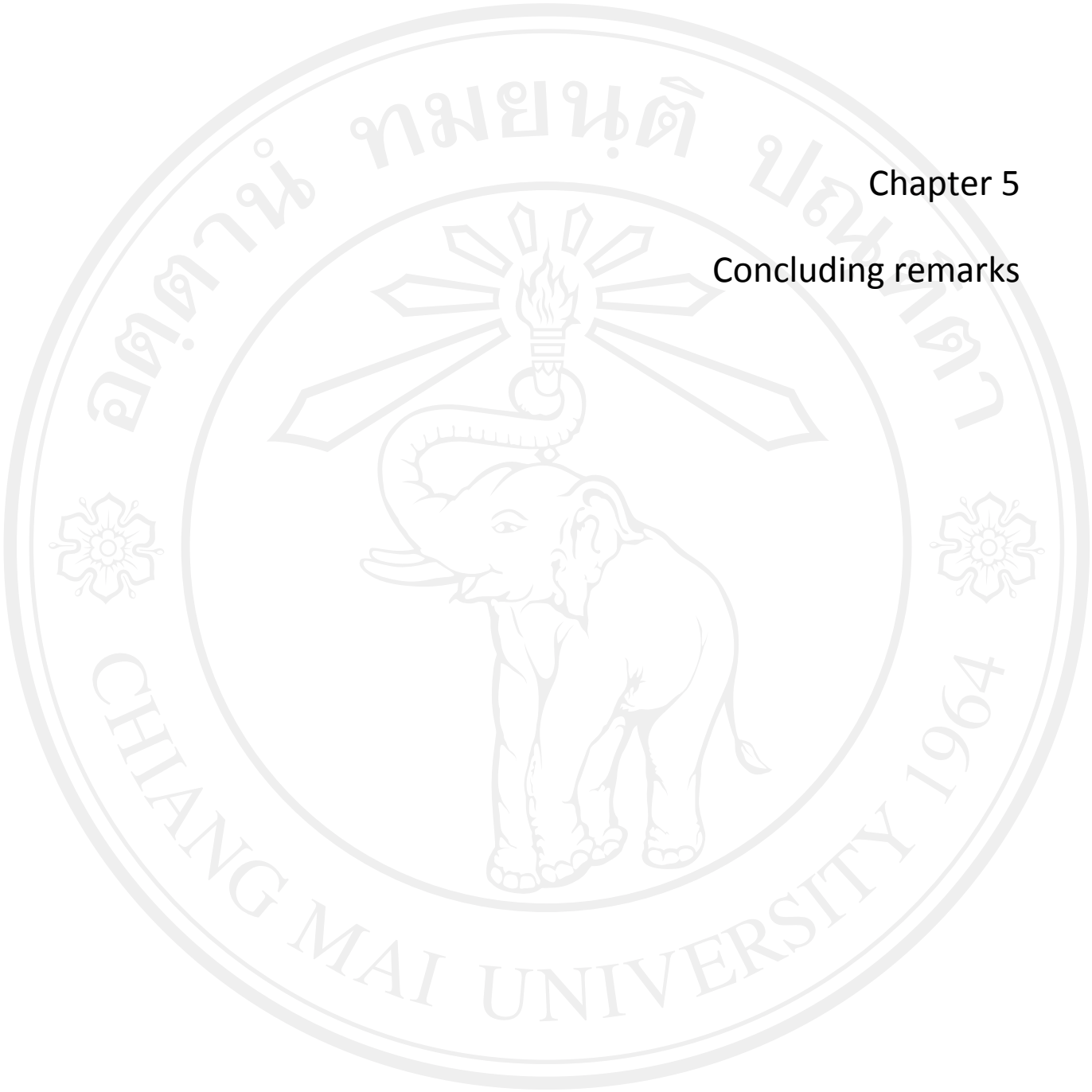
Chapter 5

Concluding remarks



Anthropometric measurements are applied in many clinical situations. Height and body weight are the measurements most commonly used. In addition, body mass index, indices of these parameters, are criterion utilized for stratification in both community and hospital nutritional status. However, many clinical situations have limited availability of these parameters due to special instrument requirements.[1-2] Therefore, estimation methods are proposed to obtain these parameters but most of them have been developed in western countries. These measurements are also included in body fat prediction. However, variation and errors of anthropometric estimation may occur. In conclusion, this thesis involving anthropometric measurements in clinical application can be divided into three aspects of height, body weight prediction and the effect of the age spectrum in body composition prediction using anthropometric parameters.

