Prevalence of Obesity in American Samoan Schoolchildren

(2013/2014 School Year)

Report to the Directors

Department of Health
Department of Education

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Territory of American Samoa
The Hon. Lolo M. Moliga, Governor
The Hon. Lemanu Peleti Mauga, Lt. Gov.

ABSTRACT

A surveillance for overweight and obesity among American Samoan schoolchildren conducted five years ago found that less than half were at a healthy weight. Many agencies and organizations had since sponsored events and activities specifically promoting physical activity, increased consumption of fruits and vegetables, and reduced consumption of sugar-sweetened beverages, calorie-dense foods, and snacks. This current surveillance of 2,175 K-12 students residing on Tutuila Island set out to determine if these intervention efforts have had an impact. It used acanthosis nigricans—an independent measure in addition to body mass index—to assess whether students were at risk of contracting a non-communicable disease as they entered adulthood. We recorded height and weight for calculating body mass index and used sex-specific CDC body mass index-for-age percentiles to categorized students as either underweight, at a healthy weight, overweight, or obese. We also examined the back of the neck for signs of acanthosis nigricans and, if present, scored it quantitatively. Both the prevalence and severity of acanthosis nigricans correlated with overweight and obesity. We found that the prevalence of overweight and obesity had increased since 2009 for both males and females. But the prevalence for males 11 years and older increased more slowly than it did for either younger males or for females. To increase precision, the BMI surveillance should be repeated with a larger sample in order to verify if a possible mitigating factor could account for this significantly slower increase in the obesity prevalence tentatively attributed to teenage males.

The U.S. Surgeon General declared it an epidemic that could dwarf the threat of terrorism[1]; the Robert Wood Johnson Foundation committed half-a-billion dollars toward reversing it[2]; the U.S. Department of Agriculture designated it as one of five priority science areas[3] and awarded the University of Hawaii $25 million to help combat it[4]; Time and Newsweek ran cover stories on it[5, 6]; a leading healthcare expert predicted that it will lead to more chronic diseases and premature deaths than exposure to tobacco, drugs, and alcohol combined[7]; HBO filmed an hour-long documentary about it[8]; the White House convened a task force to address it[9], with the First Lady leading the effort[10]; and America's top military leaders called it a threat to national security—twice[11, 12].

Childhood obesity has certainly gotten a lot of attention and garnered a lot of the nation's health research dollars. Yet surveillance studies in the United States and elsewhere have failed to show that childhood obesity is declining.

Maintaining a healthy weight is the most important thing we can do ourselves to reduce the risk of developing a noncommunicable disease, or NCD. In American Samoa, many persistent efforts over the past five years by several agencies and organizations have focused on the importance of a healthful diet and regular exercise to keep fit. Most of these efforts have specifically targeted schoolchildren. Our intent is to see if those efforts have had an impact on reducing childhood obesity in the Territory.

This is our fourth such report. Beginning in the 2006/2007 school year and continuing the following two years, we determined the body mass index, or BMI, of American Samoa's schoolchildren.[13—15]Applying these data to BMI growth charts of the Centers for Disease Control and Prevention[16] allowed us to determine the point prevalence of overweight and obesity for children and teenagers aged 2 to 20. Each report found that obesity was considerably more prevalent in our youth compared with their peers in the United States.

This report comprises our BMI measurements of schoolchildren in kindergarten through grade 12, that is, ages 5 through 18 years. It also includes BMI data from the Ameri-

can Samoa Women, Infants, and Children (WIC) program for children from birth up to 60 months, covering 2009 to 2013. In addition to determining BMI, we also examined the back of each student's neck for a skin condition—acanthosis nigricans—that might signal an increased risk for diabetes.

As elsewhere, the childhood obesity epidemic is proving to be a persistent problem for the Territory. Greater effort must be expended if we are to have any hope of overcoming the social and economic burdens imposed on individuals, families, and society by NCDs as this generation of children enters adulthood.

Materials and Methods

We conducted our survey on Tutuila Island under the auspices of the American Samoa Department of Health (DOH) and Department of Education (DOE). We received approval of the DOH Institutional Review Board and observed the DOE Family Educational Rights and Privacy Act.

In September 2013, all schools submitted enrollment numbers by sex and grade level. We found that 15,817 students were enrolled in grades kindergarten, K, to 12: 82.5% in a public school, and all but 315 residing on Tutuila Island (Table 1).

To compare the prevalence of overweight and obesity in our study with those from the United States, we arranged students into three age groups: 5, 6-11, and 12-18 years. We determined that sample sizes of 500 kindergarteners (age 5), 700 students in grade levels 1 – 6 (ages 6 to 11), and 700 students in grade levels 7 – 12 (ages 12 to 18) of equal number of males and females would allow for a 5% margin of error at the 95% confidence level[17].

During February 2014, we gave all 15 private school principals parental consent forms to distribute to selected grade levels. The number of forms provided to each school was proportional to the size of their grade level enrollments. Student selection was left to the discretion of teachers with the understanding that, as faithfully as possible, children should be selected randomly. Children who returned signed forms were measured.

Ms. Puna Tanielu (DOE Elementary Education) and Ms. Ane Tofili (DOE Secondary Education) scheduled our visits to 16 of 18 public elementary schools and four of five public high schools during February and March 2014. Principals arranged for us to measure all students in selected classes.

We first explained to students the purpose of the study and what we intended to do. If anyone had a question or a concern, we addressed it before proceeding with assent. We also used MyPlate, a U.S. Dept. of Agriculture nutrition tool, to illustrate the five food groups that comprise a healthy diet (Fig.1). Each child was given a plastic reusable MyPlate immediately following measurement.

We used a Road Rod stadiometer for measuring height within 0.1 cm. Each barefoot child was positioned erect with shoulders level, hands at the sides, weight evenly distributed on both feet, and head aligned in the Frankfort plane. We used a Tanita BWB-800 electronic medical scale to record weight within 0.1 kg. Children wore lightweight clothing or school uniforms.

Height and weight, along with the child's sex and age (from the date of birth provided either by the parent or the DOE Chancery Office) were entered into CDC software to calculate the BMI, BMI percentile, and z-score. The BMI percentile was used to categorize the child as either underweight (less than 5th percentile), at a healthy weight (5th to less than the 85th percentile), overweight (85th to less than the 95th percentile), or obese (equal to or greater than the 95th percentile).

We also examined the back of each child's neck for a sign of acanthosis nigricans, or AN. The Mayo Clinic defines AN (ak-an-THOE-sis NIE-grih-kuns) as "... a skin condition characterized by areas of dark, velvety discoloration in body folds and creases. It typically occurs in people who are obese or have diabetes. Children who develop the condition are at higher risk of developing type 2 diabetes." A single trained observer scored each child for AN on a scale of 0 to 4[18]. Zero meant that AN was absent or not detectable on close inspection. A score of 1 to 4 meant that AN was either present, mild, moderate, or severe, respectively (Fig. 2).

BMI analyses of data from the local Women, Infants, and Children (WIC) office from 2009 to 2013 are included in an

Figure 1. The MyPlate concept illustrates the five components of a balanced diet and their relative proportions: vegetables, whole grains, fruits, lean meats, and low-fat or fat-free dairy.

Figure 2. Children with acanthosis nigricans scores of 1 (top) and 4 (bottom).

