5. METHODS

5.1. PARTICIPANTS

Employees were chosen from a private firm to enrol themselves for the study. In total, 160 employees (total males = 88, total females = 72) were randomly selected and allocated into two groups of equal size of 80 participants in each group [Figure 5.1]. These groups were yoga group and physical exercise group.

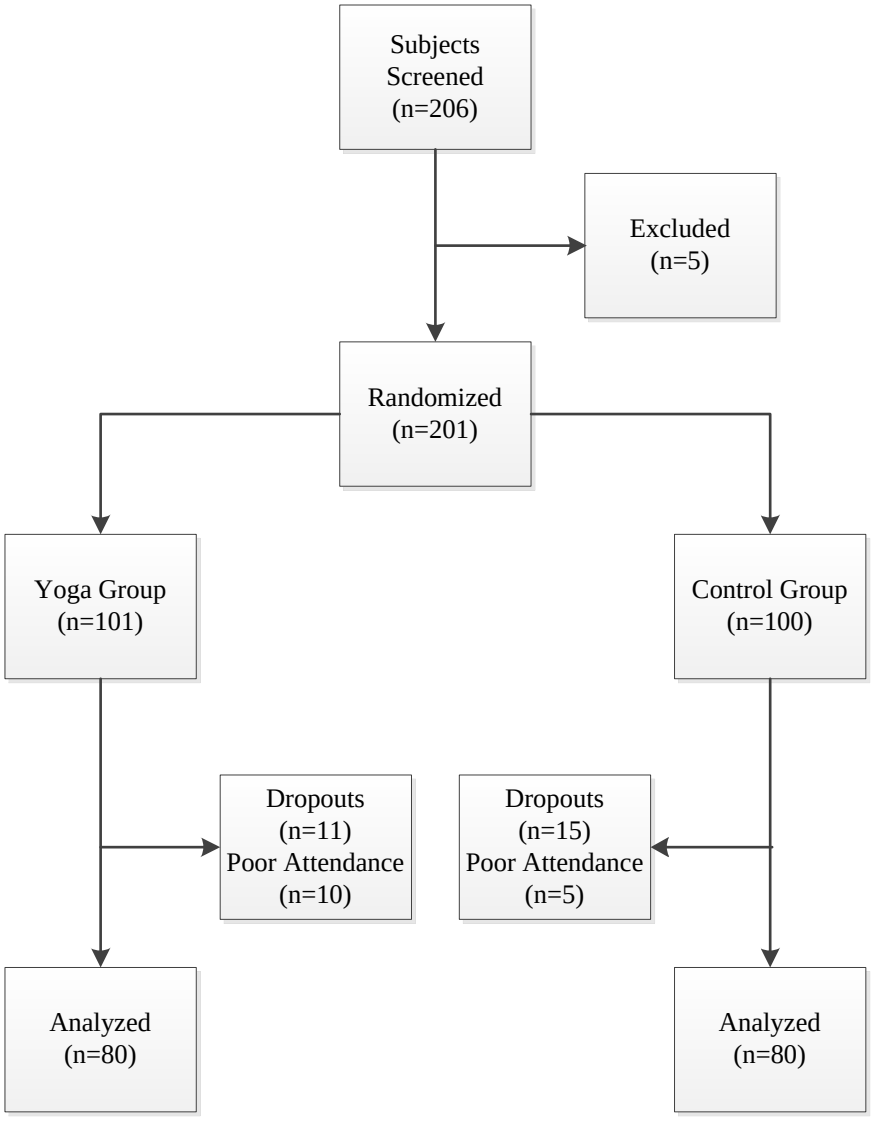

Figure 5.1. Study flow diagram of selection of subjects.

Table 5.1 shows the demographic data. The mean age for the sample for yoga group was 28.29 (*SD* = 5.21) years and for control group mean was found to be 27.20 (*SD* = 4.14) years. Gender distribution for yoga group was 46 males and 34 females wherein 42 males and 38 females in control group.

Table 5.1: Baseline characteristics of study participants

Demographic Information	**Yoga Group (n=80)**	**Control Group (n=80)**
Mean age (SD) (years)	28.29 (5.21)	27.20 (4.14)
Mean tenure (SD) (years)	4.84 (4.23)	4.03 (3.69)
Male	46	42
Female	34	38

5.1.1. Sample size

Sample size is one significant part of any study in choosing about the size of the sample going to be used in the study.

In the current study, sample is calculated to increase the precision of estimates, because for any given estimate / size of effect, the greater the sample size the more "statistically significant" the result will be. For the sample size calculation G* Power (version 3.1.9.2) program is used, assuming that we are aiming for a power required, and based on an estimate of the expected effect size, and the level of significance that we have decided to set.

Sample size analysis is done in the following steps:

1) Specify the effect size that is of scientific interest

Effect size of 0.6 was used for large effect. η^2 was used as an estimate of effect size while explaining Repeated Measures ANOVA results. The interpretation of effect size calculation was based on Cohen's *d* value (Mayers, 2013, pp. 82), effect size is large between .4 to ∞.

2) Specify the significance level of the study.

The null hypothesis is only rejected if the probability (*P*-value) is same or less than the alpha (α) level. False-positive that is type I error follows when there is incorrect rejection in the null hypothesis. There is a probability of 5% of this occurring if the alpha level value is 0.05. Alpha is often decided at 0.05 or 5% and for the current study it was also 0.05.

3) Specify the intended power of the test.

Power shows the probability of locating significance if the alternative hypothesis is true. False-negative that is type II error follows if there is incorrect acceptance of the null hypothesis. A beta (β) level can be chosen as protection against this type of error. Statistical power is defined as 1- β. Statistical power is conventionally set at 0.80 or 80% and current study set it at 0.80.

G* Power derivation:

- Effect Size = 0.6
- α err prob = 0.05
- Power (1-β) = 0.8

Output of sample size of Group 1 and Group 2 = 36 so Total = 72 (36+36)

Considering 10 % dropouts = 7.2 ~ 8

Then Total size of the participants N = 80 (72 + 8)

A total sample of N=160 (almost double the size found in the calculation above) was targeted to account for possible attrition between conditions and other factors. Sample size used in the current study was much higher than the sample size found in the calculation above. Moreover sample size of the currently study is comparable and higher than most of the similar studies done in the past.

