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Infertility and Obesity: A Cross-Sectional Study in North Indian Women

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ABSTRACT

The present study assessed the relationship between primary infertility and obesity in women of Delhi, India, independently, and in light of various demographic trait, lifestyle and reproductive variables. The present study was a part of a major project funded by the National Commission for Women of India, Government of India. The data were collected from 334 women, including 167 fertile and 167 infertile individuals. A two-part pretested modified quantitative interview schedule was used to collect data. The first part of the interview schedule included demographic traits, reproductive profile and lifestyle variables. The second part consisted of anthropometric measurements for BMI which were taken using an anthropometric rod (height) and digital weighing scale (weight). All the data were analysed through SPSS 22.0. The results revealed a higher prevalence of obesity and underweight among infertile women. There is a clear-cut indication that usual risk factors of obesity like physical inactivity, increasing age, higher age at marriage, and infertility-related biological issues seem to be promoting obesity in combination with infertility. Public health education is needed to increase awareness about the age at marriage. As physical inactivity leads to obesity among infertile women, counselling, awareness raising or improvement of lifestyle factors should be considered in the infertility treatment protocol.

Key words: *women, women's health, infertility, obesity, BMI, reproductive health*

Introduction

Obesity is a global issue, regardless of serious efforts to tackle it. Obesity is related to systemic diseases such as diabetes mellitus, cardiovascular diseases, hyperlipidemia, sleep apnea, cancers, and osteoarthritis.[1] Approximately 19 billion people worldwide are overweight, and 650 billion are obese.[2] In India, 5% of the total population is affected by obesity, and 49.8% of females in the total population of Delhi are obese.[3]

Infertility is a dilemma that is physically painful, mentally threatening, emotionally traumatic, and economically challenging for both partners. It is a communal problem as it affects the individual, family, and society as a whole.[4] It is a stressful state and most couples are not prepared to deal with the impacts of infertility.[5] World Health Organization defines infertility as a disorder in which pregnancy does not happen, followed by continued copulation. Infertility can be primary as well as secondary. Primary infertility is a condition where the woman is unable to give birth to a child, while secondary infertility occurs when individuals have a history of pregnancy but fail to conceive later[2]. World Health Organization estimates that India's overall prevalence of primary infertility is between 3.9 and 16.8%.[6] The combination of infertility and obesity poses some challenges in the life of women. Female obesity has a significant impact on reproductive function and the hormonal milieu. The association between obesity and infertility was recognized when Stein and Leventhal described a triad consisting of obesity, hirsutism and infertility as the 'Stein–Leventhal Syndrome'.[7]

The reported reasons for obesity and infertility are multifactorial. Many factors like polycystic ovary syndrome (PCOS), hormonal imbalance, menstrual dysfunctions, ageing, and higher BMI are attributed to both obesity and infertility.[8] Both infertility and obesity are health adversities that can lead to further severe conditions in terms of physical health (cardiovascular disease, diabetes) and mental health (stress, anxiety and depression).[9,10]

Studies related to the association between obesity and infertility are almost negligible in the North Indian con-

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text; thus, the present study aims to assess the relationship between primary infertility and obesity in women in Delhi (North India) independently and in light of various demographic traits, lifestyles and reproductive variables. The relationship between obesity and infertility is reported to be bidirectional.[11] In the present study, infertility is considered to be the cause and obesity a consequence.

Material and Methods

The present study was a part of a project funded by the National Commission for Women of India, Government of India. Data was collected from 334 females, including 167 fertile and 167 infertile individuals aged between 22 to 35 years. Infertile and fertile women were recruited based on strict inclusion and exclusion criteria. The inclusion criteria for infertile women were women seeking infertility treatment and who belonged to North India. The inclusion criteria for fertile women were women belonging to the same reproductive age, with successful pregnancy outcomes with children older than one year and living in North India. The exclusion criteria for both fertile and infertile women were women with known psychosomatic or psychiatric disorders and known chronic conditions.

