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RELATIONSHIP BETWEEN REDUCED LUNG FUNCTION AND BODY MASS INDEX IN WOMEN FROM RURAL AREA OF RASULWADI OF SANGLI DISTRICT.

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ABSTRACT:
In majority of rural areas biomass fuel such as wood, cow dung and crop residue is easily available. Poor families use these biomass fuels for cooking and heating purposes. Majority of poor families lives in Kutcha type of houses. In kutcha type of houses kitchens are not properly ventilated. Incomplete combustion of biomass fuel release smoke which contains high volume and number of air pollutants such as respirable particulate matter PM_{10}, CO, NO_2, SO_2, formaldehyde and other organic compounds. Prolonged exposure to such air born pollutants, have adverse effect on the respiratory system of women which causes reduced lung function. There is strong relation between reduced lung function and Body Mass Index. To study relation between reduced lung function and Body Mass Index, total 100 women were selected from rural area of Sangli District Rasulwadi. Out of 100 women 50 women using chulla and 50 women using LPG were selected. Women using chulla were considered as Subject and women using LPG were considered as Control. All women were underwent spirometery to detect COPD. Spirometric parameter, FEV_1%, FVC%, FEV_1%/FVC% were recorded. Body Mass Index of all women was calculated. Body Mass Index was categoried in four groups (Underweight <20kg/m^2, Normal Weight 20.0-25.0kg/m^2, Overweight 25.0-30.0kg/m^2, Obese >30.0 kg/m^2) In this study we found that out of 50 women who were exposed to biomass fuel smoke 10 women were suffering from Obstructive type COPD (FEV_1%<70%). In subject women Body Mass Index in underweightcategory, normal weight category, overweight category and obese category was lower than control group.

Key words: COPD, Body Mass Index, FEV_1% (Forced Expiratory Volume per one second), Forced Expiratory Volume per one second / forced vital capacity, COPD.

INTRODUCTION:

In India, Majority of women from rural area still uses biomass fuel such as wood, cow dung and crop residue for cooking and heating purpose. (Smith *et al*, 1996). In rural area most common cause of chronic obstructive disease is the indoor air pollution. For rural women biomass fuel such as wood, cow dung and crop residues are easily available. Rural women from low socio economic status live in kutcha type of houseswhere kitchens are not properly ventilated. Incomplete combustion of biomass fuel releases smoke, which contains high volume and number of air pollutants. Such as PM_{10}, CO, NO_2, SO_2, formaldehyde and other organic compounds prolonged exposure to such air causes COPD.

COPD is the inflammation and swelling of the linings of the air way that leads to narrowing and obstruction of airways.

Combustion of biomass produces a large amount of smoke that spreads into the environment as air pollutants. Exposure to such biomass smoke causes adverse effect on respiratory system. Biomass fuel smoke is the most important risk factor for COPD where indoor ventilation is inefficient (Albalak*et al.;* 1997, De Koning*et al.*; 1985).

There is strong relation between COPD and Body Mass Index women with COPD develop chronic cough, dyspnea shortness of breath, weight loss occur in some women with COPD is due to low intake of food and also because of additional energy required for breathing. (Brinnel*et al*, 2006) In COPD there is loss of body weight, which has a negative impact on quality of life (Brinnel*et al*, 2006) reduced lung function has effect on the body mass index.

MATERIAL AND METHODS

Survey of women working in the field (Subject) using chulla in rural area Rasulwadi was done. Information regarding age, type of fuel, year of exposure, hours of exposure was collected.50 women above 35 years of the age using chulla for more than 15 years (Subject) and 50 women not using LPG (Control) were selected. Spirometry was done in 100 women, (50 subject women and 50 control women).Forced expiratory volume per one second (FEV_1%). Forced Vital Capacity (FVC%). FEV_1%/FVC% was recorded. If FEV_1%<70% then there is obstructive type of COPD.