Following list shows earlier similar studies along with given sample sizes and η^2:

1) (*E.S.*=.45, (1-β) =.8, α=.05, *N*=30) Lin, S., Huang, C., Shiu, S., & Yeh, S. (2015). Effects of Yoga on Stress, Stress Adaption, and Heart Rate Variability Among Mental Health Professionals-A Randomized Controlled Trial. *Worldviews On Evidence-Based Nursing, 12*(4), 236-245.
2) (*N*=80, η^2 = 0.25) Jindani, F., Turner, N., & Khalsa, S. (2015). A Yoga Intervention for Posttraumatic Stress: A Preliminary Randomized Control Trial. *Evidence-Based Complementary And Alternative Medicine, 2015*, 1-8.
3) (*N*=24, η^2 = 0.29) Meissner, M., Cantell, M., Steiner, R., & Sanchez, X. (2016). Evaluating Emotional Well-Being after a Short-Term Traditional Yoga Practice Approach in Yoga Practitioners with an Existing Western-Type Yoga Practice. *Evidence-Based Complementary And Alternative Medicine, 2016*, 1-9.
4) (*N*=74) Hartfiel, N., Burton, C., Rycroft-Malone, J., Clarke, G., Havenhand, J., Khalsa, S., & Edwards, R. (2012). Yoga for reducing perceived stress and back pain at work. *Occupational Medicine, 62*(8), 606-612.

5) (*N*=60) Mahadevan, B., Adhia, H., & Nagendra, H. (2010). Impact of yoga way of life on organizational performance. *International Journal Of Yoga*, *3*(2), 55-56.

6) (*N*=173) Raghuram, N., Deshpande, S., & Nagendra, H. (2008). A randomized control trial of the effect of yoga on verbal aggressiveness in normal healthy volunteers. *International Journal Of Yoga, 1*(2), 76-82.

7) (*N*=37) Shapiro, D., Cook, I., Davydov, D., Ottaviani, C., Leuchter, A., & Abrams, M. (2007). Yoga as a Complementary Treatment of Depression: Effects of Traits and Moods on Treatment Outcome. *Evidence-Based Complementary And Alternative Medicine*, *4*(4), 493-502.

8) (*N*=58) Gangadhar, B., Naveen, G., Rao, M., Thirthalli, J., & Varambally, S. (2013). Positive antidepressant effects of generic yoga in depressive out-patients: A comparative study. *Indian Journal Of Psychiatry, 55*(7), 369-373.

9) (*N*=103, η^2=0.25) Kjellgren, A., Bood, S., Axelsson, K., Norlander, T., & Saatcioglu, F. (2007). Wellness through a comprehensive Yogic breathing program – A controlled pilot trial. *BMC Complementary And Alternative Medicine, 7*(1), 1-8.

10) (*N*=42) Chan, R., Giardino, N., & Larson, J. (2015). A pilot study: mindfulness meditation intervention in COPD. *International Journal Of Chronic Obstructive Pulmonary Disease,* 445-454.

11) (*N*=30) Haden, S., Daly, L., & Hagins, M. (2014). A randomised controlled trial comparing the impact of yoga and physical education on the emotional and behavioral functioning of middle school children. *Focus On Alternative And Complementary Therapies*, *19*(3), 148-155.

12) (*N*=55) Noggle, J., Steiner, N., Minami, T., & Khalsa, S. (2012). Benefits of Yoga for Psychosocial Well-Being in a US High School Curriculum. *Journal Of Developmental & Behavioral Pediatrics*, *33*(3), 193-201.

13) (*N*=24) Meissner, M., Cantell, M., Steiner, R., & Sanchez, X. (2016). Evaluating Emotional Well-Being after a Short-Term Traditional Yoga Practice Approach in Yoga Practitioners with an Existing Western-Type Yoga Practice. *Evidence-Based Complementary And Alternative Medicine*, *2016*, 1-9.

5.1.2. Selection and source of participants

Participants were recruited from a private enterprise in engineering department of information technology sector in Pune. Adequate background information about purpose of the study was provided to participants and they were allowed to participate after they signed written informed consent form. The procedures and measures in pre- and post-tests were identical. CWB checklist and other questionnaires were managed with the help of independent individual who did not participate in subject allocation or supervision of the classes but had background of area of psychology. The procedures were explained to participants and their questions were answered. CWB related studies generally face lot of challenges because of the negative and even unlawful characteristics of these acts. In case of CWB, the participants are usually expected to rate themselves lower on CWB feedback. Since many of them were reluctant and apprehensive about the self-witnessed end results of their rating on CWB, they were given assurance that there will be confidentiality of the information and their queries of specific questionnaires were also resolved in detailed manner during rating the scale to allow them to be honest in their responses. Participant's

contraindications of health (e.g. medical surgery, severe back or cervical issues, pregnant ladies, etc.) were removed from this study to ensure safe practice and prevent any injuries. Post-test measurements were implemented in the similar manner at the end of the interventions.

5.1.3. Inclusion criteria

- Employees (male/female) volitionally involved in CWB,
- Less than 60 years of age

5.1.4. Exclusion criteria

- Employees inadvertently involved in CWB,
- Under medication or pregnant ladies,
- History of any major surgery or contraindication.

5.1.5. Ethical consideration

Permission of Swami Vivekananda Yoga Anusandhana Samsthana Institutional Ethics Committee (SVYASA-IEC), Bengaluru was taken for the study.

Informed consent was collected from all the subjects in the beginning of study, the format of the same is available in Appendices section**.**

Participant were ensured of the confidentiality of the information that the information collected from the study will be kept private and name will not be used in the reporting of information in publications or presentations and only the researcher will review and analyses the data collected. It was also told that individual information will not be shared outside the research team and results will be reported in aggregate (group level) only.

