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COMPARISON OF HEALTH-RELATED COMPONENTS IN ACTIVE AND PASSIVE SMOKERS

Yildiz Analay Akbaba* PT Assist. Prof., Istanbul University-Cerrahpasa, Faculty of Health Sciences, Division of Physical Therapy and Rehabilitation. *Corresponding Author

Emrah Zirek PT M.Sc., Bingol University, Faculty of Health Sciences, Division of Physical Therapy and Rehabilitation.

ABSTRACT

BACKROUND: The aim of our study was to compare the effects of active and passive smoking on respiratory muscle strength, functional capacity, balance, quality of life and level of physical activity in young adults.

MATERIAL AND METHOD: Respiratory muscle strength was assessed by MicroRPM®. Functional capacity was evaluated 6 Minute Walk Test. Chest circumference measurement was assessed a non-elastic measuring tape. The Flamingo Balance Test, SF-12 and IPAQ were used for balance, quality of life and physical activity level evaluations.

OBSERVATION AND RESULTS: Healthy young individuals who are regularly exposed to secondhand smoke were found to have higher heart rate and higher blood pressure. On the other hand, maximal inspiratory and expiratory muscle strength values were lower than the active smokers.

CONCLUSION: Passive smoking significantly affects the health-related components such as respiratory muscle strength, heart rate and blood pressure.

KEYWORDS : Tobacco smoking, Passive Smoking, Maximum respiratory pressures, Quality of life

INTRODUCTIONS

Smoking is an important global health problem[1]. Since it is known that a large proportion of smokers begin to use tobacco during adolescence or young adulthood, the fight against tobacco in young people has a great importance for public health[2,3]. The secondhand cigarette smoke, the smoke from the burning cigarette, cigar or pipe end or directly exhaled smoke by an active smoker, is a health problem among non-smokers[4]. Passive smokers are considered to be less damaged compared to active smoking, in some studies, it is stated that passive smoking is at least as effective as active smoking, and even have higher disease risks[5,6].

The use of tobacco products is closely associated with respiratory system symptoms, impaired exercise capacity[7]. In addition, the use of tobacco products leads to decreased postural control and increased balance disorders. These disorders in motor and postural system are reported to occur as a result of the negative effects of nicotine on vestibulo-ocular and vestibulo-spinal functions[7]. Although there are many studies on the health effects of active and passive smoking, the number of studies comparing the effect on health components such as musculoskeletal health, cardiorespiratory fitness and balance is limited[8].

Therefore, the aim of our study was to compare the effects of active and passive smoking on respiratory muscle strength, functional capacity, balance, quality of life and level of physical activity in young adults. We hypothesized that the active and passive smoking will have different effects on these health components.

MATERIAL AND METHOD

This clinical study was designed as a single-center, descriptive study. This study was performed at Istanbul University Cerrahpasa between April 2018–September 2018. The research protocol was approved by the Interdisciplinary Clinical Research Ethics Committee (Protocol Number: 2018-07-12). Informed consent was provided to all participations prior to their enrollment in the study.

Eighty-five active smoker and seventy-two passive smoker young adults were assessed for eligibility. The cases were assessed by two physical therapists. The inclusion criteria were as follows a)smoking at least one cigarette per day for active smokers, b)exposure to secondhand smoke for at least 30 minutes per day for passive smokers. The exclusion criteria were: a)to have any disease that may affect respiration, balance and physical activity level, b)individuals using chronic medication c)a history of chest surgery d) former smokers

The demografic and clinical data were assessed. Inspiratory and expiratory muscle strength were evaluated by maximum inspiratory pressure (MIP) and maximum expiratory pressure (MEP) values. During the evaluation subjects seated, wore a nose clip and used a plastic mouthpiece by a Micro Medical MicroRPM® (Carefusion Micromedical, Micro RPM, USA). Each participant performed 5 acceptable and reproducible maximum maneuvers (ie, differences of ≤ 10% between values).

The chest circumference measurement was made using a non-elastic measuring tape. Difference between maximum expiration and inspiration were recorded.

6 Minute Walk Test (6MWT) was used to evaluate the functional capacity of the individuals[9]. In addition, the Modified Borg scale was used to quantify the levels of dyspnea perceived by subjects at each minute during the 6MWT.

The use of tobacco products results in increased postural oscillations and impaired balance[7]; so Flamingo Balance Test (FBT) was used in the static balance evaluation of individuals. Subjects were asked to stand on a 50 cm length and 4 cm height bar while their non-dominant leg is flexed and held at the ankle joint close to the buttocks. The time was then started with one foot in balance and the participants were asked to remain in balance for one minute. Time-time stopped when participants loosed their balance and the number of falls was counted[10]. Short Form 12 (SF-12) was used to assess physical and mental health-related quality of life[11]. The short form of the International Physical Activity Questionnaire-Short Form (IPAQ) was used to determine the physical activity levels of the individuals. The IPAQ evaluates different levels of activity intensity[12].