ANTHROPOMETRY: (Ancel*et al*, 1972)

- In total 100 women Body mass index was calculated by using the formula BMI (Kg/m^2) = Mass (Kg) / Height (m)^{2}E). (Ancel*et al*, 1972)
- BMI was categorized into four groups (World Health Organization, 2000) in total 100 women. Underweight (<20 kg/m^2), Normal weight (20.0 -25.0 kg/m^2), Overweight (25.0-30.0kg/m^2), Obese (>30.0kg/m^2)

STATISTICAL ANALYSIS: Calculated Z test based on null hypothesis: (Gupta and Kappor, 1983)

$$Cal\,|z| = \left[\frac{\overline{x_1} - \overline{x_2}}{\sqrt{\frac{\sigma 1^2}{n_1} + \frac{\sigma 2^2}{n_2}}}\right]$$

H_0: There is no significant difference between control and subject women FEV_1%.

Vs

H_1: There is significant difference between control and subject women FEV_1%.

Cal |Z| = > table Z = 1.96 at 5% level of significance. If Z value is greater than table value 1.96 then

∴ Reject H_0

∴ There is significance difference between control and subject FEV_1%.

RESULT AND DISCUSSION:

Table No.2 represents the mean values of Age, Weight, Height, BMI of control women are 40.64 Yrs, 55.48 Kg, 149.30 cms and 24.88 Kg/m^2 respectively, while mean values of Age, Weight, Height, BMI of Subject women are 41.66 Yrs, 47.46 Kg, 154.28 cms and 19.98 Kg/m^2 respectively. These values are shown at the base of each column in the Table No.2.The calculated Z values of Age, Weight, Height, BMI based on null hypothesis are at the end of each column in the Table No.2. The calculated Z values of Weight, Height and BMI are respectively 7.87 Kg, 9.06 cms and 10.47 Kg/m^2. These values are greater than the table values 1.96. So there is significant difference between Z values of Weight, Height, BMI of control and subject. The calculated Z value of Age is 1.63 Yrs this value is less than table value 1.96. So there is no significant difference between Z value of Age of control and subject.

In this study when we compared the results of spirometry of subject and control we found that there is reduction in lung function parameter FEV_1% and FEV_1/FVC% in subject women than control. In Rasulwadi 10 women were having FEV_1% < 70%. 10 women had Obstructive type of COPD.

Koksal*et al.* (2013), Berlin *et al.* (2014), Arora*et al.* (2014) in their study they reported that the lung function parameter FEV_1% and FEV_1/FVC% were significantly lower in women exposed to biomass fuel smoke than control. The reduction in FEV_1% and FEV_1/FVC% may be due to chronic inhalation of toxic substances emitted during biomass combustion leading to inflammatory changes in the bronchi and bronchioles. Our results are similar with study of Koksal*et al.* (2013), Berlin *et al.* (2014), Arora*et al.* (2014).

In the present study when we compared BMI of subject group with that of control group. We found that in subject group BMI is less than control group. The percentages of underweight and normal weight categories in subject were higher as compared to control while the percentages of overweight and obese categories were lower in subject as compared to control.

According to Sajal (2012), Maryam *et al.* (2012) in their study they found that BMI in the LPG group was significantly higher than in the group of women using biomass. The subjects using biomass fuel are vulnerable to oxidative stress. Low BMI is the major risk factor in the development of COPD. Weight loss occurs in some women with COPD is due to the low intake of food and also because of additional energy required for breathing, similarly in our investigation we found that, low BMI in subject group as compared to control.

REFRENCES:

Smith, K.R. (1996): Indoor air pollution in India. ANati Med J India. 9:103-104.

Albalak, R. (1997): Cultural practices and exposure to particulate pollution from indoor biomass cooking: effect on respiratory health and nutritional status among the Aymara Indians of the Bolivian Highlands. Unpublished Doctoral Dissertation, University of Michigan.

De Koning, H.W., Smith, K.R., Last, J.M. (1985): Biomass fuel combustion and health. Bull World Health Organ. 63:11–26.

Brinnel, Caszo., George, A.D. (2006) : COPD and Nutrition. Lung India. 23:78-81.

Ancel, Keys.,Flaminio, Fidanza., Martti, J., Karvonen., Noboru, Kimura. (1972): Indices of relative weight and obesity. J. Chron Dis. 25:329-343.

