Editorial

Obesity: lessons learned and the way forward

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1. Introduction

Obesity is a major public health concern worldwide, and its prevalence has been increasing in recent decades.[1] The existing criteria for defining obesity based on body mass index (BMI) may not reflect the variables related to obesity and the recent trends in public health.[2] In this editorial, we discuss the importance of redefining the criteria for obesity and analyzing the BMI and waist circumference (WC) distributions based on age, sex, and ethnicity.

## 2. Redefining the criteria for obesity

The current criteria for defining obesity based on BMI may not be appropriate for all populations.[2] For instance, the BMI cutoff values for obesity are 25 kg/m^2 in Korea and 30 kg/m^2 in the US, which may not reflect the differences in body composition and disease risk between these populations. Moreover, BMI does not distinguish between fat and muscle mass, which can lead to misclassification of obesity in people with high muscle mass, such as athletes.[3]

To overcome these limitations, the criteria for defining obesity should be redefined based on the latest scientific evidence and the specific characteristics of each population. For instance, waist circumference, which reflects abdominal fat accumulation, may be a better indicator of obesity-related disease risk than BMI in some populations.[4] Moreover, new measures of body composition, such as body fat percentage, may provide a more accurate assessment of obesity and its health consequences.

3. BMI and WC distributions by age, sex, and ethnicity

This shows the mortality rate changes from 1990 to 2019 due to a high BMI index using Global Burden of Disease 2019 study (Fig. 1). Analyzing the BMI and WC distributions by age, sex, and ethnicity can provide valuable insights into the prevalence and risk factors of obesity-related diseases. For instance, our previous analysis showed that the association between obesity and metabolic syndrome differed according to ethnicity, with non-Hispanic Asians showing a higher prevalence of diabetes mellitus, hypertension, and hypercholesterolemia compared to other racial groups. [2]

Moreover, our analysis showed that the distribution of BMI and WC differed by race, sex,

High body-mass index
Both sexes, All ages, Annual % change, 1990 to 2019, Deaths per 100,000
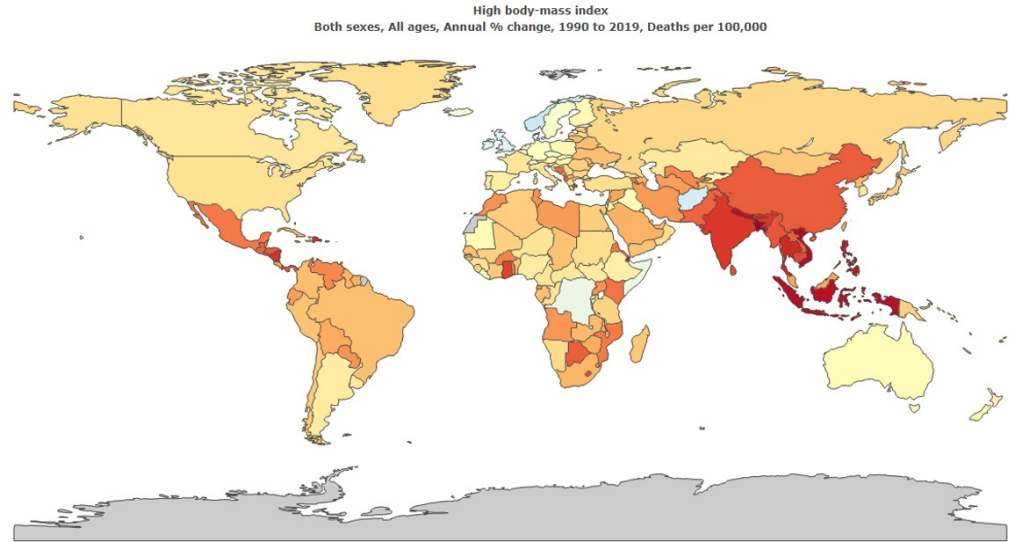
Fig. 1. Mortality rate changes from 1990 to 2019 due to a high BMI index using Global Burden of Disease 2019 study.

and age, which may be influenced by cultural, molecular, and environmental factors. Non-Hispanic Asians generally had a larger body build than Koreans but have lower weight-related measures than other racial groups. Non-Hispanic Black people showed a significant change in the early part of their lifespan, with large BMI slopes between 20 and 34 kg/m^2 for men and between 20 and 44 kg/m^2 for women. Also we provide further analysis results (Table 1).

