

Assessment of Overweight, Obesity and Malnutrition Status of *Purana* (old) Population Residing in Sigiriya, Sri Lanka.

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Abstract

Objective: The "*Purana*" population in Sri Lanka, a genetically distinct group with origins in the Sinhalese Kings of the 5th century A.D, lives near the Sigiriya Bolder Garden complex. Limited evidence exists on the prevalence of overweight and obesity among this population. This investigation aims to study the prevalence of overweight and obesity among adult "*Purana*" individuals.

Methods: *Purana* villagers in Talkote, Pidurangala, Diyakepilla, and Nagalaweve, near the Sigiriya Bolder Garden complex were selected for the study and 107 men and 199 women were recruited to the study based on ancestry, with *Purana* pedigrees traced back at least three generations. Informed consent was obtained from participants. A single observer recorded height, weight, and mid-waist circumference measurements of selected individuals. Each measurement was repeated three times and mean values were taken. BMI values were calculated. Obesity, overweight, malnutrition of each individual was determined by using calculated BMI and waist circumference based on global and South Asian cutoff values.

Results: 33.6%, 55.1%, 9.3% and 1.9% of the male adult population was underweight, normal weight, overweight and obese respectively concerning global BMI cutoffs. 33.6%, 43%, 20.6% and 2.8% of male adult population was underweight, normal weight, overweight and obese respectively concerning Asian BMI cutoffs. 17.6%, 62.3%, 17.6% and 2.5% of female adult population was underweight, normal weight, overweight and obese respectively concerning global BMI cutoffs. 17.6%, 49.7%, 24.1% and 8.5% of female adult population was underweight, normal weight, overweight and obese respectively according to Asian BMI cutoffs. 28% of males were obese while 47.2% of females were obese with reference to waist measurements.

Conclusions: In comparison to the urban populations in Sri Lanka, the male and female *Purana* inhabitants of Sigiriya showed a low prevalence of overweight and obesity.

Keywords: Obesity; Overweight; "*Purana*" population; Sigiriya; Sri Lanka

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Introduction

Over 4 million people die each year as a result of obesity and overweight, which pose health risks because of excessive fat buildup in body tissues and are of epidemic proportions (1). Overweight and obesity rates in adults and children increased from 4% to 18% globally from 1975 to 2016, with children and adolescents aged 5-19 experiencing a four-fold increase (1). The double burden of malnutrition includes obesity, and today, everywhere but sub-Saharan Africa and Asia, more people are obese than underweight (1). Overweight and obesity are increasing rapidly in low- and middle-income countries, especially urban areas. The majority of overweight or obese children are in developing countries, where the rate is over 30% higher than in developed countries (1).

Malnutrition involves deficiencies, excesses, imbalances, and impaired nutrient utilization, causing undernutrition, overweight, obesity, and diet-related noncommunicable diseases, posing a double burden (2). Obesity is a growing health problem in both developed and developing countries including Sri Lanka (3). Excess body fat is linked to an elevated metabolic risk, therefore measuring it is crucial for both therapeutic and preventive health treatments (4). Body Mass Index (BMI) is a common and widely utilized measurement technique used all over the world to determine obesity and malnutrition (4,5). According to WHO guidelines, a body mass index (BMI) of over 25 is generally regarded as overweight, and a BMI of over 30 is regarded as obese (1).

Indigenous (*Vadda*) population in rural areas and a new generation of *Vadda* people in urban areas and other urban populations residing in different major cities of Sri Lanka on obesity and malnutrition, it was reported that obesity and diabetes were substantially less common among *Vadda* people than in the rest of the country and a third of this population has a BMI of less than 18.5 kgm²(6). According to a study conducted in Sri Lanka between 2013 and 2014, the high prevalence rates of overweight and obesity in working-age males are a dangerous indicator for the country (7). Another Study shows a higher prevalence of overweight and obesity among higher-income individuals (8). Research on obesity and malnutrition prevalence in Sri Lanka's urban, rural, and *Vadda* population groups has shown limited progress. A study in Colombo district for the metropolitan population regarding the prevalence of obesity and overweight found 8.1% underweight males and 7.4% females, according to global and Asian cut-off values (3).

With higher rates of noncommunicable diseases like diabetes, hypertension, and heart disease, the *Purana* community is a genetically isolated middle-class population in the suburbs of Sigiriya. In order to better understand their health risks and potential interventions to manage or prevent these conditions, this study aims to evaluate their level of overweight, obesity, and malnutrition. The study seeks to close a knowledge gap and enhance the health outcomes and quality of life for the *Purana* community by identifying and evaluating their health status.