5.2. DESIGN OF THE STUDY

5.2.1. STRUCTURE OF INTERVENTION

The Scores in the given design were measured for yoga effect on Aggression, Affect and CWB. The study was a randomized control study with a pre-test (baseline), post-test design in which subjects were randomly assigned to the yoga and the control groups by randomization generated by computer [Figure 5.2]. Duration of the intervention was 10 weeks (5 Days/Week and one hour each day). Pre and Post measurements were implemented in an identical manner at the baseline and end of the interventions.

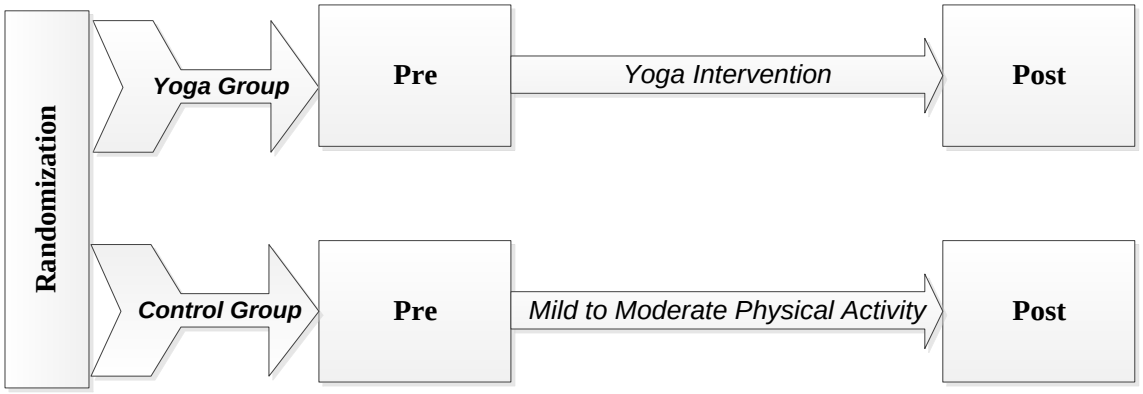

Figure 5.2. Yoga intervention research design.

5.2.2. RANDOMIZATION

Randomization was done using a computer based random generator by an independent supervisor who was not involved in the study assessments After the pre-test, the enrolled subjects were divided into either the yoga group or the control (waitlisted) group by means of randomization. In total, 160 employees (total males = 88, total females = 72) were

randomly selected and allocated into two groups (yoga and control) having 80 participants per group.

5.3. VARIABLES STUDIED (MEASURES)

The following standard and generally utilized measures were implemented at pre-intervention (baseline) and post-intervention of the ten-week intervention. The employee self-reported questionnaires were included to measure personality traits in terms such as aggression, NA, PA, and deviant behavior, that is counterproductive work behaviors (CWB) [Figure 5.3].

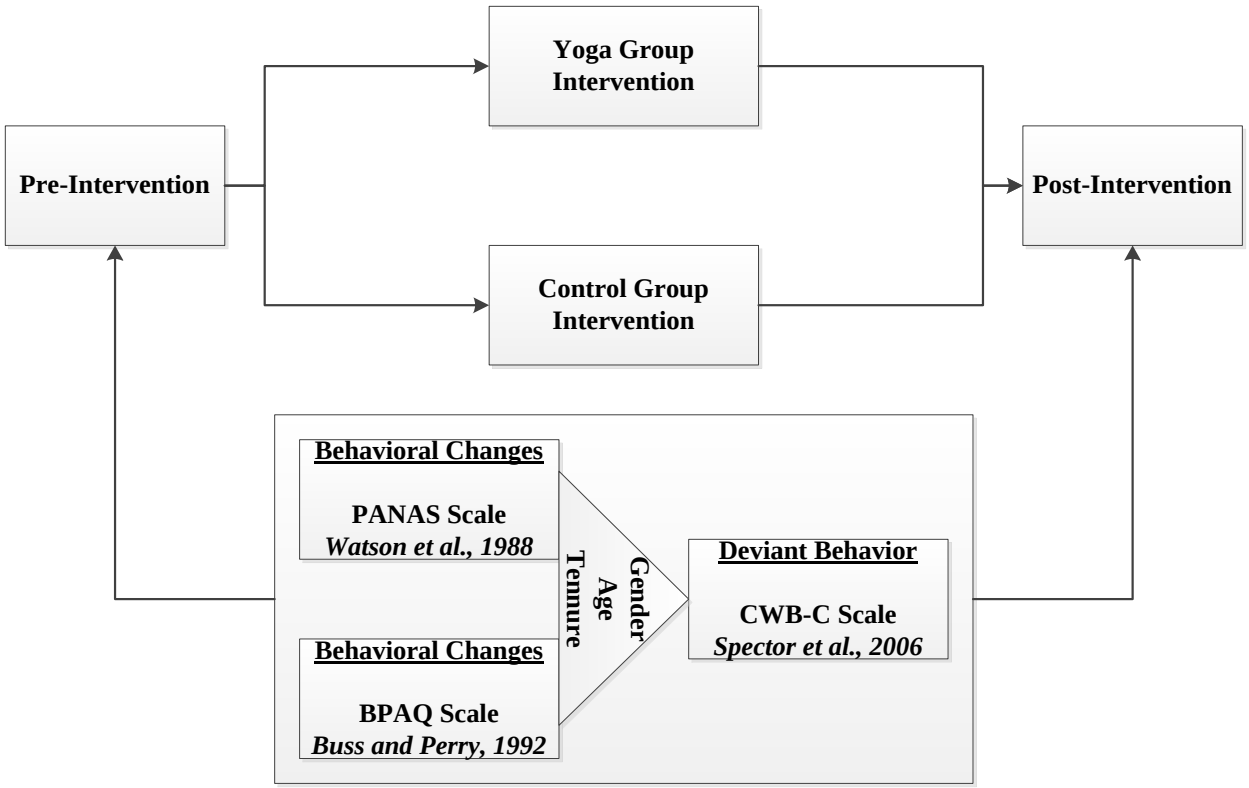

Figure 5.3. Diagrammatic representation of assessment methods.

