DOI: 10.55522/jmpas.V14I3.6761 **ISSN NO. 2320 – 7418**

International peer reviewed open access journal

Journal of Medical Pharmaceutical and Allied Sciences

Journal homepage: www.jmpas.com CODEN: JMPACO

Research article

Smoking cessation interventions for patients with chronic obstructive pulmonary disease: A prospective study

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Received - 12-11-2024**, Revised** - 25-02-2025, **Accepted** - 18-05-2025 **(DD-MM-YYYY)**

Refer This Article

Shinu Cholamugath, Silbiya Jasmine PT, Lamiya Nasrin K, Thahmina Shahnas VK, 2025. Smoking cessation interventions for patients with chronic obstructive pulmonary disease: a prospective study. Journal of medical pharmaceutical and allied sciences, V 14 - I 3, Pages - 01 – 08. Doi: https://doi.org/10.55522/jmpas.V14I3.6761.

ABSTRACT

Tobacco smoking is a primary contributor to chronic obstructive pulmonary disease, significantly impairing respiratory health. Understanding the risks of smoking and the benefits of cessation is vital for improving patient outcomes. The study aims to provide smoking cessation interventions for patients with chronic obstructive pulmonary disease (COPD), assess smoking indices and cessation status, develop Patient Information Leaflets (PILs), enhance medication adherence, and establish comprehensive smoking cessation guidelines. This prospective interventional study was conducted at a super specialty hospital over 12 months. A total of 128 participants were recruited, equally divided into an intervention group and a control group. Participants completed a questionnaire assessing their knowledge and willingness to quit smoking, followed by personalized counseling. The intervention group received individualized quit smoking programs, PILs, and used the 'Breathe Easy Diary' to track their progress and medication adherence. The intervention group exhibited a lower average smoking index (309.17) compared to the control group (463.23), with a statistically significant difference (p=0.042). The smoking cessation rate was significantly higher in the intervention group at 23.4%, versus 7.8% in the control group (p=0.015). Improved medication adherence was also noted in the intervention group.Personalized smoking cessation interventions significantly improved cessation rates, medication adherence, and reduced smoking indices in COPD patients, highlighting the need to address smoking behavior and health conditions to enhance quality of life.

Keywords: Smoking cessation, Chronic obstructive pulmonary disease, Patient information leaflets, Medication adherence.

INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a common lung condition that slowly gets worse over time, making it increasingly difficult to breathe. While smoking is the leading culprit, COPD can still develop in non-smokers. Since most people with COPD (around two-thirds) have smoked, understanding the health effects of smoking on these individuals is very important [1]. Smoking also causes a significant number of deaths from tobacco use. In fact, chronic obstructive pulmonary disease is responsible for roughly 21% of these deaths [2]. Chronic obstructive pulmonary disease (COPD) ranks high among the world's deadliest diseases [3]. COPD is the world's third biggest killer, following heart disease and stroke. Most people with severe or late-stage COPD eventually suffer respiratory failure, often a type where the blood has too much carbon dioxide (hypercapnic) [4]. While COPD is preventable and manageable, it also leads to notable effects beyond the lungs, which can intensify its severity in certain individuals.

Estimates suggest that around 3 million people in the UK (roughly 5% of the population) have COPD, but only about 900,000 have been officially diagnosed. This means a significant number (around 2 million) likely have COPD but haven't been diagnosed yet. COPD diagnosis typically happens after age 50, and the global

percentage of people with COPD (prevalence) varies between 5% and 10% depending on how it's diagnosed [5].

Tobacco smoking poses a significant risk for various diseases, particularly COPD, with nearly half of older smokers eventually developing the condition. It's a global health concern, with a 22.2% prevalence in 126 nations. Smoking negatively impacts patients' quality of life and pulmonary function. Quitting is crucial for COPD symptom improvement. Nicotine replacement therapy is a favored approach due to fewer side effects. Systemic nicotine prescription, a medically approved option, increases quitting likelihood by 55%, especially when combined with behavioral treatments like counseling and patient information leaflets [6].

On an individual level, quitting smoking reduces the risk of diseases like COPD and cancer and improves respiratory health. On a broader scale, it contributes to public health by decreasing secondhand smoke exposure and lowering healthcare costs. Through the recognition and application of successful methods, it positively influences others and promotes a healthier environment. Economically, it can enhance workforce productivity and reduce healthcare expenditures. Overall, smoking cessation plays a crucial role in improving both individual well-being and societal health [7].