Table 1. Numbers of students enrolled by grade level (K to 12) and sex (M = Male, F = Female) in 15 private and 28 public schools in American Samoa as of September 2013.

Grade Level -->	K		1		2		3		4		5		6		7		8		9		10		11		12		Totals		
Schools	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M+F
Tutuila Private	111	133	131	111	132	137	122	138	114	123	119	115	100	113	113	95	99	92	78	92	68	80	69	97	92	100	1,348	1,426	2,774
Tutuila Public	450	387	469	404	469	440	552	525	544	496	555	445	541	416	530	457	528	431	650	548	538	479	489	470	455	460	6,770	5,958	12,728
Other Public*	3	8	17	15	4	17	24	16	17	9	14	13	9	19	14	14	17	11	8	8	13	11	9	8	14	3	163	152	315
Totals	564	528	617	530	605	594	698	679	675	628	688	573	650	548	657	566	644	534	736	648	619	570	567	575	561	563	8,281	7,536	15,817
	1,092		1,147		1,199		1,377		1,303		1,261		1,198		1,223		1,178		1,384		1,189		1,142		1,124		15,817		

* A.P. Lutali, Faleasao, Fitiuta, and Olosega Elementary Schools; Manua High School.

Table 2. Numbers of students sampled by age (5 to 18 years) and sex (M = Male, F = Female) from private and public schools on Tutuila Island during February and March 2014.

Age (y) -->	5		6		7		8		9		10		11		12		13		14		15		16		17		18		Totals		
Schools	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M+F
Private	22	34	14	16	13	12	10	12	9	13	12	9	10	18	6	8	5	17	8	4	3	4	3	8	5	6	2	2	122	163	285
Public	273	215	97	106	41	27	60	49	63	54	61	53	70	61	53	59	97	69	49	39	30	47	46	49	36	51	19	16	995	895	1,890
Totals	295	249	111	122	54	39	70	61	72	67	73	62	80	79	59	67	102	86	57	43	33	51	49	57	41	57	21	18	1,117	1,058	2,175
	544		233		93		131		139		135		159		126		188		100		84		106		98		39		2,175		

appendix. We combined our data for 5-year-olds with data for 2- to 4-year-olds from ASWIC during 2013 for a conflated 2-5 year age group.

Results and Discussion

BMI Category

Actual recruitment numbers were 544, 890, and 741, for the 5, 6-11, and 12-18 age groups, respectively (Table 2). Three 19-year-old males and a female were included as 18-year-olds.

The 122 males and 163 females from private schools volunteered to participate in this study while the 995 males and 895 females from public schools were measured en masse from selected classrooms. We first determined that the different recruitment methods did not affect the proportion of students in the overweight and the obese BMI categories. For instance, heavier private school students may have been reluctant to participate, thereby skewing the results in the private school group toward a lower prevalence of overweight and obesity. We applied chi-square tests to confirm that the eight pairings by sex, school type, and BMI category did not differ statistically. This allowed us to combine the datasets for subsequent analyses.

Because less than 1% of students were underweight, we dismissed this BMI category in further analyses in order to simplify our assessment of overweight and obesity. Specifically, if students were neither overweight nor obese, then they were at a healthy weight. By examining the prevalence of healthy weight, we would see how excessive weight gain changed with age.

The percentage of healthy weight (HW) males declined linearly at a rate of 4.8% per year between ages 5 and 10, increased to around 45% for ages 11 to 14, then again decreased to about 33% for those 15 and older (Table 3, Fig. 3). For females, the percentage categorized at a healthy weight also declined more or less linearly at a rate of 4.2% per year from age 5 to 14, where it reached a plateau at about 25% (Table 3, Fig. 3). These rates of decrease in the prevalence of HW were considerably greater than rates recorded seven years earlier, i.e. 1.4% for males and 2.7% for females , K—12. (Ref. 13, pp 9 & 10).

Table 3. CDC BMI categories for males (top) and females (bottom) ages 5 to 18.

Males

Age	UW	HW	OW	OB	Total
5	1 (0.3%)	169 (57.3%)	50 (16.9%)	75 (25.4%)	295
Age	UW	HW	OW	OB	Total
6	1 (0.9%)	59 (53.2%)	16 (14.4%)	35 (31.5%)	111
7	1 (1.9%)	26 (48.1%)	9 (16.7%)	18 (33.3%)	54
8	0 (0%)	33 (47.1%)	13 (18.6%)	24 (34.3%)	70
9	0 (0%)	29 (40.3%)	16 (22.2%)	27 (37.5%)	72
10	0 (0%)	23 (31.5%)	19 (26.0%)	31 (42.5%)	73
11	0 (0%)	37 (46.3%)	13 (16.3%)	30 (37.5%)	80
Total	2 (0.4%)	207 (45.0%)	86 (18.7%)	165 (35.9%)	460
Age	UW	HW	OW	OB	Total
12	0 (0%)	27 (45.8%)	9 (15.3%)	23 (39.0%)	59
13	1 (1.0%)	44 (43.1%)	14 (13.7%)	43 (42.2%)	102
14	0 (0%)	26 (45.6%)	13 (22.8%)	18 (31.6%)	57
15	0 (0%)	11 (33.3%)	10 (30.3%)	12 (36.4%)	33
16	0 (0%)	14 (28.6%)	9 (18.4%)	26 (53.1%)	49
17	0 (0%)	15 (36.6%)	4 (9.8%)	22 (53.7%)	41
18	0 (0%)	7 (33.3%)	3 (14.3%)	11 (52.4%)	21
Total	1 (0.3%)	117 (38.6%)	53 (17.5%)	132 (43.6%)	362

Females

Age	UW	HW	OW	OB	Total
5	2 (0.8%)	154 (61.8%)	49 (19.7%)	44 (17.7%)	249
Age	UW	HW	OW	OB	Total
6	0 (0%)	76 (62.3%)	20 (16.4%)	26 (21.3%)	122
7	1 (2.6%)	21 (53.8%)	5 (12.8%)	12 (30.8%)	39
8	0 (0%)	36 (59.0%)	11 (18.0%)	14 (23.0%)	61
9	1 (1.5%)	29 (43.3%)	13 (19.4%)	24 (35.8%)	67
10	1 (1.6%)	29 (46.8%)	9 (14.5%)	23 (37.1%)	62
11	1 (1.3%)	28 (35.4%)	19 (24.1%)	31 (39.2%)	79
Total	4 (0.9%)	219 (50.9%)	77 (17.9%)	130 (30.2%)	430
Age	UW	HW	OW	OB	Total
12	1 (1.5%)	25 (37.3%)	16 (23.9%)	25 (37.3%)	67
13	0 (0%)	27 (31.4%)	26 (30.2%)	33 (38.4%)	86
14	0 (0%)	11 (25.6%)	10 (23.3%)	22 (51.2%)	43
15	0 (0%)	14 (27.5%)	14 (27.5%)	23 (45.1%)	51
16	0 (0%)	14 (24.6%)	9 (15.8%)	34 (59.6%)	57
17	0 (0%)	16 (28.1%)	18 (31.6%)	23 (40.4%)	57
18	0 (0%)	5 (27.8%)	6 (33.3%)	7 (38.9%)	18
Total	1 (0.3%)	112 (29.6%)	99 (26.1%)	167 (44.1%)	379

Age in years. Underweight (UW), healthy weight (HW), overweight (OW) and obese (OB). Data are the number of students and their percentages by age. Row total percentages correct for unequal numbers in each sex/age combination.