The ethical committees of the Lady Hardinge Medical College and the Department of Anthropology, University of Delhi approved the study. Further, informed written consent was obtained from all the participants before data collection.

Infertile women were recruited from the Gynaecology Outpatient Department (OPD) of the Lady Harding Medical College (LHMC) and Smt. Suchita Kriplani Hospital, Delhi, North India and fertile women were recruited through a household survey in Delhi based on their inclusion criteria.

A pretested modified quantitative interview schedule was used to collect the data, which consisted of two parts: the first part of the interview schedule included demographic variables (name, age, household composition, educational status, occupational status, socio-economic status, and family structure), reproductive profile (duration of marriage, age at menarche, disturbed menstruation and possible causes of infertility) and lifestyle variables (sleep pattern, physical activity and exercise). The second part included collecting anthropometric measurements (height and weight), which were taken by two trained field investigators using the standard suggested procedures of the World Health Organization.[12] A digital weighing scale (to the nearest 0.1 kg) and an anthropometric rod were used to measure the weight and height of the respondents, respectively, and the Body Mass Index (BMI) was computed with the formula: weight (kg)/height (m) 2. An adult with a BMI of 30.0 or higher is considered to be obese.[13]

Statistics

Data analysis was performed with the statistical software version (SPSS) 22.0. Descriptive statistics such as frequency and proportions were used to describe the sample and determine the prevalence of obesity among fertile and infertile women in Delhi. Pearson's Chi-square test was used to obtain the associations and strength of the relationship between the independent and the dependent variables. Binary logistic regression analysis was performed to control for confounding factors and determine the Odds Ratios (ORs) with significance level of <0.05.

Results

A higher number of women were present in the infertile category who were having abnormal BMI, whether underweight (<18.5), overweight (25–29.9) or obese (>30) and the differences were found to be statistically significant ($p<0.05$). Further, overweight and obese women were considered obese, and women with normal BMI and underweight were considered non-obese, among both fertile and infertile participants (Table 1).

Infertile women were found to be more obese and overweight as compared to fertile women. This observed difference was found to be statistically significant ($p<0.05$). Unadjusted odds ratio analysis revealed that infertile women were found to be at an almost twofold significantly increased risk for obesity OR 1.80 (C.I. at 95% = 1.152–2.820) (Table 2).

Demographic variables among obese and non-obese categories in both infertile and fertile women were similar

TABLE 1

DISTRIBUTION OF CATEGORIES OF BMI AMONG INFERTILE AND FERTILE WOMEN

BMI	Infertile women N=167 (%)	Fertile women N=167 (%)	Chi-square (P)
Normal (<18.5-24.9)	80 (47.9)	109 (65.3)	10.631 (0.01)*
Underweight (<18.5)	12 (7.2)	6 (3.6)	
Overweight (25-29.9)	57 (34.1)	39 (23.4)	
Obese (>30)	18 (10.8)	13 (7.8)	

*significance $p<0.05$

TABLE 2

DISTRIBUTION AND ASSOCIATION OF OBESITY AMONG INFERTILE AND FERTILE WOMEN

		Infertile Women N=167 (%)	Fertile Women N=167 (%)	Chi Square (χ2) (p)	Unadjusted Odd's ratio	C.I. at 95% (p)
Obesity among women	Obese	75 (44.8)	52 (31.1)	6.721 (0.009*)	1.80	1.152-2.820 (0.009*)
	Non-Obese	92 (55.1)	115 (58.9)			

*significance p<0.05; OR=odds ratio; CI=confidence interval

except for age among infertile women. Women belonging to an age group higher than 26 years were found to be more obese (46.7%), and this observed difference was statistically significant. None of the demographic variables showed any significant difference among the fertile women. (Table 3).

Out of the lifestyle variables, none of the variables was found to have a significant difference except physical activity among both infertile and fertile women. Women who were slightly active or not at all active were found to be obese.

