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Analytical studies on correlation of Obesity and Infertility with dietary habits in female community of Sialkot City

Faiza Waseem[1], *Maham Mushtaq*[2], *Habiba Shahzad*[*3], *Zikhatu Amna*[4], *Umair Mushtaq*[5]

[1] Institute of Food Science and Nutrition, University of Sargodha, Sargodha.

[2] National Institute of Food science and Technology, University of Agriculture, Faisalabad, Pakistan.

[3] Department of Food Sciences, University of Punjab, Lahore. 54590, Pakistan

[4] Institute of Food and Nutritional Sciences, Arid agriculture university of Rawalpindi, 46300, Pakistan

[5] Department of Pharmacy, Government College University, Faisalabad, 38000, Pakistan

*Correspondence Author: Habiba Shahzad (Email. Habiba.mirza111@gmail.com)

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Abstract

Infertility, according to the World Health Organization (WHO), is the inability of a couple to conceive following a minimum of two years of consistent, unprotected sexual intercourse. Infertility can be classified as primary, when conception has never transpired, or secondary, when conception fails despite a prior pregnancy. Infertility is influenced by various causes, such as hormone imbalances, genetic predispositions, reproductive system anomalies, infections, stress, and environmental exposures; still, dietary habits and lifestyle choices are pivotal. Obesity, characterized by a body mass index (BMI) of ≥30 kg/m², is a significant lifestyle-related risk factor that disturbs hormonal equilibrium, hinders ovulation, and elevates the likelihood of insulin resistance, polycystic ovarian syndrome (PCOS), and metabolic syndrome, all of which adversely affect fertility. Obesity has significant psychological and physiological effects, compromising reproductive health. This study evaluated the dietary state of infertile women aged 16 to 40 years visiting outpatient clinics. Of the 50 obese infertile women, 86% were diagnosed with secondary infertility, whereas 14% exhibited primary infertility. The results emphasize the substantial correlation between obesity and secondary infertility, highlighting the necessity for prompt lifestyle modifications, nutritional guidance, and weight management approaches to enhance fertility outcomes in women of reproductive age.

Keywords Infertility, Obesity, Body mass index (BMI), Genetic predisposition, polycystic ovarian syndrome (PCOS), Insulin resistance, Primary Infertility, Secondary Infertility

1. Introduction:

Nutrition commences with the ingestion of food, which serves multiple purposes to sustain the

human body. Adequate nutritional content in diet is essential for optimal bodily processes such as development, growth, and maintenance, hence enhancing quality of life (Gibney, 2009). Nutrition fundamentally concerns nature and quantity of nutrients. Health is defined as a condition of whole mental, social, and physical well-being, rather than only the absence of illness or disease (Babatunde et al., 2011). The psychological, social, cultural, economic, and technical factors that affect our eating choices are examined. Health difficulties related to nutrition exhibit considerable disparities between poor countries, characterized by deficiency and undernutrition, and industrialized countries, where obesity and overnutrition prevail; nonetheless, obesity has also risen in developing nations (Fernqvist et al., 2024).

Nutritional health evaluation is crucial in analyzing nutrition-related risks that may impact an individual's current or future health. Nutritional health assessment is a daily practice for the nutritional management of hospitalized patients. Nutritional health involves obtaining the appropriate quantity of nutrients necessary to sustain bodily functions. There are several methods to assess nutritional health. These metrics can enhance our understanding of current and enduring health. The process of evaluating nutritional health status is commonly referred to as nutritional health status evaluation. Numerous indications exist for assessing physical fitness and nutritional health. The primary components of health evaluation are typically referred to as ABCDs: anthropometrics, laboratory investigations, clinical findings, dietary intake history, pharmaceutical history, and the socioeconomic situation of individuals (Tang & Yang 2023). It is a crucial metric of health indicators and clinical assessments. The observations are contingent upon both nutritional deficit and excess (Maqbool et al., 2008). The therapeutic history is crucial information in the nutritional assessment. Previous and present therapeutic evidence, accompanying indicators of the current illness, laboratory examinations, and therapies such as chemotherapy, radiation, and drugs should be documented. Nutritional difficulties are often linked to certain illnesses; therefore, it is essential to ascertain the present medical condition and the accompanying drug history in use (Maka and Murphy, 2000). Family history is significant as it elucidates the communal and traditional context, particularly related to nutrition (Maqbool et al., 2008).