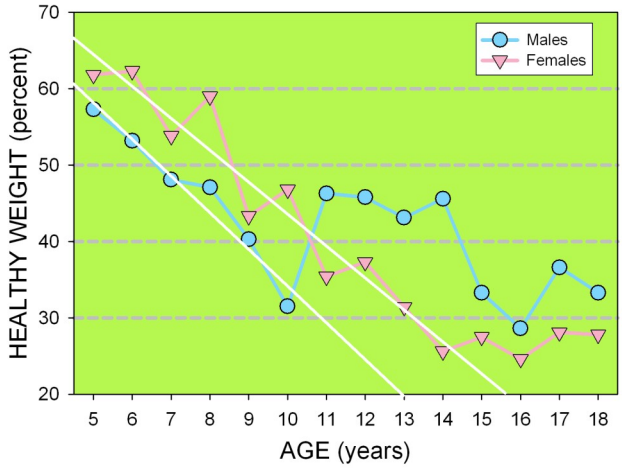

Figure 3. Prevalence of healthy weight (HW) males and females from Table 3.

The increase in the percentage of healthy weight males between ages 11 to 14 implies that those born from 2000 to 2003 gained weight much less rapidly than those born either earlier or later. For instance, in 2007 current 12-year-olds were 5-year-olds. The prevalence of healthy weight for 5-year-old males at that time was 55.5% (Fig. 2 of Ref. 15), similar to 57.3% for today's 5-year-olds (Table 3). Two years later the prevalence of healthy weight 7-year-old males was unchanged at 56.1% (Fig. 2 of Ref. 15), while the prevalence of current 7-year-old males is 48.1% (Table 3). Furthermore, the greater percentage of healthy weight males 15 years and older compared with females implies that they gained weight more slowly than males younger than 11 years. Both observations suggest that, relative to females, the current rate of weight gain for pre-pubertal males has increased.

Chance events can sometimes look otherwise, especially for small sample sizes. Repeating this study with a much larger sample could verify whether the anomalous increase in the prevalence of healthy weight males aged 11 to 14 is true. It suggests that an environmental factor(s) operating over

four consecutive years offered a measure of protection at reducing overweight and obesity. That it affected males but not females, and that it both began and ended abruptly, may offer clues to an effective intervention.

Comparing the current prevalence of overweight and obesity with those from our earlier studies showed a marked difference between the sexes and between the 6—11 and the 12—18 age groups (Table 5). [Note: *The CDC recognizes only the 95th BMI percentile cutoff for categorizing children*

Table 5. Comparison of the prevalence of overweight and obesity among States (US) based on CDC 2000 growth chart cutoffs.

BMIP Cutoff	Gender	Age (y)	1978 & 1982	2006/2007	2007/2008	2008/2009	AS 2014
97th	Boys	2 to 5					15.6
		6 to 11		24.8	24.6	23.0	30.0
		12 to 19	4.4	34.0	31.5	29.9	34.8
	Girls	2 to 5					12.3
		6 to 11		23.8	20.9	18.1	23.7
		12 to 19	5.4	29.5	32.1	31.5	29.6
95th	Boys	2 to 5					16.3
		6 to 11		33.5	30.2	29.2	35.9
		12 to 19	5.3	41.1	39.1	38.2	42.8
	Girls	2 to 5					14.0
		6 to 11		31.3	27.8	25.1	30.2
		12 to 19	13.4	41.8	42.8	43.9	44.1
85th	Boys	2 to 5					32.7
		6 to 11		52.4	48.5	47.7	54.6
		12 to 19	25.4	61.6	59.1	59.9	59.9
	Girls	2 to 5					32.3
		6 to 11		50.1	47.4	46.8	48.1
		12 to 19	42.9	69.6	68.1	69.2	70.2
Sample size	Boys	2 to 5					1,648
		6 to 11		1,200	796	948	460
		12 to 19	114	1,116	1,197	855	362
	Girls	2 to 5					1,556
		6 to 11		1,108	785	857	430
		12 to 19	112	1,051	1,223	818	379

The 85th BMI percentile cutoff is the prevalence of overweight and obesity; percentile cutoff has no official CDC category but is used by the US investi- calculate the prevalence of overweight alone, subtract the prevalence at the 2006/2007[13]], [AS 2007/2008[14]], [AS 2008/2009[15]], [AS 2009 to 2013] Ap- -2012[23]]. [AS 2014] combines data from [AS 2013] with data for 5-year-olds

as obese. The 97th BMI percentile was introduced by the authors of the U.S. studies in Table 5 as another classification of obesity. Recently, two more classifications of childhood obesity were introduced, but based on BMI: Class 2 (35 <= BMI < 40) and class 3 (BMI => 40) obesity[24]. These two classes are also used for adults, where class 2 is severe obesity and *class 3 is morbid obesity. This report uses these latest classifications as well. Also, our 12-18 year age group is expressed as the 12-19 age group in Table 5.]*

children and adolescents in American Samoa (AS) and in the United

						US			
	2009	2010	2011	2012	2013	2003 - 2006	2007-2008	2009-2010	2011-2012
	11.3	12.0	11.2	15.7	14.1	9.0	5.8	11.2	
						11.7	16.3	14.6	
						13.9	14.3	14.7	
	10.0	11.5	8.8	12.3	12.2	7.9	8.1	7.9	
						11.1	12.6	11.3	
						11.1	10.4	11.2	
	15.7	16.8	15.1	20.5	19.2	12.8	10.0	14.4	9.5
						18.0	21.2	20.1	16.4
						18.2	19.3	19.6	20.3
	14.0	15.8	13.0	16.0	15.7	12.1	10.7	9.6	7.2
						15.8	18.0	15.7	19.1
						16.8	16.8	17.1	20.7
	33.6	36.4	32.8	36.8	36.1	25.5	21.0	29.7	23.9
						33.9	35.9	33.1	33.2
						34.9	35.0	34.6	35.1
	34.7	36.5	32.5	34.6	34.7	23.3	21.4	23.4	21.7
						32.6	35.2	32.1	35.2
						33.3	33.3	32.6	33.8
	2,063	1,981	1,669	1,977	1,353	875	465	471	439
						1,013	595	621	650
						2,229	641	685	624
	2,123	2,060	1,690	1,892	1,307	895	388	432	432
						1,082	602	592	618
						2,071	558	607	592

the 95th BMI percentile cutoff is the prevalence of obesity; the 97th BMI gators to designate children and adolescents who may be very obese. (To 95th percentile from that at the 85th percentile.) [AS 1978 & 1982][19], [AS pendix, [US 2003-2006[20]], [US 2007-2008[21]], [US 2009-2010[22]], [US 2011 in this report.

The proportion of females aged 6—11 who were either overweight or obese (i.e., at or above the 85th BMI percentile cutoff) increased only slightly from 2008/2009 (46.8%) to 2014 (48.1%). Whereas for males in this age group, the prevalence rose from 47.7% in 2008/2009 to 54.6% now. This concurs with what was seen in Fig. 3. Even so, the prevalence of obesity (i.e., at or above the 95th BMI percentile cutoff) increased by greater than 5% for both males and females, with most of this increase being at the higher, 97th BMI percentile, cutoff.