All of outcome measures were assessed for only one time, in the same session.

Sample-size calculation was based on the clinically increase of heart rate by 27.7% during submaximal activity, with a standard deviation of 4.4 points. Assuming a 95% confidence interval and power of 90%, the resulting sample size was 56 participants per group[13].

Data were analyzed using the Statistical Package for Social Sciences (SPSS) Version 21.0 software package (SPSS Inc. Chicago, IL, USA). The Shapiro-Wilk test was used to confirm the distribution of the data. To compare quantitative variables between the two groups, the Chi-square test was used for categorical data, and Student's t test and the Mann- Whitney U test were used to compare continuous variables. $p<0.05$ was considered statistically significant.

OBSERVATION AND RESULTS

A total of 157 participants (85 active smokers and, 72 passive smokers) were assessed for eligibility. Seventeen were excluded according to the

criteria used in the study. After the individuals who did not meet the criteria were excluded from the study, 71 active and 69 passive smokers were included in the study. The demographic and clinical data of the groups are presented in Table 1; there was statistically significant difference in gender between the two groups. The number of woman participants was more in the passive smoking group. Age and BMI data were not statistically different.

Table 1. Demographic and clinical features

		Active Smokers	Passive Smokers	p
Age (Years)		21.78 ±1.41[a]	21.28±1.83[c]	0.06
Gender	Female	34[b]	51[b]	**0.01****
	Male	37[b]	18[b]	
BMI (kg/m^2)		23.18(16.85-33.41)	21.87(16.14-29)	0.07

[a]Data are reported as mean ± standard deviation; [b] Data are reported as number of participants; [c] Data are reported as Median (Minimum-Maximum); BMI: Body Mass Index; p *:Mann-Whitney U; p**Chi-Square; p<0.05 statically significant

The median values of the 6MWT and the comparison of the two groups are shown in Table 2. When the groups were evaluated in terms of 6 minutes walking distance, the difference between the walking distances was not statistically significant. The after test heart rate and diastolic blood pressure values were higher in passive smoker group (p = 0.01; p = 0.03, respectively) (Table 2).

Table 2. Comparison of functional capacities (6 MWT)

		Median (min-max)	Z	p*
6 MWD (m)	**Active smokers**	534 (280-657)[a]	-0.53	0.59
	Passive Smokers	510 (390-720) [a]		
HR (BT)	**Active smokers**	85 (58-120) [a]	-1.47	0.13
	Passive Smokers	87 (56-125) [a]		
HR (AT)	**Active smokers**	91 (61-123) [a]	-2.34	**0.01***
	Passive Smokers	95 (60-140)[a]		
SBP (BT)	**Active smokers**	120 (100-160) [a]	-0.10	0.91
	Passive Smokers	121 (100-159) [a]		
SBP (AT)	**Active smokers**	124 (99-161) [a]	-0.51	0.60
	Passive Smokers	125 (94-157) [a]		
DBP (BT)	**Active smokers**	72 (47-96) [a]	-0.98	0.32
	Passive Smokers	75 (53-87) [a]		
DBP (AT)	**Active smokers**	76 (44-90) [a]	-2.12	**0.03***
	Passive Smokers	79 (53-98) [a]		
MBD (BT)	**Active smokers**	0 (0-3) [a]	-0.06	0.94
	Passive Smokers	0 (0-4) [a]		
MBD (AT)	**Active smokers**	2 (1-5) [a]	-0.40	0.68
	Passive Smokers	2 (2-5) [a]		

min-max: minimum-maximum; [a]Data are reported as Median (Minimum-Maximum); 6 MWD: 6 Minute Walk Distance; HR: Heart rate; SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; MBD: Modified Borg Dyspnea; BT: Before test; AT: After test p*: Mann Whitney U, p<0.05 statically significant.

Respiratory muscle strength (maximum inspiratory and maximum expiratory muscle strength), FBT and chest circumference measurement data and the comparison of the two groups are shown in Table 3. There were statistically significant differences between the groups in maximum inspiratory muscle strength (p=0.025) and maximum expiratory muscle strength (p=0.017). In all these comparisons, the passive group achieved a worse score. There was no statistically difference between groups in FBT and chest circumference measurement data.

The comparisons of the groups in terms of quality of life and physical activity levels are shown in Table 4. There was no statistically significant difference between groups in terms of SF 12 physical (p=0.16) and mental parameters (p=0.88) and IPAQ (p=0.10).