Table 1. WC distribution by age and ethnicity based on the NHANES and KNHANES data

Ethnicity	Sex	Age (years)	N	Mean	SD	Percentile										
						Min	1th	5th	10th	25th	50th	75th	90th	95th	99th	Max
Mexican American	Male	20 - 24	79	97.84	16.60	72.6	72.6	76.1	77.0	83.1	96.7	110.3	120.7	131.1	136.9	136.9
		25 - 29	97	101.81	15.82	76.2	76.2	78.1	81.7	90.8	99.3	111.5	120.7	131.4	154.5	154.5
		30 - 34	71	101.65	14.42	73.2	73.2	78.5	86.4	92.5	100.5	109.1	120.5	132.4	139.6	139.6
		35 - 39	88	103.13	14.12	71.8	71.8	83.8	86.7	94.6	101.7	110.0	119.3	129.8	161.3	161.3
		40 - 44	65	103.78	16.54	76.1	76.1	78.6	86.2	92.5	104.3	111.5	117.7	124.9	170.8	170.8
		45 - 49	67	102.96	12.33	74.6	74.6	83.5	89.0	94.1	101.8	109.2	121.4	127.3	134.9	134.9
		50 - 54	76	105.88	14.20	83.1	83.1	85.8	90.1	96.7	101.7	113.1	124.0	137.5	150.1	150.1
		55 - 59	59	106.01	13.85	79.6	79.6	85.8	89.8	95.0	103.7	114.4	129.7	131.4	136.3	136.3
		60 - 64	116	105.47	12.49	76.2	81.4	86.9	90.0	96.7	104.4	115.7	121.8	125.1	137.1	147.8
		65 - 69	59	107.19	11.16	83.0	83.0	86.2	93.1	100.2	106.7	113.7	123.2	126.5	136.1	136.1
		70 - 74	46	104.91	13.06	84.0	84.0	87.0	88.0	97.7	104.6	114.0	119.5	129.0	140.3	140.3
		Over 75	44	103.80	10.04	84.4	84.4	85.7	90.4	98.2	103.1	108.6	118.5	120.2	129.1	129.1
	Female	20 - 24	86	94.70	17.82	64.7	64.7	70.0	73.9	82.2	92.1	104.1	118.4	134.9	143.0	143.0
		25 - 29	87	96.75	16.69	64.9	64.9	72.2	77.3	85.5	95.0	106.8	119.6	128.1	144.1	144.1
		30 - 34	76	99.44	16.16	66.6	66.6	78.4	82.7	88.5	96.8	106.9	122.2	132.5	146.7	146.7

