CHAPTER 3

METHODOLOGY

Methodology refers the theoretical analysis of methods appropriate to field of study or to body of methods and principles particular to a branch of knowledge. Research methodology is a way to systematically solve the research problem, the present chapter unfolds various methods and techniques that were used to conduct this study and arrive at conclusions.

The present study is combination of descriptive study specially classified under survey study and experimental method. The subtopics covering the methodology of this study in brief are grouped as under:

1) Research Process
2) Research Design
3) Research Variables
4) Conceptual Framework
5) Operational Definitions
6) Sample Design
7) Analysis of the data
8) Limitations of the study
9) Delimitations of the study

3.1 Research Process
The study progressed in five major steps: literature search, research design and procedure for contacting respondents, data collection method and assessment and redesigning living rooms

3.1.1 Literature search:
The literature search includes both printed and electronic sources. Printed material includes books, reports, dissertations, periodicals
(journals, magazines) statistical report, manuscripts, dictionaries, conference proceedings and hand books.

I. **Printed sources:** Printed material included books, reports, dissertations periodicals (journals, magazines, statistical report, manuscripts, dictionaries, conference proceedings and hand books.

II. **Electronic sources:** Online data base were used to search electronically available information (journal articles, magazines) abstracts, reports, briefing papers, working papers, annual reports and bulletins.

The data base includes

1. Auto Cad electronic programs.
2. 3D max electronic programs.
3. Resource Information Center.
4. Inflibnet library.
5. Electronic collection online sites.
6. Electronic books and articles. (Time and saver).

### 3.2 Research Design

Research design is a basic plan for a piece of research. It provides the glue that holds the research study together. A design is used to structure the research, to show how all the major parts of the research study- the samples of groups, measures, treatments or programs, and methods of assignment work together to try to address the central research questions. In conformity with the objectives of the study, descriptive survey and experimental design were formulated to proceed with the study. Descriptive survey was planned and systematically carried out to gather data on background characteristics, anthropometric measurements, and ergonomic in design furniture’s operation. Experimental research design was used to plan the living rooms with the ergonomic consideration, 5\textsuperscript{th}, 50\textsuperscript{th} and 95\textsuperscript{th} percentile of residents’ in terms of anthropometric data.
3.2.1 Search for the sample

Area, population and literacy rate (Hodaidah city)

Hodaidah (also called Hudaida or Hodeidah) (Arabic: الحديدة) is the fourth largest city in Yemen with a population of 400,000 people, and the Centre of Hodaidah Governorate. Situated on the Red Sea, it is an important port,
exporting coffee, cotton, dates and hides. It was developed as a seaport in the mid-19th century by the Ottoman Turks. In 1914, during the First World War German troops led by Major Freiherr Othmar von Stötzingen established a wireless station at Hodaidah, which was used during the Arab Revolt to relay communications from Constantinople to German East Africa as well as broadcast propaganda to the Sudan, British Somaliland and Abyssinia. (Waugh, 1937)

The city was briefly occupied by Saudi forces during the Saudi–Yemeni War of 1934.

After a disastrous fire in January 1961 destroyed much of Hodaidah, it was rebuilt, particularly the port facilities, with Soviet aid. A highway to Sana, the capital, was completed in 1961. The city was also the site of a Soviet naval base in the 1970s and 1980s.

**Hodaidah city is divided into three districts**

1. Al Hali District is a district of the Hodaidah Governorate, Yemen. As of 2003, the district had a population of 168,155 inhabitants (Population, 2004).

2. Al Hawak District is a district of the Hodaidah Governorate, Yemen. As of 2003, the district had a population of 155,837 inhabitants (Population, 2004).

3. Al Mina District is a district of the Hodaidah Governorate, Yemen. As of 2003, the district had a population of 92,144 inhabitants (Population, 2004).

**Location:**

The Yemen country is in the Middle East, occupying the southwestern corner of the Arabian Peninsula. Arabia Tall mountains divide Yemen’s coastal stretches from a desolate desert interior.
Yemen is sparsely populated-half of the country is uninhabitable-and its Arab people are largely rural. The site of several prosperous civilizations in ancient times, Yemen declined in importance and was a poor and forgotten land for more than a thousand years.