Table 3. Comparison of respiratory muscle strength, balance and chest circumference measurements

		Median (min-max)	Z	p*
MIP	**Active smokers**	87.33(33.67-166)	-2.247	**0.025***
	Passive Smokers	82.33(34-134.33)		
MEP	**Active smokers**	99(39.33-194)	-2.386	**0.017**
	Passive Smokers	86.67(45.33-179.33)		
FBT	**Active smokers**	6(0-15)	-0.006	0.995
	Passive Smokers	6(0-18)		
CCM	**Active smokers**	6(3-11)	-0.397	0.691
	Passive Smokers	6(3-11)		

min-max: minimum-maximum; MIP: Maximal Inspiratory Pressure; MEP: Maximal Expiratory Pressure; FBT: Flamingo Balance Test; CCM: chest circumference measurement (maximum expiration-maximum inspiration); p*: Mann Whitney U, p<0.05 statically significant.

Table 4. Comparison of quality of life and physical activity levels

		Median (min-max)	Z	p*
SF-12 Physical	**Active smokers**	51.8 (29.4-61.3)	-1.39	0.16
	Passive Smokers	49.9 (38.2-57.8)		
SF-12 Mental	**Active smokers**	32.8 (3.6-54.3)	-0.14	0.88
	Passive Smokers	32.4 (10.4-55.8)		
IPAQ	**Active smokers**	1848 (0-10770)	-1.62	0.10
	Passive Smokers	2340 (0-8560)		

min-max: minimum-maximum; SF-12: Short Form-12; IPAQ: International Physical Activity Questionnaire; ; p*: Mann Whitney U, p<0.05 statically significant.

DISCUSSION

In the current study, healthy young individuals who are regularly exposed to secondhand smoke were found to have higher heart rate and higher blood pressure. On the other hand, respiratory muscle strength values were lower than the active smokers. There was no difference between groups according to the quality of life and physical activity scores.

When the literature is reviewed, it is seen that smoking is a factor that decreases the functional capacity[14]. De Borba et al.[14] found that passive smokers were not different the respiratory capacity from active smokers. Tantisuwat et al. reported that respiratory muscle strength was significantly lower in young smokers compared to nonsmokers[15]. In the current study, there was no non-smoker group, also the inspiratory and expiratory muscle strength of the passive smoker group was lower than the active smokers.

In studies evaluating the effect of tobacco use on functional capacity, cardiopulmonary function and exercise tolerance, the study groups were mostly smokers and non-smokers[8,16]. Gondim et al. reported that active and passive smoking were not associated with heart rate variability in adolescents[17]. In our study, 6 MWD scores were similar; however heart rate and blood pressure values were higher in the passive smokers aged between 18-25 years.

Pereira et al.[7] indicated that smoking had negative effects on the the vestibulo-ocular and vestibulo-spinal functions and caused balance problems. Besides, the treatment of smokers also may be more difficult when compared to non-smokers[18]. We did not enroll non-smokers to our study, and the smokers and non-smokers showed similar balance abilities.

The effect of the smoking and secondhand smoke on healt-related quality of life and physical activity levels was another research topic of our work. Studies in the literature mostly compared smokers with non-smokers. Based on the literature, it can be said that the quality of life and physical activity levels of the smokers are worse than the non-smokers[13,19]. In our study, we found that active and passive smokers have similar quality of life and physical activity levels.

In our study, respiratory muscle strength was found to be higher in the active smoker group than the passive smokers. The 6MWD scores were similar to active smokers; but passive smoker group showed higher heart rate and blood pressure levels. There was no difference in balance, quality of life and physical activity levels of the groups. This may be described as both groups had similar effects. In previous studies, it was reported that active and passive smoking had similar health-related findings[14,17], but according to our findings, it was found that passive smoking had a significant reduction in respiratory muscle strength and worse outcomes in heart rate and blood pressure. Passive

smokers inhale the cigarette smoke without any filter; so similar levels of the active smokers, even more toxic components may be taken into their body[20]. This may be one of the reasons of lower respiratory strength and worse functional outcomes in the passive smokers. Another reason for the different results in our study may be the gender distribution of the groups.

Our study has strengths and limitations. First, both active and passive smokers were evaluated in our study and it was conducted on a large sample. In addition, according to our research, this is the first study that evaluates many components related to health such as respiratory muscle strength, functional capacity, balance, quality of life, and physical activity. One of the most important limitations of our study was that the absence of non-smoker subjects as the control group. In addition, the distribution of women and men in groups was not equal.

In the future studies, in addition to active and passive smokers, a third group, non-smokers should also be evaluated. Thus, health effects of smoking and exposure to the secondhand smoke will be better understood. In order to fight against tobacco and tobacco products better, preventive studies should be carried out not only in closed areas but in all areas where secondhande smoke is present.

CONCLUSION

Passive smoking significantly affects the health-related components such as respiratory muscle strength, heart rate and blood pressure.

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