For those 12—19 years of age, no change in the prevalence of either overweight or obesity was observed between 2008/2009 and 2014, given the $\pm$5% uncertainly in our measurements.

The prevalence of overweight and obesity among the Territory's males and females in all three age groups during 2014 was about twice that reported for children and adolescents in the United States during 2011-2012, i.e., the latest available data. For the two older age groups, it increased considerably over the past five years.

ASWIC BMI Data

Beginning in 2009 the AS Dept. of Human and Social Services has provided the AS Community College's Community and Natural Resources Division with de-identified BMI data collected by WIC staff during fiscal years, i.e. 01 October to 30 September. This data was analyzed and returned to DHSS for distribution to DOH's Maternal and Child Health Program and others. It is included at the end of this report as an appendix to provide a more complete record of the state of childhood overweight and obesity in the Territory.

In August 2013 the CDC released a report on the BMI status of 11.6 million low-income children enrolled in WIC from 40 states and two US territories: Puerto Rico and the Virgin Islands[25]. American Samoa was not included in this study because the territory did not participate in the Pediatric Nutrition Surveillance System during 2008-2011.

In 2009, the prevalence of obesity for WIC recipients in American Samoa was 15.7% for males and 14.0% for fe-

males (Table 5), for a combined prevalence of 14.8%. That same year in the United States, the combined prevalence was greater in New Jersey (18.4%), Puerto Rico (18.1%), California (17.0%), and Massachusetts (16.8%).

American Samoa's obesity prevalence in 2011 was 15.1% for males, 13.0% for females (Table 5), or 14.0% combined, that is, 0.8% less than in 2009. It would have placed American Samoa in the middle of the US rankings, tied with Washington, West Virginia, and Wisconsin. But in 2012, the prevalence of American Samoans males rose 5.4 points to 20.5%. And it rose 3.0 points to 16.0% for females, making the combined prevalence of WIC recipients 18.3%. Whether other states experienced a sharp increase in the prevalence of obesity during 2012 remains to be seen. The slight decrease in this prevalence in 2013, i.e., 17.5%, is statistically insignificant. As for our data on the 6—11 years and 12—19 years age groups, the prevalence of obesity has risen sharply despite the many programs and activities sponsored by both government and private agencies during the past five years.

Acanthosis nigricans (AN)

Acanthosis nigricans, or AN, was first described in 1890. Initially it was rarely observed. Beginning in the 1990s, it became common and began to be suspected as an indicator of high diabetes risk[26]. Subsequent studies linked AN to obesity, high fasting plasma glucose, triglycerides, LDL cholesterol, and systolic and diastolic blood pressure, and significantly lower HDL cholesterol[27]. Although AN can occur in other locations where the skin folds and creases, the Burke AN scoring method of the neck offers a convenient quantitative scale that correlates well with BMI[18].

Of the 180 males and 221 females identified as having AN, 88.5% were obese (Figs. 4 & 5). Another 8.0% were overweight, and the remaining 3.5% were at a healthy weight. Most students—31.4% (53 males; 73 females)—were rated at an AN of 1. Next were students rated at an AN of 4 (24.9%; 43 males; 57 females). They were followed by an approximately equal number of students rated at AN 2 and 3.

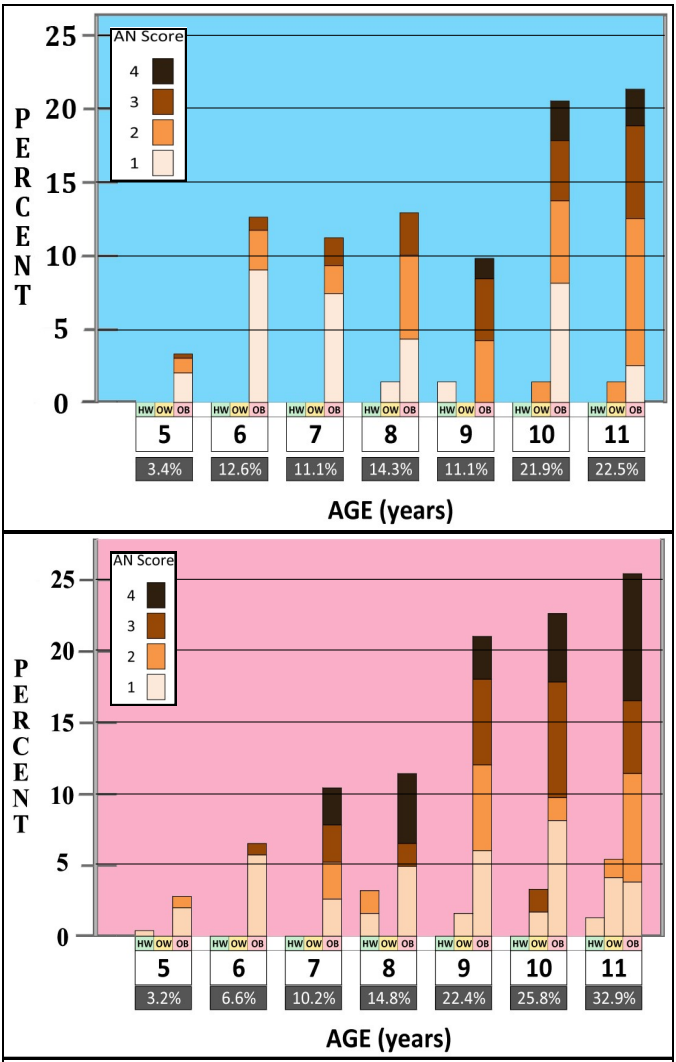

Figure 4. The frequency acanthosis nigricans (AN) was observed and scored for males (top) and females (bottom) ages 5 to 11 years who were at a healthy weight (HW), overweight (OW), and obese (OB). The percentages listed below the ages are sums of all three weight categories for each age. Legends are interpretations of the four color-coded Burke AN scores.

