ANIBES

General and Abdominal Obesity Is Related to Physical Activity, Smoking and Sleeping Behaviours and Mediated by the Educational Level: Findings from the ANIBES Study in Spain

NUMBER 12

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Obesity is a public health problem that is increasing worldwide. Recently published data as part of one of the works included in the ANIBES Study show that the prevalence of overweight and obesity in the Spanish adult population (18-65 years) is 35.8 % and 19.9 %, respectively.

The figures regarding abdominal obesity are even more disturbing, affecting 58.4 % of the adult population when waist to height ratio (WHtR) ≥ 0.5 is considered.

In the development of obesity, genetic, physiological, dietary and environmental factors are involved, among others. Apart from sex and age, which has shown to be related to obesity, other potential confounders of this association in the adult population include the socioeconomic status, physical activity, sleeping time and smoking habits.

Because of the economic downturn that has affected Spain since 2008, unemployment has increased and household economic resources declined in general. Some scientific studies have suggested that economic problems can affect not only the diet but also physical activity, smoking habits and sleep. There is some evidence of a relationship between the economic crisis in Spain and the health and lifestyle of the population, and this probably also had an impact on the factors associated with overweight and obesity.

The aim of the present work included in the ANIBES Study was to analyze the association of different socioeconomic and lifestyle factors, including physical activity, with the conditions of overweight, general and abdominal obesity in the Spanish adult population.

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Materials and Methods

The design, protocol and methodology of the ANIBES Study have been already described in detail in Ruiz E. et al, 2015 and Varela-Moreiras G. et al, 2015.

Likewise, details of the anthropometric parameters used in the ANIBES Study have been described in detail in López-Sobaler AM. et al, 2016.

Regarding physical activity, details of its estimate have been described in detail in Mielgo-Ayuso J. et al, 2016.

Height, weight and waist were measured instead of being self-reported, which is a more accurate assessment procedure.

On the other hand, measures were taken using standardized procedures by well-trained interviewers to minimize the inter-observer coefficients of variation.

One of the strengths of the study is using WHtR to assess abdominal obesity. Other studies in Spain have used waist circumference to assess abdominal adiposity, but there is scientific evidence that the WHtR may be a more accurate diagnostic tool for obesity-related chronic diseases than Body Mass Index (BMI) or waist circumference.

Furthermore, each participant answered a questionnaire that included several socioeconomic details related to age, place of birth (immigrant/ no immigrant), educational level according to years and type of education (primary or less/ secondary or medium/ university or higher), occupational status (employed/ unemployed), and monthly family income (0-1,000 €/ 1,001-2,000 €/ >2,000 €/ no answer).

This study shows the results for the quantified anthropometric, sociodemographic and lifestyle factors, with differences between sexes. Moreover, multivariate regression analyses were also included to know the association between the variables studied and the conditions of overweight, general and abdominal obesity.

Risk of overweight and general and abdominal obesity

The results of this work within the ANIBES Study show that, in Spain, being male and aged more than 40 years was associated with an increased risk of overweight and general and abdominal obesity. On the other hand, a higher educational level and spending more than 150 min/week in vigorous-intensity physical activity were associated with a lower risk of overweight and general and abdominal obesity.

Sex and age remained statistically significant in all models studied. After adjusting for other variables, the only variables that were associated with a lower risk of overweight were a higher educational level and spending more than 150 min/week in any type of vigorous-intensity physical activity. On the other hand, a higher level of education, spending more than 150 min/week in vigorous-intensity physical activity, smoking and sleeping more than 7 h/day were associated with a lower risk of general and abdominal obesity, while watching TV quite or very often was associated with increased risk of general and abdominal obesity.

The other factors did not show a significant association with the risk of suffering from excess weight.

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Overweight and obesity rates by sex

The associations of sex and age with overweight and general and abdominal obesity in the ANIBES Study have been previously described by López-Sobaler AM. et al in 2016.

Suffering from overweight (40.5 %), and general obesity (22.7 %) and abdominal obesity (64.7 %) was significantly higher in the male population participating in the ANIBES Study, compared to 31.4 %, 17.3 % and 52.5 %, respectively, in the female population.

It has been suggested that sex itself (sex hormones affect the amount and distribution of body fat) is a factor influencing body composition, as well as fat oxidation and mobilization. In the ANIBES Study, the increased risk to males of suffering from overweight or obesity may be due to the different patterns of physical activity or to different existing dietary habits of men and women.