Further, there seems to be a statistically significant difference between age at marriage and possible causes of infertility among infertile women. Women with higher age at marriage were more frequent in the obese category, i.e., women who are married after 26 years of age were more obese. Women suffering from PCOS, cysts, tubal occlusion, hormonal imbalance, disturbed menstruation and hypothyroidism were found to be more among the obese category and were more obese. However, among fertile women, none of the reproductive profile variables showed any significant difference (Table 4).

Logistic regression analysis revealed that higher age, lower physical activity and higher age at marriage were significantly associated with an increased risk for obesity. Moreover, those older than 27 years of age had a 2.35–fold significantly increased risk for obesity with OR 95% CI=1.25–4.42. On the other hand, those who got married after 26 years of age had a 3.90–fold significantly increased risk for obesity (OR 95% CI=1.77–8.60), and less active women had a 3.58–fold significantly increased risk for obesity (OR 95%CI=1.31–9.76).

TABLE 3

DISTRIBUTION OF DEMOGRAPHIC VARIABLES AMONG OBESE AND NON OBESE WOMEN IN INFERTILE AND FERTILE CATEGORIES

Characteristics		Infertile women N=167		Chi-square (χ2)	Fertile women N =167		Chi-Square (χ2)
		Obese (N=75)	Non-obese (N=92)	(p)	Obese (N=52)	Non-obese (N=115)	(p)
Age	22–25 years	23 (30.7)	46 (50.0)	6.884 (0.03)*	24 (46.2)	45 (39.1)	1.4 (0.49)
	26–30 years	35 (46.7)	34 (37.0)		18 (34.6)	51 (44.3)	
	31–35 years	17 (22.7)	12 (13.0)		10 (19.2)	19 (16.5)	
Educational status	illiterate/informal	12 (16.0)	10 (10.9)	5.04 (0.28)	12 (23.1)	34 (29.6)	7.64 (0.10)
	primary	8 (10.7)	12 (13.0)		18 (34.6)	49 (42.6)	
	middle	3 (4.0)	7 (7.6)		11 (21.2)	21 (18.3)	
	secondary/senior secondary	28 (37.3)	44 (47.8)		7 (13.5)	10 (8.7)	
	higher	24 (32.0)	19 (20.7)		4 (7.7)	1 (0.9)	
Family Structure	nuclear	30 (40)	37 (40.2)	0.001 (0.97)	34 (65.4)	77 (67)	0.04 (0.84)
	joint	45 (60)	55 (59.8)		18 (34.6)	38 (33)	
Occupational status	not working	0 (0)	3 (3.3)	6.72 (0.15)	3 (5.8)	3 (1.2)	6.42 (0.16)
	daily wage earner	19 (25.3)	28 (30.4)		34 (65.4)	83 (72.2)	
	private job	43 (57.3)	38 (41.3)		14 (26.9)	20 (17.4)	
	govt job	8 (10.7)	11 (12.0)		1 (1.9)	7 (6.1)	
	business	5 (6.7)	12 (13.0)		0 (0)	3 (2.6)	
Family Income (Rs)	6,000–10,000	17 (22.7)	18 (19.6)	0.26 (0.96)	13 (25.0)	34 (29.6)	3.11 (0.37)
	11,000–15,000	12 (16.0)	16 (17.4)		17 (32.7)	47 (40.9)	
	16,000–20,000	13 (17.3)	16 (17.4)		3 (5.8)	7 (6.1)	
	Above 20,000	33 (44)	42 (45.6)		19 (36.5)	27 (23.5)	