Table 1. Continued

Ethnicity	Sex	Age (years)	N	Mean	SD	Min	1th	5th	10th	25th	50th	75th	90th	95th	99th	Max
Mexican American	Female	35 - 39	97	102.95	17.15	69.1	69.1	82.0	84.0	92.5	99.4	109.1	123.9	133.7	178.0	178.0
		40 - 44	107	99.33	14.56	72.4	74.0	79.7	81.8	89.8	99.0	104.0	115.9	129.0	143.5	149.2
		45 - 49	83	102.12	14.25	71.1	71.1	82.7	86.4	92.5	99.6	110.1	120.8	128.5	142.9	142.9
		50 - 54	85	101.50	14.96	74.6	74.6	81.4	86.7	91.4	99.7	107.6	122.4	129.1	145.2	145.2
		55 - 59	86	103.09	15.46	72.1	72.1	81.0	85.0	90.5	101.8	114.0	126.2	127.5	143.3	143.3
		60 - 64	102	104.33	14.72	79.4	79.7	83.0	88.0	95.4	102.8	113.2	121.1	126.8	152.5	164.0
		65 - 69	66	105.57	12.01	85.1	85.1	92.5	92.6	97.7	103.0	111.7	124.9	130.3	147.4	147.4
		70 - 74	41	106.07	12.77	86.3	86.3	87.4	92.3	95.4	105.6	112.5	124.7	130.3	137.2	137.2
		Over 75	44	101.38	13.70	64.7	64.7	78.4	88.2	92.9	100.8	109.6	119.7	122.8	137.2	137.2
Other Hispanic	Male	20 - 24	63	94.53	17.38	69.5	69.5	70.5	73.5	80.7	93.1	100.8	117.1	127.0	145.5	145.5
		25 - 29	43	96.23	14.16	66.4	66.4	77.2	80.8	87.5	94.2	102.7	117.5	120.0	137.0	137.0
		30 - 34	61	101.38	15.39	73.4	73.4	80.1	84.3	89.5	101.0	111.5	120.7	123.9	153.1	153.1
		35 - 39	60	98.40	13.35	69.6	69.6	84.6	85.4	89.3	96.1	103.2	115.5	122.4	147.5	147.5
		40 - 44	58	105.55	14.35	87.7	87.7	88.8	90.6	93.6	101.5	115.0	123.9	134.1	156.4	156.4
		45 - 49	41	101.75	15.25	70.1	70.1	86.4	88.8	92.2	99.3	107.2	118.4	132.3	153.6	153.6
		50 - 54	69	105.38	13.12	74.4	74.4	87.4	91.1	98.2	103.7	112.4	120.2	127.7	149.0	149.0
		55 - 59	53	106.44	14.90	75.4	75.4	89.1	94.4	97.3	102.1	117.2	128.5	132.6	153.5	153.5
		60 - 64	102	106.94	14.70	73.2	76.6	87.5	91.0	97.9	105.4	114.0	125.5	135.0	149.4	153.5
		65 - 69	72	105.88	11.85	83.3	83.3	90.0	91.5	97.3	103.7	115.9	122.4	123.9	142.2	142.2
		70 - 74	43	105.91	14.62	73.0	73.0	85.9	92.9	96.6	104.6	110.2	121.1	138.7	148.7	148.7
		Over 75	27	103.40	11.89	79.0	79.0	83.7	86.5	94.8	102.1	113.5	119.3	119.8	125.9	125.9
	Female	20 - 24	70	91.64	17.94	64.2	64.2	69.4	71.1	78.1	86.9	103.7	115.8	127.4	150.6	150.6
		25 - 29	58	94.47	16.18	69.2	69.2	71.4	74.4	81.2	91.2	107.5	115.4	127.0	141.0	141.0
		30 - 34	64	95.90	16.31	66.4	66.4	73.3	75.4	83.3	94.2	107.7	116.0	125.0	133.7	133.7
		35 - 39	68	94.44	16.30	65.5	65.5	69.7	75.9	85.6	91.5	103.0	116.5	132.6	151.3	151.3
		40 - 44	64	95.28	13.88	69.8	69.8	73.3	75.0	84.1	96.3	104.4	110.7	113.8	136.5	136.5
		45 - 49	48	101.46	13.02	72.4	72.4	81.0	86.2	90.2	102.3	110.2	116.2	123.4	132.4	132.4
		50 - 54	91	97.88	16.13	69.1	69.1	76.4	80.2	85.7	95.0	108.7	115.8	123.0	149.3	149.3
		55 - 59	73	101.70	12.36	73.8	73.8	81.5	84.6	93.1	103.3	108.9	117.7	122.6	128.0	128.0
		60 - 64	103	100.96	14.12	68.2	69.0	79.6	83.5	92.4	100.1	108.0	118.9	130.9	135.5	136.4
		65 - 69	80	101.89	14.68	71.1	71.1	79.4	83.2	93.1	101.2	110.0	120.0	123.0	151.0	151.0
		70 - 74	55	101.02	12.83	75.8	75.8	82.8	87.5	91.7	98.4	109.7	118.9	124.0	144.2	144.2
		Over 75	46	97.88	9.05	79.0	79.0	85.0	86.4	89.7	98.0	105.8	109.6	113.3	114.8	114.8
Non-Hispanic White	Male	20 - 24	138	97.12	19.68	64.0	68.5	72.4	74.8	81.3	93.0	108.3	123.5	132.5	152.8	160.5
		25 - 29	145	96.76	17.42	67.3	67.5	75.4	77.5	83.0	92.9	109.0	122.2	129.5	144.7	146.2
		30 - 34	174	103.52	18.34	72.7	73.1	79.7	83.5	89.3	101.2	113.5	129.6	137.0	155.4	159.6
		35 - 39	153	103.92	17.56	75.0	77.6	79.6	85.0	91.5	101.0	113.0	128.7	136.5	154.5	167.1