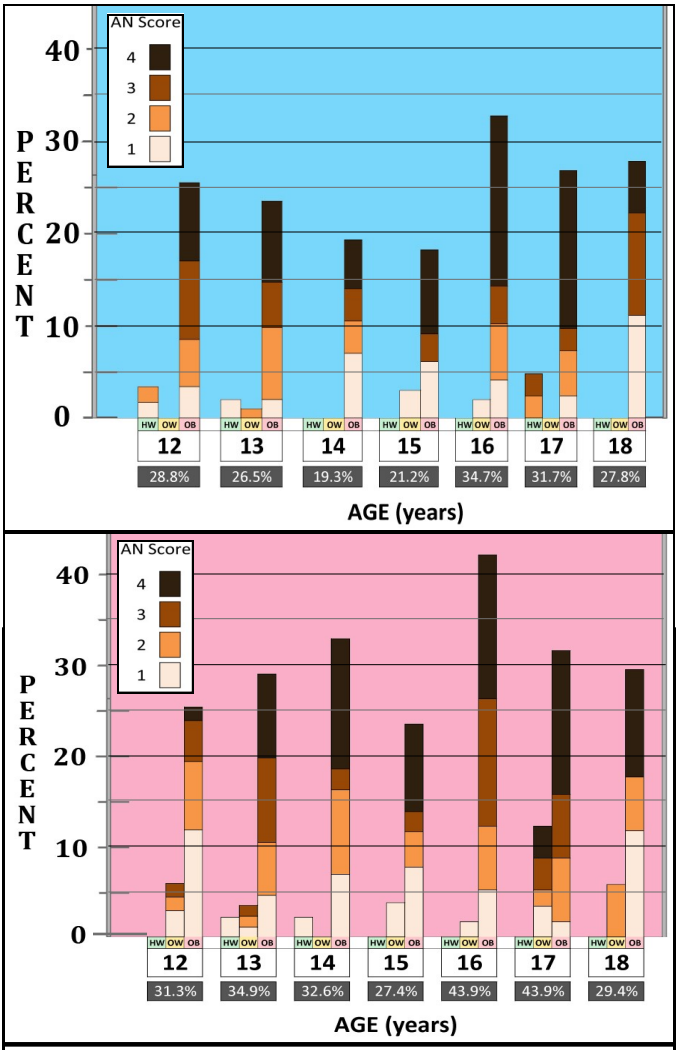

Figure 5. The frequency acanthosis nigricans (AN) was observed and scored for males (top) and females (bottom) ages 12 to 18 years who were at a healthy weight (HW), overweight (OW), and obese (OB). The percentages listed below the ages are sums of all three weight categories for each age. Legends are interpretations of the four color-coded Burke AN scores.

In addition to AN correlating with obesity, we found that it also correlated with the severity, or class, of obesity. More than half the students categorized as having class 3 obesity had an AN score of 4 (Table 6). And the proportion of students categorized as having class 1 obesity decreased as AN scores increased from 1 to 4.

Table 6. The number and percentage of obese males, females, and both combined by obesity class and acanthosis nigricans (AN) score.

Males		AN Score				Totals
		1	2	3	4	
Obesity class	1	39 (33.3%)	35 (29.9%)	27 (23.1%)	16 (13.7%)	**117 (70.1%)**
	2	5 (17.9%)	8 (28.6%)	6 (21.4%)	9 (32.1%)	**28 (16.8%)**
	3	2 (9.1%)	1 (4.5%)	1 (4.5%)	18 (81.8%)	**22 (13.2%)**
Totals		**46 (27.5%)**	**44 (26.3%)**	**34 (20.4%)**	**45 (26.9%)**	**167**
Females		**AN Score**				**Totals**
		1	2	3	4	
Obesity class	1	49 (37.1%)	31 (23.5%)	29 (22.0%)	23 (17.4%)	**132 (70.2%)**
	2	3 (10.7%)	4 (14.3%)	4 (14.3%)	17 (60.7%)	**28 (14.9%)**
	3	1 (3.6%)	4 (14.3%)	8 (28.6%)	15 (53.6%)	**28 (14.9%)**
Totals		**53 (28.2%)**	**39 (20.7%)**	**41 (21.8%)**	**55 (29.3%)**	**188**
Both		**AN Score**				**Totals**
		1	2	3	4	
Obesity class	1	88 (35.3%)	66 (26.5%)	56 (22.5%)	39 (15.7%)	**249 (70.1%)**
	2	8 (14.3%)	12 (21.4%)	10 (17.9%)	26 (46.4%)	**56 (15.8%)**
	3	3 (6.0%)	5 (10.0%)	9 (18.0%)	33 (66.0%)	**50 (14.1%)**
Totals		**99 (27.9%)**	**83 (23.4%)**	**75 (21.1%)**	**100 (28.2%)**	**355**

Children at or above the 95th BMI percentile are categorized as obese. Those at class 1 obesity have a BMI < 30. For class 2: 30 <= BMI < 40 and class 3: BMI => 40[26].

CONCLUSIONS

Despite several popular, recurring programs and activities that local agencies and organizations conducted over the past five years to promote physical activity and a healthy diet, obesity among the Territory's children has increased. Some parents object to their children being labeled "obese" based on a measurement of US children between 1963 and 1994: the CDC 2000 growth chart reference. They attribute high

BMI in Samoan youth to something other than body fat. They correctly claim that different ethnicities have different body builds[28, 29]. But attributing differences in body build as a reason to interpret BMI differently for Samoan youth should be tempered by taking into account three important points brought out in this report.

First, the obesity prevalence seen for AS WIC recipients between 2009 and 2011 was comparable to that of US WIC recipients during the same period, using the same criterion. Any difference in body build for children younger than 5 years is, therefore, negligible.

Second, BMIs calculated using height and weight data collected on 11– to 18-year-olds living on Tutuila during 1978 and 1982 found that the prevalence of obesity, based on the CDC reference, was far less then than it is today for either Samoan or US youth. In fact, only 5.3% of males back then were categorized as obese, nearly the same percentage as the CDC reference.

Third, the prevalence and severity of acanthosis nigricans observed for students in our study coincided with the prevalence and severity of obesity as determined by the CDC reference. This independent risk factor for NCDs should dispel any doubt that Samoan youth face serious health challenges if this epidemic is not brought under control.

Since 2003, at least 19 states require school-based BMI screening. The Institute of Medicine recommended in 2005 that all schools annually assess their students' BMI as part of a national strategy to address weight problems in children. Toward this end, the CDC published ten strategies that state policymakers could adopt to help schools address childhood obesity[30]. The CDC also provides free MS Excel-based software to allow schools to collect and assess BMI of their students[31]. Guidelines exist to establish a safe and supportive environment for students of all body sizes if American Samoa decides to implement this program[32]. Testing if the tantalizing clue discovered in this study is true—that teenage males were somehow spared the full influence of an obesogenic environment—will require such a territory-wide surveillance within a year or two. Otherwise the opportunity to pursue and possibly identify a potentially effective intervention may be lost.

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Appendix

The American Samoa Department of Human and Social Services Women, Infants, and Children (WIC) office and the American Samoa Community College Community and Natural Resources division have partnered since 2009 to analyze BMI data on WIC recipients aged 0 to 5 years, that is, birth up to but not including 60 months.

This appendix includes two types of table: one for children under 2 years of age and another for children 2 to 4 years of age, except for 2011, when no data was submitted for children under 2 years of age.

The first table type, i.e., for children under 2 years, divides the children by sex and by four age groups: 0 to 5 months, 6 to 11 months, 12 to 17 months, and 18 to 23 months. It categorizes children as either underweight, healthy weight, overweight, or obese using World Health Organization (WHO) BMI cutoffs published in April 2006[33, 34].

The CDC growth charts of May 2000 categorize children on BMI status beginning at age 2 to 20 years[16]. We used both the CDC and the WHO charts for WIC recipients 2 to 4 years of age for the second table type. The WHO charts are growth standards that describe how healthy children should grow under optimal environmental and health conditions. Whereas the CDC charts are a growth reference that describe how certain children grew in the United States between 1963 and 1994. CDC charts are used in clinical settings but may, in time, be superseded by the WHO charts. For this reason both are used here.