The discovery of oil in the area in the late 20th century held out the prospect of economic development and an easier life for the people of Yemen. The Republic of Yemen was created in 1990 out of the unification of the Yemen Arab Republic (YAR) and the People’s Democratic Republic of Yemen (PDRY). The YAR was commonly called North Yemen, and the PDRY was generally to the east and southeast of North Yemen. Referred to as South Yemen, although South Yemen was actually less to the south than Sana’a (Sanaa) is the Republic of Yemen’s capital and largest city.

Yemen is bounded on the west by the Red Sea and on the south by the Gulf of Aden (an arm of the Arabian Sea, which is part of the Indian Ocean, and is separated from Africa by the narrow strait of Bab el Mandeb. To the north and northeast lies Saudi Arabia and to the east is Oman; these two countries are Yemen’s only contiguous neighbors. Yemen covers about 527,970 sq km (about 203,850 sq mi). The main cities are Sana’a, Aden, Taiz, Hodidah and Mukala. The population of Yemen is 21.0 million in 2005. There are 5 major public universities: Sana’a University, Aden University, Taiz University, Hodidah University and Hadramout University.

The sample was selected from the city of Hodaidah, Republic of Yemen. The population of the present study included those abodes which were constructed using old Turkish style and traditional Yemeni style. The selection criteria which guided the sample selection were as follows:

1. The selected abode should have fully furnished living room.
2. The selected abode should have respondents form all selected age groups.
3. The selected abode should be from Hodaidah city, Yemen.
4. The selected respondents should be willing to participate as subject for the study.
5. The selected respondents should be willing to accept the changes of the living room design.

**Confidentiality**  The selected respondents were given assurance about the Confidentiality and were informed that the data was to be used for educational purpose only. A letter of introduction from the department, Identity card, University permission was carried along with PhD scholar to get positive response.

### 3.3 Variables of the study.

A variable is any characteristic that varies across people or situations that can be of different levels or types, the variables selected for the present study along with the rational for selecting; these Variables have been presented as follows:

a) **Independent variable:**

   **Age** of the selected respondents

   From birth to old age the changes reported are significant that may be accounted for most of the engineering situations (A Damon -1971). One needs to consider age before assessing discomfort of the furniture and before redesigning new furniture. Activities carried out in living room.

b) **Dependent variable:**

   Body discomfort experienced by living room users

### 3.4 Conceptual framework

A Conceptual framework provides a "cognitive map", or set of interrelated concepts for understanding a process (Boone, 2002).

a) **Conceptual framework for descriptive study:**

   To get clearer and deeper understanding of the way in which interior design of living room operation causes discomfort to the Hodaidah city
respondent, an attempt was made to identify various possible variables which have their contribution in rendering this operation arduous and drudgery. Guided by available literature and related researches, the variables were organized to develop a conceptual framework. The schematic representation of the various factors which were thought to be contributive in ergonomic investigation in the Interior Design of living room in the residential buildings in Hodaidah city.

b) Conceptual framework for study:

The study conceptualized that impact of the use of traditional furniture to the users of living rooms of selected house hold in Hodaidah city. The ergonomic assessment was done in terms of physiological cost, body discomfort experienced, and human dimensions relation to the anthropometric characteristic of the residents in living room, on the basis of anthropometric measurements the rooms were re designed to increase comfort of the users.

The design process in living room has four major components: construction, form giving, shaping, major aesthetics, and ergonomics (including anthropometry).

The process of product design and development is an interactive integration; often a compromise between these four aspects (Roozenburg and Eekels 1995) and frequently the result of working in teams (Buijs and Valkenburg 2002).

The design of a standard for living room furniture is focused on the dimensions of the furniture in relation to the body dimensions of the respondents for the structural development of a new system of sizing for living room furniture.
Figure. No. 26: Conceptual Framework For Study
Flow chart of the research

- Ergonomic Investigation in the Interior Design of Living Room in the Residences of Hodaidah City.
- Selection of Residences in Hodaidah City (416 Stratified Random Sampling)
- Experimental Study (40 Houses Purposively Selected)
- Anthropometric Measurement of (1%) Population Selected
- Collection and Analysis of Data
- Sketch and Photos of Existing Interior of Living Room
- Developing New Ergo-Friendly Living Room Interior Design
- Suggestion for Healthy Living Room Interior Design

Ergonomic Investigation in the Interior Design of living room in the residences of Hodaidah city.

Figure. No.27 : Flow chart of research
Figure no 27 shows the flow chart of research and the progress of research work carried out by the researcher in different stages.

