

# Regional Variation in Prevalence of Overweight and Obesity in Saudi Children and Adolescents

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## ABSTRACT

**Background/Aims:** There are limited data on regional variation of overweight and obesity in the Kingdom of Saudi Arabia. Therefore, the aim of this report is to explore the magnitude of these variation in order to focus preventive programs to regional needs. **Setting and Design:** Community-based multistage random sample of representative cohort from each region. **Patients and Methods:** the study sample was cross-sectional, representative of healthy children and adolescents from 2 to 17 years of age. Body mass index (BMI) was calculated according to the formula (weight/height<sup>2</sup>). The 2000 center for disease control reference was used for the calculation of prevalence of overweight and obesity defined as the proportion of children and adolescents whose BMI for age was above 85<sup>th</sup> and 95<sup>th</sup> percentiles respectively, for Northern, Southwestern and Central regions of the Kingdom. Chi-square test was used to assess the difference in prevalence between regions and a *P* value of <0.05 was considered significant. **Results:** The sample size was 3525, 3413 and 4174 from 2-17 years of age in the Central, Southwestern and Northern regions respectively. The overall prevalence of overweight was 21%, 13.4% and 20.1%, that of obesity was 9.3%, 6% and 9.1% in the Central, Southwestern and Northern regions respectively indicating a significantly-lower prevalence in the Southwestern compared to other regions (*P*<0.0001). **Conclusions:** This report revealed significant regional variations important to consider in planning preventive and therapeutic programs tailored to the needs of each region.

**Key Words:** Obesity, prevalence of overweight, regional variations, Saudi children

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Overweight and obesity in children and adolescents are widely recognized risk factors for diseases that are now reported with increased frequency in obese children and adolescents. Impaired glucose tolerance and type 2 diabetes mellitus,<sup>[1-2]</sup> liver disease,<sup>[3]</sup> cardiovascular diseases,<sup>[4]</sup> and mental disorders<sup>[5-7]</sup> are recognized diseases associated with obesity. Accordingly, surveillance of prevalence of overweight and obesity starting at an early age is important for management and prevention. Although national prevalence data are often used for the surveillance of overweight and obesity and for the design of preventive programs, regional variations are equally important to define priorities.<sup>[8]</sup>

Important regional variations have been reported from many countries. A study from the United States of America (USA) using data from the 2003 National Survey of Children's Health reported geographic variations in the prevalence of overweight between 9.9% and 32.2%, at the state and regional levels for children 5 to 17 years of age.<sup>[9]</sup> In addition, ethnic/racial variations in prevalence of obesity have been reported to vary from 12.8% in Asian to 31.2% in American Indian<sup>[10]</sup> and within Chicago city revealed prevalence of obesity in children 2-12 years varying from 11.8% in non-Hispanic whites on Chicago's North to 56.4% in non-Hispanic black communities on the south side.<sup>[11]</sup> Reports from Canada and some European countries revealed similar findings of regional variations.<sup>[12,13]</sup>

In the Kingdom of Saudi Arabia (KSA), although the national prevalence of overweight and obesity has been reported in adults<sup>[14]</sup> and more recently in children,<sup>[15]</sup> information on regional differences is scanty. The well-known regional variation in growth between regions in the Kingdom,<sup>[16]</sup>

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suggested variation in the prevalence of nutritional disorders including overweight and obesity. The objective of this report is to explore and assess the significance of regional variation in the prevalence of overweight and obesity in this population.

### PATIENTS AND METHODS

The sample used in this report was taken from the main national sample used for the National Health Profile Project which was ethically approved and funded by King Abdul-Aziz City for Science and Technology in Riyadh. Guidelines and criteria established by experts for the design of this type of study were followed.<sup>[17]</sup> Accordingly, a random multistage probability sampling design was used to calculate a representative sample from a stratified listing of households based on the population census available at the time of the study in each administrative region of the Kingdom. Data collection was made by house-to-house visits where a survey questionnaire, clinical examination and body measurements were completed by primary care physicians and nurses. Further details of the methodology and results of the national study have been reported.<sup>[18]</sup>

The 2000 center for disease control (CDC) growth reference and related software were used for the calculation of prevalence data.<sup>[19]</sup> The CDC cut offs were used for the definition of prevalence of overweight and obesity as the proportion of children and adolescents whose Body mass index (BMI) was above 85<sup>th</sup> and 95<sup>th</sup> percentile respectively. Prevalence data were calculated for three regions from the North (Hail, Jof and Northern Borders), two Southwestern regions (Gizan and Aseer) and two Central regions of the Kingdom (Riyadh and Qassim). In this study, the combinations of regions were based on population characteristics. Accordingly, the Northern region, represented by Hail, Al Jof, and the Northern Borders has a majority of stable tribal population, the Southwestern region represented by Aseer and Gizan also has a majority of stable

tribal population different from the North, and the Central region, represented by Riyadh and Qassim consisting of a multiethnic population. The reasons for this selection is to have samples of regions that are different from each other and representative of geographic and ethnic spectrum of the country. Chi-square test was used to assess the difference in prevalence between regions and a *P*-value of <0.05 was considered significant.

