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Anthropometric Profiles and Risk of Diabetes among the Tangkhul Tribal Women

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ABSTRACT

Introduction:

The Tangkhul community, a tribal group from the northeastern state of Manipur, possesses a rich array of biodiversity, traditional foods and a distinct way of life.

Methods:

This study aimed to determine the prevalence of overweight and obesity within a group of 680 women aged 30 to 75 years, representing this ethnic population. Anthropometric measurements, including height (in cm), weight (in kg), waist and hip circumference (in cm) were recorded. Body Mass Index (BMI) and Waist-Hip Ratio (WHR) were then calculated using the Asian cutoff points recommended by the World Health Organization (WHO).

Results*:*

The findings revealed that the prevalence of overweight, as well as obesity class I and class II were revealed. It is evident that there exist a strong association between body weight and prevalence of lifestyle related diseases such as pre diabetes and type 2 diabetes. The identification of risk factors as modifiable and non-modifiable factors indicated by PRESS and IDRS risk assessment tool was carried out.

Conclusion*:*

To conclude modifiable factors like anthropometric measurements such as BMI, waist circumference, WHR, blood pressure were the indicator risk factors for pre diabetes and diabetes. Other factors like lifestyle choices and non-modifiable risk factor such as family history were also the contributors to the development of pre diabetes and type 2 diabetes among women Tangkhul tribe.

Keywords: *Anthropometric, Blood pressure, IDRS, Press score, Women, Tangkhul tribe*

Introduction

The Tangkhul Tribe is a unique ethnic group that incorporates various food bio-resources into their daily diet. They traditional cuisine reflects their deep rooted heritage **(1).** However like many communities worldwide they also have shift in their lifestyle and dietary pattern. The food habits and traditional recipes that once prevailed are gradually fading, as people increasingly opt for easy and convenient food choices over quality, home-cooked traditional meals.

The World Health Organization declared obesity to be a global epidemic due to the rising prevalence of overweight and obesity and its associated consequences **(2).** Studies have shown a positive correlation between incidence of diabetes and anthropometric indices **(3).** As evident, obesity stands out as a significant risk element for the onset of type 2 diabetes mellitus **(4).**

Materials and Methods

Objectives

1. To measure the anthropometric profile and blood pressure of the women aged 30 to 75 years within the Tangkhul tribal community
2. To determine the prevalence of overweight and obesity by calculating BMI and analyze the related risk factors for lifestyle diseases such as pre diabetes and diabetes using PRESS score and IDRS tool.

A cross-sectional survey was carried out on 680 women belonging to the Tangkhul Tribe Central Ukhrul and North Ukhrul District Manipur residing in tribal hill and willing to participate in the study, aged between 30 to 75 years. The participants, residing in a tribal hill station, were surveyed using a pre-tested questionnaire from the month of September to December 2023. Individuals who were bedridden, severely ill, or unwilling to participate were excluded from the study. In regard to sample size the formula used for calculating the adequate sample size (N) = $4PQ/d^2$; whereas N is the sample size; P = Prevalence in previous studies; Q = 100 - P; d = allowable error (5-20% of P).

The baseline study of the survey information was collected with the help of physician specialized in Community and Family Medicine with registered nurse and trained Lab technician from Comprehensive Health Services & Research Centre, Ukhrul district using the pre tested interview schedule. All participants in the study were provided with detailed information regarding the objectives and nature of the research. They were assured of the anonymity and confidentiality of their personal information, as well as their freedom to withdraw from the study at any stage. Personal and socio- demographic characteristics of the subjects were obtained. Anthropometric measurements including height in centimeters, weight in kilograms, waist, and hip measurements of the respondents were recorded. Height, waist, and hip measurements were taken using a standard measuring tape, while weight and BMI were assessed using a calibrated Karada scan (OMRON HBF-375). As an added measure of assurance, BMI was recalculated, and Waist-to-Hip Ratio (WHR) was also computed and categorized based on the criteria outlined by the World Health Organization **(5).** The values were compared with the Asian cutoff points recommended by the World Health Organization **(6).** The blood pressure of individual respondents was measured using a digital blood pressure monitor (OMRON Model HEM7121J) and recorded. Additionally, with the help of ethical clearance, Fasting Blood Sugar (FBS) levels were recorded using a glucometer (Accuchek Instant).

