

EXTENDED ABSTRACT: A QUASI-COHORT TREND ANALYSIS OF ADULT OVERWEIGHT IN COLOMBIA

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Introduction

Excess weight is a risk marker for cardiovascular disease and is associated with an increased prevalence of diabetes, hypertension and metabolic syndrome and premature mortality (1) and is also a potential mediator of female infertility and cancer (2) (3). Excess weight, particularly obesity, has recently been shown to be a poor prognostic risk factor for coronavirus disease 2019 (COVID-19) and psoriasis (4). Globally, in 2016, 39% of adults were overweight and 13% were obese (5), a situation that has not been foreign to Latin American countries such as Colombia.

According to the National Survey of the Nutritional Situation (Encuesta Nacional de la Situación Nutricional - ENSIN), overweight in adults in Colombia has been increasing in recent years. In 2005, 46% of the adult population (men: 39.9% and women: 49.6%) suffered from this type of overweight malnutrition (6). In 2010 the figure rose to 51.2% (men: 45.6% and women: 55.2%) (7) and by 2015 it stood at 56.5% (men: 52.8% and women: 59.6%) (8).

Although the evolution of this phenomenon of public health interest has been captured over time, no detailed description of trends in weight, height and body mass index (BMI) is reported for the country from a combined age and quasi-cohort perspective. Our research aim is therefore to develop a descriptive quasi-cohort analysis in order to capture BMI trends for different social segments of the population in Colombia.

Data and Methods

Study design and data source

National Survey of the Nutritional Situation (ENSIN):

The ENSIN has been conducted every five years since 2005 and currently has three versions publicly available (2005, 2010 and 2015). This survey analyses a representative sample of the population aged 0-64 years and collects information on dietary intake, breastfeeding and complementary feeding, food security, physical activity, time spent watching television and playing video games, nutritional status by anthropometry and biochemical indicators (6) (7) (8).

For the purposes of the following research, we used the component of nutritional status by anthropometry and the socio-economic and demographic information of households over 20 years of age, as defined by other national and international studies and surveys (9) (10) (11).

Cross-sectional and quasi cohort approaches:

The ENSIN is not a panel survey, because it does not follow the same subjects over time. However, given the large samples sizes in each wave, a longitudinal study approach using cross-sectional data was applied, similar to what was used in a study on obesity in Spain (11). The current study covers a decade and includes 213,240 individuals aged 20-64 (see Appendix Table 1). They were aggregated into a one database, who were subsequently designated to so-called birth quasi-cohorts by subtracting their age from the year in which they were interviewed. The ENSIN has been used in different studies for food and nutrition analysis in Colombia (12) (13) (14) (15). Therefore, the data were considered suitable for the study of changes in BMI from birth quasi-cohorts.

Variables

The anthropometric nutritional status indicator BMI was obtained by taking the ratio of weight in kilograms over height squared in metres. Weight was reported in kilograms and height in centimetres. To ensure plausible BMI data, weight less than 30 kg (n: 31) and height less than 130 cm (n: 85) were removed. We then constructed the standard BMI categories underweight (levels below 18.5 kg/m²), normal (values between 18.5 kg/m² and 24.9 kg/m²), overweight (levels between 25 and 29.9 kg/m²) and obesity (values above 30 kg/m²) (16).

Regarding the sociodemographic characteristics, we analysed 20-64 year olds according to 5-year age groups, 5-year birth cohorts, sex (male and female) and, for the data pertaining to 2010 and 2015, ethnicity indigenous, Afro-Colombian and other.

Analysis

A descriptive and bivariate analysis of the information was carried out. Using the data, the following were performed Kolmogorov-Smirnov test. The results of the study are presented as averages and percentages. The statistical programme R was used to process the data.

Results

The average BMI in both men and women has increased over the 10-year period. In men, an increase in the average BMI was identified particularly in the 35-39 age group in 2005, 2010 and 2015 with 25.3 kg/m², 25.9 kg/m², 26.7 kg/m², respectively. In females, the highest increase occurred among the 55-59 age group, from 27.8 kg/m² in 2005 to 28.2 kg/m² in 2010 and 28.4 kg/m² in 2015, respectively.