WHO 2006 BMI Categories for 0 to 24 months (ASWIC, 2009)						
Males	Age (months)	Underweight	Healthy weight	Overweight	Obese	Total
	0 to 5	22 (5.8%)	234 (62.1%)	62 (16.4%)	59 (15.6%)	377
	6 to 11	11 (3.3%)	165 (49.5%)	60 (18.0%)	97 (29.1%)	333
	12 to 17	2 (0.6%)	168 (49.4%)	72 (21.2%)	98 (28.8%)	340
	18 to 23	1 (0.2%)	289 (49.1%)	126 (21.4%)	173 (29.4%)	589
	Total	36 (2.2%)	856 (52.2%)	320 (19.5%)	427 (26.1%)	1,639
Females	Age (months)	Underweight	Healthy weight	Overweight	Obese	Total
	0 to 5	10 (2.8%)	228 (64.2%)	62 (17.5%)	55 (15.5%)	355
	6 to 11	3 (0.9%)	190 (57.8%)	74 (22.5%)	62 (18.8%)	329
	12 to 17	1 (0.3%)	178 (53.5%)	70 (21%)	84 (25.2%)	333
	18 to 23	1 (0.2%)	296 (48.7%)	157 (25.8%)	154 (25.3%)	608
	Total	15 (0.9%)	892 (54.9%)	363 (22.3%)	355 (21.8%)	1,625
Both	Age (months)	Underweight	Healthy weight	Overweight	Obese	Total
	0 to 5	32 (4.4%)	462 (63.1%)	124 (16.9%)	114 (15.6%)	732
	6 to 11	14 (2.1%)	355 (53.6%)	134 (20.2%)	159 (24%)	662
	12 to 17	3 (0.4%)	346 (51.4%)	142 (21.1%)	182 (27%)	673
	18 to 23	2 (0.2%)	585 (48.9%)	283 (23.6%)	327 (27.3%)	1,197
	Total	51 (1.6%)	1,748 (53.6%)	683 (20.9%)	782 (24%)	3,264

WHO 2006 BMI Categories for 0 to 24 months (ASWIC, 2010)						
Males	Age (months)	Underweight	Healthy weight	Overweight	Obese	Total
	0 to 5	7 (2.3%)	186 (61.6%)	46 (15.2%)	63 (20.9%)	302
	6 to 11	16 (4.3%)	142 (38.0%)	71 (19.0%)	145 (38.8%)	374
	12 to 17	2 (0.6%)	135 (42.3%)	70 (21.9%)	112 (35.1%)	319
	18 to 23	6 (1.0%)	302 (47.9%)	113 (17.9%)	210 (33.3%)	631
	Total	31 (1.9%)	765 (47.0%)	300 (18.5%)	530 (32.6%)	1,626
Females	Age (months)	Underweight	Healthy weight	Overweight	Obese	Total
	0 to 5	10 (3.0%)	197 (59.7%)	62 (18.8%)	61 (18.5%)	330
	6 to 11	6 (2.0%)	150 (49.7%)	51 (16.9%)	95 (31.5%)	302
	12 to 17	3 (1.0%)	157 (50.6%)	58 (18.7%)	92 (29.7%)	310
	18 to 23	4 (0.6%)	288 (45.9%)	130 (20.7%)	205 (32.7%)	627
	Total	23 (1.5%)	792 (50.5%)	301 (19.2%)	453 (28.9%)	1,569
Both	Age (months)	Underweight	Healthy weight	Overweight	Obese	Total
	0 to 5	17 (2.7%)	383 (60.6%)	108 (17.1%)	124 (19.6%)	632
	6 to 11	22 (3.3%)	292 (43.2%)	122 (18.0%)	240 (35.5%)	676
	12 to 17	5 (0.8%)	292 (46.4%)	128 (20.3%)	204 (32.4%)	629
	18 to 23	10 (0.8%)	590 (46.9%)	243 (19.3%)	415 (33.0%)	1,258
	Total	54 (1.7%)	1,557 (48.7%)	601 (18.8%)	983 (30.8%)	3,195

WHO 2006 BMI Categories for 0 to 24 months (ASWIC, 2012)						
	Age (m)	Underweight	Healthy Weight	Overweight	Obese	Total
Males	0 - 5	39 (11.1%)	239 (68.3%)	40 (11.4%)	32 (9.1%)	350
	6 - 11	3 (1.1%)	149 (55%)	54 (19.9%)	65 (24%)	271
	12 - 17	3 (0.9%)	190 (54.4%)	68 (19.5%)	88 (25.2%)	349
	18 - 23	1 (0.4%)	141 (50.5%)	54 (19.4%)	83 (29.7%)	279
	Total	46 (3.7%)	719 (57.6%)	216 (17.3%)	268 (21.5%)	1,249
Females	0 - 5	44 (13.5%)	220 (67.5%)	29 (8.9%)	33 (10.1%)	326
	6 - 11	5 (1.7%)	157 (54.9%)	62 (21.7%)	62 (21.7%)	286
	12 - 17	5 (1.7%)	157 (54.9%)	56 (19.6%)	68 (23.8%)	286
	18 - 23	3 (1%)	145 (50.3%)	58 (20.1%)	82 (28.5%)	288
	Total	57 (4.8%)	679 (57.3%)	205 (17.3%)	245 (20.7%)	1,186
Both	0 - 5	83 (12.3%)	459 (67.9%)	69 (10.2%)	65 (9.6%)	676
	6 - 11	8 (1.4%)	306 (54.9%)	116 (20.8%)	127 (22.8%)	557
	12 - 17	8 (1.3%)	347 (54.6%)	124 (19.5%)	156 (24.6%)	635
	18 - 23	4 (0.7%)	286 (50.4%)	112 (19.8%)	165 (29.1%)	567
	Total	103 (4.2%)	1398 (57.4%)	421 (17.3%)	513 (21.1%)	2,435

WHO 2006 BMI Categories for 0 to 24 months (ASWIC, 2013)

	Age (m)	Underweight	Healthy Weight	Overweight	Obese	Total
Males	0 - 5	16 (7.2%)	157 (70.4%)	24 (10.8%)	26 (11.7%)	223
	6 - 11	4 (2.4%)	93 (56.4%)	31 (18.8%)	37 (22.4%)	165
	12 - 17	3 (1.3%)	114 (50.2%)	50 (22%)	60 (26.4%)	227
	18 - 23	1 (0.5%)	95 (48%)	39 (19.7%)	63 (31.8%)	198
	Total	24 (3%)	459 (56.5%)	144 (17.7%)	186 (22.9%)	813
Females	0 - 5	19 (8.8%)	160 (74.1%)	23 (10.6%)	14 (6.5%)	216
	6 - 11	2 (1.3%)	77 (48.7%)	32 (20.3%)	47 (29.7%)	158
	12 - 17	3 (1.4%)	120 (55.6%)	45 (20.8%)	48 (22.2%)	216
	18 - 23	0 (0%)	94 (46.3%)	56 (27.6%)	53 (26.1%)	203
	Total	24 (3%)	451 (56.9%)	156 (19.7%)	162 (20.4%)	793
Both	0 - 5	35 (8%)	317 (72.2%)	47 (10.7%)	40 (9.1%)	439
	6 - 11	6 (1.9%)	170 (52.6%)	63 (19.5%)	84 (26%)	323
	12 - 17	6 (1.4%)	234 (52.8%)	95 (21.4%)	108 (24.4%)	443
	18 - 23	1 (0.2%)	189 (47.1%)	95 (23.7%)	116 (28.9%)	401
	Total	48 (3%)	910 (56.7%)	300 (18.7%)	348 (21.7%)	1,606

WHO 2006 and CDC 2000 BMI Standards for 2- to 5-year-olds (ASWIC, Year 2009)