The essential component of nutritional assessment is the dietary intake history. It provides facts regarding both the quality and amount of food intake, as well as the dietary patterns of the family. Food histories are gathered over a period of 3 to 7 days, providing accurate information on actual intake, which is then assessed by comparing these records with reported food intakes. The primary issue with dietary records is that individuals typically do not accurately remember all consumed foods, which can mislead the researcher (Ziegler et al., 2006). The 24-hour recall method is a straightforward approach for nutritional intake evaluation, wherein the participant is asked to recollect the food consumed in the preceding 24 hours. This method allows us to determine the typical intake and is utilized to estimate energy consumption (Maqbool et al., 2008). Another method of testing is through the Food Frequency Questionnaire (FFQ). The FFQs are utilized to collect data on both the frequency and quantity of food, which is beneficial in clinical settings for determining actual and healthy consumption patterns. There are several dietary intake assessment methods, including retrospective and prospective approaches that collect data on an individual's nutritional consumption. Biomarkers are both

beneficial and crucial for assessing dietary health status. Nutritional status can be assessed through the analysis of plasma, serum, urine, stool, hair, and nail samples. Socioeconomic conditions significantly influence nutritional well-being (Iram and Butt 2006). Deficiency in key micronutrients results in malnutrition, referred to as undernutrition, which impedes physical and mental development (Mukherjee et al., 2008). The intake of junk food is a prevalent trend among the Pakistani population. Contemporary consumers alter their consumption patterns and behaviors due to several factors, including urbanization, dual-income households, industrial advancement, and commercial growth. Individuals exhibit increased desire in consuming fast food (Baig and Saeed, 2012). Individuals exhibit greater interest in snacks, burgers, pizzas, and cold beverages. The primary factor influencing lifestyle changes was urbanization (Pingali, 2004).

Infertility is classified as primary when conception has never taken place and as secondary when a female is unable to conceive following a prior conception (Padubidri, 2010). Unexplained infertility, also referred to as idiopathic infertility, is characterized by the absence of an identifiable etiology. Infertility affects 8 to 12% of couples globally (Palatty et al., 2012). The prevalence of infertility in Pakistan is 22%, comprising 4% primary and 18% secondary infertility, with unexplained infertility at approximately 10% (Ali et al., 2011). In developed nations, infertility prevalence ranges from 3.5% to 16.7%, whereas in developing countries, it ranges from 6.9% to 9.35%, including Pakistan (Bolvin et al., 2007). Females possess ovaries, fallopian tubes, and a uterus at birth. During puberty, the pituitary gland activates and secretes FSH and LH (Follicle Stimulating Hormone and Luteinizing Hormone), which subsequently encourage the ovaries to release sex hormones, namely estrogen, progesterone, and testosterone. These hormones induce several changes in a girl's body, including the development of the uterus, ovaries, and breasts, alterations in body form, voice pitch, the emergence of secondary sexual characteristics, and the growth of hair in the pubic region (Hales, 2010).

Excessive fat accumulation results in detrimental effects on the body, a condition known as obesity. Adults who are overweight and obese are categorized based on their Body Mass Index (BMI). According to WHO BMI standards, an individual is classified as obese if their BMI exceeds 30 kg/m^2. Obesity is classified into certain grades: Grade 1 (30.0–34.9 kg/m2), Grade 2 (35.0–39.9 kg/m2), Grade 3 (40 kg/m2), and Grade 4 (morbidly obese, >40 kg/m2). Obesity diagnosis criteria include waist circumference. A waist circumference of 80 cm signifies the presence of visceral fat buildup. Women with a high BMI exhibit infertility rates three times greater than those with a normal BMI (Narjes et al., 2017). The reproductive function is closely linked to body mass index (BMI) and weight. A study on lifestyle factors indicates that conception in infertile females is prolonged in those who are overweight (BMI over 35 kg/m^2) and underweight (BMI under 19 kg/m^2) (Hassan and Kellick, 2004).

