CHAPTER 3

REVIEW OF SCIENTIFIC LITERATURE

3.1 LITERATURE SURVEY OF SCIENTIFIC INVESTIGATIONS

Every individual today, irrespective of their stay in urban or rural areas, country or continent, is affected by pollution directly or indirectly. Pesticide is one of the most deteriorating substances which primarily affects farmers and their families. The industrialization of the Indian agriculture system has exposed the farmers to different sets of chemicals and substances. These are generally used to protect the crop from pests, weeds/ diseases. The generally used chemicals are insecticides, pesticides, rodenticides, hormones for the growth of plants, etc. The farmers and their families are exposed to these chemicals through skin, ingestion, or inhalations. Thereby the health outcomes of pesticide exposure depends upon the chemical composition of the large pesticide exposed to, the duration and route of exposure, and the health status of the farmers. Respiratory issues are the most common form of the disease affecting the farmer's population. Table 1 reports the summary of the studies reporting the farmers and their lung functions. In most of these studies, it has been reported that the farmer or the pesticide sprayer population has a reduced Forced Vital Capacity (FVC), and Forced Expiratory Volume (FEV1) and PEFR. The review of existing literature could not find any evidence wherein yoga was studied as an intervention to improve pulmonary function in pesticide-exposed farmers. Hence, this is the first study cum clinical trial to evaluate the effect of an integrated approach to yoga therapy on farmers. We also performed a literature review of all the studies which had reported pulmonary function as an outcome measure to evaluate the efficacy of yoga among various populations. Table 2 reports the summary of all the studies with yoga as an intervention and its effect on PFT. We were able to find 13 clinical trials on yoga and pulmonary functions irrespective of the population and out of which there were only 8 randomized controlled trials. 6 studies showed that there

was a significant improvement in FVC, FEV1, and other pulmonary parameters whereas other trials did not show any changes when compared to the control group

3.2. TABLE OF SUMMARY: Pesticide exposure and farmers

Study Details	Study Design	Sample Size	Variables	Findings
(Mekonnen & Agonafir, 2004)	Cross-sectional study	102 Pesticide sprayers 69 Non-sprayers (15-24yrs)	Lung function test	FVC↓,FEV1↓ In Pest sprayers
(Bayramieta l.,2012)	Cross-sectional	40 exposed to pesticides 40 control group (Healthy subjects)	Acetylcholinesterase level DNA damage Oxidative stress Cognitive state Psychological disorders	Oxidative stress and inhibition of AChE can be seen in OP-exposed farmers Superoxide dismutase (SOD)↑ Lipid peroxidation↑ Total thiol molecules ↑
(De Jondetal. , 2012)	longitudinal	160 Exposed farmers	Lung function test	FEV1↓andFVC↓
(Dingetal.,2 012)	Cross-sectional study	n=268	8-hydroxy-2'deoxyguanosine (8-OHdG).	Increased exposure to Ops was associated with greater levels of urinary 8-OHdG
(Fareedetal., 2013)	Cross-sectional	166 Pesticides sprayers 77 Control (18-60yrs)	Lung Function test, Cholinesterase level, Blood AChE, and BChE	Lung function significantly reduced among pesticides-sprayers. In addition, AChE and BChE were depleted considerably.

(Malekirade tal.,2013)	Cross-sectional	187 exposed farmers 187 healthy controls	GHQ 28, SNI (Subjective Neurocognition inventory), fasting blood glucose, BUN, CL,TG,GTT, HDL, AST,ALT,ALP	The exposed farmers showed FBG↑, BUN↑, CL↑,GTT↑,AST↓,ALP↓. The rates of anxiety/ insomnia and severe depression were significantly higher in the farmers. In addition, exposure to Ops are prone to neuropsychological disorders and diabetes.
(Desalu,Busari, &Adeoti,2014)	Cross-sectional study	228farmers	Wright peak flowmeter	Recurrent breathlessness, chronic cough, sputum, and nasal symptoms were independently associated with pesticide-exposure. Mean PEFR was lower in farmers using pesticide when compared with those not using pesticides
(Paul etal.,2018)	Longitudinal study	n=430	Spanish& English verbal learning test(SEVLT), Adiponectin, Homocysteine,Leptin,IL6,TNFα,CRP,Cortisol	Cognitive decline and mortality in pesticide exposed population

Table 1.Summary table of scientific research on pesticide exposure and lung functions

Author, Year of publication, Country	Objective/s	Study design	Duration of Pranayama	Sample size	Details of intervention	Outcome measure (s)	Result
Bhatt and Rampallivar 2016, India (Bhatt &Rampallivar, 2016)	Effect of Pranayama on ventilator functions in asthma patients	RCT	Three months	40: 40	Different types of Pranayama (Bhastrika, Kapalbhati, Anuloma-Viloma, Bhramri, and Ujjayi) Few days of expert supervised sessions, followed by a home continuation	PR, SBP, DBP, RR FVC, FEV1, FEV1 / FVC %, PEFR	Significant reduction in PR (P<0.05), SBP (P<0.05) and increase in FVC (P<0.05), PEFR (P<0.05) and FEV1 (P<0.001) in the IG posttest compared to the pretest. No significant change in CG.
Katiyar and Bihari 2006, India (Bihari &Katiyar, 2006)	Effect of Pranayama in patients with COPD	RCT	Three months	24: 24	Performance of pranayama (Bhastika, Kapalabhati, Vhasya, Anulom-Vilom, Bhramid and Udgeedh pranayama) for at least 30 min daily, 6 days a week, for 3 months	FVC, FEV1, PEFR, 6 min walk test, PO2, pCO2, and (SGRQ) score	Significant posttest increase of PEF (P<0.05), distance walked in 6 min test (P<0.05), and a significant decrease in SGRQ score (P<0.02) in IG compared to CG