		Underweight		Healthy weight		Overweight		Obese		
	Age (y)	WHO	CDC	WHO	CDC	WHO	CDC	WHO	CDC	Total
Males	2	3 (0.5%)	7 (1.2%)	305 (52.0%)	411 (70.0%)	148 (25.2%)	102 (17.4%)	131 (22.3%)	67 (11.4%)	587
	3	1 (0.2%)	8 (1.3%)	360 (58.8%)	405 (66.2%)	121 (19.8%)	110 (18.0%)	130 (21.2%)	89 (14.5%)	612
	4	2 (0.2%)	11 (1.3%)	501 (58.1%)	527 (61.1%)	177 (20.5%)	159 (18.4%)	183 (21.2%)	166 (19.2%)	863
	Total	6 (0.3%)	26 (1.3%)	1,166 (56.5%)	1,343 (65.1%)	446 (21.6%)	371 (18.0%)	444 (21.5%)	322 (15.6%)	2,062
		Underweight		Healthy weight		Overweight		Obese		
Females	2	3 (0.5%)	6 (1.0%)	319 (52.1%)	408 (66.7%)	150 (24.5%)	129 (21.1%)	140 (22.9%)	69 (11.3%)	612
	3	4 (0.6%)	8 (1.3%)	367 (59.5%)	386 (62.6%)	136 (22.0%)	139 (22.5%)	110 (17.8%)	84 (13.6%)	617
	4	2 (0.2%)	8 (0.9%)	602 (67.3%)	571 (63.9%)	136 (15.2%)	170 (19.0%)	154 (17.2%)	145 (16.2%)	894
	Total	9 (0.4%)	22 (1.0%)	1,288 (60.7%)	1,365 (64.3%)	422 (19.9%)	438 (20.6%)	404 (19.0%)	298 (14.0%)	2,123
		Underweight		Healthy weight		Overweight		Obese		
Both	2	6 (0.5%)	13 (1.1%)	624 (52.0%)	819 (68.3%)	298 (24.9%)	231 (19.3%)	271 (22.6%)	136 (11.3%)	1,199
	3	5 (0.4%)	16 (1.3%)	727 (59.2%)	791 (64.4%)	257 (20.9%)	249 (20.3%)	240 (19.5%)	173 (14.1%)	1,229
	4	4 (0.2%)	19 (1.1%)	1,103 (62.8%)	1,098 (62.5%)	313 (17.8%)	329 (18.7%)	337 (19.2%)	311 (17.7%)	1,757
	Total	**15 (0.4%)**	**48 (1.1%)**	**2,454 (58.6%)**	**2,708 (64.7%)**	**868 (20.7%)**	**809 (19.3%)**	**848 (20.3%)**	**620 (14.8%)**	4,185

Where multiple measurements were taken, only the most recent was used for determining the Body Mass Index category.

WHO 2006 and CDC 2000 BMI Standards for 2- to 5-year-olds (ASWIC, Year 2010)

		Underweight		Healthy Weight		Overweight		Obese		
		WHO	CDC	WHO	CDC	WHO	CDC	WHO	CDC	
Males	Age									Total
	2	2 (0.4%)	12 (2.5%)	244 (50.8%)	305 (63.5%)	98 (20.4%)	93 (19.4%)	136 (28.3%)	70 (14.6%)	480
	3	0 (0.0%)	2 (0.4%)	294 (52.1%)	348 (61.7%)	121 (21.5%)	113 (20.0%)	149 (26.4%)	101 (17.9%)	564
	4	2 (0.2%)	8 (0.9%)	530 (57.4%)	578 (62.6%)	205 (22.2%)	179 (19.4%)	186 (20.2%)	158 (17.1%)	923
	Total	**4 (0.2%)**	**22 (1.1%)**	**1,068 (54.3%)**	**1,231 (62.6%)**	**424 (21.6%)**	**385 (19.6%)**	**471 (23.9%)**	**329 (16.7%)**	1,967
Females	Age	Underweight		Healthy Weight		Overweight		Obese		Total
		WHO	CDC	WHO	CDC	WHO	CDC	WHO	CDC	
	2	3 (0.6%)	14 (2.8%)	248 (49.0%)	322 (63.6%)	119 (23.5%)	93 (18.4%)	136 (26.9%)	77 (15.2%)	506
	3	2 (0.4%)	9 (1.7%)	315 (57.8%)	330 (60.6%)	109 (20.0%)	118 (21.7%)	119 (21.8%)	88 (16.1%)	545
	4	3 (0.3%)	18 (1.8%)	637 (64.5%)	598 (60.6%)	177 (17.9%)	213 (21.6%)	170 (17.2%)	158 (16.0%)	987
	Total	**8 (0.4%)**	**41 (2.0%)**	**1,200 (58.9%)**	**1,250 (61.3%)**	**405 (19.9%)**	**424 (20.8%)**	**425 (20.9%)**	**323 (15.8%)**	2,038
Both	Age	Underweight		Healthy Weight		Overweight		Obese		Total
		WHO	CDC	WHO	CDC	WHO	CDC	WHO	CDC	
	2	5 (0.5%)	26 (2.6%)	492 (49.9%)	627 (63.6%)	217 (22.0%)	186 (18.9%)	272 (27.6%)	147 (14.9%)	986
	3	2 (0.2%)	11 (1.0%)	609 (54.9%)	678 (61.1%)	230 (20.7%)	231 (20.8%)	268 (24.2%)	189 (17.0%)	1,109
	4	5 (0.3%)	26 (1.4%)	1,167 (61.1%)	1,176 (61.6%)	382 (20.0%)	392 (20.5%)	356 (18.6%)	316 (16.5%)	1,910
	Total	**12 (0.3%)**	**63 (1.6%)**	**2,268 (56.6%)**	**2,481 (61.9%)**	**829 (20.7%)**	**809 (20.2%)**	**896 (22.4%)**	**652 (16.3%)**	4,005

Where multiple measurements were taken, only the most recent was used for determining the Body Mass Index category.

WHO 2006 and CDC 2000 BMI Categories for 2- to 5-year-olds (ASWIC, 2011)