Gupta, C., and Kapoor, K. (1983): Fundamentals of mathematics statistics. (8).

Koksal, Hulya., Attila , Saygi., Nesrin, Sariman., Emel, Ahci., Sirin, Yurtlu., Huri, Yilmaz., Yeliz, Duzgun. (2013): Evaluation of clinical and functional parameters in female subjects with Biomass smoke exposure. Respir care. 58(3):424-430.

Berlin, Jeneth., Raj, T. (2014) : Altered lung function test in asymptomatic women using biomass fuel for cooking. Journal of clinical and diagnostic research. 10:BC01–BC03.

Arora, Priya., Gupta, Rajesh., Chopra, Rahul., Gupta, Anupama., Mishra, Neena., Sood, Sushma. (2014): Effect of chronic exposure to biomass fuel smoke on pulmonary function test parameters. Int. J. Res. Med. Sci. 2(4):1488-1494.

Sajal, De. (2012): Body Mass Index Among Patients With Chronic Obstructive Pulmonary Disease. Indian J PhysiolPharmacol. 56(4) :353-8

Maryam, B. Akor-Dewu., Joseph, O. Ayo., Andrew, R. Collins., M.M. Mabrouk., Alexander, B. Adelaiye., Fatima, L. Ciroma. (2012): Comparative study of haematological and cardiorespiratory parameters in women exposed to biomass or mixed fuels. AIJOCR. 2(8) : 257-263.

Table No. – 1

Data of Spirometry (FEV_1%, FVC%, FEV_1/FVC%) of Rural Women from RasulwadiExposed to Biomass smoke

Sr. No.	CONTROL					SUBJECT				
	Age	Years	FEV_1%	FVC%	FEV_1/ FVC%	Age	Years	FEV_1%	FVC%	FEV_1/ FVC%
1	40	11	98.03	91.30	88.69	41	22	54.46	67.47	69.05
2	42	22	76.32	86.26	88.47	43	23	61.43	77.69	66.15
3	44	24	98.03	91.30	88.69	38	18	121.33	114.67	86.26
4	41	22	121.33	114.67	86.26	45	25	54.46	67.47	69.05
5	39	12	98.03	91.30	88.69	42	14	87.33	58.72	79.39
6	44	24	121.33	114.67	86.26	38	20	53.37	36.36	80.56
7	36	18	98.03	91.30	88.69	37	20	53.37	36.36	80.56
8	41	23	121.33	114.67	86.26	39	21	53.37	36.36	80.56
9	37	20	101.27	96.37	86.02	47	24	87.58	86.26	88.47
10	40	13	101.27	96.37	86.02	44	26	98.03	91.30	88.69
11	42	11	98.03	91.30	88.69	41	20	98.03	91.30	88.69