In terms of proportions according to BMI category, there was a 9.5% decline in people with "normal" weight, from 47.3% in 2005 to 37.8% in 2015. In men, the decrease was 10.3% (52.6%, 42.3%) and in women 9.8% (44%, 34.2%). In men, the decline was concentrated between the ages of 35 and 59, with the largest reduction being in the 35-39 age group with 14.4% (48.2%, 33.8%). In women, the decrease was focused between 35 and 64 years of age and it was evident that while in the 20-24 years age group, the normality was (65.4%, 55.4%); for the 60-64 years age group the figures ranged from (29.2%, 24.4%). Regarding the proportion of overweight population, an increase of 4.8% (34.1%, 38.9%) was observed. In men, the increase was 5.9% (34%, 39.9%) and in women 4% (34.1%, 38.1%).

For the obesity category, between 2005 and 2015 the proportion of the population increased by 5.9% (15.4%, 21.3%). In contrast to overweight, men reported lower figures for obesity compared to women. By 2005, 10.5% of men suffered from obesity, in 2015 the figure reached 15.7%. The age group 55-59 years showed the highest increases (15%, 19.6%). In women, in 2005 the proportion was 18.4%, in 2015 it reached 25.7%, reporting an increase of 7.3%. Similar to men, obesity was higher in the 55-59 age group, which in this case exceeded 30% (30.5%, 33.9%), followed by the 60-64 age group with 26.3%, and 33% (see Appendix Figure 3).

Regarding the BMI trends by sex, quasi-cohort at birth and age, in men, almost all cohorts increased in average BMI as they move from one five-year age interval to the next until age 59, with the exception of the 1945-1949 quasi-cohort where the average BMI remained stable. It is noteworthy that in the 30-34 age group, the average weight decreased by 0.2 kg/m² between the 1980-1984 and 1985-1989 quasi-cohorts, which is statistically significant at 95%. A similar situation occurs with the 1985-1989 and 1990-1994 quasi-cohorts in the 25-29 age group, where the average BMI decreased by 0.3 kg/m². For women, the average BMI was higher compared to men, however, the pattern of rising average BMI was also identified between five-year age intervals. In contrast to men, in the 50-54 age group in the 1955-1959 and 1960-1964 quasi-cohorts the average BMI was the same 28.2 kg/m². In turn, in the same quasi-cohorts but in the 55-59 age group there was a decrease in the average BMI by 0.7 kg/m² (Figure 1).

At the ethnic level, information was available for 2010 and 2015. For Afro-Colombians, normal weight decreased by 7.9% from 44.4% to 36.5%, overweight changed from 33.1% to 35.8%, while obesity increased by 6.6% (19.4% to 26%). It should be noted that overweight in this ethnic group was higher in women than in men in both years. In 2010 the figures for overweight were 19.2% vs. 13.9% and for obesity 13.9% vs. 5.5%, while in 2015 overweight increased more among men (19.7% vs. 16.1%) but obesity more among women (18.1% vs. 7.9%). For obesity, the highest figures for both men and women were in the 45-49 age group (among men increasing from 11.8% to 26.9%) and among women respectively from 29.7% to 42.8%).

For indigenous people normal weight changed from 49.4% to 39.8%, overweight from 35.7% to 40.3% and obesity increased from 13.5% to 18.8%. Like Afro-Colombians, women had higher figures for overweight in 2010 and 2015 than men, while percentage point increases were similar for both sexes. In 2010 the figures for overweight were 19.5% vs. 16.2% and for obesity 9.6% vs. 3.9%, while in 2015 the values for overweight were 22.1% vs. 18.2% and for obesity 13.2% vs. 5.6%. For

obesity, the highest figures for men were in the 60-64 age group (8.7% to 20.1%) and for women in the 40-44 age group (20.7% to 32.7%).

With respect to subjects belonging to other ethnicities, a decrease in normal weight of 5.2% (43% to 37.8%), an increase in overweight from (36.4% to 39.1%) and in obesity from (18.3% to 21%) was found between 2010 and 2015. As with previous ethnicities, overweight was higher in women than in men and increased over time, but to a lesser extent. In 2010 the figures for overweight were 20.7% vs. 15.8% and for obesity 12.6% vs. 5.7%, while in 2015 the values for overweight were 21.3% vs. 17.8% and for obesity 14% vs. 7%. For obesity, the highest figures for men were in the 55-59 age group 16.4% to 19.9% and for women in the 60-64 age group 32.5% to 36.7%.