To address ovulatory infertility, it is advisable to adopt certain dietary recommendations: utilize unsaturated fats in place of trans fats, incorporate plant proteins instead of animal proteins, choose whole grains over refined carbohydrates, and consume a daily multivitamin and iron supplement. Similar to nutrition, physical activity is crucial for maintaining energy balance (Chavarro et al., 2007). Obesity and overweight are increasingly prevalent issues in both industrialized and developing nations, including Pakistan, and these conditions exacerbate other health issues, such as reproductive health. Obesity

is widespread among infertile women, and numerous researchers have demonstrated the correlation between obesity and infertility.

2. Methodology of Research:

2.1 Criteria for Inclusion and Exclusion

The study included both infertile women and their fertile counterparts as volunteers.

2.2 Parameters

Demographics, anthropometrics, socioeconomic status, food intake, and eating habits served as independent variables, while physiological status (infertility) constituted the dependent variable. Additionally, lifestyle patterns and family background acted as confounding variables. The factors were examined at baseline and during the intervention.

2.3 Research Location

The Islam Medical College of Sialkot was designated as the research location following the acquisition of written consent from the appropriate authorities.

2.4 Target Demographic

The study population comprised fertile and infertile women. Upon receiving information regarding the research objectives and appropriate educational materials, individuals who consented to participate completed informed consent forms in accordance with the Declaration of Helsinki.

2.5 Sampling Methodology

The participants were selected by convenience and purposive sampling, both of which are non-probability sampling methods.

2.6 Sample Size

A total of 100 participants were recruited, consisting of 50 infertile and 50 fertile women.

2.7 Research Methodology

The study employed a cross-sectional design, appropriate for evaluating illness prevalence and investigating relationships between risk factors and health outcomes, while facilitating the gathering of varied dietary and health-related data.

2.8 Instruments for Data Collection

A self-administered questionnaire was created to gather data on demographics, medical history, weight increase habits, infertility-related risk factors, and any pertinent inquiries.

2.9 Demographics, Anthropometric Assessments, and Energy Calculations

The demographic information, including name, age, gender, socioeconomic status, education, ethnicity, and income, were documented. The physical activity of each volunteer was evaluated by a questionnaire designed by UWHPRC.

Anthropometric data, such as height (cm) were obtained using a stadiometer, and weight (kg) was recorded with a Burer Germany (BG-64) scale. Body mass index (BMI), ideal body weight (IBW), and lean body weight (LBW) were computed utilizing specialized software. The acquired data was juxtaposed with the benchmarks for assessing the dietary and health status of the volunteers.

Additionally, the body composition of the subjects, including weight (Kg), body fat (%), body water (%), muscle mass (%), bone mass (Kg), and AMR (Kilocalories), was assessed using a Bio-Electrical Impedance scale, model BG-64.

Table1 Illustrates the correlation between age and the physiological status of volunteers. The largest proportion of infertile patients (44.0%) is within the age range between 25 to 32 years. The biggest percentage of fertile volunteers (36%) is within the age group of 16-24.

Table 1. Age and Physiological Status of Volunteers

Age	Physiological Status			
	Disease free (Fertile)		Diseased (obese Infertile)	
	F	%	F	%
16-24	18	36	15	30
25-32	17	34	22	44
32-40	15	30	13	26
Total	50	100.0	50	100.0

3. Results and Discussion

The aim of this study was to investigate the nutritional health condition, prevalence, and correlation of obesity and infertility with eating habits among women. Nutritional health evaluation is a thorough method employed to examine physiological changes over the lifespan and acts as a crucial indication of overall health via clinical and dietary observations. Various indicators are utilized for this objective, including demographic data, vital signs, family and medical history. The results of this study are organized under the following areas.

- Demographics
- Weight gain history
- Medical background
- Infertility risk factors and further inquiries concerning infertility

3.1 Demographics

Age, education, social level, and physical activity are encompassed by this category. The detrimental impact of education on reproduction is evident. Socioeconomic conditions significantly influence nutritional well-being. Deficiency in key micronutrients results in malnutrition, referred to as undernutrition, which impedes physical and mental development. The intake of junk food is a prevalent trend among the Pakistani population, contributing to obesity. The consumption of fast food rises with an increase in income. Physical activity plays a significant effect in ovulatory infertility. Extreme physical activity to the point of exhaustion results in ovulatory sterility, but moderate exercise has a beneficial effect on obese females and enhances ovulation.