*significance p<0.05

TABLE 4

DISTRIBUTION OF LIFESTYLE AND REPRODUCTIVE VARIABLES AMONG OBESE AND NON OBESE WOMEN

CHARACTERISTICS		Infertile women N=167		Chi-square (χ2) (p)*	Fertile women N =167		Chi-square (χ2) (p)
		Obese (N–75)	Non-obese (N–92)		Obese (N–52)	Non-obese (N–115)	
Activity	Extremely active	20 (26.7)	37 (40.2)		25 (48.1)	40 (34.8)	
	Moderately active	29 (38.7)	20 (21.7)		4 (7.7)	29 (25.2)	
	Active	11 (14.7)	29 (31.5)	4.92 (0.004)	19 (36.5)	43 (37.4)	11.18
	Slightly active	12 (16.0)	3 (3.3)		4 (7.7)	2 (1.7)	(0.02)
	Not active at all	3 (4.0)	3 (3.3)		0 (0)	1 (0.9)	
Any form of vigorous activity	Never	35 (46.7)	19 (7.6)		20 (38.5)	44 (38.3)	
	Seldom	10 (13.3)	8 (3.2)		24 (46.2)	47 (40.9)	0.798
	Sometimes	21 (28.0)	24 (9.6)	3.69 (0.46)	8 (15.4)	24 (20.9)	(0.67)
	Often	5 (6.7)	391.2)		2 (0.8)	0 (0)	
	Very often	4 (5.3)	4 (1.6)		0 (0)	0 (0)	
Sleep pattern	<6hrs	5 (6.7)	12 (13.0)		9 (17.3)	16 (13.9)	
	6–7hrs	38 (50.7)	32 (34.8)	5.043 (0.16)	25 (48.1)	38 (33.0)	5.153
	7–8hrs	27 (36.0)	39 (42.4)		17 (32.7)	59 (51.3)	(0.16)
	>8hrs	5 (6.7)	9 (9.8)		1 (1.9)	2 (1.7)	
Age at menarche	<12yrs	8 (10.7)	8 (8.7)		17 (32.7)	1 (0.9)	0.455
	13–16yrs	65 (86.7)	79 (85.9)	0.926 (0.629)	35 (67.3)	114 (99.1)	(0.499)
	Above 16yrs	2 (2.7)	5 (5.4)		0 (0)	0 (0)	
Disturbed menstruation	Yes	27 (36.0)	37 (40.2)	0.311 (0.577)	2 (3.8)	5 (4.3)	0.022
	No	48 (64.0)	55 (59.8)		50 (96.2)	110 (95.6)	(0.882)
Age at marriage	<18	8 (10.7)	12 (13.0)		3 (5.8)	10 (8.7)	
	18–25	41 (54.7)	69 (75.0)	12.75 (0.005)	46 (88.5)	99 (86.1)	0.437
	26–30	25 (33.3)	10 (10.9)		3 (5.8)	6 (5.2)	(0.795)
	>30	1 (1.3)	1 (1.1)		0 (0)	0 (0)	
Bleeding during menstruation	Heavy bleeding	10 (13.1)	17 (18.5)		17 (32.7)	44 (40.9)	
	Normal bleeding	48 (64.9)	64 (69.6)	3.111 (0.211)	30 (57.7)	50 (43.5)	2.71
	Less bleeding	16 (21.6)	4 (12.0)		5 (9.6)	18 (15.7)	(0.25)
Duration of infertility	1–5yrs	54 (72.0)	72 (78.3)		–	–	–
	5–10yrs	16 (21.3)	14 (15.2)	3.118 (0.373)	–	–	–
	10–15yrs	5 (6.7)	4 (4.3)		–	–	–
	Above 15yrs	0 (0)	2 (2.2)		–	–	–
Administration of birth control w/o consulting doctors	Yes	4 (5.3)	9 (9.8)	1.139 (0.28)	9 (17.3)	24 (20.9)	0.287
	No	71 (94.7)	83 (90.2)		43 (82.7)	91 (79.1)	(0.59)
Possible causes of infertility	Tubal occlusion	11 (14.7)	8 (8.7)		–	–	–
	PCOS/PCOD	15 (20)	1 (1.0)		–	–	–
	Cyst	12 (16)	9 (9.8)		–	–	–
	Hormonal imbalance	5 (6.7)	3 (3.2)	57.0 (0.000)	–	–	–
	Fibroid	0 (0)	5 (5.5)		–	–	–
	No menstruation for the last 6 months	7 (9.3)	1 (1.1)		–	–	–
	Hypothyroidism	15 (20.0)	7 (7.7)		–	–	–
	Other reason	10 (13.3)	58 (63.0)		–	–	–

