COMPARISON OF INTELLECTUAL CAPACITY AMONG TOBACCO USERS AND NON – TOBACCO USERS – A CROSS SECTIONAL STUDY

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ABSTRACT

Background: Most of the previous studies reveal that prenatal exposure of tobacco influences the cognitive ability of the children. There are limited studies assessing the association between intellectual capacity and nicotine among adults in Indian population. The aim of the present study was to compare the Intellectual Capacity (IC) and addiction levels among tobacco users and non-tobacco users at a public hospital in Chennai city. **Materials and Methods:** One hundred and fifty participants aged 18 to 40 years were recruited for the present study. Among them, 75 participants constituted the study group and 75 participants constituted the control group. The selected study participants were divided into three sub groups I, II and III, each group consisting of 25 participants. Participants who were using smoking form of tobacco were recruited in to Group I, participants who were using smokeless form of tobacco to Group II, participants who were using both (smoking and smokeless) form of tobacco to Group III. The level of tobacco addiction for study population (Group- I, Group- II, Group- III) was assessed by Fagerstrom addiction scale. Intellectual capacity level in study group and control group was assessed using Raven's Progressive Matrices (RPM). **Results:** Majority of the participants had very low dependence in Group – I (68%) and Group – II (48%). In Group-III, most of the participants had medium dependence (52% for smoking and 68% for smokeless form of tobacco) and none of the participants had very high dependence. The difference in IC between tobacco users and non-tobacco users was not statistically

significant (P >0.05). There was weak correlation between IC and level of dependence on tobacco for smoking form (r = - 0.093) and smokeless form (r = - 0.037). **Conclusion:** The present study concluded that there was no significant difference in the intellectual capacity between tobacco users and non-tobacco users.

KEYWORDS: Level of dependence, Intellectual Capacity, Ravens Progressive Matrices, Fagerstorms addiction scale, Tobacco users.

INTRODUCTION

The most common substance abuse in the world is 'Tobacco'. According to WHO (2009), consumption of tobacco has been growing at the rate of 2% to 5% per annum. It is estimated that number of deaths due to tobacco will increase from 3 million per year worldwide to 70 million per year by 2025. Nearly 80% of the more than one billion smokers worldwide live in low- and middle-income countries, where the burden of tobacco-related illness and death is heaviest.[1]

According to Global Adults Tobacco Survey (GATS) in 2009 to 2010, 34.6% of adults in India had used tobacco.[2] In India, average age for initiation of tobacco is around 17.8 years.[2] The most common reasons cited for children to start using tobacco are peer pressure, parental tobacco habits, pocket money given to children norms, stress, health concerns, risky behaviours, parental smoking, family income, friends, depression, and self-esteem.[3,4] Men use more smoking form of tobacco than women. Women are more likely to use smokeless tobacco. Beedis are smoked more than cigarettes especially in rural areas.[5] The greatest challenge that India faces is the highest rates of oral cancer in the world which constitutes 12% of all cancers in men and 8% of cancers among women.[1]

Exposure to Environmental Tobacco Smoke (ETS) has consistently been linked with adverse health effects in children, including middle ear disease, colic sudden infant death syndrome, asthma exacerbations and various respiratory difficulties. There is increasing but inconsistent evidence that tobacco smoke exposure is linked with intellectual impairments and behavioral problems in children.[6] A child's cognitive functioning may be influenced by genetic, familial, educational and social factors as well as prenatal, developmental and physical factors. The development of Intelligent Quotient (IQ) is associated with tobacco exposures affecting brain growth during the fetal period, but also factors operating during an individual's life course.[7]

Most of the previous studies reveal that prenatal exposure of tobacco influences the cognitive ability of the children but not retard the growth of the brain.[8] Weissman et al in 1999[9] and Thapar et al in 2003[10] found that catecholaminergic dysfunction, including attention deficit hyperactivity disorder, conduct disorder and cognitive deficits have been occured in the offsprings of maternal smoking.[8, 9,10] According to Subin Park in 2014, in both humans and rodents, there are sensitive periods during early postnatal life during which sensory input shapes the maturation of sensory circuits.[7] According to Reiss et al in 1996[11], Iwasaki et al in 1997[12], Courchesne et al in 2000[13], brain development continues for an extended period postnatally. The brain increases in size by four-fold during the preschool period, reaching approximately 90% of adult volume by age 6. However, brain development involves the ongoing interplay of genetic and environmental factors.[14]

There are limited studies assessing the association between intellectual capacity and nicotine among Indian adult population. The aim of the present study was to compare the Intellectual Capacity (IC) and addiction levels among tobacco users and non-tobacco users at Tamil Nadu Government Dental College and Hospital, Chennai.