Preliminary results of BMI trends by ethnicity indicated that in Afro-Colombian men the highest figures were reported in the 40-44 age group, with increases across the successive 1965-1969, 1970-1974 and 1975-1979 quasi-cohorts of 1.2 kg/m² (respectively, 25.8 kg/m², 26.5 kg/m², 27 kg/m²). In Afro-Colombian women, the highest values were found in the 45-49 age group among the 1960-1964, 1965-1969, 1970-1974 quasi-cohorts, with an increase of 1.3 kg/m² (27.7 kg/m², 29.2 kg/m², 29 kg/m²). In indigenous men, the average BMI was higher in the 55-59 age group among the 1950-1954, 1955-1959, 1960-1964 quasi-cohorts, with an increase of 1.3 kg/m² (26.2 kg/m², 27.4 kg/m², 27.5 kg/m²). In indigenous women, the average BMI was higher in the 40-44 age group in the 1970-1974 quasi-cohort with 28.1 kg/m², it should be noted that in the 1965-1969 quasi-cohort the average was 26.9 kg/m², which generates an increase of 1.2 kg/m², however, in the 1975-1979 quasi-cohort the average decreased to 27.6 kg/m². For other ethnicities, in males the average BMI was higher in the 35-39 age group among the 1970-1974, 1975-1979, 1980-1984 quasi-cohorts, with an increase of 1.1 kg/m² (25.9 kg/m², 26.5 kg/m², 27 kg/m²). In women the average BMI was highest in the age group 60-64 years in the 1945-1949, 1950-1954, 1955-1959 quasi-cohorts with an increase of 0.6 kg/m² (28.2 kg/m², 28.1 kg/m², 28.8 kg/m²) (Figure 2).

Discussion

Preliminary research results suggest that Colombia has undergone a nutritional transition in which overweight and obesity increased between 2005 and 2015. This increase was concentrated at ages over 35 years, i.e. from the 1960-1964 birth quasi-cohort onwards; although among women, increases in excess weight was also evident among women aged 60-64 years. According to the existing literature, it has been shown that in European (17) and Latin American (18) countries excess weight is higher in women than in men. In fact, research with an ethnic focus also reports this affirmation (19). It should also be taken into account that in Colombia only until in 1975 was the National Health System created, which did not have universal coverage, and only in 1991 was the right to health incorporated as a public service, under the control and direction of the State (20), historical fact that may be related to the nutritional and health status of individuals in these age groups.