5.3.1. Buss and Perry Aggression Questionnaire (BPAQ)

Buss and Perry's (1992) Aggression Questionnaire (BPAQ) of 29-item was used to measures trait aggressiveness. There are four distinct behavioral sub traits, and can be represented by individual subscale. These subscales are anger, hostility, physical and verbal aggression. Responses of the participants were collected on scale (5-point Likert) that range from 'Extremely uncharacteristic of me' to 'Extremely characteristic of me'. Buss & Perry (1992) reported internal consistency of .89 for total score. Alpha for the aggression scale in this study was .866.

5.3.2. Positive and Negative Affect Schedule (PANAS)

The 20-item scale from Watson, Clark, and Tellegen's (1988) was used to measure PA and NA. This scale comprises of words that define positive emotions (for example, Determined, Attentive, and Active) and negative emotions (for example, irritable, upset, and scared). Participants were requested to specify the level to which they normally feel each emotion, with response options ranging from 1 (very slightly or not at all) to 5 (extremely). Scores with higher values indicate high levels of PA and NA. For the Positive Affect Scale Watson et al. (1988) reported the Cronbach alpha coefficient of .86 to .90. In case of Negative Affect Scale, 0.84 to .87. The internal consistency for the PA scale in this study was .865 for baseline scores and NA scale it was .951 for baseline scores.

5.3.3. Counterproductive Work Behavior Checklist (CWB-C)

Deviant behavior was assessed by the Counterproductive Work Behavior Checklist (CWB-C) (Spector et al., 2006) that contains 45 item CWB-C, covering behavioral reactions of an individual. This scale contains two subscales in such a way that scoring is possible on

all items or as two subscales. These subscales are categorized into CWB for individual and the organization. Responses of the participants were collected on scale (5-point Likert), with range of 'never' to 'once or twice per week. Spector et al. (2006) reported that coefficient alphas ranged from .55 to .90 for the various subscales. For this study, the internal consistency with the present sample was .868.

5.4. INTERVENTIONS

The study was a randomized control trial with a pre-test and post-test design in which subjects were allocated to the yoga group and the control group in randomization by computer generated program.

5.4.1. Rationale behind intervention protocol

Inclusion of the various topics and practices of intervention is based on the background study of the benefits of the practice. Intent was to select practices which will help people overcome habit of deviant behavior, aggression and negative emotions. Various literature sources (Yoga Poses Categories, 2016; Yoga and Food, 2016; Benefits of Sun Salutation, 2016; Benefits of Meditation, 2016; Satyananda Saraswati, 1996; Iyengar, 2009) are sought to arrive at finalizing fix set of yoga intervention routine. Benefits of each practice are outlined below.

Yogic Theory:

Ancient yoga theory creates base for the understanding of purpose of practicing yoga. It also helps in understanding of *guṇa* of individual person. Yogic philosophies are full of psychological wisdom and give richer insight of our understanding for self. Modern research in psychology might not have come from recent research outcome but it reveals great similarity with ancient knowledge of yoga (Vorkapic, 2016).

Yogic Diet:

Sattvik diet is useful for the purification of body and calming effect on mind. It gives feeling of lightness, energetic and freshness. *Rajasik* diet leads to unstable body and mind. *Tamasik* diet results in lethargy.

Postures, Pranayama and Meditation:

postures have subtle positive effect on our system and mind because mind ,body, emotion and thoughts are linked. Postures work on the anatomical body and pranayama works on pranic level of improvements.

Sūrya Namaskāra: It activates solar plexus and it results in creativity and enhances psychic abilities. It also serves as warm-up for postures makes body ready to perform posture practice. It removes all fatigue and laziness. If done with fast pace then it acts as a good cardiovascular activity. It increases endurance and removes anxiety and restlessness.

Trikoṇāsana: It stimulates nervous system and alleviates nervous depression. Reduces anxiety, stress, back pain and sciatica and Increases equilibrium of mind and body, reduces back pain and sciatica.

Vīrabhadrāsana: It generates auspiciousness and peace. Also good for developing courage, grace and peace. It is beneficial for people with sedentary lifestyle and jobs. It relieves cramps in legs. Brings elasticity to legs and back muscles.

Pārśvakoṇāsana: It increases peristaltic activity and relieves body pain. Abdominal organs are more contracted and that aids digestion. Helps good blood circulation in abdominal and spinal regions.

Vṛkṣāsana: It rejuvenates. It gives a sense of balance and poise. It improves concentration. It stretches legs, arms and back.

Ardhamatsyendrāsana: Improves oxygen intake of lungs and makes spine flexible. It massages liver and spleen. It improves digestion.

Bhujangāsana: It tones abdominal area and it is good for reliving fatigue and stress. It improves respiration. This posture is known to relieve back-pain. Also helpful for blood circulation.

Bhastrikā: Removes toxins and balances *tridoṣa*. It increases exchange of oxygen and carbon dioxide into the bloodstream. Increases metabolic rate. It helps in inducing peace, tranquillity, concentration and helps do meditation easily.

Kapālabhāti: It cleanses respiratory system. Balances nervous system, Helps in purification of *nāḍī*. It helps in energizing mind and removes insomnia issue.

Anuloma-Viloma: Increases awareness. It activates right and left hemisphere of brain. It purifies *nāḍī*. It balances energy. It is helpful in stress related disorders. It balances nervous system.

Bhrāmari: It reduces stress and cerebral tension and therefor very good to take control of anger and anxiety. It generates base for meditative state. It brings awareness inward. Resonance of the sound creates soothing effect in the mind and in the nervous system.

Yoganidrā and Dhyāna:

Meditation and *Yoganidrā* practices are important tools to combat aggression, conflicts and other psychological issues. It builds awareness, decision making ability, calmer mind and body, clarity of thoughts, positive affect. These practices also have physiological benefits such as low BP, improved immune system and improved energy. Other psychological benefits are stability of mind, increased creativity, feeling of well-being, contentment, and inward awareness.