Assessing the smoker's readiness to quit is the initial step in the cessation process. The five key steps, often referred to as the "Five A's," provide a framework for addressing tobacco use. These steps include healthcare providers talking to patients about tobacco use, recommending they quit, gauging their motivation to quit, helping them through a quit attempt, and scheduling follow-up support. It entails inquiring about tobacco use, providing advice on quitting, evaluating commitment and barriers to change, supporting individuals dedicated to quitting, and scheduling follow-up sessions to monitor progress. The 5 R's framework serves as the basis for motivational interventions for reluctant smokers. These include: i) Relevance: Understanding how quitting would personally benefit the individual. ii) Risks: Identifying potential drawbacks of smoking. iii) Rewards: Recognizing the benefits of quitting. iv) Roadblocks: Addressing challenges to cessation. v) Repetition: Consistently reinforcing motivation during interactions with patients. It's crucial to emphasize to smokers that multiple attempts may be needed before successfully quitting. India ranks as the third-largest tobacco producer globally and the second-largest consumer of tobacco products [8]. Research suggests COPD deaths could even surpass those from breast and lung cancer combined. Smoking is the major cause in most cases (85-90%), significantly impacting quality of life and putting a strain on healthcare systems [13]. The Global Initiative for Chronic Obstructive Lung Disease (GOLD) highlights that COPD can not only be prevented and treated, but it can also have important effects outside the lungs (called extra pulmonary effects) that can make the condition more serious for some patients [14].

This study investigates how smoking behaviors and quit attempts differ among individuals with COPD. Also, it emphasizes the critical importance of smoking cessation interventions in enhancing both individual health and public well-being [7].

We conducted a questionnaire survey to assess patient's usage of tobacco and related products, particularly focusing on understanding their knowledge about smoking cessation therapies. Patients were given counseling with the help of patient information leaflets (PILs), and they utilized the 'Breathe Easy Diary' to track their progress in quitting smoking. The combined data gathered from these initiatives allowed us to examine the widespread use of tobacco products in our local community. This overall perspective underscores the significance of promoting awareness about smoking cessation and enhancing understanding of COPD in our society.

MATERIALS AND METHODS

This prospective interventional study was conducted at a super speciality Hospital in Perinthalmanna, India, for a period of one year. The research focused on the pulmonology department.

The sample size was calculated using the formula for estimating proportions, resulting in a required sample of 128 participants.

This study was approved by the ethical committee of the institution and an official consent was also given for the purpose of performing the study. It was certified by the Institutional Ethics Committee and approved the proposal of the study as per letter No: (KAS: ADM: IEC: 0109L: 23). The patients from the selected departments were monitored during the study period based on the inclusion and exclusion criteria:

Inclusion Criteria

The outpatients and inpatients diagnosed with COPD, Patients with history of smoking, Patients aged 40 to 75 years of either gender, Patients who are currently smoking, Patients who are willing to quit smoking, Patients who are physically and cognitively able to participate in interventions.

Exclusion Criteria

Patients with severe comorbidities, Inability to provide informed consent, Patients having visual or hearing impairment.

The study was conducted in five phases. In phase 1, COPD patients were carefully screened for eligibility, with all participants providing written informed consent. Phase 2 involved collecting each patient's information, ensuring comprehensive coverage of demographic, medical, and copd-specific details, as well as medication and smoking history. Data were collected from 128 study participants who were willing to quit smoking, with 64 allocated to the 'INTERVENTION' group and the remaining 64 to the 'CONTROL'

group. In phase 3, patients completed a questionnaire aimed at assessing their comprehension of smoking cessation therapies and their willingness to quit. During phase 4, the study participants in 'INTERVENTION' group participate in 'INDIVIDUAL QUIT SMOKING PROGRAMS' in which patient receive interventions like counseling on smoking cessation importance and patient information leaflets (pils), and were given the 'breathe easy diary' to track their progress and to check their medication adherence. To empower healthcare professionals in supporting patients with COPD who are trying to quit smoking, a comprehensive smoking cessation guideline has been developed. Phase 5 focused on smoking cessation assessments which were conducted through individual consultations during follow-up utilizing data from the 'breathe easy diary'.

Data were analyzed using Microsoft Excel and SPSS version 20.0, with frequency and percentage summaries. The Chi-square test and independent t-test were applied to compare proportions, with a significance level set at $p < 0.05$.

RESULTS AND DISCUSSION

A total of 128 patients met the study's inclusion/exclusion criteria, with 64 allocated to the 'INTERVENTION' group and the remaining 64 to the 'CONTROL' group. The average age of study participants was slightly higher in the control group (69.62) compared to the intervention group (68.17). Out of 128 patients, the vast majority (120) were male, with only 8 females. In the control group, 90.6% (n=58 patients) were male, while 9.4% (n=6 patients) were female. Similarly, the intervention group had a higher proportion of males (96.9%, n=62 patients) compared to females (3.1%, n=2 patients).

The mean number of cigarettes per day among study participants in the control group was higher than that of the study participants in the intervention group. The control group had a mean of 14.45 with a standard deviation of 9.01, while the intervention group had a mean of 13.46 with a standard deviation of 7.98.