Sr. No.	CONTROL					SUBJECT				
	Age	Years	FEV_1%	FVC%	FEV_1/ FVC%	Age	Years	FEV_1%	FVC%	FEV_1/ FVC%
12	36	18	121.33	114.67	86.26	45	14	61.43	77.69	66.15
13	39	21	121.33	114.67	86.26	46	25	54.46	67.47	69.05
14	42	22	78.00	61.07	77.78	44	24	21.56	25.74	69.23
15	39	23	95.54	91.43	86.16	45	23	51.08	83.41	83.04
16	41	20	82.56	61.07	83.04	38	18	33.08	36.36	80.56
17	45	11	101.27	96.37	86.02	40	20	33.08	36.36	80.56
18	39	20	121.33	114.67	86.26	46	25	33.08	36.36	80.56
19	42	23	101.27	96.37	86.02	38	20	61.43	77.69	66.15
20	40	14	121.33	114.67	86.26	42	13	101.27	96.37	86.02
21	37	20	121.33	114.67	86.26	40	20	21.56	25.74	69.23
22	39	21	87.58	86.26	88.47	42	21	54.46	67.47	69.05
23	41	22	98.03	91.30	88.69	46	25	53.37	54.82	80.56
24	42	12	101.27	96.37	86.02	44	24	53.37	36.36	80.56
25	44	22	87.33	58.51	79.39	42	23	92.79	90.32	86.16
26	48	30	92.79	91.43	86.16	39	18	121.33	114.67	86.26
27	36	17	121.33	114.67	86.26	42	23	33.08	36.36	80.56
28	45	26	82.56	61.07	83.04	46	27	33.08	36.36	80.56
29	39	20	87.33	90.66	79.39	40	14	33.08	36.36	80.56
30	38	13	105.18	102.62	86.38	43	25	33.08	36.36	80.56
31	40	21	87.33	58.51	79.39	39	20	78.40	72.15	85.96
32	44	27	83.04	61.07	83.04	49	30	70.94	65.56	91.14
33	42	23	98.03	91.30	88.69	37	18	51.82	72.77	83.04
34	38	10	87.58	86.26	88.47	49	25	92.79	91.43	86.16
35	39	22	98.03	91.30	88.69	41	21	121.33	114.67	86.26
36	37	20	121.33	114.67	86.26	42	20	87.33	58.51	79.39
37	40	21	98.03	91.30	88.69	39	20	87.58	86.26	88.47
38	41	11	121.33	114.67	86.26	40	21	98.03	91.30	88.69
39	38	20	101.27	96.37	86.02	42	13	98.03	91.30	88.69
40	39	21	101.27	96.37	86.02	38	20	50.70	53.92	87.27
41	40	22	98.03	91.30	88.69	45	24	87.58	86.26	88.47
42	36	12	121.33	114.67	86.26	42	20	101.27	96.37	86.02
43	39	20	121.33	114.67	86.26	46	23	80.42	91.43	86.16
44	42	22	79.00	61.07	78.95	40	20	121.33	114.67	86.26
45	38	20	92.31	91.43	85.71	37	21	81.14	70.66	83.04
46	46	26	83.04	61.07	83.04	41	21	42.74	39.34	93.46
47	49	13	101.27	96.37	86.02	38	18	61.43	77.69	66.15
48	44	27	121.33	114.67	86.26	40	19	92.79	91.43	86.16
49	38	20	101.27	96.37	86.02	38	18	121.33	114.67	86.26
50	44	11	121.33	114.67	86.26	37	20	87.33	58.51	79.39
Mean	**40.64**	**19.28**	**101.98**	**94.21**	**85.84**	**41.66**	**20.94**	**70.34**	**69.50**	**81.18**

Sr. No.	CONTROL					SUBJECT				
	Age	Years	FEV_1%	FVC%	FEV_1/ FVC%	Age	Years	FEV_1%	FVC%	FEV_1/ FVC%
Var.	9.19	24.92	206.01	316.85	7.48	10.46	12.82	812.78	688.28	55.45
Sqrt	0.63	0.87	4.51	4.48	1.12					
Z	1.63	1.91	7.01	5.51	4.15					