References

1. Bokzurt B, Agular D, Deswal A, Dunbar SB, Francis GS, Horwich T, et al. Contributory Risk and Management of Comorbidities of Hypertension, Obesity, Diabetes Mellitus, Hyperlipidemia, and Metabolic Syndrome in Chronic Heart Failure: A Scientific Statement From the American Heart Association. *Circulation*. 2016; 134(23). doi:10.1161/CIR.0000000000000450.
2. Broughton DE, Moley KH. Obesity and female infertility: potential mediators of obesity's impact. *Fertil Steril*. 2017; 107(4): p. 840-847. doi: 10.1016/j.fertnstert.2017.01.017.
3. Iyengar NM, Gucalp A, Dannenberg AJ, Hudis CA. Obesity and Cancer Mechanisms: Tumor Microenvironment and Inflammation. *J Clin Oncol*. 2016; 34(35): p. 4270-4276. doi: 10.1200/JCO.2016.67.4283.
4. Llamas VM, Ovejero ME, Salgado BL. Obesity - A Risk Factor for Psoriasis and COVID-19. *Actas Dermosifiliogr*. 2021; 112(6): p. 489-494. Doi: 10.1016/j.adengl.2021.03.013.
5. WHO. Obesity and overweight. [Online].; 2021 [cited 2021 October 18]. Available from: <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>.
6. ICBF. Encuesta Nacional de la Situación Nutricional en Colombia Bogotá; 2005.
7. Profamilia, INS, ICBF, Ministerio de la Protección Social. Encuesta Nacional de la Situación Nutricional en Colombia 2010 978-958-623-112-1 I, editor. Bogotá: Da Vinci Editores & Cia. S N C; 2011.
8. Universidad Nacional de Colombia, Instituto Nacional de Salud, Instituto Colombiano de Bienestar Familiar, Ministerio de Salud y Protección Social. Encuesta Nacional de la Situación Nutricional 2015. In. Bogotá; 2019.
9. Briceño G, Durán P, Colón E, Line D, Merker A, Abad V, et al. Protocolo del estudio para establecer estándares normativos de crecimiento de niños colombianos sanos. *Pediatría*. 2012; 45(4): p. 235-242.
10. INEGI, Instituto Nacional de Salud Pública, Secretaría de Salud. Encuesta Nacional de Salud y Nutrición 2018. [Online].; 2018 [cited 2021 August 27]. Available from: https://ensanut.insp.mx/encuestas/ensanut2018/doctos/informes/ensanut_2018_presentacion_resultados.pdf.
11. Cámara AD, Spijker JJ. Super size Spain? A cross-sectional and quasi-ohort trend analysis of adult overweight and obesity in an accelerated transition country. *J Biosoc Sci*. 2010; 42: p. 377-393. doi: 10.1017/S0021932009990629.
12. Vecino OA, Arroyo AD. A tax on sugar sweetened beverages in Colombia: Estimating the impact on overweight and obesity prevalence across socio economic levels. *Soc Sci Med*. 2018; 209: p. 111-116. doi: 10.1016/j.socscimed.2018.05.043.
13. Herrán OF, Patiño GA, Del Castillo SE. Dietary transition and excess weight in adults according to the Encuesta de la Situación Nutricional en Colombia, 2010. *Biomedica*. 2016; 36(1): p. 109-120. Doi: 10.7705/biomedica.v36i1.2579.
14. Flórez PA, Gómez LF, Parra DC, Cohen DD, Arango PC, Lobelo F. Time spent traveling in motor vehicles and its association with overweight and abdominal obesity in Colombian adults who do not own a car. *Prev Med*. 2012; 54(6). doi: 10.1016/j.ypmed.2012.04.002.
15. Kasper NM, Herrán OF, Villamor E. Obesity prevalence in Colombian adults is increasing fastest in lower socio-economic status groups and urban residents: results from two nationally representative surveys. *Public Health Nutr*. 2014; 17(11). doi: 10.1017/S1368980013003418.
16. WHO. 10 datos sobre la obesidad. [Online].; 2021 [cited 2021 August 9]. Available from: <https://www.who.int/features/factfiles/obesity/facts/es/#:~:text=El%20C3%ADndice%20de%20masa%20corporal,igual%20o%20superior%20a%2030>.
17. Marques A, Peralta M, Naia A, Loureiro N, de Matos MG. Prevalence of adult overweight and obesity in 20 European countries. *Eur J Public Health*. 2014; 28(2): p. 295-300.

18. Jiwani SS, Carrillo LR, Hernández VA, Barrientos GT, Basto AA, Gutiérrez L, et. al. The shift of obesity burden by socioeconomic status between 1998 and 2017 in Latin America and the Caribbean: a cross-sectional series study. *Lancet Glob Health*. 2019.
19. Hernandez DC, Reesor LM, Murillo R. Food insecurity and adult overweight/obesity: Gender and race/ethnic disparities. *Appetite*. 2017; 1(117): p. 373-378.
20. Guerrero R, Gallego AI, Becerril-MV, Vásquez J. Sistema de salud de Colombia. *Salud pública Méx*. 2011; 2: p. 144-155.

