Obesity and Non-communicable Diseases: Estimation of Optimal Obesity Cut-Offs Among Karbi Females of Karbi Anglong District, Assam, North-east India

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Abstract

Introduction: Obesity is an etiologically complex and multifactorial phenotype, underpinned by a variety of factors including; diet, genetic predisposition, physical activities, physiological, and behavioural factors. Almost 50% people are overweight or obese globally which is 40.3% for India. Obesity is a medical condition, primarily associated with excess adiposity that can manifest not just in terms of body size but also metabolically and can progressively cause and/or exacerbate a wide spectrum of co-morbidities. Body size or obesity is a major concern in the medical science whenever they seek to diagnose a disease that can be measured using anthropometry which is very ethnic specific. Therefore, for country like India with various ethnic groups ethnic specific cut-off points for different anthropometric measures are essential for assessment of obesity and early prevention of its consequences.

Objectives: In this backdrop, the present study, to best of the knowledge is the first attempt, to discern the best obesity predictor and population-specific obesity cut offs among Karbi females of Karbi Anglong district, Assam, North-East India.

Materials and Methods: To achieve this purpose the present study consisted 179 females of Karbi population residing in Karbi Anglong district, Diphu, Assam.

Anthropometric measurements were taken using the standard protocol And required indices were calculated using the standard formulae. PBF was assessed by an OMRON body scanner following the instruction manual.

Results: WC (AUC= 0.938) exhibited the largest AUC followed by HC (AUC= 0.932). According to Youden Index population-specific optimal cut-off points were found to be 66.75 cm for WC, 84.60 cm for HC, 26.45% for PBF and 0.77 for WHR.

Conclusion: The identified optimal cut-off values for WC, HC, PBF and WHR of the Karbi population is comparatively higher than the Asian Indian, JIS, Javanese and Ethiopian cut-off values but lower than the other Tibeto-Burman speaking population (Halam and Tripuri). This population-specific obesity cut offs among Karbi females will be very helpful for the advancement of obesity related clinical research which in turn will help the medical practitioner and researchers from many fields for effective screening of obesity and preventing its consequences.

Keywords: Obesity, Non-communicable Diseases, Anthropometry, Cut-off.

Introduction

Obesity is an etiologically complex and multifactorial phenotype, underpinned by a variety of factors including; diet, genetic predisposition, physical activities, physiological, and behavioural factors[1-2]. WHO described obesity[3] as "one of today's most blatantly visible yet most neglected public health problems" and used the term "globesity" to reflect an "escalating global epidemic of overweight and obesity". According to some studies[4-5], worldwide prevalence of obesity is reaching epidemic to pandemic proportions. WHO had estimated more than 1.9 billion adults worldwide (39%) are overweight, and over 650 million

(13%) are obese. Furthermore, researches[6] of NCD Risk Factor Collaboration, reported that the obesity prevalence is increasing in every country and the greatest increases were noted in South Asia (India), Southeast Asia, the Caribbean, and Southern Latin America. India is a developing country which is in a transitional state[7-8] of under nutrition due to poverty and obesity due to the industrialization and rapid urbanization, means experiencing double burden of malnutrition[9] i.e., coexistence of both under over nutrition and North-east India[10] is not an exception. However, the prevalence of overweight and obesity is still low in north-east Indian states, the increasing trend (1.3-14.5%) has a definite cause of concern[10]. The current trajectory of prevalence acceleration would result in almost half of the world's population being overweight (38%) or obese (20%) by 2030[11].

Obesity is a medical condition, primarily associated with excess adiposity that can manifest not just in terms of body size but also metabolically[12] where the excess body fat accumulates to the extent that it may have a negative effect on health[13]. Depending on the degree and duration of weight gain, obesity can progressively cause and/or exacerbate a wide spectrum of co-morbidities[12-15] which includes (Fig:1); Metabolic syndromes (Hypertension, T2DM, CVD, Dyslipidemia, Liver Dysfunction, respiratory and musculoskeletal disorders), Reproductive health issues (sub-fertility to infertility), psychosocial problems (negative body image perception, low self-esteem, depression, and decreased quality of life), and even certain types of cancer. The great prevalence of this condition, its severe consequences for health makes the prevention of obesity a major public health priority. Therefore, prevention strategies are very important in

this regard which in turn also will lower the medical costs.

