Infertility of Women: Factor Analysis as a Tool for Evaluating Patterns of Life Style Factors

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Abstract: *It is reasonable to believe that patterns of life style factors may represent valid picture of infertility than isolated factors, most of the research has found out the relation between life style factors and infertility considering single factor at a time. This study makes a pioneering attempt to use factor analysis as a tool for evaluating patterns of life style factors responsible for women to become infertile. Information on sixteen life style factors related to diet, physical activity, media, psychological stress and body mass index (BMI) were obtained from infertile women who underwent assisted reproductive technology (ART) treatment at a fertility center situated in Pondicherry, India. Application of factor analysis established that sedentary life made these women to consume more junk food, and electronic media watching made them to a lead stressful life.*

Keywords: Infertile Women, Life Style factors, Factor Analysis, Junk food, stress

1. Introduction

The term "healthy lifestyle" has been periodically addressed in relation to healthy diet, regular sleep, good habits and a moderate approach to stressful moments. This concept implies that healthy life factors are a cluster of social, demographic and behavioral patterns. This conceptualization suggests that analysis of healthy lifestyle factors need to include the interplay between the individual personal characteristics, social interactions, and socioeconomic and environmental living conditions, and also information about what life people lead and how they lead it. [1] Many life style factors are modifiable habits and they can greatly influence the overall health and well being including fertility. The growing interest and amount of research in this field have made it evident that life style factors have significant impact on fertility. [2]

Life style analysis is the personality domain developed through the combination of demographic, social and psychological factors. [3] The focus on life style traits, as distinct from more abstract personality variable and attitude is meant to describe the behavior of any person directly. [4] The behavior of any person is like a latent variable and it cannot measure directly and it has to be described using life style factors. Factor analysis is suitable statistical method to develop latent variables which are used to produce relatively homogeneous segments that are useful for understanding an individual's personality behavior. By understanding this segment patterns, proper education and other means of influence can be developed to shape infertile person's behavior. [5]

Infertility is a universal public health problem. It is defined as incapable of producing offspring within a specified period. Statistics say that globally 60-80million couples are suffering from infertility every year, of which, 15-20 millions live in India alone. [6] According to UN ranking, India is on 77th rank and fertility rate from 2000-2005 is 3.11 and fertility rate from 2005-2010 is 2.81. [7] Researchers have been acknowledging the fact that life style

factors like older age when starting family, extremes of weight, maternal smoking, improper diet, lack of exercise, drug abuse, and psychological stress, consumption of caffeine and alcohol, and environmental pollutants have had a dramatic impact on reproductive performance. [8] A review article made a statement that biological and life style related factors rather than socio-demographic factors, seems to determine infertility level in India. [9] A study conducted in a rural area in India observed that life style factors like frequency of intercourse, BMI, alcohol, and tobacco consumption play a role in determining reproductive status and have significant impact on fertility. [10]

No attempt is made till today to study the interactions among life style factors in the development of infertility [11] and much of such research work is required to determine how the interactions between these factors play a pivotal role in such case. Using this knowledge, clinicians will be better able to treat infertile patients and make knowledgeable decisions about the use of Assisted Reproductive Techniques (ART). Hence, it will be interesting to study how these modifiable factors individually and in cluster could be responsible for the development of infertility among women who are in the reproducing age. Identifying the patterns of these modifiable life style factors offers a comprehensive approach to study life style habits of infertility persons and makes it possible to examine the relations with these factors in order to propose a suitable solution to prevent infertility. This paper makes an attempt to find out how the occurrence of patterns of life style factors determine the status of reproduction performance of women who underwent ART program using factor analysis.

2. Factor Analysis

Factor analysis is a statistical technique which analysis correlated variables to identify the underlying dimensions that explain these correlations. In other words, this analysis is used to understand the patterns of relations among different variables, and also for data reduction and data summarization. [12] Danielle and his friends (2013) have

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observed that that factor analysis might be a more appropriate method for identifying overall dietary patterns associated with diabetes. They identified two groupings, first group consists of fruit, vegetables, high-fiber rich bread, medium-fat dairy, and fish and it is called prudent group, and second consists of take-away food, meat, and snacks and is known as western pattern. [13] Despite its wide applications in different fields, factor analysis has not seen application in the area of infertility to determine factor structure of life style factors related to infertility.