MATERIALS AND METHODS

The present study was a cross-sectional design. The study group was 75 tobacco-users belonging to 18 to 40 years. The study group was further divided into three Subgroups. Group I comprised of 25 subjects who were using smoking form of tobacco, Group II comprised of 25 subjects who were using smokeless form of tobacco and Group III comprised of 25 subjects who were using both smoking and smokeless form of tobacco. The control group (matched by age and sex) comprised of 75 participants who had no history of usage of any form of tobacco. The study procedure was explained to the selected participants by providing information sheet to them and written informed consent was obtained. Ethics clearance was obtained from the Institutional Ethics Committee of Tamil Nadu Government Dental College and Hospital, Chennai.

Case record form was used to record the demographic data for study group and control group. The history of tobacco usage like age of onset, the number, frequency, duration of usage of tobacco, alcohol consumption and any other substance abuse (Cannabinoids, Stimulants, Opioids, Club drug, Dissociative drugs, Hallucinogens, Prescription Medications) was recorded.

Tobacco Addiction

The level of tobacco addiction for study population (Group- I, Group- II, Group- III) was assessed by Fagerstrom addiction scale. This addiction scale consisted of 6 questions for assessing addiction level for participants using smoking form of tobacco and 9 questions for assessing addiction level for participants using smokeless form of tobacco. The score for each question was summed up for each group.[15,16] Depending upon the scores, the subjects are categorized into various dependence level.

Intellectual capacity

Intellectual capacity level of each participant in study group and control group was assessed using Raven's Progressive Matrices (RPM).[17] The RPM test is a commonly used test of general human intelligence. The RPM test is a standardized intelligence test that consists of visually presented, geometric-analogy-like problems in which a matrix of geometric figures is presented with one entry missing and the correct missing entry must be selected from a set of answer choices.[17] RPM test consists of 5 sections (A to E), in which each section consisted of 12 questions making it a total of 60 questions. The study and control group participants were asked to answer this RPM questionnaire in a given answer sheet within the fixed time limit of 45 minutes. The questionnaire was evaluated by the chief investigator. Based on the scores obtained, the intellectual capacity of participants was categorized into various percentiles.[17]

Statistical analysis was done using SPSS version 22. The difference in the intellectual capacity between the study and control group was assessed by chi-square test. The correlation between addiction level of tobacco and IC was determined by spearman's correlation.

RESULTS

Out of 150 participants, 75 participants were tobacco users (study group) and 75 were non – tobacco users (control group). The study group participants were further divided into three groups based on the type of tobacco usage with 25 participants in each group (Group I- smoking form of tobacco, Group II- smokeless tobacco and Group III – both forms).

All the selected participants were men with a mean age of 27.5 years. The most prevalent type of tobacco usage was cigarette (92%) followed by mawa (74%). Seventy two percent of tobacco users and 65% of non-tobacco users were alcoholics. (Table 1).

The level of dependence on tobacco was assessed using Fagerstorm scale. Table 2 demonstrates the number and percentage of tobacco dependence of the study group participants. On assessing the level of dependence of tobacco among the study group, majority of them had very low dependence in Group – I (68%) and Group – II (48%). In Group- III, most of the participants had medium dependence (52% for smoking and 68% for smokeless form of tobacco) and none of the participants had very high dependence.

On comparison between 25 Group I study participants and 75 control group participants (Table 3) 48% of smokers were either Intellectually Average (IA) or Definitely Above Average (DAA) and only 4% were Intellectually Superior (IS) whereas 71% of control group participants were Intellectually Average and 29% were Definitely Above Average (DAA). The results were statistically insignificant (P >0.05).

Among the Group II study participants (Table 4) 44% and 56% were Intellectually Average (IA) and Definitely Above Average (DAA) respectively. Among the control group participants, 30% and 70% were Intellectually Average (IA) and Definitely Above Average (DAA) respectively. The difference in IC between Group II study participants and control group was not statistically significant (P >0.05).

Table 5 shows IC of participants in Groups III study participants and control group. Twenty four percent and 76% of group III participants were Intellectually Average (IA) and Definitely Above Average (DAA) respectively. Among the control group participants, 30% and 70% were Intellectually Average (IA) and Definitely Above Average (DAA) respectively. The difference in IC between Group III study participants and control group was not statistically significant (P >0.05).

Table 6 reflects the correlation between addiction level of tobacco and IC using spearman's correlation. There was very weak correlation between the level of dependence and IC among participants using smoking form of tobacco (r = - 0.093) which was statistically insignificant (P >0.05). There was very weak correlation between level of dependence and IC among participants using smokeless form of tobacco (r = - 0.037) which was statistically insignificant (P >0.05). In Group – III study participants, there was very weak correlation between level of dependence and IC among participants using smoking and smokeless form of tobacco (r = 0.153 and r = - 0.124) which was statistically insignificant (P >0.05).