The Sigiriya Bolder garden complex is home to a small *Purana* population that dates back to the Sinhalese Kings of the 5th century A.D. (1,450 YBP). They are currently recognized by their '*Purana*' surnames, such as "Aluthgedara, Gamagedara, Undiyagedara, Beddeggedara, Millagahagedara, Kongahagedara" etc. They maintain a caste system through intermarriages within the community and are considered isolated breeding units with extended family endogamy (9).

The *Purana* community in rural villages in Sigiriya, Sri Lanka, faces potential risks of inheritance genetic disease, noncommunicable disease, and nutritional defiance disorders. Limited information exists on predisposing factors like lifestyle patterns, nutrition status, overweight, obesity, and malnutrition. This study aims to study the overweight, obesity, and malnutrition status of the *Purana* population in Talkote, Pidurangala, Diyakepilla, and Nagalaweve.

Materials and Methods

A cross-sectional survey was conducted in 2018 on a randomly selected sample of one hundred and seven (107) males and 199 females adult *Purana* inhabitants living in the four *Purana* villages who belong to *Purana* pedigrees to determine the obesity and malnutrition status of adults in *Talkote*, *Diyakepilla*, *Pidurangala* and *Nagalaweve* at Sigiriya suburbs. The sample size was calculated using the Cochran formula for the unknown population ($n = (z^2pq)/d^2$). An updated electoral register obtained from the Grama Niladhari division was used as the

sampling reference. The *Purana* individual selection was based on the *Purana* pedigree recorded in the survey conducted at *Purana* villages in Sigiriya suburbs in 1981. The selected pedigrees such as *Gamagedara*, *Aluthgedara*, *Undiyagedara*, *Liyangedara* and *Beddedara* which represented the *Purana* population in *Talkote*, *Pidurangala* and *Diyakepilla* villages were traced back to at least three generations. *Millagahagedara*, *Kongahagedara* and *Aluthgedara* pedigrees which represented the *Purana* population in *Nagalaweve* village also were traced back to three generations. The selected individual was marked in the updated electoral register obtained from each Grama Niladhari division and They were randomly selected for the study. The selected individual was given the opportunity to give their informed consent before being enrolled in the study.

Individuals with psychiatric/cognitive disorders or language barriers, individuals who were extremely debilitated or participated in the pre-test and pregnant or lactating mothers were excluded from data collection. The height and the weight of selected individuals were measured according to the methods described in NHANES (National Health and Nutritional Examination Survey, 2007) by using a stadiometer and digital weighing scale respectively. The body mass index (BMI) of each individual was calculated using the recorded height and weight of each individual.

The study population was grouped as underweight, normal weight, overweight and obese by applying the global cutoff values define underweight (BMI < 18.5 kg/m²), normal weight (BMI 18.5-24.9 kg/m²),

overweight (BMI 25- 29.9 kg/m²), and obese (BMI $\geq$ 30 kg/m²) and Asian BMI cutoff values define underweight (<18.5kg/m²), normal weight (BMI 18.5-22.9 kg/m²), overweight (BMI 23-27.49 kg/m²), and obese (BMI $\geq$ 27.5 kg/m²).

Waist circumference was measured according to the WHO guidelines (WHO 2008a; WHO, 2008b), using a measuring tape. The measurement was taken at the approximate midpoint between the lower margin of the last palpable rib and the top of the iliac crest according to the WHO STEPS protocol for measuring waist circumference. With reference to WHO cut-off values, the population was grouped as overweight, obese or malnourish. Socio-demographic details were attained under the consent of the population which included age, sex, education level, marital status, household, employment, and income.

Ethical clearance was obtained from the ethical review committees of the Faculty of Medical Sciences, University of Sri Jayewardenepura, Sri Lanka for the study. Permission to conduct the study was obtained from relevant authorities in the Grama Niladhari division and the Provincial government. An information sheet was provided prior to the invitation to participate in the survey and written consent was obtained from all participants.

Results and Analysis

The mean age of the male population was 51.17 years old, and female was 46.73 years old. The mean height and weight of the males were 1.6559m and 56.2337kg respectively and also the mean height and the weight of females

were 1.5302m and 51.3769kg respectively. The mean BMI of the male population was 20.5038 kgm⁻² and female was 21.9299 kgm⁻². 18.92% and 6.19% were obese and overweight without considering gender with reference to calculated BMI. The mean waist circumference of males was 0.9079m and females was 0.8628m.