Obesity can be assessed in several ways and anthropometry is one of them[16]. Anthropometric measurements like BMI, WC, HC, WHR, WSR has already been used for assessing overall and central obesity[17]. BMI and WC are commonly used[18] to measure overall and central obesity respectively. Subsequently, WC, WHR, WSR, PBF and CI are used as better obesity predictor than BMI for the risk assessment of different metabolic syndrome[19-21]. Ethnicity and socioeconomic status are independent factors[22] that influence obesity in men and women globally. India has more than 600 various ethnic groups residing in different geographical regions[10] having differences in body dimension and adiposity indices[23]. Obesity has also been misclassified in such diversified populations because of using worldwide cut-offs[24,25], which is misleading in risk assessment for NCDs[25]. Therefore, ethnic specific anthropometric cut-off points are essential for assessment of obesity.

India has a variety of tribal communities that constitute about 8.6% of the total population However, tribal populations in north east India are underrepresented in terms of obesity research[26]. Estimation of overweight and obesity of these tribal communities are very essential, especially because they are often compromised by poor access to healthcare services[27]. Furthermore, recent studies[8,28] reported that women (15-61%) have higher prevalence of overweight and obesity as compared to men (12-54%) in India.

In this backdrop, the present study, to best of the knowledge is the first attempt, to discern the best obesity predictor and population-specific obesity cut offs among Karbi females of Karbi Anglong district, Assam, North-East India.

Materials & Methods

The present study consisted of 179 females of Karbi population residing in Diphu, Karbi Anglong district, Assam. The Karbis are the major indigenous population of entire Karbi Anglong district. Karbis belongs from the Ancestral Tibeto-Burman (ATB) linguistic group[8,29].

Informed consent was obtained from each participant prior to the study. Measurements like; HT, WT, HC, WC were taken from each participant using the standard protocol[30]. BMI [WT (kg) / HT (m2)], WHR [WC (cm) / HC (cm)], WSR [WC (cm) / HT (cm)] and CI [WC (m) / $[(0.109) \times \{WT (kg)/HT (m)\}]$] were calculated using the standard formulae[31-34]. PBF was assessed by an OMRON body scanner with a scale following the instruction manual. The participants were categorized as of normal weight (BMI >18.5–22.9 kg/m2), overweight (BMI ≥ 23–27.5 kg/m2) and obese (BMI ≥ 27.6 kg/m2) as per Asian cut-offs (WHO Expert Consultation, 2004).

Results & Discussion

The present discourse vindicated the prevalence of combined over-weight and obesity among Karbi females by using Asian Indian BMI cut-offs[36,37], approximately 46% (Table 2) which is comparatively higher in present study than earlier study (31.5%) done among same population[8]. The heterogeneity of result proves the fact that, the epidemic of obesity is increasing day by day may be due to urban and rural populations experiencing a major demographic, socio-economic and nutritional transition at varying rates. Furthermore, ROC curve (Table 3 & Fig: 3) determined best predictors of obesity are HC and PBF among the Karbi females. These findings partially agreed with earlier studies among Vietnamese[38] and Han Chinese populations[39] where PBF

in men or women is used as criteria for the diagnosis of obesity. Similarly in Asian populations, higher PBF is better predictor for obesity related complications compared with the other where obesity related complications were predicted by BMI[40]. Studies[41-43] from North-eastern part of India also corroborated with the present findings where HC was identified as the best predictor of obesity along with WC, WSR and BMI. The optimal cut-off values, identified through the Youden Index (Table 4) for WC, HC, PBF and WHR of the Karbi population is comparatively higher than the Asian Indian[36], JIS[44], Javanese[45] and Ethiopian[46] population while it is lower than the other Tibeto-Burman speaking population (Halam and Tripuri) of Tripura, North-east India[41]. The variability in cut-off values has been obtained may be due to differential regional fat distribution among different populations. Therefore, from the public health perspective, it is important to calculate ethnic specific cut-off points for the various anthropometric indices to achieve effective screening and prevent its consequences and the present attempt took this research one step ahead.
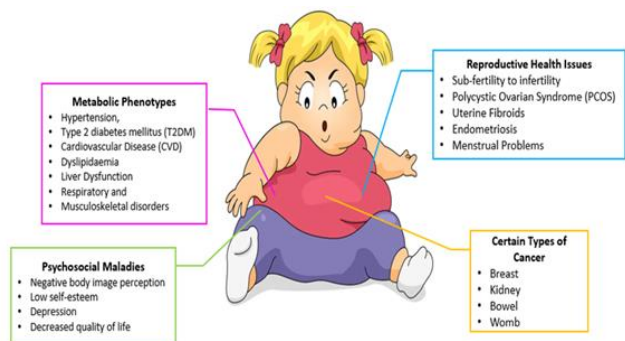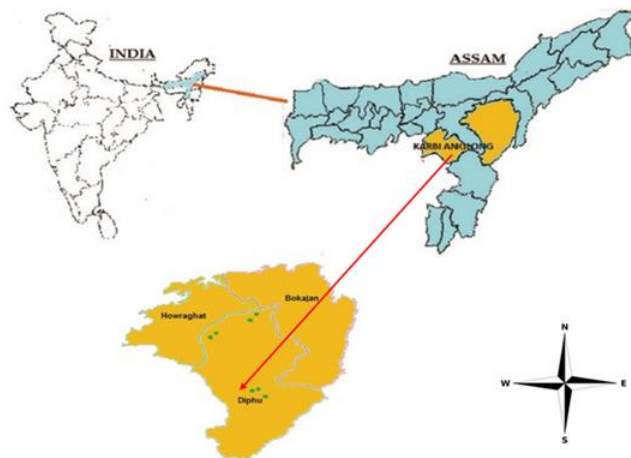