The PRESS score was computed based on several factors: age score (<30 years = 0 score, 30 to 60 years = 35 score, and >60 years = 40 score), family history of diabetes = 35 score, waist-hip ratio (raised >0.5) = 15, and diastolic blood pressure (raised > 90 mmHg) = 10 score. A total score greater than 45 was considered indicative of a high risk for

pre-diabetes **(7).**

On the other hand, the IDRS (Indian Diabetes Risk Score) comprises four risk factors: age, waist circumference, physical activity and exercise, and parental history of diabetes. Each risk factor was assigned a score in multiples of ten, resulting in a total score ranging from 0 to 100. Subjects with an IDRS score of ≥60 were classified as high-risk cases of diabetes, those with scores between 30 and 50 fell into the medium-risk category, and scores less than 30 were placed in the low-risk group **(8).**

Statistical analysis

The data was analyzed using SPSS (IBM) version 25.0. Descriptive analysis was conducted, and a Chi-square test and Regression was performed to determine if any statistically significant associations existed with 95% confidence interval, and results with $p < 0.05$ were considered statistically significant.

Results

Table 1: Socio-demographic characteristics of the selected tribal women

Socio demographic characteristic	Category	N= 680	%
Age in years	30 - 40	116	17.1
	40 - 50	252	37.1
	50 - 60	167	24.6
	60 - 70	140	20.6
	Above 70	5	0.7
Marital status	Unmarried	83	12.2
	Married living with spouse	526	77.4
	Divorced	4	0.6
	Widow	67	9.9
Family type	Nuclear	679	99.9
	Joint family	1	0.1
Education	Illiterate	5	0.7
	Lower primary	25	3.7
	Upper primary	266	39.1
	Higher school	293	43.1
	Pre degree	60	8.8
	Degree and above	22	3.2
Income	≤ 9000	490	72.1
	9001-27000	168	24.7
	> 27000	22	3.2
Total family members	1-4	323	47.5
	5-7	345	50.7

	Above 7	12	1.8

Source: *Compiled from Primary data*

Table 1 presents the socio-demographic characteristics of the Tangkhul tribe women selected from Ukhrul District, Manipur. Within this group, (37.1%) were in the age range of 40-50 years, and (24.6%) were between 50-60 years old. The majority of the women (77.4%) were married, and a significant proportion lived as nuclear family.

It is clear that (43.1%) of the Tangkhul tribe women completed their higher secondary education followed by (39.1 %) with upper primary education. It is understood that only 8.8 per cent and 3.2 per cent had completed pre degree and degree.

In regard to income of the tribal women, it was observed that majority of 72.1 % fall in the category of below Rs. ≤ 9000/- month. The majority of the women 24.7 % and 3.2% reported monthly income between Rs. 9001-27000/- and Rs. >27000/- respectively. As the selected population is not from the mainland, the socio-economic status was not classified using any of the standard scales.

Table 2: Press score and IDRS risk of the selected tribal women

Component	**N=680**	**%**
PRESS score		
Low risk	265	39
High risk	415	61
IDRS		
Low	99	14.6
Medium	305	44.9
High	276	40.6

Source: *Compiled from* Primary data

Table 2 shows that the largest portion of respondents (61%) fell into the high risk category according to the Press score, with the remaining 39% classified as low risk. Looking at the IDRS scores approximately 14.6% of respondents were categorized as low risk, followed by 44.9% in the medium-risk category, and 40.6% identified as high risk. This suggests a range of risk levels among the population surveyed, highlighting the importance of targeted preventive measures and health education initiatives to address diabetes risk factors effectively.

Table 3: Association between anthropometric indices and risk of the selected tribal women

PRESS Score	**Low risk (<45) n =265**	**High risk (> 45) n=415**	**Total N=680**	**p value Chi square**
Waist circumference				
Normal <80cms	229 (55.3)	185 (44.7)	414 (60.9)	
First degree obese >80-89cms	36 (14.8)	208 (85.2)	244 (35.9)	0.000***
Second degree obese ≥90 cms	0 (0.0)	22 (100.0)	22 (3.2)	
WHR				
Normal 0.85 cm lesser	227(55.5)	182 (44.5)	409 (60.1)	

High 0.85 cm greater	38 (14.0)	233 (86.0)	271 (39.9)	0.000***
BMI				
Under weight (<18.5)	45 (70.3)	19 (29.7)	64 (9.4)	0.000***
Normal (18.5-22.9)	182 (53.1)	161 (46.9)	343 (50.4)	
Over weight (23-24.9)	26 (23.4)	85 (76.6)	111 (16.3)	
Class I (>25-29.9)	12 (8.5)	130 (91.5)	142 (20.9)	
Class II (>30)	0 (0.0)	20 (100.0)	20 (2.9)	

Source*: Compiled from primary data**WHO - *Asian /Indians*, 2000

Table 3 depicts the anthropometric measurements, including height, weight, waist circumference, and hip circumference, were recorded to evaluate obesity among the participants. The relationship between BMI, waist circumference, WHR, and the degree of risk according to the PRESS Score and IDRS is presented.