5.4.2. Grouping and schedule

Groupings and schedule were as follows:

Yoga Group:

a) Theory and postures (35 minutes): Yogic theory on *Rāja-Yoga*, *Bhakti-Yoga*, *Karma-Yoga*, *Jñāna-Yoga*, and *Sattvik* diet. *Asana* covered were *Sūrya Namaskāra* (Sun Salutations), *Trikoṇāsana* (Triangle Pose), *Vīrabhadrāsana* (Warrior Pose), *Pārśvakoṇāsana* (Side Angle Pose), *Vṛkṣāsana* (Tree Pose), *Ardhamatsyendrāsana* (Half Twist Pose), and *Bhujangāsana* (also known as Cobra Pose).

b) Breathing (15 minutes): *Bhastrikā* (Bellows breathing), *Kapālabhāti* (Skull shining breathing), *Anuloma-Viloma* (nostril breathing- alternate), *Bhrāmari* (Bee breathing)

c) Meditation (10 minutes): *Dhyāna*, *Yoganidrā*

Control Group:

a) Physical activity and theory (35 minutes): Theory on project management. Physical activities covered were *Spot Jogging, Loosening exercises, Strengthening exercise, Wrist movement and rotation, Neck movement and rotation, Head movements and rotations*.

b) Breathing (15 minutes): *Normal slow breathing*

c) Rest (10 minutes): *Resting*

5.5. DATA EXTRACTION

A self-report measure is the approach which has been taken in research which attempts to establish base rates of various types of behavior. There are potential problems with self-report measures when the research topic contains topic of sensitive matter such as CWB. Individuals will likely be reluctant to reveal that they engage in deviant behaviors if they feel that their responses are likely to be identified and are not kept confidential. If there is underreporting for this reason, then the prevalence of deviant behaviors will be underestimated. This possible problem was taken care of by ensuring that the survey data will be completely kept unidentified (anonymous) and confidential. Making participants understand that the data collected for the study would be used for the analysis of research only and that their employer would not have access to the data made it more likely that individuals responded in a straightforward and honest manner. Anonymity and confidentiality of the data was emphasized [Figure 5.4].

Base line assessment was done by self-administering standardized questionnaires. Questionnaires were scored using 5 point-likert scales mentioned earlier. Data collection was done for each of the subjects before (Pre) and after (Post) yoga intervention.

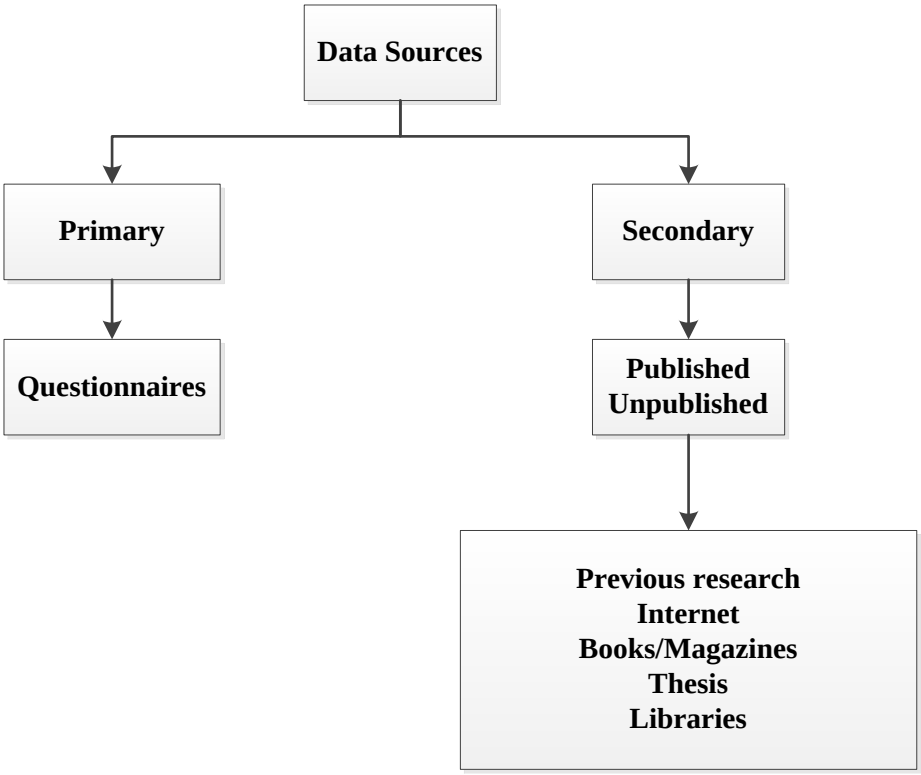

Figure 5.4. Diagrammatic representation of data collection methods.

5.5.1. Scoring details of PANAS scale

Scale :

- *PANAS (Positive & negative affect schedule)* (Watson,Clark, Tellegen, 1988)

Items:

- 20-item

5-point scale :

- 1-Very Slightly or Not at All , 2-A Little , 3-Moderately , 4-Quite a Bit, 5-Extremely

Reliability **:**

- 0.86 to 0.96 for positive affect and 0.84 to 0.87 for negative affect

Scoring of affectivity:

Response	Score
Very Slightly or Not at All	1
A Little	2
Moderately	3
Quite a Bit	4
Extremely	5

Positive Affect Score: Add the scores on items 1, 3, 5, 9, 10, 12, 14, 16,17, and 19. Scores can range from 10 – 50, with higher scores representing higher levels of positive affect.

Negative Affect Score: Add the scores on items 2, 4, 6, 7, 8, 11, 13, 15, 18, and 20. Scores can range from 10 – 50, with lower scores representing lower levels of negative affect.

Earlier Usage in India:

- Narasimhan, L., Nagarathna, R., & Nagendra, H. (2011). Effect of integrated yogic practices on positive and negative emotions in healthy adults. *International Journal Of Yoga*, *4*(1), 13-19.
- Pandey, R. & Shrivastava, N. (2008). Psychometric evaluation of a hindi version of positive-negative affect schedule. *Industrial Psychiatry Journal*, *17*(1), 49-54.
- Rajesh, S., Pradhan, B., Deshpande, S., Ilavarasu, J., Singh, R., & Singh, M. (2015). Hindi version of Vedic Personality Inventory-reliability and construct validity. *International Journal of Yoga - Philosophy, Psychology and Parapsychology*, *3*(1), 1-4.