TABLE – 1: DEMOGRAPHIC PROFILE OF THE PARTICIPANTS

		Study Group n (%)			Control Group n (%)
Demographic data					
		I	II	III	
Sex	Men	25(100)	25(100)	25(100)	75(100)
	Women		0		0
Age (years)	Mean $\pm$SD	28.8$\pm$6.2	27.7$\pm$6.7	31.9$\pm$5.7	27.5$\pm$6.2
	Hindu	16(64)	18(72)	17(68)	49(65)
Religion	Christianity	5(20)	4(16)	5(20)	19(25)
	Muslims	4(16)	3(12)	3(12)	7(10)
	Others	0(0)	0(0)	0(0)	0(0)
	Profession or honors	0(0)	0(0)	0(0)	0(0)
	Graduate or post graduate	1(4)	0(0)	0(0)	0(0)
	Intermediate or post high school	1(4)	3(12)	1(4)	5(7)
Education status	High school certificate	16(64)	14(15)	12(48)	42(56)
	Middle school certificate	6(24)	5(20)	10(40)	19(25)
	Primary school certificate	1(4)	3(12)	2(8)	9(6)
	Illiterate	0(0)	0(0)	0(0)	0(0)
	Upper	1(4)	0(0)	0(0)	6(8)
Socio economic	Upper middle	5(20)	1(4)	0(0)	24(32)
Status	Lower middle	14(56)	6(24)	9(36)	19(25)
	Upper lower	5(20)	18(72)	16(64)	26(35)
	Lower	0(0)	0(0)	0(0)	0(0)
Smoking form of tobacco	Cigratte		45(90)		-
	Bidi		5(10)		-
Smokeless form of	Mawa		43(86)		-
tobacco	Pan masala		5(10)		-
	Hans		2(4)		-
Alcohol intake	Yes		54(72)		49(65)
	No		21(28)		26(35)

TABLE 2: LEVEL OF DEPENDENCE AMONG STUDY GROUPS

Level of dependence	Group I (smoking form) n (%)	Group II (smokeless form) n (%)	Group III	
			Smoking form n (%)	Smokeless form n (%)
Very low	17(68)	12(48)	10(40)	6(24)
Medium	6(24)	10(40)	13(52)	17(68)
High	2(8)	3(12)	2(8)	2(8)
Very high	0(0)	0(0)	0(0)	0(0)

TABLE 3: COMPARISON OF INTELLECTUAL CAPACITY BETWEEN GROUP – I STUDY PARTICIPANTS (SMOKING FORM) AND CONTROL GROUP

IC	Group – I (%)	Control group (%)	Chi square value	p –value
Intellectually Superior (IS)	4	0		
Intellectually Average (IA)	48	30		
Definitely Above Average (DAA)	48	70	6.404	0.141
Definitely Below Average (DBA)	0	0		
Intellectually Defective (ID)	0	0		

TABLE 4: COMPARISON OF INTELLECTUAL CAPACITY BETWEEN GROUP – II STUDY PARTICIPANTS (SMOKELESS FORM) AND CONTROL GROUP

IC	Group – II (%)	Control group (%)	Chi square value	p –value
Intellectually Superior (IS)	0	0		
Intellectually Average (IA)	44	30		
Definitely Above Average (DAA)	56	70	1.824	0.177
Definitely Below Average (DBA)	0	0		
Intellectually Defective (ID)	0	0		

TABLE 5: COMPARISON OF INTELLECTUAL CAPACITY BETWEEN GROUP – III STUDY PARTICIPANTS (SMOKING AND SMOKELESS FORM) AND CONTROL GROUP

IC	Group – III (%)	Control group (%)	Chi square value	p-value
Intellectually Superior (IS)	0	0		
Intellectually Average (IA)	24	30		
Definitely Above Average (DAA)	76	70	0.265	0.798
Definitely Below Average (DBA)	0	0		
Intellectually Defective (ID)	0	0		

TABLE 6: CORRELATION BETWEEN LEVEL OF DEPENDENCE IN SMOKING AND SMOKELESS FORM OF TOBACCO WITH INTELLECTUAL CAPACITY

	Dependence score		Intellectual capacity score
Spearman's rho	(Group – I) Smoking form	Correlation Coefficient	-0.093
		p-value	0.657
	(Group – II) Smokeless form	Correlation Coefficient	-0.037
		p-value	0.861
	(Group – III) Smoking form	Correlation Coefficient	0.153
		p-value	0.466
	(Group – III) Smokeless form	Correlation Coefficient	-0.124
		p-value	0.556

DISCUSSION

John Horn in 1983 described that intellectual development may be divided into two types, Crystallized intelligence and Fluid intelligence. Crystallized intelligence is accumulated information and verbal skills, which increase with age. Fluid intelligence is the ability to reason abstractly, which steeply increases from infancy till early adulthood, remains constant from early to middle adulthood and then steadily declines from middle adulthood till late adulthood.[18] Thus, fluid intelligence was assessed in the early adulthood which ranges from 18 to 40 years[19] thereby eliminating age as a confounding factor.