The association between obesity-related anthropometric measurements and the PRESS Score among the participants reveals significant findings. Waist circumference, WHR, and BMI are all strongly correlated with the degree of risk according to the PRESS Score. Participants with normal waist circumference (<80 cm) predominantly fell into the low-risk category (55.3%), while those with first-degree obesity (80-89 cm) and second-degree obesity (≥90 cm) were more likely to be in the high-risk category (85.2% and 100%, respectively). Similarly, a normal WHR (<0.85) was associated with low risk (55.5%), whereas a high WHR (>0.85) was linked to a higher risk (86%). Regarding BMI, underweight individuals (BMI <18.5) were mostly at low risk (70.3%). However, as BMI increased, so did the risk. Those in the Class I (BMI 25-29.9) and Class II (BMI >30) categories predominantly fell into the high-risk group (91.5% and 100%, respectively). These significant associations ($p < 0.000$) highlight the strong link between higher anthropometric measures of obesity and increased diabetes risk as per the PRESS Score.

Table 4: Association between anthropometric indices and risk of the selected tribal women

IDRS	**Low risk n = 99**	**Medium n=305**	**High risk n=276**	**Total N=680**	**p value Chi square**
Waist circumference					0.000***
Normal <80cms	76 (18.4)	184 (44.4)	154 (37.2)	414 (60.9)	
First degree obese >80-89cms	23 (9.4)	117 (48)	104 (42.6)	244 (35.9)	
Second degree obese ≥90 cms	0 (0.0)	4 (18.2)	18 (81.8)	22 (3.2)	
WHR					0.003**
Normal 0.85 cm lesser	74 (18.1)	182 (44.5)	153 (37.4)	409 (60.1)	
High 0.85 cm greater	25 (9.2)	123 (45.4)	123 (45.4)	271 (39.9)	
BMI					0.000***
Under weight (<18.5)	10 (15.6)	32 (50.0)	22(34.4)	64 (9.4)	

Normal (18.5-22.9)	64 (18.7)	150 (43.7)	129 (37.6)	343 (50.4)	
Over weight(23-24.9)	22 (19.8)	53 (47.7)	36(32.4)	111 (16.3)	
Class I (>25-29.9)	3 (2.1)	66 (46.5)	73 (51.4)	142 (20.0)	
Class II (>30)	0 (0.0)	4 (20.0)	16 (80.0)	20 (2.9)	

Source*: Compiled from primary data**WHO - *Asian /Indians*, 2000;

Table 4 shows the women participated in the study were classified into high risk, medium risk, and low risk categories for diabetes based on the IDRS (Indian Diabetes Risk Score) risk assessment tool.

Among the selected women, 40.6% were classified as high risk for diabetes, followed by 44.9% in the medium risk category, and 14.6% in the low-risk category of diabetes mellitus. Waist circumference, WHR, and BMI all show significant association with diabetes risk levels. Participants with a normal waist circumference (<80 cm) were more evenly distributed across low (18.4%), medium (44.4%), and high (37.2%) risk categories. Those with first-degree obesity (80-89 cm) predominantly fell into medium (48%) and high (42.6%) risk groups, while second-degree obesity (≥90 cm) was significantly associated with high risk (81.8%). A normal WHR (<0.85) correlated with lower risk, whereas a high WHR (>0.85) showed an even split between medium (45.4%) and high (45.4%) risk categories. BMI analysis demonstrated that underweight individuals (<18.5) had a lower distribution across all risk levels, while those in higher BMI categories, particularly Class I (25-29.9) and Class II (>30), showed a significant shift towards the high-risk category (51.4% and 80%, respectively). These significant associations ($p < 0.003$) for WHR and $p < 0.000$ for both waist circumference and BMI) underscore the critical link between increased anthropometric measures of obesity and higher diabetes risk as defined by the IDRS.

The multinomial regression analysis was conducted to investigate the statistically significant associations between high-risk Press scores and various predictors, including age, body mass index (BMI), waist circumference, waist-hip ratio (WHR), blood pressure (both systolic and diastolic), and family history of diabetes. The regression table summarizes the coefficients (B), standard errors (SE), p-values, odds ratios (Ex (B)/OR), and 95% confidence intervals (CI) for the odds ratios.