Table 2. Education and Physiological Status of Volunteers

Educational Status	Physiological Status			
	Disease free (Fertile)		Diseased (obese Infertile)	
	F	%	*f*	%
Educated	35	70.0	42	84.0
Un Educated	15	30.0	8	16.0
Total	50	100.0	50	100.0

Table 2 presents the educational and physiological status of the subjects. The majority of infertile patients (84.0%) possessed an education. The research indicated that an increase in educational attainment correlates with a progressive decline in fertility rates. This may result from insufficient physical activity or an increased intake of fiber-poor foods, such as fast and junk foods. Alaka (2002) greater prevalence of infertility among educated females.

Table 3. Socioeconomic Status and Physiological Status of Volunteers

Socioeconomic status	Physiological Status			
	Disease free (Fertile)		Diseased (obese Infertile)	
	F	%	*f*	%
High income	7	14.0	26	52.0
Low income	18	36.0	8	16.0
Middle income	25	50.0	16	32.0
Total	50	100.0	50	100.0

The above Table 3 demonstrated that (52%) patients suffered from infertility fall in higher income group and (32%) fall in middle income group while only (16%) in lower income group. This study is corroborated by Thomas et al., (2010) who performed study on the developed market of UAE which had harmful effects on healthy eating patterns such a shift from traditional foods like fruits and vegetables towards junks and fast foods. Individuals of elevated socioeconomic level have a preference for quick foods and sugary beverages. These individuals exhibit habits of minimal or no physical activity.

Table 4 Frequency distribution of subjects' physical activity and physiological state. The results indicated that a significant proportion (40.0%) of highly active participants are more susceptible to infertility. This result is corroborated by Gudmundsdottir (2009), who conducted research on exercise at varying frequency and intensities, revealing that different quantities of exercise had distinct effects on fertility. The relationship between physical exercise and fertility is due to alterations in hypothalamic-pituitary hormones. Excessive physical exertion to the point of exhaustion may result in ovulatory infertility. Table 4.1.4 indicates that light active volunteers constituted 34%, whereas sedentary lifestyle volunteers represented 12%, both of whom exhibited a propensity for infertility. Moderate exercise, without reaching fatigue, positively influences obese females and enhances ovulation. This study, corroborated by Ramlau et al. (2007), demonstrates that weight loss and activity in overweight patients enhance fertility and quality of life.

Table 4. Physical activity & Physiological Status of Volunteers

Physical Activity	Physiological Status			
	Disease free (Fertile)		Diseased (obese Infertile)	
	F	%	*f*	%
Light active	13	26.0	17	34.0
Moderate active	21	42.0	3	6.0
Sedentary	3	6.0	6	12.0
Very active	13	26.0	20	40.0
Total	50	100.0	50	100.0

Status of Volunteers

3.2 Weight Gain Pattern

The weight gain pattern of obese infertile patients was also a significant feature that has been addressed. The objective of this pattern was to ascertain the precise source of weight increase.

Table 5. Weight Gain Pattern & Physiological

Weight gain pattern	Physiological Status			
	Disease free (Fertile)		Diseased (obese Infertile)	
	Ƒ	%	Ƒ	%
Gradual increase	2	4.0	6	12.0
Intermittent diet & exercise	3	6.0	20	40.0
Nil	38	76.0	8	16.0
No pattern	4	8.0	11	22.0
Sudden with pregnancy	3	6.0	5	10.0
Total	50	100.0	50	100.0

Table 5 presents the frequency distribution of weight gain patterns and physiological statuses of the volunteers. The findings indicated that 40% of obese infertile participants had weight increase as a result of intermittent dieting and exercise. Seventy-six percent of fertile subjects had no pattern of weight gain.

3.3 Obesity related history

This section addresses obesity-related issues such as sleep apnea and heartburn.

Table 6. Sleep Apnea and Physiological Status of Volunteers

Table 6 presents the frequency distribution of sleep apnea and the physiological status of participants. The findings indicated that only 8% of obese infertile individuals and 4% of fertile volunteers reported experiencing sleep apnea. There is no substantial correlation between sleep apnea and obesity.