A chi-square test indicated a significant difference (p-value = 0.001) between the control and intervention groups regarding previous quit attempts. Among participants in the control group, a smaller proportion (10.9%, N=7) had previously attempted to quit smoking compared to those who had not (89.1%, N=57). Conversely, the intervention group showed a higher percentage (35.9%, N=23) of individuals with prior quit attempts, while 64.1% (N=41) reported no previous quit attempts.

In the control group, a small percentage of participants made multiple attempts to quit smoking: 3.1% (n=2) tried twice, and another 3.1% (n=2) tried three times. The majority of control group participants, 89.1% (n=57), reported no attempts to quit smoking. Conversely, the intervention group demonstrated higher rates of smoking cessation attempts. Approximately 9.4% (n=6) of participants made two attempts, 17.2% (n=11) made three attempts, and 9.4% (n=6) made four attempts. However, the largest proportion of the intervention group, 64.1% (n=41), also reported no smoking cessation attempts. The chi-square analysis revealed a significant difference between the groups (chi-square = 11.83, p = 0.008).

Table 1: Study participants who tried quitting

		Tried Quitting		Chi square value	P value
		No	YES		
Control	n	57	7	11.15	0.001*
	%	89.1%	10.9%		
Intervention	n	41	23		
	%	64.1%	35.9%		

Figure 1: Study participants who tried quitting

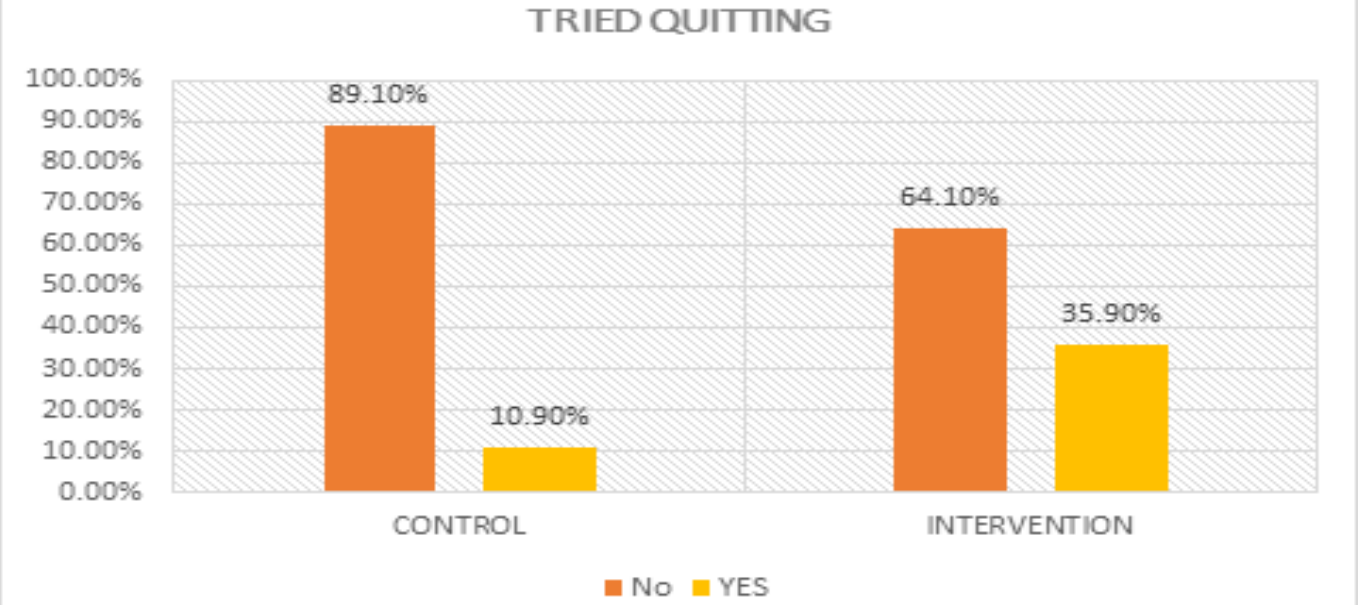


Table 2: Number of times study participants tried smoking cessation

						Chi square value	P value
		2	3	4	Nil		
Control	n	2	3	57	**57**	11.83	0.008*
	%	3.1%	4.7%	89.1%	89.1%		
Intervention	n	11	6	41	41		
	%	17.2%	9.4%	64.1%	64.1%		