Factor analysis is an explorative multivariate technique which is used for grouping quantitatively measurable variables into clusters known as factors, on the basis of the correlation between original variables. Factors are linear combinations of original variables, uncorrelated, and arranged in descending order according to variances covered by them. Principal component factor analysis is commonly used for extracting factors. Two statistics, namely, The Bartlett's test of Sphericity and The Kaiser-Meyer-Olkin measure are used to find the suitability of data under study, the former is used to test the hypothesis that if a correlation matrix is an identity matrix and the latter is used for testing sampling adequacy,. A data is meant for factor analysis if this hypothesis is not accepted and its sampling adequacy is more than 0.5. Varimax rotation is the commonly used rotation to tune the quality of factor loadings. Number of factors to be considered for the analysis is decided by observing three items, the scree plot, the total variance covered by the factors extracted, and the factor loadings. [14]

3. Methods

This is a descriptive cross sectional hospital based study. Data was collected by the first author from one of the fertility centers situated in Pondicherry, India. Participants are patients diagnosed with primary infertility. Considering the prevalence of primary infertility as 18.9 percent, the sample size was calculated with marginal error of 6% for 95% Confidence interval with 20 % non response rate as 195. [15] One hospital was selected from a list of eighteen hospitals situated in Pondicherry by simple random sampling. The sample was all the primary infertile women who were diagnosed by this center and had their case history and investigation reports.

A pre-tested semi structured questionnaire was used for this study. It collected information on socio-economic status, anthropometric measurements, lifestyle and dietary habits of the participants. Stress level was assessed using Cohen perceived stress scale, physical activity was assessed using International physical activity questionnaire. Ethical approval was obtained from the School of public health ethics committee at SRM University, India. Approval was taken from the chief doctor and concerned health departments in the fertility centre. Informed consent was obtained from participants prior to data collection.

The data collection was carried out by the first author by covering, on the average, ten samples in a day for a period of 20 days. Face to face interview was conducted with primary infertile women in their own vernacular language. Collected data were checked for the consistency and completeness. Data were analyzed by SPSS software (22version).

4. Results

The results of this study are presented in two stages. In stage one a brief description of the data is presented. In stage two, result of factor analysis is presented. Descriptive statistics of this study is discussed in detail in another paper. A brief summary is presented here.

4.1 Descriptive Analysis

Descriptive analysis deals with the frequency and percentages of profiles of women who underwent ART program at the center. About 35% of the participants where in the age group of 28- 33 years. Around 55 % of them were married at the age of 19- 22 years. 75 % of the participants were from urban. About half of the population have completed their under graduation. About 69 % of women were working out of which 57% had day shift and 47 % of them worked for 8 hours per day. Nearly half of the participants (50%) were obese and more than half of the participants (67%) were having waist circumference greater than 80 cms.

About 50 % do moderate physical activity .It was found that larger group of participants around 92 % of them had moderate stress .About 56 % of them have watched television for 1-2 hours per day. Almost three fifth of the participant were sitting ideally or were doing sitting posture work for 1-2 hours per day. About 46 % of the participants have consumed hotel food at least once a week. Majority of the participants 90 % were non vegetarians. Almost two fifth of the participants 40 % consumed two liters of water per day. It was found that once in a week about three fifth and two fifth of the participants have consumed meat and chicken respectively. About 61 % consumed white rice once a day. About 31 % of participants consumed white bread two to four times a week. 22 % of participants had chips once a week, 29 % of participants had sweets/cakes two to four times a week. Nearly three fifth (62 %) and two fifth (48%) of the participants have consumed coffee and tea once a day respectively. About 41 % of participants consumed carbonated beverage one – three times a month.

4.2 Factor analysis to determine the lifestyle pattern

Principal component factor analysis was conducted to determine if underlying structures exist for the lifestyle related factors. Rejection of hypothesis of Bartlett's test of sphericity and the Kaiser-Meyer-Olkin (KMO = 0.601) measure of sampling adequacy more than 0.5 indicates that it is appropriate to proceed with factor analysis. Factors were also orthogonally rotated (varimax) to enhance the difference between loadings, which allowed easier interpretability. The analysis produced 7 factor solutions which explained 61% of the variance in the model. After rotation, first factor accounted for 12.5% of total variance, while the second factor accounted for 9.7 %, third factor for 8.4%, fourth factor for 7.4 %, fifth factor for 6.9%, sixth and seventh factors for 6.2 and 5.6 % respectively. Factors were retained based on the following criteria: Identification of a

breakpoint in the scree plot, proportion of variance explained and the factor interpretability. As all the sixteen variables are loaded in the five factors, we considered five factors for interpretation. The factor-loading patterns (Components) identified is presented in the following table.