The Raven Progressive Matrices (RPM) test is a commonly used test of general human intelligence.[17] Raven's Progressive Matrices Test is a well-validated measure of basic cognitive functioning for different cultural, ethnic and socioeconomic groups on a worldwide and within country basis. Raven's Progressive Matrices and Mill Hill Vocabulary Scales were developed for use in fundamental research into the genetic and environmental determinants of intelligence.[20]

Raven and Court in 1998 explained that the Raven's Progressive Matrices have been used in many countries for decades as a measure of problem-solving and reasoning ability. Raven's.

Progressive Matrices was constructed in the late 1930s as a test of nonverbal or abstract reasoning ability. RPM has become one of the leading and most frequently used tests of this ability and has been described as the paradigm test of nonverbal, abstract reasoning ability.

The fact that the Raven's shows less influence of cultural factors than more verbally-laden assessments has made it very appealing as global measure of cognitive ability.[21]

According to Ryan and Tippins 2009, the global exposure of the Raven's abstract reasoning format has several important advantages for inclusion in a global selection strategy. Specifically, its familiarity increases the likelihood of local management support, it promotes positive participant reactions and helps ensure that scores aren't unduly influenced by language or culture.[22]

The Fagerström Test for Nicotine Dependence (FTND) is a widely used six-item questionnaire, which has often been used as a measure of physical dependence on nicotine. Since 1991, FTND is one of the most widely accepted evaluative instruments to establish and quantify nicotine dependence.[23] According to Dijkstra and Tromp in 2002,[24] Etter in

2005,[25] FTND is reliable and valid in several different contexts.

The present study results revealed statistically no significant difference in IC between tobacco and non-tobacco users among Indian population. However, Marcus Pembrey et al in 2014[26] stated that boys born to exposed fathers had lower IQ scores. Taylor et al in 2003[27] revealed that current tobacco smokers have lesser IC than ever and never smokers in Scotland which is in contrary with results of the present study.

The current study revealed that there was weak correlation between IC and tobacco dependence (r= -0.086) which was relatively similar to a study conducted by Modig K et al in 2011 (r = -0.06).[28] The association between addiction level of tobacco and IC was statistically insignificant (P >0.05) which was consistent with a study conducted by Edith Claros et al in 2008.[29]

According to Rosa Alati et al in 2008, there was no statistically significant difference between maternal and paternal alcohol, tobacco consumption during pregnancy and childhood IQ at the age of 8 years.[30] However, Kimberly Yolton in 2005 found that there was inverse relationship between IC and environmental tobacco among U.S adolescence children ranging from 6 to 16 years.[8]

The varied results may be attributed to the difference in the age group selected for the present study. Participants in the early middlehood (18-40 years) were recruited in the present study whereas in the previous studies, IC was assessed among children and adolescents.

There is scientific evidence from previous studies that prenatal and postnatal exposure to nicotine influences intellectual development among children and adolescents. Since there were limited studies assessing the association between IC and tobacco usage among adults, the present study was carried out with an assumption in mind that IC influences the usage of tobacco and its addiction. Higher IC individuals have more mental stability and stress combating strategies and thus may have less indulgence in tobacco usage. As there was no statistically significant difference in the IC among tobacco and non-tobacco users, we could not generate hypothesis from the present study.

CONCLUSION

There was no statistically significant difference in the intellectual capacity among tobacco users and non-tobacco users. There was weak correlation between intellectual capacity and

level of tobacco addiction. However, the ill-effects of tobacco are well documented which invites strategies at international, national and regional level to combat tobacco usage and further to control and prevent tobacco-related morbidity and mortality worldwide.

RECOMMENDATIONS

Further research is warranted with a large sample size using prospective study design to establish causal relationship between intellectual capacity and tobacco usage. However, it is imperative to reinforce stress combating strategies at individual level in tobacco cessation counseling centers to curtail addiction on tobacco. Fiscal policy by increasing the taxation of tobacco products could be imposed by the government as a regulatory approach. Existing laws on tobacco must be strictly strengthened and newer laws and regulations must be implemented. Therefore, a combination of regulatory, educative and service approach is the need of hour to make our environment tobacco-free, thus promoting good general health and oral health as well.

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