5.5.2. Scoring details of BPAQ scale

Scale :

- *The Buss Perry Aggression* (Buss & Perry, 1992)

Items:

- 29-item; 1-9 Physical Aggression; 10-14 Verbal Aggression; 15-21 Anger; 22-29 Hostility

5-point scale :

- 1 (extremely uncharacteristic of me) to 5 (extremely characteristic of me)

Reliability :

- Physical Aggression at 0.85, Verbal Aggression at 0.72, Anger at 0.83, Hostility at 0.77, and the total BPAQ score at 0.89

Scoring of workplace aggression:

Response	Score
Extremely uncharacteristic of me	1
Somewhat uncharacteristic of me	2
Neither uncharacteristic nor characteristic of me	3
Somewhat characteristic of me	4
Somewhat characteristic of me	5

The Aggression scale consists of 4 factors, Physical Aggression (PA), Verbal Aggression (VA), Anger (A) and Hostility (H). The total score for Aggression is the sum of the factor scores.

Earlier Usage in India:

- Sharma, M. & Marimuthu, P. (2014). Prevalence and psychosocial factors of aggression among youth. *Indian Journal of Psychological Medicine*, *36*(1), 48-53.
- Rohtash, S. (2011). Family environment and personality as predictors of aggression. *Indian Journal Of Psychological Science*, *2*(2), 19-28.
- Gupta, A. (2016). Sociodemographic characteristics and aggression quotient among children in conflict with the law in India: A case–control study. *The national medical journal of India*, *28*(4), 172-175.

5.5.3. Scoring details of CWB-C scale

Scale :

- *Counterproductive Work Behavior Checklist* (CWB-C) (Paul E. *Spector*, 2006)

Items:

- 45-item , CWB-Org: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 13, 14, 15, 16, 17, 18, 19, 22, 23, 24, 25 ; CWB-Person: 11, 20, 21, 26-44

5-point scale :

- 1-Never, 2-Once/Twice,3-OnceOrTwice/Month,4-OnceOrTwice/Week,5-EveryDay

Reliability :

- Abuse at 0.85,Production deviance at 0.63, Sabotage at 0.55, Theft at 0.63 , Withdrawal at 0.64, CWB-Organization at 0.86, CWB-Person at 0.86, CWB-Total at 0.90

Scoring of CWB:

Response	Score
Never	1
Once/Twice	2
OnceOrTwice/Month	3
OnceOrTwice/Week	4
EveryDay	5

To score the CWB-C, sum responses to items shown below for each subscale (organizational versus person), or all the items for the total score.

CWB organization: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 13, 14, 15, 16, 17, 18, 19, 22, 23, 24, 25.

CWB person: 11, 20, 21, 26-44.

Earlier usage in India and Indian subcontinents:

- Rishipal, & Jain, N. (2016). Employee Obsolescence and Counterproductive Work Behavior among Employees of Government Organizations and Departments. *European Journal Of Business And Management*, *2*(27), 82-86.
- Rana, H. & Punia, B. (2014). Management Mechanisms and Implications of Workplace Deviance for Green Organisational Behavior, *2*(8), 1-8.
- Sharma, A. & Thakur, K. (2016). Display of Counter Productive Work Behavior in Relation to Person-Organization Fit. *Global Journal of human-social science: Arts & Humanities - Psychology*, *16*(1), 1-9.

5.6. DATA ANALYSIS

The analysis of the data was done in SPSS (Statistical Package for Social Sciences) (version 21). The results pertaining to the analysis was done and the graphical representation of relevant results was presented [Figure 5.5].

