smoking 20 cigarettes (1 pack) per day for 1 year, or 40 cigarettes per day for half a year, and so on [19].

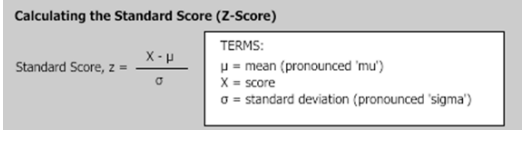
One pack-year is the equivalent of 365.24 packs of cigarettes or 7,305 cigarettes.

It is calculated as:

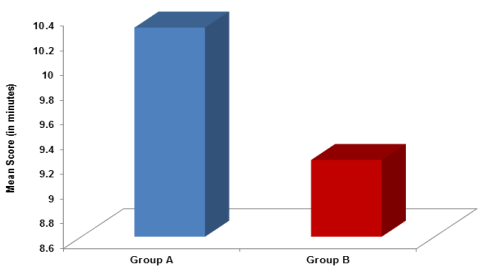
	Smokers [n= 50] (mean of z-score) SD	Non smokers [n=50] (mean of z-score) SD
Manual Dexterity OCT (time taken in min)	10.29(1.83)	9.22(1.39)

$$\text{Pack Years} = \frac{\text{No. of cigarettes smoked per day}}{20} \times \text{no. of years smoked}$$

Table 2. Domain z-score

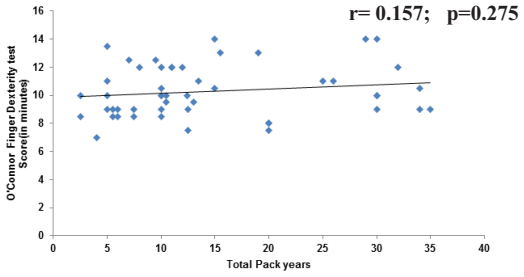


GRAPH 1. COMPARISON OF MEAN SCORES IN THE O'CONNOR FINGER DEXTERITY TEST BETWEEN THE TWO GROUPS



The mean score of smokers in the O'Connor Finger Dexterity test was 10.290(1.838); compared to the score of non smokers 9.220(1.397). In other words, smokers took a longer duration of time to complete the given task as compared to non smokers.

CHART 1. RELATIONSHIP BETWEEN TOTAL PACK YEARS AND MANUAL DEXTERITY



- The Pearson Coefficient of Correlation (r) between the total pack years and the O'Connor Finger dexterity test score was calculated, and found to be 0.157. The two-tailed P value is 0.2751, considered not significant.

DISCUSSION:

Cigarette smoking has been known to have an impact on the neurobiology and studies by Timothy C. Durazzo et al [25] have shown that it affects many aspects of neurocognition, like auditory–verbal and visuospatial learning, visuospatial memory, cognitive efficiency, executive skills, general intelligence, processing speed, fine motor dexterity and postural stability.

The majority of research on the neurocognitive consequences of chronic smoking has been conducted with adults greater than 60 years of age. Compared to the amount of research conducted with elderly individuals, there are a limited number of studies in adults in the 25–60 year old age range [14]. This study was designed to examine the effect of smoking specifically on the manual dexterity, in an Indian population.

The participants for the study were randomly selected and after applying the inclusion and exclusion criteria, they were divided into two groups, with 50 participants in each group.

Group A- Smokers (cases); Group B- Non smokers (controls)

All the participants were males, and the mean age of both the groups was comparable. The mean age in Group A was 40.72 with a SD of 7.75 years. The mean age in Group B was 39.48 with a SD of 8.75 years.

O'Connor Finger Dexterity Test

A timed test of both manual and fine dexterity, it involves manipulating and placing small pins, three at a time, into 100 small holes of a pegboard [145].

Smokers performed more poorly than non smokers on this test. The mean time taken by smokers to complete the given task, in minutes was 10.29 with a SD of 1.83. Mean time taken by non smokers was 9.22 with a SD of 1.39. (Refer Graph.1; page 42) This suggests a deficit in the hand and finger dexterity in smokers. These findings are consistent with the results of studies by Timothy C. Durazzo et al [9,145]

Correlation between duration / chronicity of smoking and neuromotor deficit

Duration/ chronicity of smoking were measured in terms of pack years. Correlation between the duration of smoking / pack years and neuromotor deficit was determined by calculation the Pearson's correlation coefficient (r). There was no correlation seen between pack years and decreased manual dexterity (assessed by the O'Connor finger dexterity test) (r= 0.157; p=0.275).

There are several potential chronic smoking-related biological mechanisms that may work independently, or in concert, to promote the neurocognitive and neurobiological abnormalities demonstrated by smokers [9].

This study has limitations that may influence the generalizability of the

findings. Medical, psychiatric and alcohol/substance histories were based on self-report, the participants weren't actually tested for substance/alcohol consumption prior to assessment. Additionally, group performances were potentially influenced by factors not directly assessed in this study such as nutrition, exercise, and previous exposure to environmental cigarette smoke or premorbid /genetic predispositions. Also, all of the participants were males, which did not allow for the examination for sex effects.

These results, which are consistent with the results of several similar studies done previously, in addition to the existing information about the serious repercussions of long term cigarette smoking emphasizes the urgent need for health care bodies and the governments alike to take all efforts needed to encourage smoking cessation among the smoking population.

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