Table 5: Association of Press score with age, anthropometric, blood pressure and diabetes history among the selected tribal women

Variables	**B**	**S.E**	**P value**	**Ex(B)/ OR**	**95% C.I for EXP (B)**	
					Lower	**Upper**
Age in years	0.342	0.098	0.000***	1.408	1.162	1.708
BMI	1.055	0.155	0.000***	2.872	2.118	3.895
Waist circumference	0.146	0.055	0.008**	1.158	1.039	1.290
WHR	4.569	2.250	0.042**	96.406	1.172	7928
BP Systolic	0.177	0.113	0.119**	1.194	.956	1.491
BP Diastolic	0.319	0.110	0.004**	1.375	1.108	1.707

Family history on diabetic	-0.541	0.200	0.007**	0.582	0.393	0.861

Source: *Compiled from primary data;* Ref category: 2-high risk press score

Table 5 depicts the association of PRESS score with age, anthropometric, blood pressure and diabetes history among the selected group. The association of the PRESS score with various factors including age, anthropometric measurements, blood pressure, and diabetes history among the selected group shows several significant findings. Age has a positive association with the PRESS score, with an odds ratio (OR) of 1.408 (95% CI [1.162, 1.708]), indicating that for each unit increase in age, the likelihood of a higher PRESS score increases by 40.8% (p = 0.000). BMI also shows a strong positive association, with an OR of 2.872, (95% CI [2.118, 3.895]) suggesting a nearly threefold increase in risk with higher BMI values (p = 0.000). Waist circumference is similarly associated with the PRESS score OR = 1.158, (95% CI [1.039, 1.290]), indicating increased risk with larger waist measurements (p = 0.008). WHR has a very high OR of 96.406 (95% CI [1.172, 7928, reflecting a substantial increase in risk for higher WHR values, though with a wide confidence interval (p = 0.042).

Systolic blood pressure shows a non-significant association (p = 0.119), with an OR of 1.194, (95% CI [0.956, 1.491]) whereas diastolic blood pressure is significantly associated with the PRESS score OR = 1.375, (95% CI [1.108, 1.707]), p = 0.004), indicating increased risk with higher diastolic values. Interestingly, a family history of diabetes has a negative association with the PRESS score OR = 0.582, (95% CI [0.393, 0.861]) suggesting that individuals with a family history of diabetes are less likely to have a higher PRESS score (p = 0.007). These findings underscore the multifactorial nature of diabetes risk, emphasizing the importance of managing BMI, waist circumference, WHR, and blood pressure, while considering family history in risk assessments.

Discussion

Significant socio-economic changes have occurred with the progression of urbanization in India over the past 40-50 years **(9).** This shift has led to alterations in physical activity levels, adoption of unhealthy habits such as tobacco and alcohol use, and increased stress levels, resulting in a rise in overweight, obesity, and various chronic diseases **(10, 11 & 12).** The escalating obesity rates are also leading to a higher incidence of diabetes. Despite India having lower rates of overweight and obesity, these dietary and activity pattern changes are slowly affecting even tribal communities, as indicated by recent study findings.

According to the World Health Organization **(13),** addressing obesity is a collective societal responsibility rather than an individual one. Solutions should involve creating supportive environments and communities where physical activity is easily accessible, as well as ensuring healthy meals are affordable to combat obesity and its associated health risks such as type 2 diabetes. Regular physical activity is crucial for overall health, aiding in the prevention of diseases like hypertension and type 2 diabetes. WHO recommends that adults engage in either 75 minutes of high-intensity physical activity per week or a combination of 150 minutes of moderate to high-intensity activity for optimal health **(13).**

Both general and abdominal obesity contribute to insulin resistance, a key mechanism underlying pre diabetes and type 2 diabetes. Excess fat, especially around the abdominal area, can disrupt insulin signaling, leading to impaired glucose metabolism **(14).**

Similarly adipose tissue, especially in the abdomen, is not just a passive storage site for fat but also an active endocrine organ. It releases inflammatory cytokines and hormones that can interfere with insulin action and promote insulin resistance, paving the way for pre diabetes **(15).**

In general Individuals with pre diabetes who are also obese, particularly with abdominal obesity, are at

a significantly higher risk of progressing to type 2 diabetes. The combination of insulin resistance, inflammation, and metabolic dysfunction creates a fertile ground for the development of diabetes.