Table 7 Heart Burning and Physiological Status of Volunteers

Heart Burning	Physiological Status			
	Disease free (Fertile)		Diseased (obese Infertile)	
	Ƒ	%	*f*	%
No	44	88.0	22	44.0
Yes	6	12.0	28	56.0
Total	50	100.0	50	100.0

Table 7 presents the frequency distribution of heartburn incidents and the physiological health of volunteers. The results indicated that 56% of obese infertile subjects reported experiencing heartburn. A substantial correlation exists between heartburn and obesity. Fat exhibits a paradoxical link with heartburn, as the prevalence of heartburn escalates with growing fat.

3.4 Medical History

This section addresses the medical history of uric acid levels, renal problems, cardiovascular diseases, joint issues, and sleep disorders.

Table 8 Uric acid and Physiological Status of Volunteers

Uric acid	Physiological Status			
	Disease free (Fertile)		Diseased (obese Infertile)	
Sleep Apnea	Physiological Status			
	Disease free (Fertile)		Diseased (obese Infertile)	
	Ƒ	%	*f*	%
No	48	96.0	46	92.0
Yes	2	4.0	4	8.0
Total	50	100.0	50	100.0

	F	%	*f*	%
No	50	100.0	46	92.0
Yes	0	0	4	8.0
Total	50	100.0	50	100.0

Table 8 displayed the correlation between uric acid levels and the physiological status of volunteers, yielding a non-significant result. The statistical analysis indicated that only 8% of obese infertile females had elevated uric acid levels.

Table 9 sleep disorders and Physiological Status of Volunteers

Sleep Disorders	Physiological Status			
	Disease free (Fertile)		Diseased (obese Infertile)	
	f	%	*f*	%
No	50	100.0	20	40.0
Yes	0	0	30	60.0
Total	50	100.0	50	100.0

The research demonstrated a highly substantial correlation between sleep disturbances and the physiological status of volunteers, as presented in Table 9 Sixty percent of obese infertile patients experienced sleep difficulties.

Table 10. cardiovascular diseases and Physiological Status of Volunteers

CVD'S	**Physiological Status**			
	Disease free (Fertile)		**Diseased (obese Infertile)**	
	F	**%**	***f***	**%**
No	50	100.0	46	92.0
Yes	0	0	4	8.0
Total	50	100.0	50	100.0

Table 10 demonstrated the association between cardiovascular illnesses and the physiological status of participants, yielding a non-significant result. The statistical analysis indicated that only 8% of obese infertile females have cardiovascular diseases.

Table 11. Joint Disorders and Physiological Status of Volunteers

Joint Disorders	Physiological Status			
	Disease free (Fertile)		Diseased (obese Infertile)	
	f	%	*f*	%
No	50	100.0	43	86.0
Yes	0	0	7	14.0
Total	50	100.0	50	100.0

Table 11 demonstrated the correlation between joint problems and the physiological status of volunteers, yielding a non-significant result. The statistical analysis indicated that only 7% of obese infertile females exhibit joint issues.

Table 12. Kidney Disorders and Physiological Status of Volunteers

Kidney Disorders	**Physiological Status**			
	Disease free (Fertile)		**Diseased (obese Infertile)**	
	f	**%**	***f***	**%**
No	50	100.0	47	94.0

Yes	0	0	3	6.0
Total	50	100.0	50	100.0

Table 12 demonstrated the correlation between kidney problems and the physiological status of volunteers, yielding a non-significant result. The statistical analysis indicated that merely 3% of obese infertile females have kidney problems.

3.5 Infertility risk factors and further inquiries on infertility

This section addresses the prevalence and types of infertility, menstrual patterns, menstrual blood loss, dysmenorrhea, pelvic inflammatory disease (PID), hot flashes, and hirsutism, with results presented below.

Table 13. Prevalence and type of Infertility

Fertility Type	Physiological Status			
	Disease free (Fertile)		Diseased (obese Infertile)	
	F	%	F	%
Primary	0	0	7	14.0
Secondary	0	0	43	86.0
Total	50	100.0	50	100.0

Table 13 illustrates the frequency and types of infertility among females in Sialkot. It was established that out of 50 infertility cases, 7 patients (14%) experienced primary infertility, while 43 patients (86%) experienced secondary infertility. This study is corroborated by Ali et al. (2011), who reported that the prevalence of infertility in Pakistan is 22%, comprising 4% primary infertility and 18% secondary infertility.

