STATISTICAL MODEL FOR BETTER NUTRITION ASSESSMENT USING ANTHROPOMETRIC METHODS

by

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Declaration

The work described in this thesis was carried out by me under the supervision of Dr. P. Kalukottage and a report on this has not been submitted whole or in part to any university or any other institution for another Degree/Diploma.

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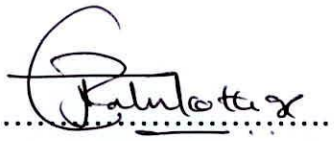
Declaration

I/~~We~~ certify that the above statement made by the candidate true and that thesis is suitable for submission to the university for the purpose of evaluation.



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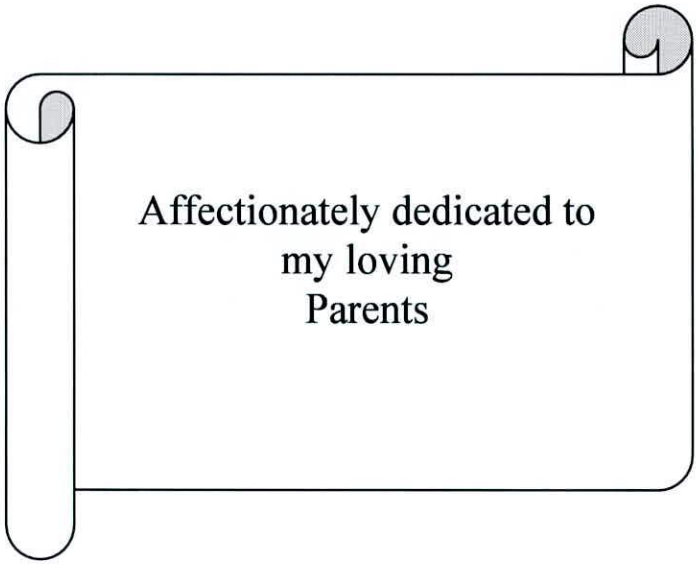
DEDICATION



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CONTENT

List of graphs

Abbreviation

CHD - Coronary Heart Disease

BMI - Body Mass Index

FFM - Fat Free Mass

WHO - World Health Organizations

WHR - Waist to Hip Ratio

WC - Waist Circumference

WHtR - Waist to Height Ratio

CT - Computer Tomography

BIA - Bio-electrical Impedance Analysis

MUAC - Mid Upper Arm Circumference

TC - Thigh Circumference

BF% - Body Fat Percentage

ABSTRACT

Increased body fat is the main risk factor for several nutrition related non-communicable diseases such as hypertension, cardio-vascular disease, diabetes etc. There are several methods to directly assess body fat percentage with higher accuracy levels but they need advanced equipments, higher cost and advanced technical knowledge. Anthropometric indices use several body measurements and are also widely used as simple methods to asses the risk of nutrition related non-communicable diseases.

Objective of the study is to develop a simple and reliable statistical model to predict body fat percentage using anthropometric measurements. This study was a cross sectional study which has covered total of 300 apparently healthy Sri Lankan office workers. Body fat percentage, anthropometric measurements and relevant general details were collected and analyzed. Best subset regression method used to build regression model to predict body fat percentage.

One sided prediction interval, based on the fitted regression model, was proposed to predict health risk of an individual. If the cutoff value lies within that interval, then the individual can be classified as having a health risk. This proposed method was tested with small sample, and found that their health risk is classified accurately.

Also the study suggested that the BMI cut off values should be adjusted as 25.3 for females and 26 for males to classify risk in the same context. In general, 25 can be considered as a better cut off value for BMI to classify risk for study population.

Chapter 1

Introduction

INTRODUCTION

1.1 Background and justification

1.1.1 Nutritional transition

With the rapid change in food habits and lifestyle patterns, diet related chronic diseases became a major public health problem in many countries. Coronary Heart Disease (CHD), diabetics, cancer, hypertension are related with personal nutritional status. Obesity (high fat percentage in the body) is the leading causative factor for above diseases. Nutrition transition, behavioral changes and sedentary lives are the major causes for obesity condition.

Coronary Heart Disease (CHD) is one of the leading causes of death, accounting for 27% of all deaths in 2000 in Sri Lanka. A key issue in the management of diet related chronic diseases is prevention. Many of these risk factors, including obesity, can be prevented or modified through appropriate lifestyle changes and dietary habits. However identify the risk in early stages, will allows for proper management of these diet related chronic diseases.

1.1.2 Nutrition assessment methods

Several assessment methodologies are adopted to determine the risk of diet related chronic diseases which classified into following main categories.

1. Anthropometric methods
2. Biochemical methods
3. Clinical methods
4. Dietary assessment methods

From these main types of assessment methods, dietary assessments are used to asses the food habits and food intake which enables to identify the possible risk factors. However these dietary assessments have higher workloads inherited with those assessment

methods. Those two methods take more time and experienced human resources to conduct detailed interviews with the subjects.

Measuring blood cholesterol and tri-glicerides levels can be considered as more accurate bio-chemical method of assessing risk of cardio vascular diseases. However cost of applying biochemical methods for nutritional assessments is higher when compared with other methods and also these techniques need higher expertise knowledge and technology.

Due to those limitations, anthropometric methods are widely used as a simple and feasible nutritional assessment method.

1.1.2.1 Anthropometric methods

Anthropometrics are the objective measurements of body muscle and fat. They are used to compare individuals, to compare growth in the young, and to assess weight loss or gain in the mature individual. Weight and height are the most frequently used anthropometric measurements, and skin fold measurement of several areas of the body is also taken.

Use of anthropometry requires two essential items: an anthropometric indicator and a cut-off point. The indicator, often called an anthropometric index, is a measurement or a combination of measurements made in the field, such as weight and height, or the combination of measurements with additional data, such as age. Common anthropometric indices are as follows.

1. BMI – Body mass index
2. Waist to hip ratio
3. Waist to height ratio
4. Mid upper arm circumference
5. Skin fold thickness - body fat percentage

To estimate body fat, skin fold measurement can be made using skin-fold calipers. Most frequently, triceps and sub scapular skin-folds are measured. Measurements can then be compared to reference data, and to previous measurements of the individual, if available. This can be considered as more reliable method of nutrition assessment as it gives an idea about the body fat level, which is known as a main risk factor of diet related chronic diseases.

Accuracy level of each indicator defers from one community to another based on the various demographic, cultural and behavioral factors. Therefore identification of simple, efficient and most accurate anthropometric index or combination of indices can be considered as the key aspect of early diagnosis and effective prevention from diet related chronic diseases.

Also the cutoff values of these indicators are set according to international standards and rarely adopted to more accurate regional and national standards. This leads to misinterpretation of nutritional status and eventually reduces the effectiveness of decisions made on the results of nutritional assessments. Identification of cutoff values with a suitable statistical analysis will also enhance the specificity and sensitivity.

1.1.3 Project context

Proposed project focused on developing a statistical model to identify simple and reliable anthropometric measurement/indices with the objective of enhancing the overall accuracy, and efficiency of nutritional assessments. At the same time the proposed project focused on enhancing sensitivity and specificity of anthropometric indices by defining more reliable cutoff values which suits to local conditions.