Figure 2: Number of times study participants tried smoking cessation

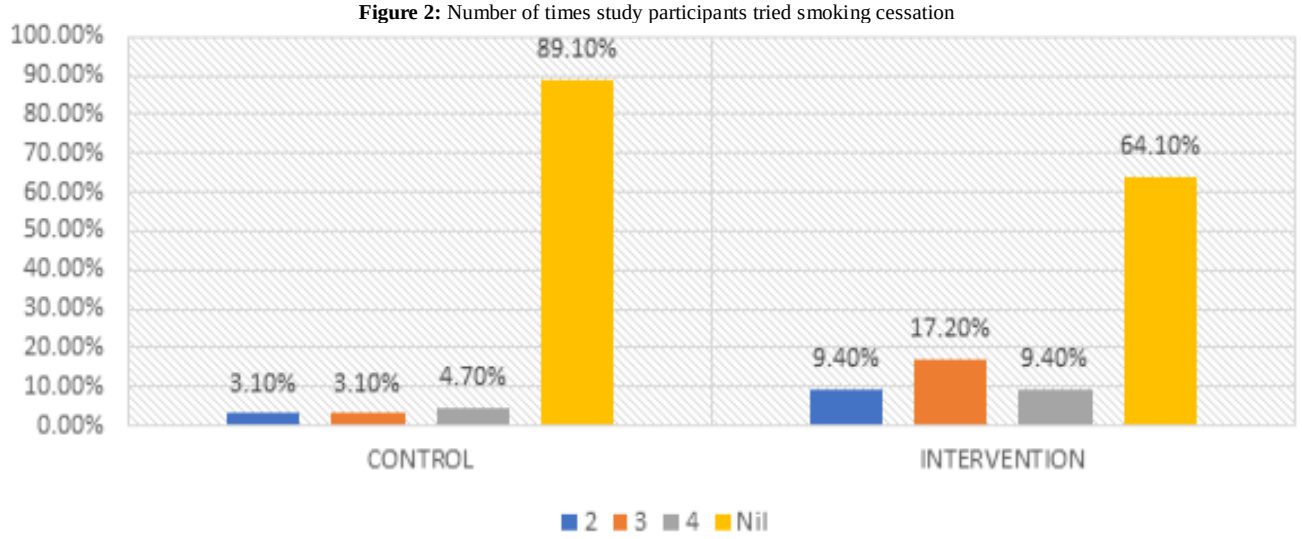


Table 3: Smoking index of study participants

	N	Mean	Std. Deviation	T value	P value
Control	64	463.23	279.75	6.87	0.042*
Intervention	64	309.17	103.17		