Table No.2

Body Mass Index of Rural Women exposed to biomass fuel smoke Rasulwadi

SR. NO.	Control					Subject				
	Name	Age (Yrs)	Weight (Kg)	Height (cms)	BMI Kg/m^2	Name	Age (Yrs)	Weight (Kg)	Height (cms)	BMI Kg/m^2
1	RRP	40	50	150	22.22	YBJ	41	45	152	19.48
2	SBP	42	55	148	25.11	RBJ	43	42	153	17.94
3	ISP	44	49	150	21.78	SAJ	38	52	150	23.11
4	RSP	41	51	146	23.93	SVJ	45	42	154	17.71
5	HPP	39	50	150	22.22	PSJ	42	45	150	20.00
6	IBP	44	52	151	22.81	ASJ	38	43	152	18.61
7	SYB	36	59	148	26.94	BRJ	37	48	158	19.23
8	SSB	41	55	147	25.45	KHJ	39	44	155	18.31
9	SSS	37	58	150	25.78	LGJ	47	48	152	20.78
10	KSS	40	52	151	22.81	SDJ	44	51	152	22.07
11	SVS	42	56	150	24.89	PVJ	41	53	155	22.06
12	SBS	36	50	147	23.14	JNB	45	45	154	18.97
13	SVS	39	59	149	26.58	SDJ	46	46	158	18.43
14	SSC	42	57	148	26.02	VTJ	44	44	160	17.19
15	SMP	39	58	150	25.78	SBC	45	52	152	22.51
16	SPP	41	55	149	24.77	JSJ	38	45	154	18.97
17	JRP	45	52	148	23.74	KVJ	40	45	159	17.80
18	SVP	39	65	150	28.89	PVJ	46	44	154	18.55
19	MBP	42	54	147	24.99	JNJ	38	47	154	19.82
20	SJP	40	58	151	25.44	UAJ	42	49	156	20.13
21	KBP	37	60	149	27.03	LYJ	40	41	158	16.42
22	SMP	39	45	146	21.11	BSJ	42	45	159	17.80
23	TSP	41	60	152	25.97	SGP	46	46	156	18.90
24	SKS	42	59	151	25.88	ASP	44	47	159	18.59
25	SDM	44	69	150	30.67	RRJ	42	51	152	22.07
26	MVM	48	61	149	27.48	SSJ	39	50	152	21.64
27	UJM	36	62	148	28.31	KAJ	42	47	158	18.83
28	SDP	45	60	150	26.67	GEC	46	46	160	17.97
29	PVP	39	56	149	25.22	SNC	40	48	156	19.72

SR. NO.	Control					Subject				
	Name	Age (Yrs)	Weight (Kg)	Height (cms)	BMI Kg/m²	Name	Age (Yrs)	Weight (Kg)	Height (cms)	BMI Kg/m²
30	SVP	38	65	150	28.89	SPJ	43	45	158	18.03
31	RVS	40	60	147	27.77	PPJ	39	45	160	17.58
32	CAS	44	58	150	25.78	LSJ	49	44	152	19.04
33	MPK	42	55	157	22.31	AMJ	37	49	155	20.40
34	SDP	38	62	150	27.56	VKJ	49	52	151	22.81
35	MSS	39	59	151	25.88	SRJ	41	51	153	21.79
36	AVP	37	68	148	31.04	CAJ	42	50	151	21.93
37	SSP	40	50	147	23.14	SVJ	39	52	158	20.83
38	KBP	41	65	152	28.13	MKJ	40	50	154	21.08
39	SRP	38	63	149	28.38	SNJ	42	50	154	21.08
40	CAS	39	60	150	26.67	JNJ	38	46	152	19.91
41	PSP	40	51	151	22.37	SBJ	45	50	156	20.55
42	SSP	36	58	147	26.84	BDC	42	51	158	20.43
43	MDP	39	45	148	20.54	SSM	46	50	151	21.93
44	PTP	42	50	149	22.52	BBJ	40	52	146	24.39
45	SNP	38	43	150	19.11	YAC	37	50	152	21.64
46	SPP	46	45	147	20.82	RAM	41	49	158	19.63
47	SDP	49	51	151	22.37	ADL	38	40	148	18.26
48	VMP	44	49	150	21.78	LSK	40	54	154	22.77
49	MSP	38	48	151	21.05	PMK	38	47	149	21.17
50	BDP	44	42	146	19.70	ASM	37	45	150	20.00
	Mean	**40.64**	**55.48**	**149.30**	**24.88**		**41.66**	**47.46**	**154.28**	**19.98**
	Var.	**9.19**	**40.53**	**3.73**	**7.79**		**10.46**	**11.37**	**11.36**	**3.20**
	Sqrt	**0.63**	**1.02**	**0.55**	**0.47**					
	Z	**1.63**	**7.87**	**9.06**	**10.47**					

Table No. 3
Weight Category wise Body Mass Index in Control and Subject womenRasulwadi.

Village	Control				Subject			
	<20 Kg/m²	>20.1 and <24.99 Kg/m²	>25 and <29.99 Kg/m²	>30 Kg/m²	<20 Kg/m²	>20.1 and <24.99 Kg/m²	>25 and <29.99 Kg/m²	>30 Kg/m²
Rasulwadi	2	21	25	2	26	24	0	0