Figure 1. BMI by sex, age group and quasi birth-cohort

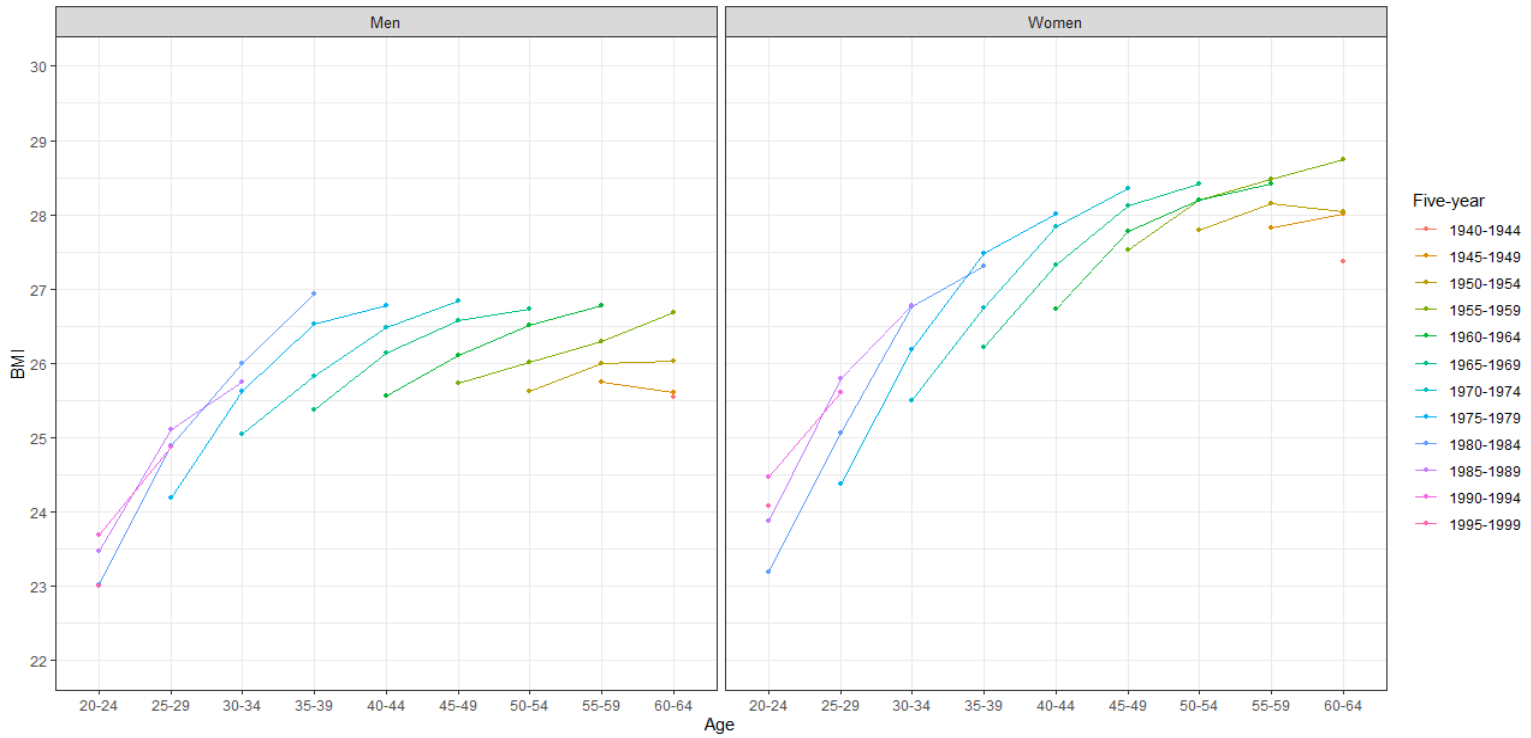
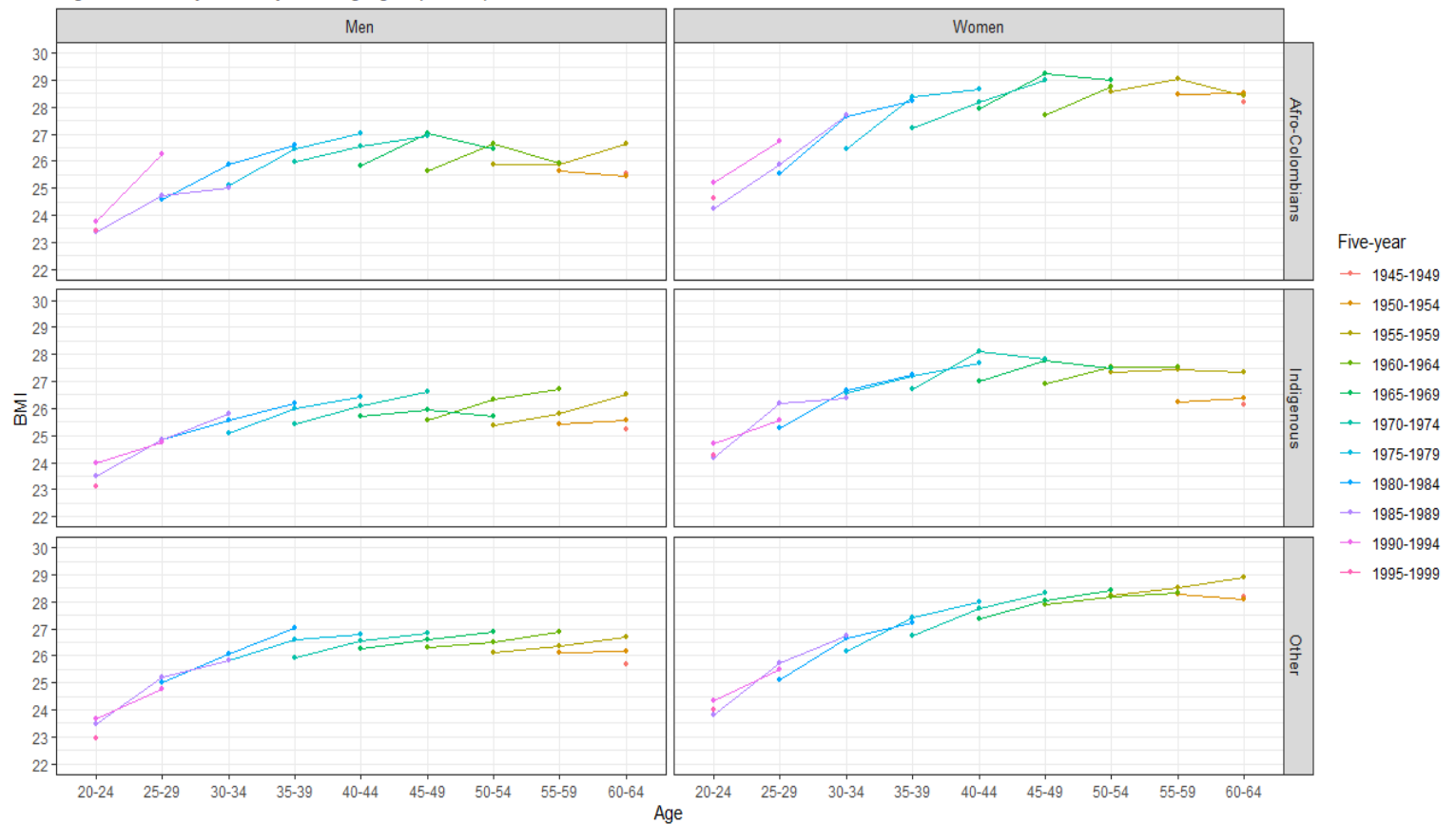