Prakasamma and Bhaduri 1984, India (Prakasamma&Bhaduri, 1984)	Effect of Pranayama as a nursing intervention in the care of patients with pleural effusion	Controlled	20 day	10:10	Anuloma-viloma Pranayama for 30 min daily for 20 days after aspiration of pleural fluid	FVC, FEV1 , MVV, PEFR, CE and RS	Significant increase in posttest FVC, CE in IG (P<0.1) compared to CG
Prem et al., 2013, India (Prem et al., 2013)	Effect of Pranayama on QOL and pulmonary function in patients with bronchial asthma	RCT	Three months	40:40	Patients trained to perform diaphragmatic breathing, thoracic breathing, upper lobe breathing, and full yogic breathing progressing to right nostril breathing, left nostril breathing, and alternate nostril breathing for 3-5 days with a session of 60 min each day. They were instructed to practice the exercise at home for 15 min twice daily for three months	AQLQ score, Asthma Control Questionnaire and FEV1 , FEV1 /FVC	IG showed a significant improvement (P=0.042) in the total asthma QOL Questionnaire score. The study also included a parallel 3rd group who practiced Buteyko techniques as an intervention (n=40)
Saxena and Saxena 2009, India (Saxena & Saxena,	Effect of Pranayama in patients with mild to	RCT	Three months	25:25	The practice of breathing exercises (deep breathing, Sasankasana breathing,	Symptoms score, FEV1 %, PEFR	Significant improvement in posttest symptoms (P<0.01), FEV

2009)	moderate bronchial asthma				Anuloma-viloma, Bhramari, Omkara) for 20 min twice daily for three months		1 % (P<0.001) and PEFR (P<0.001) in IG compared to CG
Singh et al., 1990, UK (Singh et al., 1990)	Effect of Pranayama on airway reactivity in subjects with bronchial asthma	Controlled Cross over	0.5 months	22 22	The practice of slow deep breathing through the Pink City Lung Exerciser for 15 min, twice a day, for two weeks	FEV1, FVC, PEFR, symptom score, inhaler use, PD20 histamine level	PD20 increased significantly in IG compared to CG (P=0.013)
Sodhi et al., 2009, India (Sodhi et al., 2009b)	Effect of Pranayama on pulmonary functions in patients with bronchial asthma	RCT	Eight weeks	60 60	Yoga breathing exercises (deep breathing, Kaplabhati, Bhastrika, Ujjayi, and Sukhapurvaka pranayama) for 45 min, twice daily on all days of the week for eight weeks	PEFR, FVC, FEV1, FEF25-75, FEV1 /FVC %	Significant increase in PEFR, FVC, FEV1, FEF25-75, FEV1 /FVC % at four weeks and eight weeks in the IG compared to baseline (P<0.01), but not in the CG
Lori Pbert et al. USA 2012 (Pbert et al., 2012)	Effect of mindfulness training on asthma quality of life and lung	RCT	Eightweek	41 41	MBSR group-based meditation program	peak expiratory flow, Perceived Stress Scale (PSS) QOL	significant improvements in quality of life and PSS but not in PEF

	function						
Pallavi yadav et al India 2021 (Yadav et al., 2021)	Yoga on control of asthma in children with bronchial asthma.	RCT	Three months	70 70	IAYT	FVC, FEV1, FEV1/FVC, PEFR, pediatric Asthma Quality of Life Questionnaire (PAQLQ)	significant improvement in FVC, FEV1, FEV1/FVC, and PEFR and QOL, which was better as compared to CG
GülyeterErdoğanYüce et al. Turkey, 2019 (ErdoğanYüce&Taşcı, 2020)	evaluated the effect of pranayama on asthma control, pulmonary function, and quality of life in people with asthma	RCT	One month	27 28	Pranayama 20 min once daily for one month and relaxation	Asthma Control Test (ACT), Asthma Quality of Life Questionnaire (AQLQ), pulmonary function test (PFT)	improved asthma control and asthma-related quality of life in people with asthma, but it did not show a significant difference in PFT values
PuneethRaghavendra et al., India, 2016 (Raghavendra et al., 2016)	Effect of kapalabhati on pulmonary function	RCT	One month	30 30	kapalabhati for 10 minutes, control group deep breathing	FVC, FEV1, FEV1/FVC	Kapalabhati group showed better results than CG
A AKhanam et al	Effect of	Controlled	Seven days	--	IAYT	FVC, FEV1,	FVC, FEV1, PEFR did not

1996, India(Khanam et al., 1996)	yoga training on pulmonary function of asthmatics	trial				PEFR, PIF, BHT, and CE	show any significant change. PIF ($P < 0.01$), BHT ($P < 0.01$) and CE ($P < 0.01$) showed significant improvement.

Table 2: Yoga Studies with pulmonary function test