Table 14. Menstrual Pattern and Physiological Status of Volunteers

Menstrual Pattern	Physiological Status			
	Disease free (Fertile)		Diseased (obese Infertile)	
	f	%	*f*	%
Irregular	1	2.0	8	16.0
Irregularly regular	6	12.0	36	72.0
Regular	43	86.0	6	12.0
Total	50	100.0	50	100.0

Table 14 illustrates the correlation between menstruation cycles and the physiological health of the subjects. The statistical analysis indicates that 72% of obese infertile females experience irregularly regular menstrual cycles, 16% have irregular cycles, and 12% have irregularly regular cycles, whereas 86% of fertile participants exhibit normal menstruation. Menstrual disorders are significantly correlated with infertility. Menstrual problems such as amenorrhea, oligomenorrhea, and menorrhagia are prevalent among females. This may be attributable to variables contributing to menstruation disorders, such as body weight, body composition, energy balance, excessive activity, a sedentary lifestyle, unhealthy dietary patterns, and stress. This study is corroborated by Kubrak et al. (2007) concluding that menstrual problems are significantly linked to infertility.

4. Conclusion

The initial section of the questionnaire addressed demographics, including age, education, socioeconomic level, and physical activity. The findings indicated that the biggest proportion of infertile patients (44.0%) belonged to the age range

of 25-32 years. The majority of infertile patients (84.0%) possessed an education. The research indicated that an increase in educational attainment correlates with a progressive decline in fertility rates. A strong correlation was identified between physiological status and socioeconomic category. A majority of the infertile patients (52%) were found to come from high-income families. A substantial correlation exists between physical activity and physiological condition. Highly active volunteers (40.0%) exhibit a greater susceptibility to infertility. This study observes that varying amounts of exercise exert distinct effects on fertility. Extreme physical activity to the point of exhaustion is associated with ovulatory infertility, whereas the study also indicates that 34% of lightly active volunteers and 12% of sedentary volunteers experienced infertility risks.

A section of the questionnaire addressed weight gain patterns, revealing that 40% of obese infertile participants experienced weight gain attributed to intermittent dieting and activity, in contrast to fertile participants, who exhibited no weight gain pattern (76%).

Another section of the questionnaire addressed family history, revealing a substantial correlation, as 44% of obese participants reported a favorable history of obesity. Results indicate that familial history significantly influences obesity, and genetic factors may possibly contribute to its development. No significant correlation was identified regarding family history of infertility.

The mid-section of the questionnaire pertained to medical history, and the results were non-significant.

The last section of the questionnaire addressed risk factors and inquiries pertaining to infertility prevalence and types, menstrual patterns, blood loss during menstruation, menstrual pain (dysmenorrhea), pelvic inflammatory disease (PID), polycystic ovarian syndrome (PCOS), hot flashes, and hirsutism. The findings indicated that 14% of the 50 volunteers experienced primary infertility, while 86% suffered from secondary infertility. Seventy-two percent of obese infertile females experienced irregular menstrual cycles, whereas eighty-six percent of fertile participants had regular menstruation. Fifty-eight percent of obese infertile women experienced serious blood loss, in contrast to twelve percent of fertile women.

5. Recommendations:

- The subsequent recommendations have been produced after analyzing this research investigation.
- The demographic study concludes that elevated education levels, high socioeconomic class, and a sedentary lifestyle are primary contributors to infertility. It is advised to substitute low-fiber foods with fibrous alternatives, decrease the consumption of junk and fast foods, and cultivate a routine of regular exercise.
- According to the analysis of weight increase patterns, the majority of obese infertile participants had weight gain due to inconsistent dieting and exercise. Therefore, it is advisable to visit a nutritionist for a dietary plan and adhere completely to that plan to achieve weight reduction.
- An extensive assessment of nutritional health condition concerning obesity-induced infertility is necessary, since it is a growing global issue among females and a primary contributor to divorce in Pakistan.
- Research on the causes and risk factors of obesity and infertility should be undertaken.

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