Fig: 1: Co-morbidities associated with obesity

Fig: 2. Studied Area

VARIABLES	MEAN ± SD
Age (years)	30.90± 11.89
Height (cm)	152.85± 5.50
Weight (kg)	54.60± 9.82
WC (cm)	75.22 ± 12.95
HC (cm)	89.48± 9.58
PBF	31.67± 12.43
BMI	23.33± 4.08
WHR	0.84±0.08
WSR	0.49±0.09

Table 1: Characteristics of Studied Population

CATEGORY	KARBI (n= 79)
Over-weight & Obese	46.42%
Non-Obese	53.57%

Table 2: Classification of Studied Population by BMI Categories (WHO, 2004)

Variables	Area under the ROC curve (95% CI) (n= 79)	p
WC (cm)	0.938 (0.878- 0.998)	p<0.05
HC (cm)	0.932 (0.876- 0.988)	p<0.5
WHR	0.829 (0.732- 0.925)	p<0.5
PBF (%)	0.899 (0.827- 0.970)	p<0.5

Table 3: ROC (Receiver Operating Characteristics) Curve for Anthropometric Obesity Indicators Using the BMI Classification (WHO 2004)
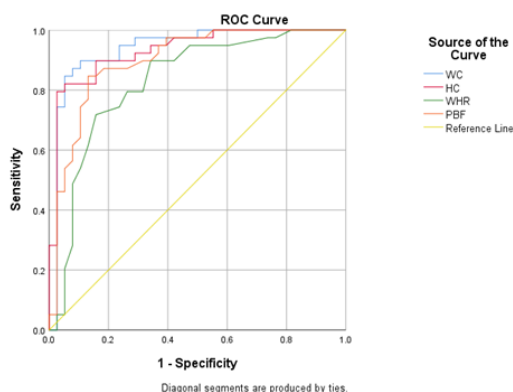
Fig: 3: ROC Curve of Anthropometric Variables Pertaining to Obesity in Studied Population

Variables	Karbi (n=79)			
	Cut off Point	Sensitivity	Specificity	Youden index
WC (cm)	66.75	1.00	0.50	0.50
HC (cm)	84.60	1.00	0.55	0.55
PBF (%)	26.45	1.00	0.55	0.55
WHR	0.77	0.94	0.60	0.54

Table 4: Optimal Cut Off Points for the Studied Population

Conclusions

Obesity, a condition characterized with an increase in the size and amount of fat cells in the body. Although it is an easily recognizable condition by specialists and layperson, yet not exist a widely accepted clinical definition of it. The definition of the term given by the Obesity Medicine Association captures both its complex aetiology and diverse consequences (metabolic, biomechanical, NCDs and psychosocial[6,47]. Despite of several consequences and higher prevalence obesity is rarely addressed in the context of medical research. Medical science includes many subjects that try to understand how the body functions are fit and healthy, and how healthy the body shape and size should be whenever diagnosis of a disease is concerned. Therefore, medical science is closely related to the shape of the human body, can of course be measured using anthropometric concepts which is very ethnic specific. Therefore, for country like India with various ethnic groups[10], ethnic specific cut-off points for different anthropometric measures are essential for assessment of obesity as worldwide cut-offs[24,25] are misleading. The present attempt tried to discern population-specific obesity cut offs among Karbi females that will be helpful for the advancement of obesity related clinical research which in turn will help the medical practitioner and researchers from many fields for effective screening of obesity and preventing its consequences.

Abbreviations

WHO- World Health Organization

T2DM- Type 2 Diabetes Mellitus

CVD- Cardiovascular Disease

NCDs- Non-communicable Diseases

BMI- Body Mass Index

WC- Waist Circumference

HC- Hip Circumference

WHR- Waist-to-Hip Ratio

WSR- Waist-to-Stature Ratio

PBF- Percentage of Body Fat

CI- Conicity Index

JIS- Joint Scientific Statement

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