4.3 Life Style Patterns

The first component consists of variables like physical activity, average sitting time per day, eating readymade food items like white bread, chips, sweets, and carbonated beverage are positively loaded. Component 1 corresponds to Physical activity and Junk foods. The second component consists of variables like type of food, chicken, meat, water intake which are positively loaded. Component 2 corresponds to animal protein diet and water. The third component is highly positively loaded with BMI, waist circumference. Component 3 corresponds to BMI-Waist circumference. The fourth Component is positively loaded with eating hotel food. Component 4 corresponds to hotel food consumption. The fifth Component is highly positively loaded with average time spent for watching TV, mobile phone usage, stress. Component 5 corresponds to Stress and sedentary lifestyle.

Table 1: Principal component analysis for lifestyle related factors

Factors	loadings
Factor 1	
Physical activity	0.411
Average time sitting per day	0.311
White bread	0.599
Chips	0.772
Sweets	0.657
Carbonated beverage	0.603
Factor 2	
Type of food(vegetarian/ non vegetarian)	0.715
Chicken	0.411
Meat	0.758
Water intake	0.779
Factor 3	
BMI	0.833
Waist circumference	0.794
Factor 4	
Hotel food	0.631
Factor 5	
Watching TV	0.578
Mobile phone usage	0.539
Stress	0.641

5. Discussion

The current study's main aim is to indentify how the life style variables are interrelated in the case of infertile women who underwent ART program using factor analysis. No attempt is made so far to take up such research. From the principal component factor analysis interesting lifestyle patterns were identified. In the first factor, participants who are physically inactive and spend more time ideally sitting had the habit of eating junk food items like white bread, chips, sweets, and carbonated beverages. This implies that lower frequency of physical active participation and higher the frequency of Junk-food consumption. Factor 1 corresponds to interaction between Physical activity and Junk foods. Hence this factor can be named as inactivity-junk food factor. Second factor consists of variables like type of food, chicken, meat, water intake which are positively loaded. Majority of the participants (90%) were non vegetarians. This result indicates that the infertile women of this study who consume chicken also consume meat. Factor 2 corresponds to animal protein diet and water. This factor named as eating pattern factor. The consumption of these foods produces more heat in the body. Studies show the consumption of meat and chicken is greatly associated with ovulatory disorder infertility. [16] Third factor is highly positively loaded with BMI, and waist circumference. Weight includes waist circumference and hence, both measurements behave alike, factor 3 is known as anthropometric factor. Obesity and the effects of abnormal weight on infertility have been reported in several papers. [17, 18] About 50% of the participants are obese. They should be advised to go for weight reduction exercise. Fourth factor is positively loaded with eating hotel food. The habit of eating hotel foods inclines the public to unhealthy eating habits where taste is given more important rather than the nutrient values. However, lack of consideration of nutrient contents, irregular eating time, poor food quality and premise's cleanliness might expose the people to certain health issues. [19] Factor 4 corresponds to hotel food consumption and it is referred to Hotel-food factor. People who frequently cook meals at home eat healthier and consume fewer calories than those who cook less, according to new Johns Hopkins Bloomberg School of Public Health research. [20] Infertile women are advised to take home based food during ART program. The fifth factor is highly positively loaded with average time spent for watching TV, mobile phone usage, and stress level. Factor 5 corresponds to stress and sedentary lifestyle and it is referred to as stress ridden sedentary lifestyle factor. This set up makes us to understand that participants who had moderate to high level of stress had the habit of watching television and using mobile phones for longer duration of time and vice versa. The effects of adult lifestyle - diet in women, and sedentary habits generally are important factors affecting the fertility of women. [21] Life style modifications such as practicing yoga or going for cognitive behavioral therapy may aid for healthy pregnancy.

Application of factor analysis on life style patterns of the infertile women in this study is described as, whenever they are inactive, they like to consume more junk food, their liking for meat and chicken are similar, and also usage of electronic visual media have made them to lead stressful life. These women are expected to modify their life style by leading active life, avoiding eating junk food, meat, chicken and hotel food very often, and not using electronic media for a longer period to increase their reproductive performance. The major limitation of this study is that of recall bias. That is, this study involves self-reported behaviors which might have been misrepresented by participants. This type of study should be repeated on different population in different location to confirm the results of this study.

6. Conclusion

The results of this study made us to believe that factor analysis is one of the suitable methods to extract patterns of life style factors responsible for poor reproductive

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performance in women. We believe that the results of this study may be of some help to clinicians treating infertile women to suggest life style modifications to the patients.

7. Recommendations

Further research is needed to confirm the current findings and to look at the associations between lifestyle factors and infertility. There may also be a cumulative effect of lifestyle habits on the outcome of fertility treatment, which should be investigated in future research.

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