	Age	WHO Underweight	CDC Underweight	WHO Healthy Weight	CDC Healthy Weight	WHO Overweight	CDC Overweight	WHO Obese	CDC Obese	Total
Males	2	4 (1.4%)	10 (3.5%)	150 (52.3%)	187 (65.2%)	72 (25.1%)	47 (16.4%)	61 (21.3%)	43 (15.0%)	287
	3	5 (0.9%)	13 (2.3%)	333 (58.4%)	375 (65.8%)	125 (21.9%)	100 (17.5%)	107 (18.8%)	82 (14.4%)	570
	4	2 (0.2%)	10 (1.2%)	493 (60.7%)	527 (64.9%)	168 (20.7%)	148 (18.2%)	149 (18.3%)	127 (15.6%)	812
	Total	11 (0.7%)	33 (2.0%)	976 (58.5%)	1,089 (65.2%)	365 (21.9%)	295 (17.7%)	317 (19.0%)	252 (15.1%)	1,669
	Age	WHO Underweight	CDC Underweight	WHO Healthy Weight	CDC Healthy Weight	WHO Overweight	CDC Overweight	WHO Obese	CDC Obese	Total
Females	2	0 (0.0%)	4 (1.5%)	153 (56.9%)	188 (69.9%)	59 (21.9%)	38 (14.1%)	57 (21.2%)	39 (14.5%)	269
	3	3 (0.5%)	10 (1.7%)	374 (62.5%)	396 (66.2%)	124 (20.7%)	126 (21.1%)	97 (16.2%)	66 (11.0%)	598
	4	5 (0.6%)	18 (2.2%)	558 (67.8%)	524 (63.7%)	138 (16.8%)	167 (20.3%)	122 (14.8%)	114 (13.9%)	823
	Total	8 (0.5%)	32 (1.9%)	1,085 (64.2%)	1,108 (65.6%)	321 (19.0%)	331 (19.6%)	276 (16.3%)	219 (13.0%)	1,690
	Age	WHO Underweight	CDC Underweight	WHO Healthy Weight	CDC Healthy Weight	WHO Overweight	CDC Overweight	WHO Obese	CDC Obese	Total
Both	2	4 (0.7%)	14 (2.5%)	303 (54.5%)	375 (67.4%)	131 (23.6%)	85 (15.3%)	118 (21.2%)	82 (14.7%)	556
	3	8 (0.7%)	23 (2.0%)	707 (60.5%)	771 (66.0%)	249 (21.3%)	226 (19.3%)	204 (17.5%)	148 (12.7%)	1,168
	4	7 (0.4%)	28 (1.7%)	1,051 (64.3%)	1,051 (64.3%)	306 (18.7%)	315 (19.3%)	271 (16.6%)	241 (14.7%)	1,635
	Total	19 (0.6%)	65 (1.9%)	2,061 (61.4%)	2,197 (65.4%)	686 (20.4%)	626 (18.6%)	593 (17.7%)	471 (14.0%)	3,359

WHO 2006 and CDC 2000 BMI Categories for 2- to 5-year-olds (ASWIC, 2012)

	Age	WHO	CDC	WHO	CDC	WHO	CDC	WHO	CDC	Total
		Underweight		Healthy Weight		Overweight		Obese		
Males	2	4 (0.5%)	20 (2.7%)	390 (51.9%)	473 (63%)	130 (17.3%)	123 (16.4%)	227 (30.2%)	135 (18%)	751
	3	4 (0.6%)	15 (2.3%)	370 (57.7%)	406 (63.3%)	115 (17.9%)	93 (14.5%)	152 (23.7%)	127 (19.8%)	641
	4	6 (1%)	17 (2.9%)	307 (52.7%)	318 (54.6%)	103 (17.7%)	104 (17.9%)	166 (28.5%)	143 (24.6%)	582
	Total	14 (0.7%)	52 (2.6%)	1067 (54.1%)	1197 (60.6%)	348 (17.6%)	320 (16.2%)	545 (27.6%)	405 (20.5%)	1,974
	Age	WHO	CDC	WHO	CDC	WHO	CDC	WHO	CDC	Total
		Underweight		Healthy Weight		Overweight		Obese		
Females	2	7 (1%)	25 (3.4%)	401 (54.6%)	476 (64.9%)	140 (19.1%)	132 (18%)	186 (25.3%)	101 (13.8%)	734
	3	3 (0.5%)	15 (2.5%)	356 (59.1%)	368 (61.1%)	101 (16.8%)	112 (18.6%)	142 (23.6%)	107 (17.8%)	602
	4	3 (0.5%)	13 (2.4%)	360 (65.5%)	339 (61.6%)	93 (16.9%)	108 (19.6%)	94 (17.1%)	90 (16.4%)	550
	Total	13 (0.7%)	53 (2.8%)	1117 (59.2%)	1183 (62.7%)	334 (17.7%)	352 (18.7%)	422 (22.4%)	298 (15.8%)	1,886
	Age	WHO	CDC	WHO	CDC	WHO	CDC	WHO	CDC	Total
		Underweight		Healthy Weight		Overweight		Obese		
Both	2	11 (0.7%)	45 (3%)	791 (53.3%)	949 (63.9%)	270 (18.2%)	255 (17.2%)	413 (27.8%)	236 (15.9%)	1,485
	3	7 (0.6%)	30 (2.4%)	726 (58.4%)	774 (62.3%)	216 (17.4%)	205 (16.5%)	294 (23.7%)	234 (18.8%)	1,243
	4	9 (0.8%)	30 (2.7%)	667 (58.9%)	657 (58%)	196 (17.3%)	212 (18.7%)	260 (23%)	233 (20.6%)	1,132
	Total	27 (0.7%)	105 (2.7%)	2184 (56.6%)	2380 (61.7%)	682 (17.7%)	672 (17.4%)	967 (25.1%)	703 (18.2%)	3,860

WHO 2006 and CDC 2000 BMI Categories for 2- to 5-year-olds (ASWIC, 2013)

	Age	WHO	CDC	WHO	CDC	WHO	CDC	WHO	CDC	Total
		Underweight		Healthy Weight		Overweight		Obese		
Males	2	3 (0.8%)	6 (1.5%)	202 (50.9%)	247 (62.2%)	72 (18.1%)	77 (19.4%)	120 (30.2%)	67 (16.9%)	397
	3	6 (1.5%)	8 (1.9%)	220 (53.3%)	249 (60.3%)	84 (20.3%)	72 (17.4%)	103 (24.9%)	84 (20.3%)	413
	4	7 (1.2%)	11 (1.9%)	336 (57.3%)	362 (61.8%)	111 (18.9%)	87 (14.8%)	132 (22.5%)	126 (21.5%)	586
	Total	16 (1.1%)	25 (1.8%)	758 (54.3%)	858 (61.5%)	267 (19.1%)	236 (16.9%)	355 (25.4%)	277 (19.8%)	1,396
	Age	WHO	CDC	WHO	CDC	WHO	CDC	WHO	CDC	Total
		Underweight		Healthy Weight		Overweight		Obese		
Females	2	3 (0.8%)	14 (3.6%)	215 (55%)	247 (63.2%)	68 (17.4%)	70 (17.9%)	105 (26.9%)	60 (15.3%)	391
	3	3 (0.8%)	8 (2.1%)	233 (60.8%)	244 (63.7%)	76 (19.8%)	77 (20.1%)	71 (18.5%)	54 (14.1%)	383
	4	4 (0.7%)	8 (1.4%)	367 (65.4%)	350 (62.4%)	90 (16%)	105 (18.7%)	100 (17.8%)	98 (17.5%)	561
	Total	10 (0.7%)	30 (2.2%)	815 (61%)	841 (63%)	234 (17.5%)	252 (18.9%)	276 (20.7%)	212 (15.9%)	1,335
	Age	WHO	CDC	WHO	CDC	WHO	CDC	WHO	CDC	Total
		Underweight		Healthy Weight		Overweight		Obese		
Both	2	6 (0.8%)	20 (2.5%)	417 (52.9%)	494 (62.7%)	140 (17.8%)	147 (18.7%)	225 (28.6%)	127 (16.1%)	788
	3	9 (1.1%)	16 (2%)	453 (56.9%)	493 (61.9%)	160 (20.1%)	149 (18.7%)	174 (21.9%)	138 (17.3%)	796
	4	11 (1%)	19 (1.7%)	703 (61.3%)	712 (62.1%)	201 (17.5%)	192 (16.7%)	232 (20.2%)	224 (19.5%)	1,147
	Total	26 (1%)	55 (2%)	1573 (57.6%)	1699 (62.2%)	501 (18.3%)	488 (17.9%)	631 (23.1%)	489 (17.9%)	2,731

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