Table 1. Continued

Ethnicity	Sex	Age (years)	N	Mean	SD	Min	1th	5th	10th	25th	50th	75th	90th	95th	99th	Max
											Percentile					
Non-Hispanic White	Male	40 - 44	149	105.46	15.64	68.2	75.0	83.2	87.8	94.5	103.6	115.8	127.8	135.5	148.8	153.2
		45 - 49	172	106.00	16.23	74.0	77.0	81.5	86.9	96.2	104.2	112.8	126.0	137.2	159.8	162.7
		50 - 54	145	106.53	16.24	75.2	77.9	81.8	88.8	95.4	104.1	116.8	128.4	136.4	154.1	156.5
		55 - 59	200	106.73	15.83	69.5	75.7	84.4	88.8	96.2	103.5	116.3	130.9	139.3	146.2	149.5
		60 - 64	190	109.28	16.86	70.2	77.4	85.8	91.4	97.1	106.8	117.7	132.9	146.5	153.2	159.6
		65 - 69	152	108.98	14.90	74.4	74.5	88.8	91.9	97.8	107.4	118.5	130.0	136.4	143.8	155.0
		70 - 74	220	107.76	13.94	69.8	79.4	83.5	88.6	98.9	108.0	116.3	124.3	132.4	139.7	156.1
		Over 75	418	106.43	12.56	76.9	80.2	86.3	90.8	97.7	105.5	115.0	123.6	129.2	136.5	155.7
	Female	20 - 24	157	89.88	18.28	63.7	65.0	67.6	70.2	73.8	86.5	101.3	118.5	125.7	143.2	145.9
		25 - 29	175	95.66	19.38	64.6	65.3	71.0	75.0	80.0	91.2	108.9	123.1	127.5	161.0	169.5
		30 - 34	163	96.56	18.62	67.1	69.7	73.5	75.3	82.4	92.3	108.2	121.4	130.4	153.3	154.9
		35 - 39	169	100.42	19.34	66.5	70.0	75.1	78.0	84.8	96.6	113.2	128.0	135.8	162.3	166.0
		40 - 44	140	101.35	18.62	65.0	66.5	74.6	78.9	88.2	98.6	114.6	127.4	134.9	148.6	159.5
		45 - 49	173	101.43	18.20	68.7	68.8	76.5	80.2	86.6	100.5	113.4	125.7	133.7	149.2	169.6
		50 - 54	151	103.43	18.20	68.7	70.5	74.5	80.5	89.4	102.2	114.6	126.7	137.2	152.9	159.2
		55 - 59	201	101.13	17.16	66.5	71.7	77.4	82.5	89.9	98.4	110.5	123.8	129.2	147.6	187.5
		60 - 64	170	103.95	17.88	69.0	70.0	76.4	80.7	90.4	102.6	116.2	129.3	132.9	148.4	149.9
		65 - 69	179	104.04	16.89	69.3	71.5	79.8	84.2	90.3	102.6	116.2	126.5	132.8	153.6	163.6
		70 - 74	159	102.99	13.89	67.4	73.8	82.2	86.4	93.3	101.4	111.5	120.5	128.4	137.1	143.1
		Over 75	380	99.19	13.49	71.6	73.5	77.8	81.8	90.2	98.6	107.8	116.1	119.9	135.4	148.1
Non-Hispanic Black	Male	20 - 24	122	85.34	16.36	62.3	63.2	68.5	70.3	74.6	80.3	90.9	107.2	113.4	148.6	153.2
		25 - 29	119	92.50	17.66	68.7	69.3	72.0	74.5	79.5	87.4	103.2	120.9	127.8	137.4	155.4
		30 - 34	105	99.78	20.71	67.2	67.2	71.3	77.9	83.4	95.6	110.4	131.4	139.5	161.5	161.6
		35 - 39	94	99.08	19.06	69.5	69.5	72.6	75.7	85.6	96.8	108.0	124.6	136.6	153.5	153.5
		40 - 44	131	104.52	15.63	69.0	74.8	77.1	84.1	93.8	104.1	114.7	124.2	134.4	143.1	144.6
		45 - 49	130	105.22	18.58	71.1	74.9	77.4	82.5	90.5	102.8	118.0	130.8	141.0	145.4	147.7
		50 - 54	132	103.68	16.92	69.5	70.1	73.0	80.3	94.3	103.2	114.3	124.5	136.3	145.4	154.4
		55 - 59	120	104.04	16.21	70.2	72.0	77.0	86.0	92.6	102.0	115.3	125.7	136.3	145.8	148.4
		60 - 64	229	102.21	16.50	65.9	69.6	77.5	82.0	91.4	101.6	111.7	121.9	132.5	147.4	169.6
		65 - 69	158	105.70	16.86	72.2	74.6	78.8	82.2	95.3	103.8	114.6	127.5	133.1	157.4	158.5
		70 - 74	76	103.79	16.31	72.3	72.3	78.0	85.0	92.6	103.1	112.5	125.2	132.3	155.7	155.7
		Over 75	103	99.64	13.89	67.6	71.6	78.5	82.6	88.8	99.2	110.3	118.1	121.5	125.7	137.0
	Female	20 - 24	124	91.51	18.80	58.7	62.1	67.5	69.1	75.7	89.5	104.3	116.2	121.8	133.2	171.6
		25 - 29	162	97.21	19.74	64.0	65.0	69.5	72.5	80.5	95.6	113.0	123.0	132.5	143.5	147.8
		30 - 34	156	101.44	19.94	63.2	64.5	72.0	76.5	86.8	97.7	115.0	129.6	137.5	152.0	152.7
		35 - 39	127	104.60	19.42	69.6	70.0	76.1	79.2	91.9	103.0	116.5	129.3	137.0	165.0	173.1
		40 - 44	155	108.10	19.34	73.3	73.8	79.0	84.3	92.4	106.4	120.8	135.0	141.0	160.0	164.9