Table 1: Distribution of male BMI values according to the global BMI cutoffs

	No	%	Valid %	Cum %
underweight	36	33.6	33.6	33.6
normal	59	55.1	55.1	88.8
overweight	10	9.3	9.3	98.1
obesity	2	1.9	1.9	100.0
Total	107	100.0	100.0	

*Cum % - cumulative percentage

A total of 33.6%, 55.1%, 9.3% and 1.9% of the male adult population was underweight, normal weight, overweight and obese respectively concerning global BMI cutoffs (Table 1). 33.6%, 43%, 20.6% and 2.8% of the male adult population was underweight, normal weight, overweight and obese respectively concerning Asian BMI cutoffs (Table 2). A 28% of males were obese concerning waist circumference (Table 3). 17.6%, 62.3%, 17.6% and 2.5% of the female adult population was underweight, normal weight, overweight and obese respectively concerning global BMI cutoffs (Table 4). 17.6%, 49.7%, 24.1% and 8.5% of the female adult population was underweight, normal weight, overweight and obese respectively according to Asian BMI cutoffs (Table 5).

47.2% of females were obese with reference to waist measurements (Table 6).

Table 2: Distribution of male BMI values according to the Asian BMI cutoffs

	No	%	Valid %	Cum %
underweight	36	33.6	33.6	33.6
normal	46	43.0	43.0	76.6
overweight	22	20.6	20.6	97.2
obesity	3	2.8	2.8	100.0
Total	107	100.0	100.0	

*Cum % - cumulative percentage

Table 3: Distribution of male waist circumference values

	No	%	Valid %	Cum %
<90cm	77	72.0	72.0	72.0
>90cm	30	28.0	28.0	100.0
Total	107	100.0	100.0	72.0

*Cum % - cumulative percentage

Table 4: Distribution of female BMI values according to the global BMI cutoffs

	No	%	Valid %	Cum %
underweight	35	17.6	17.6	17.6
normal	124	62.3	62.3	79.9
overweight	35	17.6	17.6	97.5
obesity	5	2.5	2.5	100.0
Total	199	100.0	100.0	17.6

Table 5: Distribution of female BMI values according to the Asian BMI cutoffs

	No	%	Valid %	Cum %
underweight	35	17.6	17.6	17.6
normal	99	49.7	49.7	67.3
overweight	48	24.1	24.1	91.5
obesity	17	8.5	8.5	100.0
Total	199	100.0	100.0	17.6

*Cum % - cumulative percentage

Table 6: Distribution of female waist circumference values

	No	%	Valid %	Cum %
<80cm	105	52.8	52.8	52.8
>80cm	94	47.2	47.2	100.0
Total	199	100.0	100.0	52.8

*Cum % - cumulative percentage

Discussion

According to this study, 62.3% of women and 49.7% of men have BMIs that are within the normal range when measured using global cutoffs, whereas 55.1% of men and 43% of women have BMIs that are within the normal range when measured using Asian cutoffs. Males of the *Purana* population are less likely to be obese (1.9% according to the global cutoffs and 2.8% according to the Asian cutoffs) than females (2.5% according to the global cutoffs and 8.5% according to the Asian cutoffs).

When compared to the study done on the "prevalence of obesity in Sri Lanka at the national level" survey with our results. The *Purana* adults' obesity and overweight without considering gender (Obesity 18.92% and overweight 6.19%) is lower than that of Sri Lankan adults (obesity 25.2% and overweight 9.2%) according to the Asian BMI cutoffs (7). Reported waist measurements of the urban population of Colombo revealed a high incidence of obesity in males (40.0%) and females (66.4%) respectively (3). However, the prevalence of male obesity in this study is 28% in adult males and 47.2% in adult females and figures are lower than that of the urban population living in Colombo.

Many researchers have attempted to reveal overweight and obesity in a variety of communities in Sri Lanka, mostly they focused on the *Vadda* and urban populations. According to a study conducted in 2016 among the indigenous (*Vadda*) population, males were 15% overweight and 2.5% obese, while females were 19.6% overweight and 3.9% obese according to the Asian BMI value. They found that the prevalence of overweight and obesity among the *Vadda* group was lower than that of Sri Lanka's rural population (6). With comparing to our study finding with *Vaddas* study findings, obesity and overweight of males and females of the *Purana* population (males - 20.6% overweight and 2.8% obese, females - 24.1% overweight and 8.5% obese) is higher than that of the *Vadda* community. As *Vadda* engages in a more active lifestyle in hunting and gathering that involves strenuous work in fields. They consume more energy for their daily activities, which increases the probability that they will have less overweight

and obesity (6). As there will likely be a transition in the lifestyle of *Purana* Population from hunting and gathering to cultivation. In comparison to *Vedda*, *Purana* Population shows a higher prevalence of adult obesity and overweight.