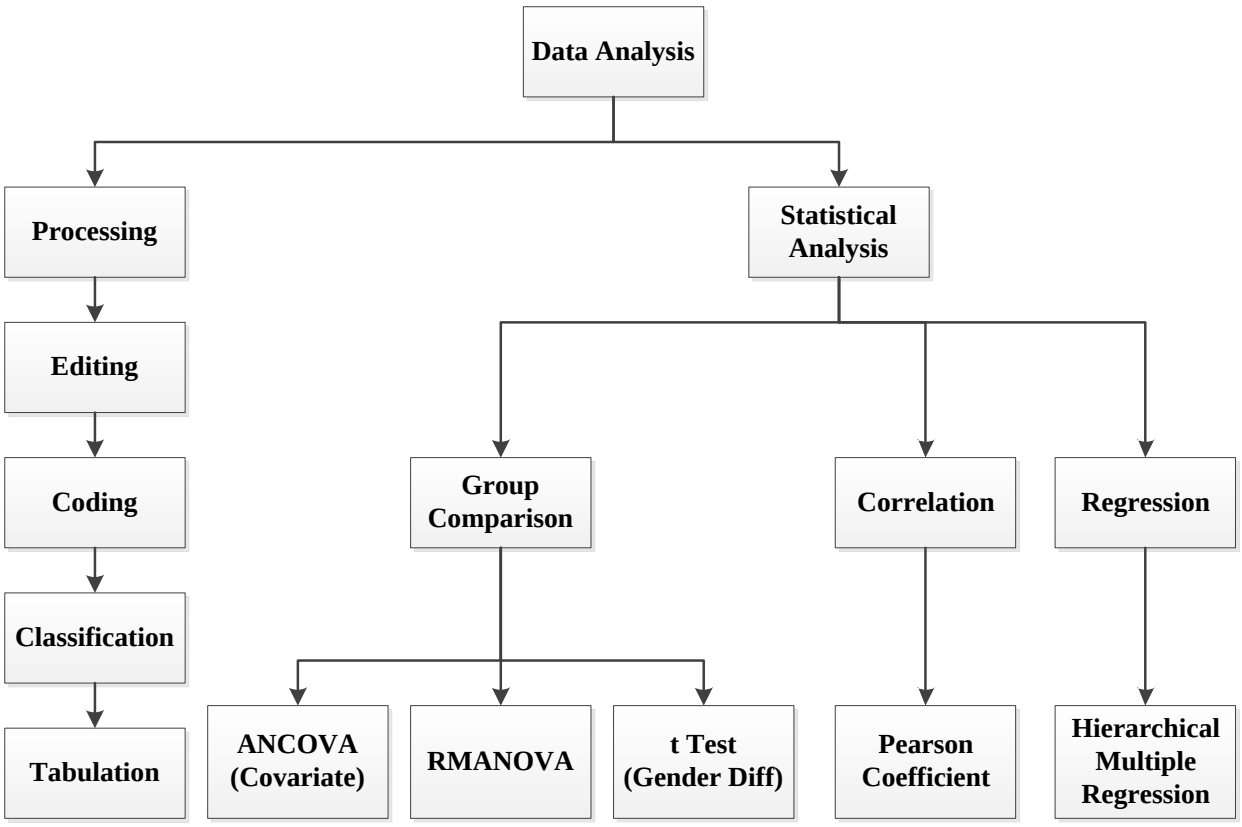

Figure 5.5. Diagrammatic representation of analytical methods.

5.6.1. Parametric tests

Following statistical tests that were used to analyze the data to test the hypotheses. Data was coded in Excel and imported to SPSS for analysis.

1) Statistical tests (For Correlation):

The Pearson product-moment correlation coefficient is a measure of the strength of the linear relationship and it was used to evaluate the association of demographic variables, CWB, NA, PA, and aggression [Figure 5.6].

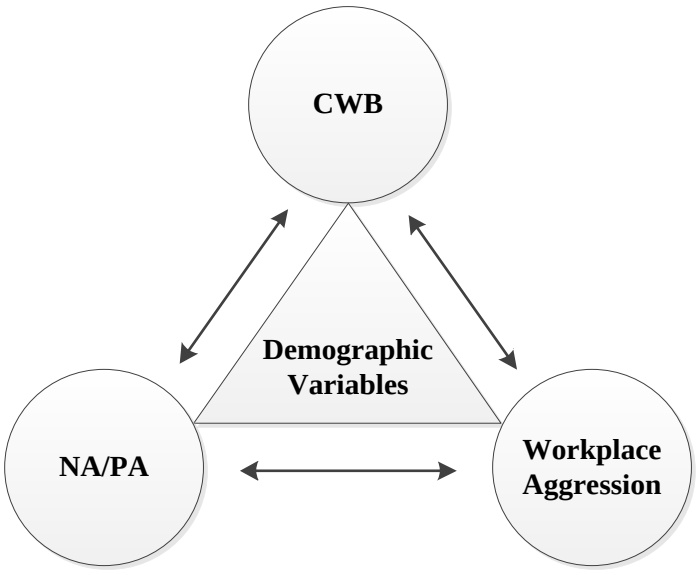

Figure 5.6. Diagrammatic representation of correlation.

Following guidelines were followed:

- A correlation coefficient of 0.0 indicates that there is no relationship.
- A correlation coefficient of -1.0 (inverse relationship) or + 1.0 (direct relationship) indicates a perfect relationship.
- As a rule of thumb, *r* values of 0 to .2 are generally considered weak, .3 to .6 moderate, and .7 to 1 strong

This test will provide following information:

- Direction of the relationship
- Strength of the relationship (r)
- Coefficient of determination (r^2)
- Significance level

2) Statistical tests (For group comparison):

The data presented in Repeated Measures ANOVA (RMANOVA) design includes a measure repeated over time, a measure repeated across more than one condition or several related and comparable measures. Filtering of error variance was performed by means of Analysis of covariance (ANCOVA) test, using baseline scores as covariate. In the current study, two groups were present those were yoga and control group for two conditions that is pre and post interventions. Differences between groups in demographic variables were analysed using chi-squared as appropriate. Gender difference was analyzed using independent *t*-test.

3) Statistical tests (For Regression):

Hierarchical Multiple linear regression was used to evaluate how well aggression, gender and interaction of aggression and gender predicted the outcome of CWB. In the first step aggression was entered and Gender was entered in the second step. Finally aggression and gender interaction product was tested [Figure 5.7].

This test provides following information:

- Multicollinearity: This will be calculated by formula 1 - R Square for each variable
- R Square to measure variances R, R^2, ΔR^2

- R : R is a measure of the correlation between the observed value and the predicted value of the criterion variable.
- R^2: measure of how good a prediction of the criterion variable we can make by knowing the predictor variables
- ΔR^2: variance in the criterion variable.

- Standardized regression coefficients (β) - how strongly each predictor variable influences the criterion variable. The gradient (beta) tells us how outcome values change for every unit change in the predictor. Higher the beta value the greater the impact of the predictor variable.
- *t* value is used to test if predictor makes a meaningful contribution to the variance. whether the gradient is 'significantly greater than 0.

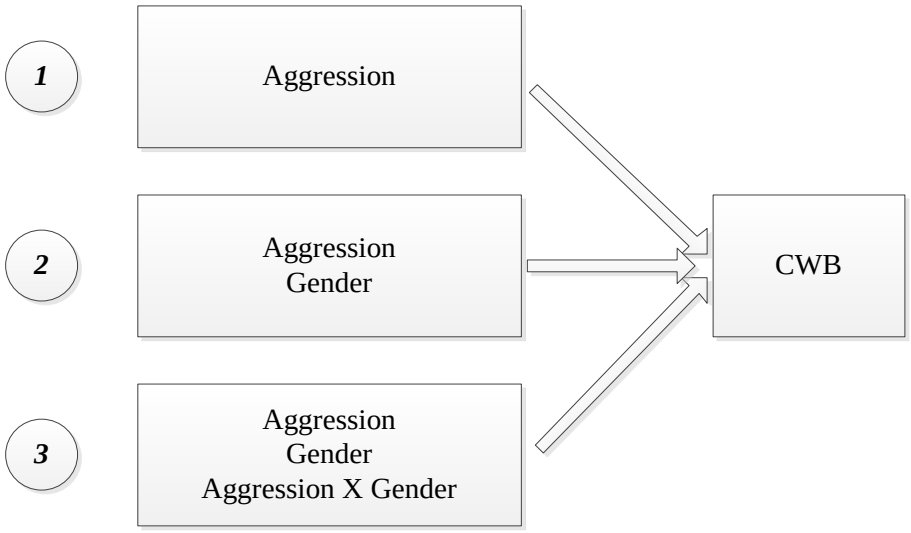

Figure 5.7. Stages of hierarchical multiple regression.