Table 1. Continued

Ethnicity	Sex	Age (years)	N	Mean	SD	Min	1th	5th	10th	25th	50th	75th	90th	95th	99th	Max
						Percentile										
Non-Hispanic Black	Female	45 - 49	147	107.32	18.84	75.2	77.2	79.8	83.0	92.0	105.8	120.0	136.4	140.0	157.3	163.7
		50 - 54	139	109.55	19.61	64.9	72.2	80.8	85.8	97.0	107.2	121.7	142.1	149.0	156.3	158.1
		55 - 59	164	106.54	18.27	57.9	68.0	78.3	84.5	94.0	106.4	118.7	131.2	138.0	151.0	157.4
		60 - 64	201	104.28	15.70	66.2	72.0	79.2	84.0	93.0	103.0	113.9	124.2	130.5	141.8	151.2
		65 - 69	133	105.87	15.48	68.7	71.9	77.0	83.5	97.2	105.0	116.8	125.4	128.8	142.4	143.5
		70 - 74	68	104.13	13.72	75.9	75.9	86.2	89.0	94.5	103.7	111.5	121.6	128.0	143.6	143.6
		Over 75	109	101.73	15.16	71.6	73.8	76.9	81.4	93.2	100.7	111.4	121.3	129.9	139.9	142.0
Non-Hispanic Asian	Male	20 - 24	57	87.77	12.02	70.7	70.7	71.5	73.1	80.7	85.0	95.4	101.4	118.8	126.6	126.6
		25 - 29	82	88.31	11.27	65.3	65.3	70.3	72.8	81.2	87.3	95.3	100.4	106.9	121.1	121.1
		30 - 34	76	95.84	14.29	70.5	70.5	76.7	79.8	88.0	94.9	102.2	108.4	126.5	152.2	152.2
		35 - 39	54	95.46	10.52	76.5	76.5	81.2	84.5	88.4	93.6	100.0	110.1	115.8	129.1	129.1
		40 - 44	77	93.49	10.25	73.6	73.6	76.5	80.9	86.1	93.3	100.0	109.1	112.5	117.5	117.5
		45 - 49	79	93.45	10.91	68.2	68.2	75.4	81.0	86.2	92.5	102.0	107.1	116.1	120.4	120.4
		50 - 54	82	93.97	10.21	71.3	71.3	80.0	81.7	87.6	94.7	99.0	104.9	110.4	132.8	132.8
		55 - 59	70	94.41	12.92	76.4	76.4	79.7	82.2	86.4	91.4	99.0	106.6	123.7	148.0	148.0
		60 - 64	69	94.03	10.84	66.0	66.0	76.4	78.7	87.5	94.4	99.7	108.8	111.0	130.1	130.1
		65 - 69	39	94.13	7.67	77.3	77.3	84.6	85.0	87.7	93.9	99.3	107.2	108.5	108.6	108.6
		70 - 74	27	92.32	9.14	69.2	69.2	81.9	83.6	88.2	90.7	97.9	102.2	113.0	116.2	116.2
		Over 75	41	94.10	10.02	73.3	73.3	79.5	82.1	87.3	94.0	100.4	103.4	108.5	119.5	119.5
	Female	20 - 24	48	80.58	11.58	65.6	65.6	66.5	67.3	72.5	77.2	86.3	99.0	105.2	111.6	111.6
		25 - 29	82	85.57	13.41	64.5	64.5	70.5	71.8	74.3	82.9	93.3	108.4	113.5	120.0	120.0
		30 - 34	87	83.27	10.68	66.3	66.3	68.4	69.8	74.1	81.0	93.5	97.9	101.0	106.5	106.5
		35 - 39	69	83.80	10.05	63.4	63.4	69.2	72.5	75.2	83.5	90.1	98.9	102.4	105.8	105.8
		40 - 44	78	84.71	11.67	62.7	62.7	71.4	72.7	77.1	83.3	88.6	98.1	106.7	140.4	140.4
		45 - 49	84	88.07	11.60	70.8	70.8	74.5	75.9	78.4	85.2	95.8	103.2	111.5	118.1	118.1
		50 - 54	93	88.24	8.77	73.6	73.6	74.8	77.9	81.7	86.8	93.5	101.2	103.7	112.0	112.0
		55 - 59	67	88.01	10.88	65.0	65.0	71.4	73.4	77.8	89.0	97.5	101.9	103.2	111.5	111.5
		60 - 64	73	89.13	12.67	67.0	67.0	70.6	75.0	80.9	87.0	96.4	109.3	116.2	123.1	123.1
		65 - 69	52	91.00	10.73	74.8	74.8	76.2	79.0	83.6	89.7	95.7	105.0	113.3	128.0	128.0
		70 - 74	40	91.38	10.65	74.1	74.1	75.9	80.9	82.6	90.2	98.7	106.6	114.1	116.3	116.3
		Over 75	43	88.10	9.63	64.0	64.0	75.7	77.5	79.8	87.9	95.3	100.6	101.3	111.2	111.2
Korean	Male	20 - 24	815	82.29	11.25	57.60	63.7	68.0	70.2	74.9	80.3	87.7	97.6	103.2	118.3	147.5
		25 - 29	841	86.38	10.89	61.70	67.2	71.5	73.8	79.0	84.8	92.2	101.1	105.8	117.7	135.9
		30 - 34	860	87.74	10.02	62.00	68.2	73.0	75.9	80.9	86.6	93.7	100.8	104.8	116.1	124.9
		35 - 39	1,188	87.75	9.36	60.00	68.6	72.8	75.9	81.4	87.4	93.7	99.3	102.7	114.3	132.8
		40 - 44	1,177	87.69	9.37	61.40	67.3	72.4	75.5	81.5	87.6	93.2	99.7	103.3	112.7	128.3
		45 - 49	1,219	87.63	8.63	58.10	67.8	73.5	77.2	82.0	87.6	92.8	98.4	101.9	110.3	126.4