One-third of the people of the city were overweight or obese, according to studies conducted in the urban suburbs of Colombo (3). 34.3% of people were overweight and 31.2% of people were obese based on Asian cutoff values. It was reported that overweight and obesity of males were 37.0% and 15.8%, respectively, according to the global BMI cutoffs and 34.3% and 31.2%, respectively, according to the Asian BMI cutoffs (3). However, in our study, 2.8% of males were obese and 20.6% of males were overweight according to Asian BMI cutoffs. In addition, 8.5% of females and 24.1% of females were obese according to the Asian BMI cutoffs. All of these obesity and overweight study results of this study are lower than those that were reported for the urban population (6). These two studies comparatively show that the prevalence of overweight and obesity is higher in urban populations. This may be due to different lifestyle factors such as lower levels of physical activity, poor nutrition, elevated levels of stress, and more convenient access to foods high in calories. This shows that, when compared to the metropolitan population, the *Purana* population's lifestyle is still advantageous for maintaining a low body weight.

According to a study done in the Central province of Sri Lanka in 2017 (8), a higher incidence of overweight and obesity among

working-age males in urban areas of Sri Lanka was reported. The prevalence rates of overweight and obesity among them were 31.8 and 12.3%, respectively (8). This study also presented prevalence rates of overweight and obese males were 20.6%, 2.8% which were lower percentages when considering the urban population (8). It suggests that the male *Purana* population lifestyle facilitates the reduction of overweight and obesity more than in the male urban population. However, our findings show that the prevalence of overweight and obesity in the *Purana* population (Obesity 18.92% and overweight 6.19%) is much lower than that of the reported values of the national level research (According to WHO Asian norms, Overweight, obese were 25.2%, 9.2%, respectively) (7).

Purana people's lifestyle aids in the reduction of overweight and obesity more than in the urban population. The reason for this is that the *Purana* population lives in an agricultural environment, whereas the urban population does not have access to this type of environment. Living in an agricultural environment may lead to a more active lifestyle, as the *Purana* population may engage in activities such as farming, animal husbandry, and other physically demanding tasks that involve manual labor such as chena cultivation, heavy home gardening, manual faddy cultivation, walking and cycling towards the *Kadamandiya* (a small collection of shops) which is located 5 km away from the village to purchase items for day-to-day consumptions etc. This type of lifestyle requires a lot of energy expenditure, which may lead to weight loss and a lower risk of obesity. On the other

hand, the urban population tends to have a more sedentary lifestyle, with many people spending most of their day sitting in front of a computer or on a couch. This type of lifestyle requires much less energy expenditure, which can lead to weight gain and an increased risk of obesity.

Although our research primarily is focused on the impact of obesity and overweight in the *Purana* population of Sigiriya, Sri Lanka. This study reveals that the prevalence of being underweight is higher in males (33.6 % according to Asian cutoff values) than in females (17.6 % according to Asian cutoff values) in the *Purana* population. The study done in Colombo district regarding the prevalence of obesity and overweight showed that the percentage of underweight males was 8.1% and 7.4% in females according to both cut-off values (3). When comparing this study with our study, it is obvious that the percentage of the underweight population is higher in *Purana* population of Sigiriya than in the metropolitan population in Colombo district. According to the proposed World Health Organization cut-off values for BMI for Asians, there are only 30% of males and 27% of females are underweight in this *Vadda* population. (6). According to Asian BMI cutoffs, the prevalence of underweight in males was 8.1% and 7.4% in females in Sri Lanka's urban population (3). The prevalence of underweight status in the *Purana* population of male and females are low compared to the *Vadda* population but higher compared to the urban population.

The Indigenous *Vadda* population showed the BMI of males and females were 20.21 kgm⁻²

(19-21.3 kgm⁻²) and 20.4 kgm⁻² (19.31-21.49 kgm⁻²) respectively (8). Their BMI values are lower compared to *Purana* population's BMI values of male 20.5038kg/m⁻² and female 21.9299 kg/m⁻². Furthermore, central obesity is higher in both males and females of the *Purana* population when compared with the national data (28% in males and 47.2% in females while the national percentage is 26.2%) (7).

Conclusion

According to this study, the male and female *Purana* population of Sigiriya has a lower prevalence of overweight and obesity than the metropolitan inhabitants living in Sri Lanka. The active way of life such as chena cultivation, heavy home gardening, manual faddy cultivation, walking and cycling towards the *Kadamandiya* (a small collection of shops) which is located 5 km away from the village to purchase items for the day today consumptions would be beneficial in reducing overweight and obesity in their population and maintaining average BMI.

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