Figure 2. BMI by ethnicity, sex, age group and quasi birth-cohort



Appendix

Table 1. Number of after-screening sample cases used in the analysis by sex, age and quasi birth-cohort

Quasi birth-cohort	Age group								
	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64
Males									
1940-1944									1030
1945-1949								1381	1899
1950-1954							1791	2293	2021
1955-1959						2089	2750	2340	743
1960-1964					2400	3361	2939	887	
1965-1969				2516	3739	3164	1050		
1970-1974			2608	3780	3282	1078			
1975-1979		2976	3953	3173	1105				
1980-1984	3534	4509	3700	1111					
1985-1989	4672	3891	1273						
1990-1994	4421	1383							
1995-1999	1489								
Females									
1940-1944									1498
1945-1949								2127	2401
1950-1954							2782	3053	2517
1955-1959						3746	4183	3074	947
1960-1964					3886	4728	3734	1228	
1965-1969				4299	5146	4007	1393		
1970-1974			4302	5181	4141	1335			
1975-1979		4584	5293	4395	1366				
1980-1984	5096	5773	4638	1557					
1985-1989	5521	4743	1610						
1990-1994	5189	1721							
1995-1999	1715								

Source: micro-data from the ENSIN 2005-2015. Own calculations

Figure 3. BMI category by sex, age group and first and last survey year