*significance $p<0.05$

In infertile women, only physical activity showed a significant difference in Pearson chi-square analysis. However, after regression analysis, physical activity also did not show any significant association with obesity (Table 5).

Discussion

In the present study, a higher prevalence of not only overweight and obesity but also of underweight is found among the infertile women. A similar result was found in a study by Zain and Norman[1], in which they revealed that the prevalence of overweight, obesity and underweight is higher among infertile women. Overweight and obesity among infertile women could be due to some metabolic reasons like abnormal eating behaviour and a sedentary lifestyle[14], and underweight could be caused by stress due to family pressure disturbing neuropsychiatric pathways. A study by Green et.al.[15] also revealed that the underweight is associated with ovulatory dysfunction and infertility among women. In the present study, infertility is found to pose an almost two-fold significant risk for obesity. Similar results were also observed by Katole and Saoji,[6] and Zain and Norman[1], who found that infertility poses a three-fold significant risk for obesity among the women of central India.

Of all the socio-demographic, lifestyle, and reproductive variables considered for comparison between obese and non-obese categories, higher age, lower physical activity, possible causes (PCOS, hormonal imbalance, menstrual irregularity and hypothyroidism) of infertility, and higher age at marriage were significantly different in the infertile women. The present study depicts that with age obesity increases, which in turn might aggravate infertility. Similar results were found in studies conducted by Gouda and Prusty[16] and Kukji et al.[17], where they also observed that obesity increased in women with age. Infertility could be an additional factor for increasing weight, as reported in the study among the south Indian population.[18]

In the present study, it is observed that being slightly or not physically active can lead to obesity among both infertile and fertile women. These findings are in concordance with another study[8], which stated that less physical activity is a primary reason for obesity and overweight. A study by Blair and Brodney[19] supporting the present results revealed that less physical activity leads to overweight and obesity among women. Awareness about obesity and physical activity should be increased among infertile women at the treatment level itself. Cardozo et al.[20] also indicated that women undergoing fertility treatment should be motivated for obesity education and weight-loss interventions.

According to the present study, women who marry at a higher age are more prone to gaining weight and being obese among the infertile group**.** Marriage at higher age and appraisal of socioeconomic status of women has contributed to modified dietary habits and physical inactivity, and thus these aspects might contribute to the development of obesity among women.

In the present study, causes for infertility like polycystic ovary syndrome (PCOS), hypothyroidism, disturbed menstruation and hormonal imbalance increase obesity among infertile women[21–24]. The present study does not describe if obesity is due to these conditions or infertility. Yildiz, et al.[25] described that PCOS is one of the leading causes of obesity and the primary cause of infertility. Obesity was found to be very common in women with hypothyroidism, and it was also found that thyroid dysfunction causes obesity and infertility among women.[26] Hormonal imbalance and menstrual dysfunction are also directly attributed to obesity and affect women's reproductive function.[6] However, these women are expected to be on medication, and the observed obesity could be because of medication. Furthermore, the medication might be aggravating the association between obesity and these conditions.

None of the demographic, lifestyle and reproductive variables differed significantly between obese and non-obese fertile women except for physical activity. The reason could be due to the sample size bias because there are fewer obese individuals in the fertile category. There is a clear-cut indication that usual risk factors of obesity like physical inactivity, increasing age, higher age at marriage, and infertility-related biological issues seem to be promoting obesity in combination with infertility.