First, using anthropometric measurement for stature or height prediction has been proposed with different formulas in distinct settings. However, lack of evidence in Thai people has been demonstrated. This thesis proposed the height prediction model using anthropometric length parameters. Linear regression was analyzed to create a predictive formula. First, ten parameters were included and analyzed. Of these, demispan, sitting height and knee height were selected with a correlation coefficient of more than 0.5 and significant F test in all age groups and genders. All single parameters and the highest predictive value of double (sitting and knee height) and triple regression models (demispan, sitting and knee height) were also proposed and these were modified into a simple formula. After validation of both formulas the correlation, quantitative error and relative error were comparable. The simple formula had more than ninety percent precision with an error of up to ten centimeters in the validation group (89.7 to 99.0% in range). Of these, knee height had the least predictive error in all subgroups. However, there was comparable accuracy using of these single parameters in external validation in admitted patients. The double and triple models had decreased error only in the younger group. In the authors study summary, anthropometric parameters with demispan, sitting height, knee height and combination could be applied to height prediction in the adult Thai with acceptable error. These formulas should be applied only in people who cannot be directly measured.[3]

Second, for the body weight prediction in Thai people, the authors developed the prediction model using height and body circumference(s). Eight circumferential level parameters were included at the first measurement. Linear regression equations were developed in a modeling sample group divided by gender and age (younger <60 years and older ≥ 60 years). Original regression equations were modified to simple equations by coefficients and intercepts adjustment. After the covariate selection processes, covariate circumference of chest, waist, umbilical level and hip were selected for single covariate equations (Sco). To reduce the body somatotype difference, the combination covariate circumferences were created by summation between the chest and one torso circumference of waist, umbilical level or hip and used in the equation development as a combination covariate equation (Cco). Of these equations, Cco had significantly less 10% threshold errors comparing with Sco. Although simple covariate equations had more evidence errors than the original covariate equations, there was comparable error between the types of equations.

The chest containing covariate equation had the most appropriate performance for Sco equations. For Cco equations, although there were no differences between covariates using summation of chest and hip (C+Hp) and other Cco but C+Hp had slightly higher performance validity. In summary, body weight can be predicted by height and circumferential covariate equations. Cco had more Sco error tolerance. Original and simple equations had comparable validity. Chest and C+Hp containing covariate equations had more precision within the type of Sco and Cco equations respectively.[4] In addition, external validation in admitted patient using of chest and hip circumference have been demonstrated that most accurate estimation range located up to 90 kg with mean error less than 8 kg (S.D. range 2.19 – 7.06 kg) or 10% of error (S.D. range 1.54 – 12.05%) from actual weight except chest (C) containing formula in younger male and older female patient. Using all of these formulas in obese patient had tendency of an underestimation.

Third, regarding predictive error, anthropometric parameters are commonly used for body fat prediction. However, several factors might distort the prediction results such as gender, ethnic differences, age and anthropometric measurement error. However, the authors have demonstrated that the age spectrum of younger, middle and older might disturb the prediction validity of body fat prediction using body mass index. The coefficient of age altered the PFM differently between younger, middle and older [0.07; $p=0.02$ vs. 0.13; $p<0.01$ vs. 0.26; $p<0.01$ respectively]. All coefficients of age alterations in all FM and FFM derived variables between each age spectrum were tested demonstrating a significant difference between the younger (<60 years) and older group (≥60 years) except the PFFM to BMI ratio (PFFMR) [Difference of PFM and FMI (95% confidence interval): 17.8(12.8 -22.8), $p<0.01$ and 4.58(3.4-5.8), $p<0.01$ respectively]. The comparison between measured PFM and calculated PFM demonstrated a significant difference with increments of age. In the authors' summary, the relationship between body fat mass and body mass index have variations on the age spectrum. A calculated formula in older people might be distorted with the utilization of constant coefficients.[5]

In summary, this thesis reviews the clinical application using anthropometric measurement parameters, their anthropometric and body composition measurement methods as well as using anthropometrics for height, body weight and body composition of body fat prediction (chapter 1-3). In addition, anthropometric measurement error could be an important confounder and validation determinant. Directed and derived results interpretation of these should be used with caution in many points of view (Chapter 4). The principle research based on this thesis fulfill a knowledge gap in predictive value of height and body weight using anthropometric parameters of Thai people (Chapter 2 and 3, Appendix B and C) as well as demonstrating how the role of age spectrum disturbs the predictive value of body composition validity (Chapter 4, Appendix D)

References

1. WHO. Physical status: the use and interpretation of anthropometry. Report of a WHO Expert Committee. World Health Organ Tech Rep Ser 1995;854:1-452.
2. Gibson RS. Priniples of nutrition assessment. 2nd ed. Oxford: Oxford University Press; 2005.
3. Chittawatanarat K, Pruenglampoo S, Trakulhoon V, Ungpinitpong W, Patumanond J. Height prediction from anthropometric length parameters in Thai people. Asia Pac J Clin Nutr 2012;21:347-54.
4. Chittawatanarat K, Pruenglampoo S, Trakulhoon V, Ungpinitpong W, Patumanond J. Development of gender- and age group-specific equations for estimating body weight from anthropometric measurement in Thai adults. Int J Gen Med 2012;5:65-80.
5. Chittawatanarat K, Pruenglampoo S, Kongsawasdi S, Chuatrakoon B, Trakulhoon V, Ungpinitpong W, Patumanond J. The variations of body mass index and body fat in adult Thai people across the age spectrum measured by bioelectrical impedance analysis. Clin Interv Aging 2011;6:285-94.