Figure 3: Number of cigarettes on nth day

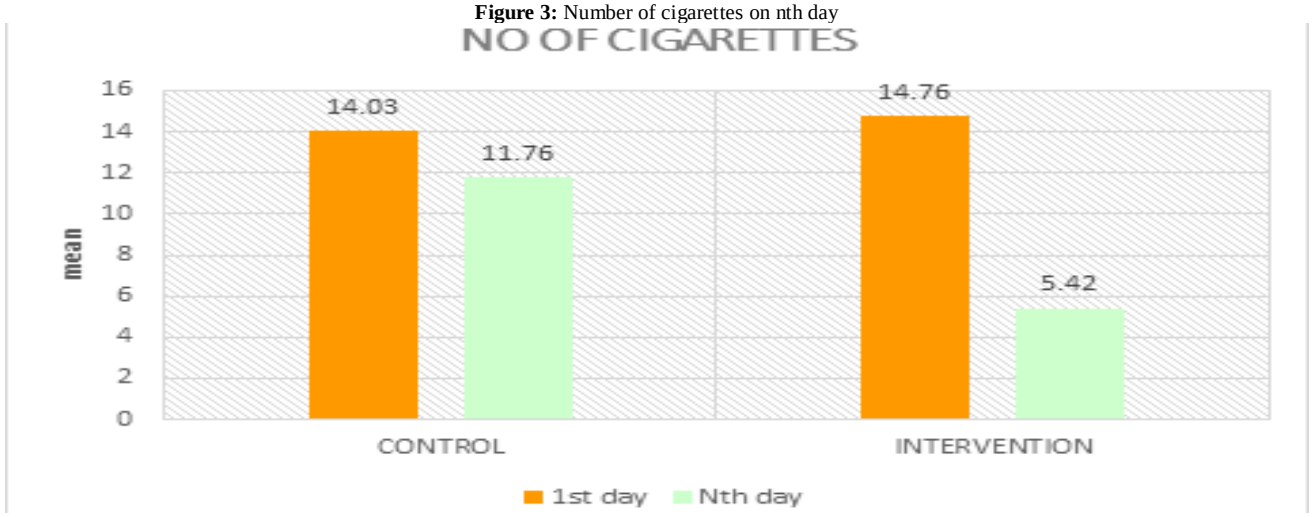


Figure 4: Smoking Index of Study Participants

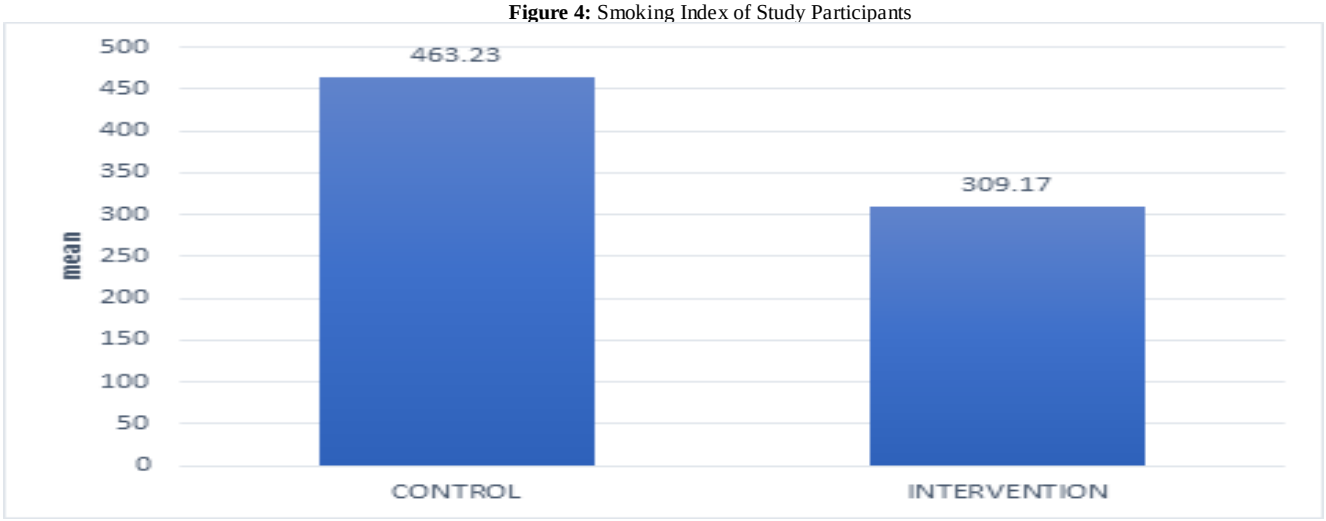


Figure 5: Medication adherence of study participants

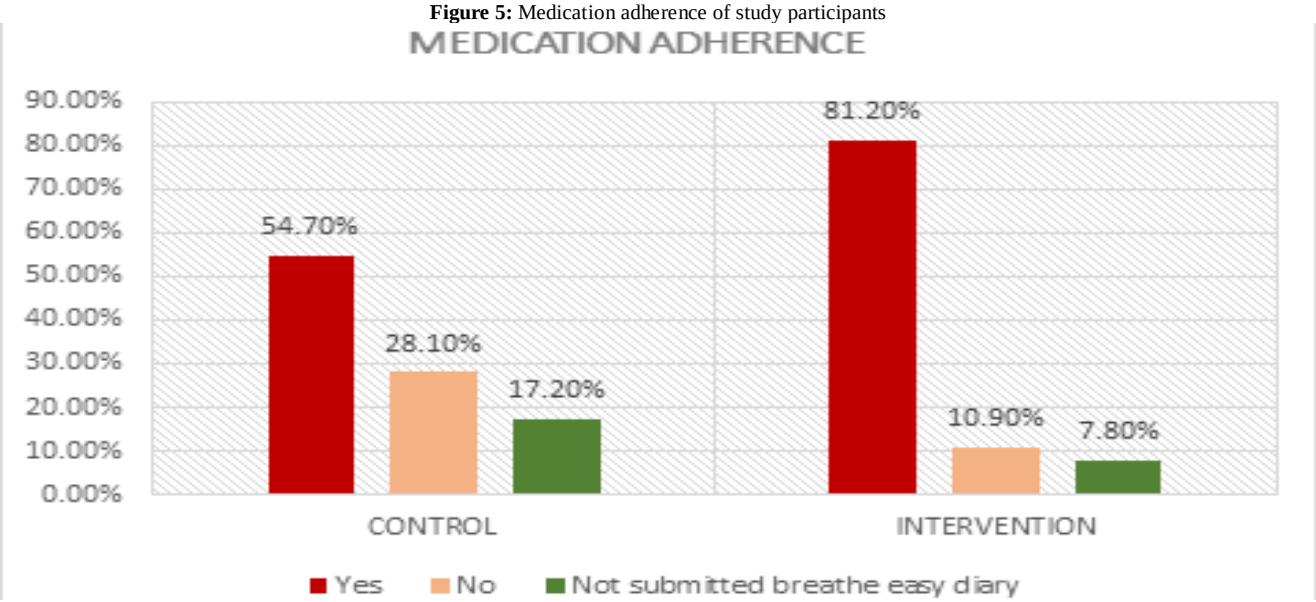


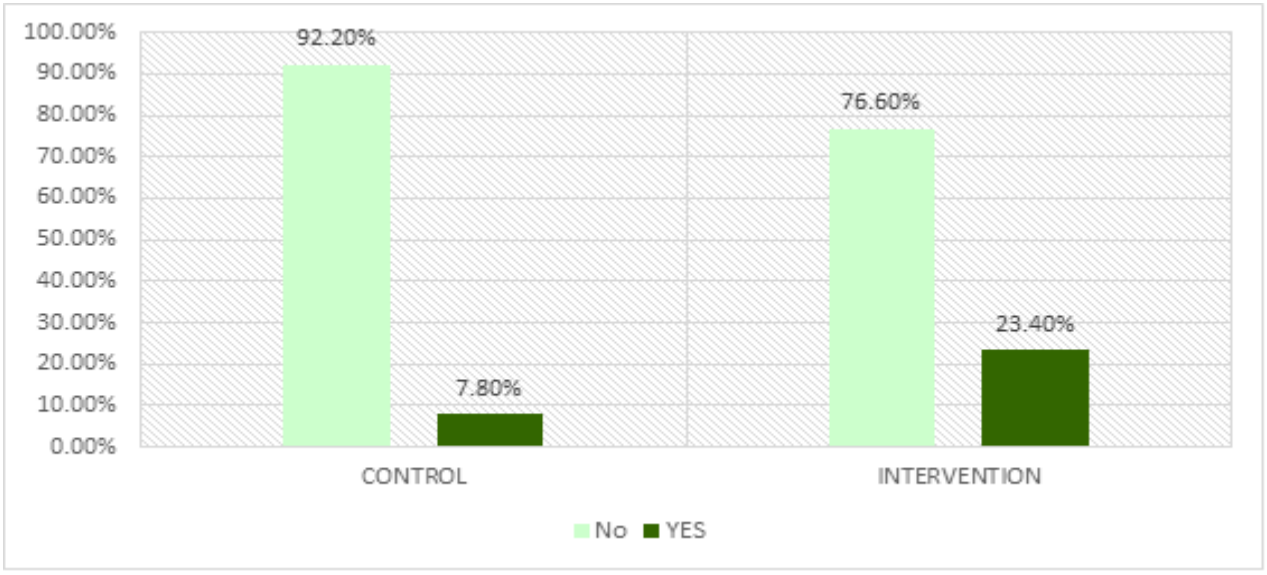
Table 4: Medication adherence of study participants

					Chi square value	P value
	Yes		No	Not submitted breathe easy diary		
Control	n	35	18	11	10.41	0.005*
	%	54.7%	28.1%	17.2%		
Intervention	n	52	7	5		
	%	81.2%	10.9%	7.8%		

Table 5: Quitting status

			No	Yes	Chi square value	P value
	Control	n	59	5	5.92	0.015*
		%	92.2%	7.8%		
	Intervention	n	49	15		
		%	76.6%	23.4%		

Figure 6: Quitting status



Among the 64 participants in the control group, the vast majority (98.4%, n=63) did not attempt alternative quitting methods, while a small proportion (1.6%, n=1) did. Similarly, in the intervention group of 64 individuals, 92.2% (n=59) did not try alternatives, and 7.8% (n=5) did. A chi-square analysis revealed no significant difference in the use of alternative quitting methods between the two groups (chi-square = 2.79, p = 0.104).

The majority of participants in both groups primarily relied on cigarette smoking. In the control group, a small percentage (1.6%, n=1) reported using tobacco as an alternative, while 98.4% (n=63) did not use any alternatives. The intervention group showed a similar pattern, with 92.2% (n=59) exclusively smoking cigarettes. However,

a small proportion of this group explored other options, with 3.1% (n=2) using hookah and 4.7% (n=3) using tobacco as alternatives.

On comparing the number of cigarettes on 1st day and nth day, the control group's mean score decreased from 14.03 on day one to 11.76 on day n, with a standard deviation of 1.38. In contrast, the intervention group showed a more substantial decline, with scores dropping from 14.76 on day one to 5.42 on day n, with a standard deviation of 0.94. A t-test indicated a significant difference in scores between the two groups (t=4.191, p=0.001).

Participants in the control group exhibited significantly higher smoking indices compared to those in the intervention group. The smoking index was calculated by multiplying the 'number of cigarettes smoked per day' multiplied by the 'years of smoking'. The control group had a mean score of 463.23 with a standard deviation of 279.75, while the intervention group's mean was 309.17 with a standard deviation of 103.17. A t-test was conducted to compare the means of the two groups, resulting in a t-value of 6.87 and a p-value of 0.042. However, the difference between the groups is statistically significant (p=0.042).