Table 1. Continued

Ethnicity	Sex	Age (years)	N	Mean	SD	Percentile										
						Min	1th	5th	10th	25th	50th	75th	90th	95th	99th	Max
	Male	50 - 54	1,152	87.75	8.39	62.40	68.7	74.4	77.6	82.2	87.3	93.0	98.4	101.7	109.6	123.7
		55 - 59	1,322	87.41	8.20	62.50	68.4	74.3	77.5	82.2	87.1	92.2	97.7	101.1	108.8	129.8
		60 - 64	1,288	88.00	8.27	60.50	68.1	74.2	77.7	82.9	87.8	93.2	98.5	102.0	108.5	118.6
		65 - 69	1,111	87.82	8.54	57.80	67.1	73.2	76.4	82.5	88.1	93.1	98.7	100.8	108.2	121.5
		70 - 74	993	88.23	8.89	54.50	66.0	73.4	77.0	82.8	88.3	94.1	99.6	102.7	109.4	116.4
		Over 75	1,376	87.25	9.21	58.60	65.7	71.1	75.0	81.4	87.7	92.8	99.2	102.2	109.3	117.7
	Female	20 - 24	888	72.05	9.34	54.50	58.0	60.9	62.5	65.8	70.0	76.2	84.4	91.7	104.3	115.9
		25 - 29	888	73.54	9.96	54.80	58.8	61.7	63.5	66.7	71.3	78.2	86.4	92.5	109.6	139.2
Korean		30 - 34	1,020	76.08	10.19	24.50	60.2	63.4	65.2	68.9	74.2	81.4	90.4	96.6	104.5	127.3
		35 - 39	1,505	77.12	9.89	55.70	61.4	64.2	66.0	70.0	75.5	82.6	90.5	96.1	106.4	127.6
		40 - 44	1,475	77.39	9.70	52.50	61.0	64.3	66.6	70.3	75.8	82.7	90.5	95.3	107.5	119.2
		45 - 49	1,605	78.74	9.22	58.30	62.7	65.8	67.8	72.2	77.6	84.0	91.0	95.6	105.6	118.0
		50 - 54	1,548	79.67	8.97	56.00	61.3	67.2	69.5	73.4	78.7	84.8	91.5	96.2	104.6	121.0
		55 - 59	1,727	80.93	9.04	54.00	62.8	67.3	70.2	74.7	80.1	86.6	92.2	96.3	107.4	120.2
		60 - 64	1,641	83.03	8.72	52.30	64.5	69.4	72.4	77.0	82.6	88.3	94.5	98.3	105.8	120.9
		65 - 69	1,407	84.65	8.91	57.20	63.2	71.0	73.7	79.0	84.4	89.9	95.6	99.6	107.6	130.0
		70 - 74	1,228	85.11	8.93	58.00	64.5	70.5	73.8	79.1	85.3	90.7	96.8	100.3	106.3	113.6
		Over 75	1,917	84.74	9.51	50.50	61.8	68.5	72.6	78.4	85.0	91.0	96.4	100.0	107.2	117.0