The current study reveals a statistically significant relationship between overweight, obesity, and the Indian Diabetic Risk Score (IDRS). This finding aligns with similar studies such as the ICMR-INDIAB Study **(16 & 17).** Individuals with elevated BMI values, especially those in the overweight and obese categories, often have higher IDRS scores. General obesity contributes to insulin resistance, which is a major factor in the development of type 2 diabetes. IDRS also considers waist circumference as one of its components, recognizing the significance of abdominal obesity in diabetes risk assessment. A larger waist circumference, especially in relation to hip circumference, is indicative of abdominal obesity **(18).**

Individuals with abdominal obesity, as measured by a high waist circumference or waist-to-hip ratio, often have higher IDRS scores. Thus, it summarized that association between obesity-related anthropometric measurements and the PRESS Score among the participants reveals significant findings. Waist circumference, WHR, and BMI are all strongly correlated with the degree of risk according to the PRESS Score. Participants with normal waist circumference (<80 cm) predominantly fell into the low-risk category (55.3%), while those with first-degree obesity (80-89 cm) and second-degree obesity (≥90 cm) were more likely to be in the high-risk category (85.2% and 100%, respectively). Similarly, a normal WHR (<0.85) was associated with low risk (55.5%), whereas a high WHR (>0.85) was linked to a higher risk (86%). Regarding BMI, underweight individuals (<18.5) were mostly low risk (70.3%), but as BMI increased, so did the risk, with those in the Class I (25-29.9) and Class II (>30) categories overwhelmingly falling into the high-risk group (91.5% and 100%, respectively). These significant associations

($p < 0.000$) highlight the strong link between higher anthropometric measures of obesity and increased diabetes risk as per the PRESS Score.

In IDRS, 40.6% were classified as high risk for diabetes, followed by 44.9% in the medium risk category, and 14.6% in the low-risk category of diabetes mellitus. Waist circumference, WHR, and BMI all show significant association with diabetes risk levels. Participants with a normal waist circumference (<80 cm) were more evenly distributed across low (18.4%), medium (44.4%), and high (37.2%) risk categories. Those with first-degree obesity (80-89 cm) predominantly fell into medium (48%) and high (42.6%) risk groups, while second-degree obesity (≥90 cm) was significantly associated with high risk (81.8%). A normal WHR (<0.85) correlated with lower risk, whereas a high WHR (>0.85) showed an even split between medium (45.4%) and high (45.4%) risk categories. BMI analysis demonstrated that underweight individuals (<18.5) had a lower distribution across all risk levels, while those in higher BMI categories, particularly Class I (25-29.9) and Class II (>30), showed a significant shift towards the high-risk category (51.4% and 80%, respectively). These significant associations [($p < 0.003$) for WHR and ($p < 0.000$) for both waist circumference and BMI] underscore the critical link between increased anthropometric measures of obesity and higher diabetes risk as defined by the IDRS.This risk may be due unhealthy lifestyle practices that are likely to contribute in increasing the risk of pre diabetes and type 2 diabetes **(19 & 20).** Additionally, **Huang et al., (20)** stated that women with a normal BMI and Waist-to-Hip Ratio can still fall into the high-risk category of the IDRS. This may be attributed to factors such as insulin resistance, abdominal fat distribution, genetic predisposition, unhealthy lifestyle, and poor habits.

These findings highlight the critical need for preventive measures in the Tangkhul community, emphasizing the importance of early intervention to mitigate the risk of diabetes and related health complications. By addressing obesity and diabetes risk factors through targeted lifestyle changes, preventive medicine can play a pivotal role

in improving health outcomes. Clinicians should consider incorporating routine screening for obesity and diabetes risk factors in their practice, particularly for high-risk populations and tribal women. Implementing culturally tailored lifestyle interventions and education programs can help reduce the prevalence of diabetes and enhance the overall well-being of the community.

Conclusion

In conclusion, the study indicates a notable prevalence of overweight, as well as obesity class I and class II (17.6%, 23.5%, and 3.1%, respectively) within the Tangkhul tribe. It is evident that there is a strong correlation between body weight and the prevalence of lifestyle-related diseases like pre diabetes and type 2 diabetes. To address this, modifiable factors like anthropometric measurements and overall lifestyle choices need to be altered within the Tangkhul tribe to prevent illnesses. Therefore, the PRESS and IDRS serve as valuable tools to identify individuals at risk for pre diabetes and diabetes. Prompting early lifestyle interventions can be done through health care educators by collaborating the governments to prevent or delay the onset of the disease by educating and lifestyle modifications and appropriate preventive medicine to monitor their glycemic levels. Hence, fewer future health complications. To add on, the prevalence of obesity and overweight is not as pronounced within the Tangkhul tribe compared to other populations; the alarming trend towards increased rates and higher risk necessitates proactive measures like nutrition and lifestyle intervention before obesity and diabetes become prevalent among them.

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Ethical clearance

The ethical was approved by Shija Hospitals and Research Institute, Institutional Ethics Committee, Langol Imphal West, Manipur.

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Conflict of Interest

The authors declare that they have no competing interests.

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