Adherence to medication and diary submission were assessed in both groups. In the control group, 54.7% (n=35) adhered to their medication regimen, while 28.1% (n=18) did not. Additionally, 17.2% (n=11) failed to submit the required breath-easy diary. The intervention group demonstrated higher medication adherence, with 81.2% (n=52) complying and 10.9% (n=7) not adhering. Diary submission rates were also higher in the intervention group, with only 7.8% (n=5) failing to submit the diary. A chi-square test was conducted to compare the distribution of responses between the control and intervention groups. The calculated chi-square vaIn the control group, a small percentage (7.8%, N=5) had quit smoking cigarettes, while the majority (92.2%, N=59) had not. In contrast, the intervention group showed a higher rate of smoking cessation, with 23.4% (N=15) quitting and 76.6% (N=49) continuing to smoke. A statistical analysis (chi-square test) showed a significant difference (p-value = 0.015) in the distribution of responses between the control group and the intervention group. Medication errors and drug interactions were thoroughly checked, 16 out of 128 patients failed to submit the 'Breath Easy Diary' during follow up.

Tobacco smoking is a major risk factor for several diseases, especially COPD, with almost half of older smokers eventually developing the condition. It is a global health problem, with a 22.2% prevalence in 126 countries. Smoking negatively affects patients' quality of life and pulmonary function. Quitting is essential for improving COPD symptoms.

This study was a prospective interventional study carried out among the outpatient and inpatient of Pulmonology department over a period of 12 months at super specialty hospital, in order to provide smoking cessation interventions for patients with chronic obstructive pulmonary disease.

Data were collected from 128 study participants who were willing to quit smoking, with 64 allocated to the 'INTERVENTION' group and the remaining 64 to the 'CONTROL' group. Patients were allocated to either the 'INTERVENTION' or 'CONTROL' group based on specific criteria. Those assigned to the intervention group received or expressed willingness to undergo nicotine replacement therapy and other smoking cessation medications. The physician prescribed these treatments solely to individuals willing to adhere to therapy, considering factors such as age and ability to tolerate withdrawal symptoms. An Interview questionnaire was provided to the study participants to assess their knowledge about smoking cessation therapies and their willingness to quit smoking, based on which patient counseling was administered accordingly. The study participants in 'INTERVENTION' group participate in 'INDIVIDUAL QUIT SMOKING PROGRAMS' in which patient receive interventions like counseling on smoking cessation importance and Patient Information Leaflets (PILs), and were given the 'Breathe Easy Diary' to track their progress and to check their Medication adherence. 16 out of 128 patients failed to submit the 'Breath Easy Diary' during follow up. To empower healthcare professionals in supporting patients with COPD who are trying to quit smoking, a comprehensive smoking cessation guideline has been developed.

The average age of study participants was slightly higher in the control group (69.62) compared to the intervention group (68.17). Participants were divided into two groups: intervention and control. The intervention group received interventions such as individual quit smoking program, while the control group did not. Only those willing to participate in therapy and meet certain criteria, such as age and ability to handle withdrawal symptoms, were given these treatments. These results are consistent with a previous study by Si Lei et al. (2020) published in Respiratory Medicine 172 (106155), that examined the long-term effects of tobacco control strategies using cognitive intervention for smoking cessation in COPD patients [7].

Most participants in this study (120 out of 128) were male, with only 8 females. This gender imbalance was consistent in both the control and intervention groups. These findings indicate that COPD patients with smoking habits are primarily male. This study's results align with the findings presented by Yekaterina Pashutina, Daniel Kotz, and Sabrina Kastaun in their research titled "Attempts to quit smoking, use of smoking cessation methods, and associated characteristics among COPD patients," published in npj Primary Care Respiratory Medicine (2022) 50 [10].

The mean number of cigarettes per day among study

participants in the control group was higher than that of the study participants in the intervention group. The control group had a mean of 14.45 with a standard deviation of 9.01, while the intervention group had a mean of 13.46 with a standard deviation of 7.98. This outcome aligns with the findings of Mehran Zarghami, Fatemeh Taghizadeh, Ali Sharifpour, and Abbas Alipour in their study titled "Efficacy of guided self-change for smoking cessation in chronic obstructive pulmonary disease patients: A randomized controlled clinical trial", published in Tobacco Induced Diseases (2019);17(December):90 [6].

The chi-square test found a significant difference (p-value = 0.001) in the number of previous quit attempts between the control and intervention groups. More people in the intervention group had tried to quit smoking before compared to the control group. This is consistent with a previous study by Liu Y et al. in the American Journal of Preventive Medicine in 2022, which looked at smoking cessation rates among US adults with and without COPD (11). The control group had fewer participants who tried to quit smoking multiple times, with most reporting no attempts. In contrast, the intervention group had more participants attempting to quit smoking two or more times. However, a large proportion of participants in both groups did not attempt to quit smoking. The chi-square test showed a significant difference between the groups (chi-square = 11.83, p = 0.008). These findings are consistent with a previous study by Liu Y et al. in the American Journal of Preventive Medicine in 2022, which looked at smoking cessation rates among US adults with and without COPD [11]. The study found that most participants in both the control group and the intervention group did not try additional methods to quit smoking. Only a small number of participants in each group explored alternative approaches. This suggests that the majority of participants relied primarily on the interventions provided within the study itself.