	Male	20 - 24	31	93.92	15.66	67.8	67.8	70.5	72.5	79.2	92.8	110.4	112.0	114.2	117.6	117.6
		25 - 29	27	96.13	16.55	70.2	70.2	73.5	77.0	82.0	94.0	109.0	122.0	122.6	123.2	123.2
		30 - 34	36	100.87	16.08	78.7	78.7	78.8	82.1	86.8	97.5	112.6	124.6	130.2	134.3	134.3
		35 - 39	21	100.51	17.95	76.0	76.0	80.5	81.1	89.4	99.6	109.5	115.3	132.4	150.4	150.4
		40 - 44	29	111.32	22.27	77.0	77.0	77.7	78.8	96.5	109.8	132.0	142.7	145.1	148.6	148.6
		45 - 49	29	104.00	17.53	75.7	75.7	78.5	81.3	88.6	104.7	113.3	132.5	132.8	137.6	137.6
		50 - 54	25	105.87	18.75	76.1	76.1	78.8	81.2	89.9	107.7	117.1	132.4	139.0	151.8	151.8
		55 - 59	28	105.74	17.35	79.5	79.5	86.5	88.6	94.7	100.7	117.6	127.0	135.4	164.1	164.1
		60 - 64	13	111.59	15.55	97.7	97.7	97.7	100.0	102.3	104.6	110.7	139.6	143.8	143.8	143.8
Other Race		65 - 69	25	100.01	15.63	71.7	71.7	77.0	78.3	90.5	98.8	109.6	117.6	118.4	144.5	144.5
		70 - 74	18	110.29	17.41	82.5	82.5	82.5	89.3	93.6	109.9	128.6	133.8	139.6	139.6	139.6
		Over 75	20	109.08	12.30	82.6	82.6	87.2	92.5	102.8	110.8	116.9	119.1	129.6	139.4	139.4
	Female	20 - 24	26	97.69	19.77	71.5	71.5	72.5	73.4	81.4	92.9	108.9	122.5	130.7	152.2	152.2
		25 - 29	32	96.60	19.74	65.0	65.0	70.5	72.5	80.6	93.9	106.8	124.1	129.3	142.0	142.0
		30 - 34	33	97.87	20.46	70.5	70.5	73.3	73.8	80.9	95.1	111.0	124.4	127.9	152.2	152.2
		35 - 39	27	109.49	18.72	79.5	79.5	82.9	91.2	100.0	106.4	115.8	138.2	151.2	163.8	163.8
		40 - 44	25	98.03	17.05	68.7	68.7	70.1	77.6	86.2	100.0	107.0	122.4	127.3	133.4	133.4
		45 - 49	18	98.56	16.29	75.4	75.4	75.4	75.6	88.0	95.4	107.2	130.1	132.8	132.8	132.8
		50 - 54	15	106.64	20.04	77.2	77.2	77.2	86.8	93.3	103.5	113.1	143.0	152.8	152.8	152.8