5.6.2. Assumptions of parametric tests

In statistical analysis, all parametric tests assume some certain characteristic about the data, also known as assumptions. Violation of these assumptions changes the conclusion of the research and interpretation of the results. Depending on the parametric analysis, the assumptions vary. Current study verified violation of these assumptions for accurate and precise interpretation.

Independence of observation: There was no relationship between the observations in each group or between the groups themselves because there were different participants in each group with no participant was involved in more than one group. each participant responded to their own survey without any interaction with any other participant who was completing a survey at the same time. Thus, there is no reason to expect that the assumption of independence was violated for this data.

Normal Distribution: The populations from which the samples are taken are normally distributed. With large sample size (e.g. 30+) violation of sample size should not cause any major problem (Pallant, 2013, p 198). According to central limit theorem, the sample is large enough where the sample size is greater than 40 and the distribution must have no outliers and a common suggestion is that the Kolmogorov–Smirnov test should be used in samples greater than 50, while the Shapiro–Wilk test is better for samples smaller than that (Mayers, 2013).

Following numerical and visual outputs were investigated to ensure sample is normally distributed (Mayers, 2013).

1) z-scores for skew and kurtosis were within limits of +1.96 and -1.96

2) The Kolmogorov–Smirnov test showed $P > 0.05$

3) Graphical Methods:

    a. Histograms were bell shaped,

    b. Normal Q-Q plots were liner and plotted values did not vary from plotted value vary more from a straight line

    c. Box Plots were symmetrical both the sides.

Homoscedasticity - Homogeneity of variance: Variability of scores for each of the groups was similar. Since Levene's test is a diagnostic statistic that tests the null hypothesis that the variance is homogeneous or equal across all cells . In the current study, Levene's test value was greater than 0.05.

Type 1 Error/ Type 2 Error: Type 1 error (reject Null hypothesis when it is true) was avoided by using $\alpha = 0.05$. Type 2 error (fail to reject Null hypothesis when it is false) was avoided by taking power = 0.8 (80%) . Power is also affected by sample size. When sample size is large (N=100 or more), "power is not an issue" (Pituch & Stevens, 2016).

Random Sampling: Random allocation is a procedure in which identified sample participants are randomly assigned to a treatment and each participant has the same probability of being assigned to any particular treatment. Sample observations in the current study were obtained using computer generated random allocation.

Effect Size: An effect size is a quantitative measure of the difference between two groups. Eta squared ($\eta 2$) calculation was done to report the effect size. The meaning of effect size varies by context, but the standard interpretation as given by Mayers (2013) is:

- .4 to ∞ = large

- .25 to .4 = moderate
- <.25 = small

Effect size value (*d* = .6) was assumed to calculate the sample size of the study.

Influence of treatment on covariate measurement: Covariate was measured prior to intervention. This was done to avoid covariate also being influenced by the treatment.

Reliability of covariate:

ANCOVA assumes that covariates are measured without error and to ensure that, current study used scales which have high internal consistency and reliability.

Linear relationship between dependent variable and covariate: There is a relationship between the dependent variable and each covariate is linear (straight line). Violations of this assumption are likely to reduce the power (sensitivity) of the test. Scatter plots were used to validate it graphically. General distribution of scores for each of the groups appeared to be a linear in the study and no curvilinear indicator was observed.

Homogeneity of regression slopes:

This assumes that the correlation between the covariate and dependent variable does not differ significantly across the independent variable groups This was verified by similar slopes on the regression line for each group. Equal slopes indicated that there is no interaction between the covariate and the treatment. Slopes were parallel in current study. Also tested by means of interaction variables (*Group * Baseline Score*) using custom univariate model and it was greater than 0.05, that means current study has not violated the assumption of homogeneity of regression slopes.

Level of measurement:

It is concluded that parametric tests can be performed on Likert scale data and they do not affect the conclusions drawn from the results (Norman, 2010). We have also compared similar other studies and found them using Likert scale.

Multicollinearity:

Multicollinearity exists whenever two or more of the predictors in a regression model are moderately or highly correlated. In multiple regression, the variance inflation factor (*VIF*) is used as an indicator of multicollinearity. Computationally, it is defined as the reciprocal of tolerance: $1 / (1 - R^2)$. All other things equal, researchers desire lower levels of VIF, as higher levels of VIF are known to affect adversely the results associated with a multiple regression analysis. In fact, the utility of VIF, as distinct from tolerance, is that VIF specifically indicates the magnitude of the inflation in the standard errors associated with a particular beta weight that is due to multicollinearity. Various recommendations for acceptable levels of VIF have been published in the literature. To satisfy the criteria to avoid multicollinearity, we need the '*Tolerance'* data not to be too close to 0. Scores below .1 are of serious concern; scores below .2 might cause some concern (Menard, 1995). In the current study multicollinearity was examined through "collinearity diagnostics" of regression calculation. Tolerance in the given study was above that, so it was good. The *VIF* figure performs a similar check on collinearity between the predictor variables and is the reciprocal of tolerance. *VIF* scores above 10 indicate a problem (Myers, 1990). The *VIF* scores found in the study were within the required range.

Sphericity:

Sphericity is the condition where the variances of the differences between all combinations of related groups (levels) are equal. The violation of sphericity is serious for the Repeated Measures ANOVA, with violation causing the test to become too liberal (i.e., an increase in the Type I error rate). Therefore, determining whether sphericity has been violated is very important. Mauchly's Test of Sphericity tests the null hypothesis that the variances of the differences are equal. In the current study there were only two groups and Sphericity was confirmed as 1.000 (maximum), which is highly non-significant. Mauchly's Test of Sphericity indicated that the assumption of sphericity had not been violated.