Among the 64 participants in the control group, the vast majority (98.4%, n=63) did not attempt alternative quitting methods, while a small proportion (1.6%, n=1) did. Similarly, in the intervention group of 64 individuals, 92.2% (n=59) did not try alternatives, and 7.8% (n=5) did. These findings are consistent with a previous study by Raj Kumar et al., published in Monaldi Archives of Chest Disease (2023), which examined smoking cessation in the Indian context (9). Majority of participants in both groups primarily relied on cigarette smoking. Only a small percentage of participants in the control group (3.1%, n=2) used tobacco alternatives, while the remaining 96.9% (n=62) did not. Similarly, in the intervention group, 92.2% exclusively smoked cigarettes. However, a small proportion (7.8%) explored other options, including hookah and tobacco. These findings are consistent with a previous study by Raj Kumar et al., published in Monaldi Archives of Chest Disease (2023), which examined smoking cessation in the Indian context [9].

On comparing the number of cigarettes on 1st day and nth day, the control group's mean score decreased from 14.03 on day one to 11.76 on day n, with a standard deviation of 1.38. In contrast, the intervention group showed a more substantial decline, with scores dropping from 14.76 on day one to 5.42 on day n, with a standard deviation of 0.94. A t-test indicated a significant difference in scores between the two groups (t=4.191, p=0.001). This outcome aligns with the findings of the study titled "The long-term outcomes of tobacco control strategies based on the cognitive intervention for smoking cessation in COPD patients", published in Respiratory Medicine 172 (2020) 106155 by Si Lei et al [7].

The control group had a significantly higher smoking index compared to the intervention group. The smoking index, calculated by multiplying the number of cigarettes smoked per day by the years of smoking, was higher in the control group (mean: 463.23) than in the intervention group (mean: 309.17). A statistical analysis confirmed a significant difference (p-value = 0.042) between the two groups. This finding aligns with the results of a previous study titled "The long-term outcomes of tobacco control strategies based on the cognitive intervention for smoking cessation in COPD patients", published in Respiratory Medicine 172 (2020) 106155 by Si Lei et al. This study highlights a notable difference in the smoking index between the control and intervention groups, indicating higher smoking intensity and duration among control group participants compared to those receiving interventions [7].

The intervention group demonstrated better adherence to medication and diary completion compared to the control group. In the control group, only 54.7% adhered to medication, while 81.2% in the intervention group did. Similarly, diary completion rates were higher in the intervention group (92.2%) compared to the control group (82.8%). A statistical analysis confirmed a significant difference (p-value = 0.005) between the two groups. These findings align with a previous study by Qin et al. (2021) which explored adherence and efficacy of smoking cessation treatment among COPD patients in China. This can be attributed to the individualized quit smoking interventions provided to participants within the intervention group which include patient counseling with the help of patient information leaflet [12].

The intervention group had a significantly higher success rate in quitting smoking compared to the control group. In the control group, only a small percentage (7.8%) had quit smoking, while the majority (92.2%) continued to smoke. Conversely, the intervention group had a higher quitting rate of 23.4%, with 76.6% still smoking. This can be attributed to the individualized quit smoking interventions provided to participants within the intervention group. A statistical analysis confirmed a significant difference (p-value = 0.015) between

the two groups. These findings align with a previous study by Liu Y et al. published in the American Journal of Preventive Medicine in 2022, which investigated smoking cessation rates among US adults with and without COPD [11].

Strengths of the Study

The study employed a prospective design, allowing for a comparison between the intervention group and the control group which enabled a direct comparison of the effectiveness of smoking cessation interventions. This design helps in assessing the true impact of the intervention. Additionally, the use of a "Breathe Easy Diary" provided valuable data on participants' progress and adherence to therapy. The study's focus on individual counseling with the help of patient information leaflets (PILs) and support also contributed to its strengths, as it aimed to provide personalized assistance to participants in their quitting efforts. To empower healthcare professionals in supporting patients with COPD who are trying to quit smoking, a comprehensive smoking cessation guideline has been developed.

Limitations of the Study

The study primarily relied on self-reported data, which may introduce bias. Additionally, the study's findings may not be applicable to other regions or healthcare settings due to its specific geographic location. The study's short duration may have prevented long-term follow-up, potentially limiting our understanding of long-term outcomes and the possibility of relapse.

CONCLUSION

This study evaluated the effectiveness of personalized smoking cessation programs for individuals with COPD. The intervention group, which received individualized support, demonstrated significantly higher smoking cessation rates compared to the control group. This personalized approach included one-on-one consultations, patient information leaflets, and a diary for tracking progress. The study highlights the importance of addressing individual needs and providing comprehensive support to help COPD patients quit smoking and improve their overall health.

ACKNOWLEDGEMENT

The authors gratefully acknowledge the pulmonologist for their insightful guidance and support. Special thanks to all the health care professionals of pulmonology department for their collaboration and contributions.

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