3.5 Operational definitions:

- **Small children**: Male /Female children between the ages of 3 years to 10 years are operationally defined as small children.
- **Adolescent**: Male /Female children between the ages of 11 years to 17 years are operationally defined as adolescent.
- **Adult**: Male /Female individual between the ages of 18 years to 40 years are operationally defined as adult.
- **Older groups**: Male /Female individual between the ages of 41 years to 65 years are operationally defined as older groups.
- **Body discomfort**: It is defined as the pain arising as a result physical problems experienced by users of the living room because of the living room furniture that does not fit with anthropometric measurements.

3.6 Sampling design

**Sample and sample size:**
A multistage purposive cum random sampling was done to select sample of the study. Stratified weighted random sampling was used for drawing sample for general survey and purposive sampling was used for study group. The sample for survey was selected from Hodaidah city population about 416136 inhabitants (Population, 2004). One percent of the total population (416) population was selected for anthropometric measurements and survey. Out of 416 houses holds 40 houses and their living rooms were studied for furniture arrangements and the problems faced by the occupants. Ten households were purposively selected for redesigning the interior of living room where the emphasis was on ergonomic consideration and anthropometric measurement of Hodaidah city population.
3.6.1 Selection, Description and Development of the Tool:

The data were collected through personal interviews visiting each household separately. Interviews were conducted in both Arabic and local dialect to provide more comfort to the respondents during interviews. Before beginning the interview, the investigator introduced himself to the respondent and explained the purpose of the interview (Thakur, 2007).

The interview schedule consisted of main five sections:

**Section 1:** This section consists of questions to seek information related to anthropometric measurement of population from Hodaidah city (one percent sample) in order to develop guides for redesigning living room furniture using anthropometric measurement of living room user. The sample for survey was selected from Hodaidah city population about 416136 inhabitants (Population, 2004). One percent of the total population (416) population was selected for anthropometric measurements and survey. The following samples (with raw data) were used for this study (Figure No.28).

The anthropometric measurements were taken from the following areas:

A. **Standing Anthropometric measurements (in mm) with mean, SD, 5th, 50th and 95th percentile:**

1. Weight: Nude body weight is measured by a physician scale.
2. Stature: The vertical distance from the floor to the vertex.
3. Eye height: Vertical distance from the floor to the inner canthus (corner) of the eye.
4. Shoulder height: Vertical distance from the level of acromion to the floor.
6. Shoulder grip length: Distance from the acromion to the center of an object gripped in the hand, with the elbow and wrist straight.
7. Upper limb length: Distance from the acromion to the fingertip with the elbow and wrist straight.
B. Sitting Anthropometric measurements (in mm) with mean, SD, 5th, 50th and 95th percentile

8. Sitting height: Vertical distance from the sitting surface to the vertex (i.e. the crown of the head).
9. Sitting shoulder height: The vertical distance between the sitting surface and the lateral tip of the shoulder.
10. Sitting elbow height: Vertical distance from the underside of elbow to seat surface with flexed arm.
11. Sitting eye height: Vertical distance from the level of eye to the seat surface.
12. Knee height: Vertical distance from the level of the patella to the floor.
13. Shoulder breadth: Horizontal distance between right and left deltoid muscles.
14. Chest (bust) depth. Maximum horizontal distance from the vertical reference plane to the front of the chest in men or breast in women.
15. Elbow-fingertip length: Distance from the back of the elbow to the tip of the middle finger in a standard sitting position.
16. Popliteal height: Horizontal distance from the back of the uncompressed buttocks to the popliteal angle, at the back of the knee, where the back of the lower legs meet the underside of the thigh.
17. Hip breadth: Maximum horizontal distance across the hips in the sitting position.
18. Buttock-knee length: The horizontal distance between the maximum protrusion of a buttock and the anterior point of the knee of a seated subject, the knee is flexed 90 degrees.
19. Thigh thickness: Vertical distance from the seat surface to the top of the uncompressed soft tissue of the thigh as its thickest point, generally where it meets the abdomen.
Figure No.28: describes the Anthropometric measurements
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However all anthropometric estimation are in mm, except for body weight, given in Kg