TABLE 5

LOGISTIC REGRESSION ANALYSIS OF DIFFERENT VARIABLES BY OBESITY AMONG INFERTILE WOMEN

Variables		Obese (infertile women) N	Non obese (infertile women) N	Unadjusted Odds Ratio (OR)	C.I at 95%	P value
Age (years)	Above 27	39	36	2.35	1.25– 4.42	0.007
	Below 27	36	63			
Age at marriage (years)	Above 26	26	11	3.90	1.77–8.60	0.00
	18–25	49	81			
Physical Activity	Inactive	15	6	3.58	1.31– 9.76	0.01
	Active	60	86			

*significance p<0.05; OR=odds ratio; CI=confidence interval

Study limitations

In addition to the sample size bias mentioned above, it should be also acknowledged that Body Mass Index (BMI), although utilized globally as a practical low-cost objective measure for tracking obesity, as an indirect measure of body fat has various drawbacks as a measure of obesity. It is true that it has been recommended that measures of waist circumference (WHtR and WHR) as well as of skin-fold thickness should be used in combination with BMI as a more precise way to determine obesity. The current study was based on data collected from the Lady Hardinge Medical College, Delhi where the information required for calculating Body Mass Index (BMI) was already documented in the outpatient department (OPD) of the hospital. So, keeping in view the limitation of time available in the gynecology OPD, the data related to other variables such as waist circumference (WHtR and WHR) and skin fold thickness were not documented. However, there is still a need to address the association of other key factors like skin-fold thickness and waist circumference (WHtR and WHR) in future to precisely determine obesity in the case of fertile and non-fertile women.

We have used in our study the WHO's universal BMI cut-offs which have been widely used in various studies globally. As the body fat distribution in Asian Indians differs considerably from other ethnic groups, many studies recommend the use of revised consensus BMI cut-offs for Asian Indians for BMI classification (overweight 23–24.9 kg/m^2, and that for obesity ≥25 kg/m^2).We acknowledge that considering the revised consensus BMI-cut offs for Asian Indian BMI classification could have been a more precise method for the study.

Conclusion

The present study revealed a higher prevalence of obesity and underweight among infertile women, of all the variables: older age, higher age at marriage, and various medical conditions (PCOS, hormonal imbalance, hypothyroidism and disturbing menstruation). Public health education is needed to increase awareness about the age at marriage. As physical inactivity leads to obesity among infertile women, counselling, awareness raising or improvement of lifestyle factors should be considered in the infertility treatment protocol.

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NEPLODNOST I PRETILOST: STUDIJA POPREČNOG PRESJEKA U ŽENA U SJEVERNOJ INDIJI

S A Ž E T A K

Rad analizira odnos između primarne neplodnosti i pretilosti u žena u svjetlu različitih demografskih obilježja, reproduktivnih varijabli i načina života. Podaci su prikupljeni od 334 žene u Delhiu, Indija, i to 167 plodnih i 167 neplodnih žena. Za prikupljanje podataka korišten je unaprijed testiran modificiran upitnik. Prvi dio upitnika uključivao je demografske varijable, reproduktivni profil i varijable životnog stila. Drugi dio se sastojao od antropometrijskih mjerenja za BMI, uz pomoć antropometrijskog štapa za visinu i digitalne vage za težinu. Svi podaci analizirani su putem SPSS 22.0. Rezultati su otkrili veću prevalenciju pretilosti i pothranjenosti među neplodnim ženama. Postoji jasan pokazatelj da uobičajeni čimbenici rizika od pretilosti kao što su tjelesna neaktivnost, viša dob, starija dob pri sklapanju braka i biološki problemi povezani s neplodnošću, doprinose pretilosti u kombinaciji s neplodnošću. Potrebna je edukacija u javnom zdravstvu kako bi se povećala svijest o dobi za brak. Kako tjelesna neaktivnost dovodi do pretilosti među neplodnim ženama, savjetovanja i poboljšanje čimbenika načina života treba uključiti u protokol liječenja neplodnosti.