Table 1. Continued

Ethnicity	Sex	Age (years)	N	Mean	SD	Percentile										
						Min	1th	5th	10th	25th	50th	75th	90th	95th	99th	Max
	Female	55 - 59	21	101.16	16.83	78.6	78.6	81.8	83.5	88.9	96.8	114.8	124.2	125.3	138.2	138.2
		60 - 64	24	103.28	14.76	71.2	71.2	76.6	90.4	95.2	100.7	111.8	124.6	128.5	134.9	134.9
Other Race		65 - 69	15	109.03	12.73	82.5	82.5	82.5	96.0	98.8	109.5	115.7	123.7	132.6	132.6	132.6
		70 - 74	11	106.64	6.84	93.1	93.1	93.1	98.0	102.0	108.7	112.3	113.7	115.0	115.0	115.0
		Over 75	10	95.90	15.08	80.1	80.1	80.1	80.9	85.6	92.7	102.9	118.1	132.4	132.4	132.4

Abbreviations: KNHANES, Korea National Health and Nutrition Examination Survey; NHANES, National Health and Nutrition Examination Survey; SE, standard error; WC, waist circumference

4. Implications for public health

The findings of our study have important implications for public health policies aimed at preventing and managing obesity-related diseases. First, redefining the criteria for obesity based on the latest scientific evidence and population-specific characteristics can provide a more accurate assessment of obesity and its health consequences. Second, analyzing the BMI and WC distributions by age, sex, and ethnicity can help identify populations at higher risk of obesity-related diseases and tailor interventions accordingly.[4]

Moreover, our findings suggest that public health interventions aimed at promoting physical activity and healthy eating habits should consider the specific characteristics of each population, such as age, sex, and ethnicity.[5] Interventions aimed at reducing sedentary behavior and promoting physical activity may need to be tailored differently for men and women or for different racial groups. Similarly, interventions aimed at promoting healthy eating habits may need to consider the cultural and environmental factors that influence food choices.[6]

6. Conclusion

Our previous study highlights the importance of redefining the criteria for obesity and analyzing the BMI and WC distributions based on age, sex, and ethnicity.[7] By doing so, we can provide a more accurate assessment of obesity and its health consequences, identify populations at higher risk of obesity-related diseases, and tailor interventions accordingly. Our findings have important implications for public health policies aimed at preventing and managing obesity-related diseases.

Author contribution

Dr SYR contributed to the preparation of this commentary.

Funding

Competing interests

The author has no conflicts of interest to declare for this study.

Provenance and peer review

Commissioned; internally peer reviewed.

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