The following subjects were included in the list of anthropometric measurements

- 33 respondents (children, aged 3 – 6 female) were measured on about 21 body dimensions.
- 32 respondents (children, age 3 – 6 male) were measured on about 21 body dimensions.
- 52 respondents (children, age, 7– 10 female) were measured on about 21 body dimensions.
- 52 respondents (children, age 7 – 10 male) were measured on about 21 body dimensions.
- 22 respondents (children, age 11 – 13 female) were measured on about 21 body dimensions.
- 22 respondents (children, age 11 – 13 male) were measured on about 21 body dimensions.
- 11 respondents (teenagers, age 14 – 17 female) were measured on about 21 body dimensions.
- 10 respondents (teenagers, age 14 – 17 male) were measured on about 21 body dimensions.
- 45 respondents (adult, age 18 – 45 female) were measured on about 21 body dimensions.
- 50 respondents (adult, age, 18 – 45 male) were measured on about 21 body dimensions.
- 42 respondents (adult, age, 41 – 65 female) were measured on about 21 body dimensions.
- 45 respondents (adult, age, 41 – 65 male were measured on about 21 body dimensions.

Section 2: this section had questions framed to gather information on household activities carried out in living room to design living room space.

Section 3 this section dealt with opinions of the users regarding the existing living room seating arrangement.
Section 4 covered a comprehensive study for pain and discomfort caused to the respondents while using the living room. This will help the researcher to redesign comfortable furniture. 40 respondents were measured the physical problem regarding living room furniture design.

Section 5 This section covered the questions on physical problems experienced by users of the living room because of the design of living room furniture that does not fit them covering redesigning of the selected living rooms.

Section 6 This part of the study was an experimental work covering redesigning of the selected living rooms.

Tools and equipment used:
Interview schedule, observation sheet, sketches; photographs will be used to collect the data. Anthropometrics measurement equipment like Steel measuring tape, Stadiometers, Weight Watcher and Large and Small Anthropometer was used to collect the anthropometric data.

Plate No 5 : Anthropometrics measurement equipment
Body map techniques for assessing of body part discomfort:-

Body map was used to measure the localized discomfort musculoskeletal problems and intensity of the pain in different body parts resulting from postural discomfort (Corlett and Bishop 1976). Body Part Discomfort Score (BPDS) can be obtained using “Human Graphic” (Figure 28). In this technique the body is divided into a number of regions.

Figure No.29: Body Part Discomfort Score (BPDS) can be obtained using “Human Graphic”

Validation: The interview schedule for survey was validated for correctness and content by giving it to the experts from different institution such as NIOH (National Institutes Of Occupational Health) Ahmedabad, Department of...
family and community Sciences, M.S. University ,Home Science College, Vallabh Vidya nagar .According to the suggestions of the expert changes were incorporated to finalize the tool.

3.7 Analysis of data

The data collected through survey were categorized, coded, and then tabulated.

In this study, the users of living room in residential buildings at Hodaidah city contributed and answered a research questionnaire and their living room were redesigned.

The coding of the raw data was carried out using SPSS (statistical Package for social sciences). It was done to convert raw data into categories for meaningful analysis of the surveyed data.

For the present study, the data were categorized in the following manner:

- Age (in completed years): It was categorized into four exclusive categories with equal intervals.
  - Age 3 to 10 years (Female and Male) small children
  - Age 11 to 17 years (Female and Male) adolescent.
  - Age 18 to 40 years (Female and Male) adults.
  - Age 41 to 65 years (Female and Male) older group

Activities carried out in living room.

The activities carried out in living room in Hodaidah city were as follows:
- Watching TV.
- Conversation between family members.
- Eat snacks.
- Children’s play.
- Reading newspapers, magazines and books.
To redesign the living room interior and furniture design, data from Hodaidah city population are needed. However, not all relevant variables for all Republic of Yemen are available. The data of respondents were used (specified above). No data were found for countries with populations with smaller body heights, such as Portugal and Spain. The anthropometric monument of one percent population was treated using descriptive statistics and 5th, 50th and 95th percentiles were calculated with mean and SD to create anthropometric data base of Hodaidah city and was used for redesigning the interior.

For experimental work 10 house were be selected purposively for interior design detailed study.

3.8 Limitations of the study

The anthropometric data base created for the study and the new living room design developed would be applicable to population of the Hodaidah city only.

3.9 Delimitations of the study

1. The study was limited to the population of the Hodaidah city.
2. The study was limited to only living room interior redesigning of the selected population.
3. The study was limited to ten selected house hold of Hodaidah city for redesigning the selected households.