### RESULTS

The national data was collected over a period of two years (2004 and 2005). The sample size used for this analysis was 11,112 children and adolescents from 2 to 17 years of age (49.4% girls), with 3525, 3413 and 4174 in the Central, Southwestern and Northern regions respectively. Table 1 displays the overall prevalence of overweight (BMI>85<sup>th</sup> percentile) according to age, sex and regional category indicating increasing prevalence of overweight with age in all regions. There was a significantly lower overall prevalence of overweight in the Southwestern (13.4%) than in the Central (21%; *P*<0.0001) and Northern regions (20.1%; *P*<0.0001), but no significant difference between Central and Northern regions (*P*=0.332). The overall prevalence of obesity (BMI>95<sup>th</sup> percentile) is depicted in Table 2, indicating a similar pattern of increasing overall prevalence with advancing age. Similarly, there was a significantly lower overall prevalence in Southwestern regions (6%) compared to the Central (9.3%; *P*<0.0001) and Northern regions (9.1%; *P*<0.0001), but there was no significant difference in the overall prevalence of obesity between the Central and Northern regions (*P*=0.729). There was no clear pattern of gender variation between regions in the prevalence of overweight or obesity. However, girls had significantly higher prevalence of overweight than boys only in the Northern regions (21.8% vs 18.5%; *P*=0.009), whereas boys had a significantly higher prevalence of obesity in the Central regions only (10.3% vs 8.3%; *P*=0.041).

**Table 1: Prevalence of overweight (BMI>85<sup>th</sup> centile) by age, sex and region**

Age (years)	Central			Southwest			North		
	No >85 <sup>th</sup> centile/total number of children (%)			No >85 <sup>th</sup> centile/total number of children (%)			No >85 <sup>th</sup> centile/total number of children (%)		
	Boys	Girls	All	Boys	Girls	All	Boys	Girls	All
2 to <6	85/512 (16.6)	70/463 (15.1)	155/975 (15.9)	37/390 (9.5)	30/425 (7.1)	67/815 (8.2)	87/540 (16.1)	89/544 (16.4)	176/1084 (16.2)
6 to <13	169/831 (20.3)	174/825 (21)	343/1656 (20.7)	94/785 (12)	91/740 (10.8)	185/1525 (12.1)	172/986 (17.4)	171/949 (18)	343/1935 (17.7)
13 to <18	128/450 (28.4)	115/444 (25.9)	243/894 (27.2)	91/540 (16.9)	113/533 (21.2)	204/1073 (19)	133/591 (22.5)	188/564 (33.3)	321/1155 (27.8)
Overall	382/1793 (21.3)	359/1732 (20.7)	741/3525 (21)	222/1715 (12.9)	234/1698 (13.8)	456/3413 (13.4)	392/2117 (18.5)	448/2057 (21.8)	840/4174 (20.1)

BMI: Body mass index

**Table 2: Prevalence of obesity (BMI >95<sup>th</sup> centile) by age, sex and region**

Age (years)	Central			South west			North		
	No >95 <sup>th</sup> centile / total number of children (%)			No >95 <sup>th</sup> centile / total number of children (%)			No >95 <sup>th</sup> centile / total number of children (%)		
	Boys	Girls	All	Boys	Girls	All	Boys	Girls	All
2 to <6	43/512 (8.4)	30/463 (6.5)	73/975 (7.5)	11/390 (2.8)	13/425 (3.1)	24/815 (2.9)	40/540 (7.4)	39/544 (7.2)	79/1084 (7.3)
6 to <13	83/831 (10)	75/825 (9.1)	158/1656 (9.5)	45/785 (5.7)	35/740 (4.7)	80/1525 (5.2)	89/986 (9)	69/949 (7.3)	158/1935 (8.2)
13 to <18	59/450 (13.1)	39/444 (8.8)	98/894 (11)	52/540 (9.6)	48/533 (9.0)	100/1073 (9.3)	66/591 (11.1)	77/564 (13.7)	143/1155 (12.4)
Overall	185/1793 (10.3)	144/1732 (8.3)	329/3525 (9.3)	108/1715 (6.3)	96/1698 (5.7)	204/3413 (6)	195/2117 (9.2)	185/2057 (9)	380/4174 (9.1)

BMI: Body mass index

## DISCUSSION

National prevalence data are the most widely used tool for the estimation and surveillance of overweight and obesity. However, as indicated in the introduction, there are important variations not only between regions but also within large cities in many countries. Identification of these variations is important for targeting preventive and therapeutic programs.

There are two important findings in this study. The first was the increasing prevalence of overweight and obesity in all regions. The prevalence of overweight and obesity in this report is almost double the prevalence reported about 10 years ago by El Hazmi and Warsy.<sup>[20]</sup> The second most important finding was the highly significant difference in prevalence of overweight and obesity between the Southwestern and the other regions whereas the difference between the Central and Northern region were generally insignificant, a pattern similar to previous reports.<sup>[20,21]</sup>

Well-known potential causes of regional variation in prevalence of overweight and obesity include not only differences in individual risk factors such as ethnic background of the child, dietary habits, physical activity, family educational level and income, but also regional differences in access to health care, availability and easy access to physical activities.<sup>[22]</sup> In a report from Canada, there was an increased risk of overweight from west to east with inverse relationship between socioeconomic status and prevalence of overweight regardless of geographical region, the risk of being overweight was more related to geography than demographic variables such as family background and income.<sup>[13]</sup> A study from the United Kingdom (UK), however concluded that UK country (England, Wales, Scotland, and Northern Ireland) and English regional differences in early childhood overweight were independent of individual risk factors, suggesting a role for regional risk factors such as quality of the environment,

access to physical activity and promotion of healthy eating habits.<sup>[12]</sup>

The low prevalence of overweight and obesity in the Southwest in this study does not necessarily mean better health than other regions but is most probably related to the well established higher prevalence of underweight, wasting and stunting.<sup>[23]</sup> Whether this pattern is related to ethnic or environmental factors remains to be established.

## CONCLUSION

In conclusion, this report demonstrates the importance of regional variation in prevalence of overweight and obesity, findings that are important for design of preventive programs tailored to specific regional needs. However, the most important limitation of this study is the cross sectional nature that does not allow for identification of risk factors for overweight and obesity in different regions of the kingdom. Further research is needed to identify the causes of these variations and to include other regions, in order to tailor preventive and therapeutic programs to regional needs.

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