Characteristics of the study population

	Total	Men	Women
N (%)	1,655	798 (48.2)	857 (51.8)
Age (years) (Mean ± SD)	39.97 ± 12.2	39.6 ± 12.2	40.3 ± 12.2
18-40 years (n,%)	883 (53.4)	435 (26.3)	448 (27.1)
41-65 years (n,%)	772 (46.6)	363 (21.9)	409 (24.7)
Weight (kg) (Mean ± SD)	74.2 ± 16.48	82.4 ± 15.34	66.6 ± 13.62 *
Height (cm) (Mean ± SD)	167.7 ± 9.35	174.5 ± 6.95	161.3 ± 6.37 *
BMI (kg/m^2) (Mean ± SD)	26.3 ± 5.15	27.1 ± 4.87	25.6 ± 5.3 *
Overweight (n,%)	592 (35.8)	323 (40.5)	269 (31.4) *
Obesity (n,%)	329 (19.9)	181 (22.7)	148 (17.3) *
Waist circumference (cm) (Mean ± SD)	88.1 ± 14.5	93.8 ± 13.61	82.7 ± 13.19 *
WHtR (Mean ± SD)	0.53 ± 0.08	0.54 ± 0.08	0.51 ± 0.09 *
Abdominal obesity [a] (n,%)	966 (58.4)	516 (64.7)	450 (52.5) *
Region (n,%)			
South	425 (25.7)	198 (24.8)	227 (26.5)
Central	379 (22.9)	197 (24.7)	182 (21.2)
Atlantic	281 (17.0)	137 (17.2)	144 (16.8)
Mediterranean	570 (34.4)	266 (33.3)	304 (35.5)
Habitat size[b] (n,%)			
Rural	564 (34.1)	266 (33.3)	298 (34.8)
Semi-urban	561 (33.9)	284 (35.6)	277 (32.3)
Urban	530 (32.0)	248 (31.0)	282 (32.9)
Level of education (n,%)			
Primary or less	443 (26.8)	212 (26.5)	231 (26.9)
Secondary or medium	810 (48.9)	396 (49.6)	414 (48.3)
University or higher	402 (24.3)	190 (23.8)	212 (24.7)
Family income (n,%)			
0 - 1,000 €	315 (19.0)	162 (20.3)	153 (17.9)
1,000 - 2,000 €	647 (39.1)	290 (36.3)	357 (41.7)
≥ 2,000 €	303 (18.3)	151 (18.9)	152 (17.7)
No answer (%)	390 (23.6)	195 (24.4)	195 (22.8)
Immigrant population (n,%)	65 (3.9)	58 (7.27)	48 (5.6)
Rate of unemployment (n,%)	272 (16.4)	228 (28.6)	118 (13.8)
Smoking status (n,%)			
Non smoker	1,076 (65.0)	480 (60.1)	596 (69.5)
Smoker	579 (35.0)	318 (39.8)	261 (30.4)
Vigorous physical activity (min/week) (Mean ± SD)	149.2 ± 264	209 ± 302	94 ± 209 *
< 75 min/week (n,%)	1,041 (62.9)	420 (52.6)	621 (72.5)
75 - 149 min/week (n,%)	118 (7.1)	49 (6.1)	69 (8.1)
150 - 299 min/week (n,%)	185 (11.2)	107 (13.4)	78 (9.1)
≥ 300 min/week (n,%)	311 (18.8)	222 (27.8)	89 (10.4)

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	Total	Men	Women
N (%)	1,655	798 (48.2)	857 (51.8)
Moderate-vigorous physical activity (min/week) (Mean ± SD)	565 ± 509	524 ± 513	603 ± 503 *
< 150 min/week (n,%)	415 (25.1)	230 (28.9)	185 (21.6)
150 - 300 min/week (n,%)	224 (13.6)	114 (14.3)	110 (12.9)
≥ 300 min/week (n,%)	1,013 (61.3)	452 (56.8)	562 (65.5)
Time watching TV			
Never or almost never (n,%)	56 (3.4)	30 (3.7)	26 (3.0)
Low frequency (n,%)	204 (12.3)	88 (11.02)	116 (13.5)
Frequently (n,%)	311 (18.8)	140 (17.5)	171 (19.9)
Quite often (n,%)	651 (39.4)	318 (39.8)	333 (38.8)
Very often (n,%)	432 (26.1)	222 (27.8)	210 (24.5)
Sleep time (h/day) (Mean ± SD)	7.46 ± 1.13	7.46 ± 1.10	7.46 ± 1.16
< 7 h/day (n,%)	318 (20.6)	147 (19.8)	171 (21.3)
7 - 8 h/day (n,%)	506 (32.7)	259 (34.8)	247 (30.8)
≥ 8 h/day (n,%)	722 (46.7)	338 (45.4)	384 (47.9)

BMI: Body Mass Index. SD= Standard Deviation
* Significant differences regarding sex
[a] Abdominal obesity defined by WHtR ≥ 0.5
[b] Habitat size: rural populations: 2,000-30,000; semi-urban: 30,000-200,000; urban population: over 200,000 inhabitants

Overweight and obesity rates by sociodemographic characteristics

Socioeconomic status level is generally measured by occupation, educational level and income. Although they are not completely independent, analysis of these three socioeconomic status dimensions together is of great interest.

In general terms, most participants in this research had a high school diploma (48.9 %), an average monthly income between 1,000 and 2,000 € in most cases (39.1 %), and 16 % were unemployed. Moreover, approximately a third were smokers.

Most participants in this study (62.9 %) spent less than 75 min/week in vigorous physical activity, and they indicated watching TV quite often (39.4 %) or very often (26.1 %).

Habitat

According to the results obtained, living in the Atlantic region was associated with lower risk of abdominal obesity.

Physical activity

Physical activity is a key determinant of energy expenditure. Adults over 18 years should perform at least 150 min/week of moderate vigourous-intensity aerobic physical activity or at least 75 min/week of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate-vigorous physical activity. Recently, it has been shown that in Spain, 27 % of the adult population did not meet international recommendations regarding physical activity, and 20.1 % of adults never performed moderate vigorous-intensity physical activity.

The results of the ANIBES Study showed that women spent more time on moderate vigorous-intensity physical activity, though 21.6 % of them spent less than 150 min/week on any type of physical activity.

In contrast, men spent more time per week on vigorous-intensity physical activity and 52.6 % of this population spent less than 75 min/week.

The multivariate regression analysis suggests that vigorous-intensity physical activity may have a greater effect on preventing overweight and obesity than physical activity of lower

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intensity, since moderate vigorous-intensity physical activity was not associated with the prevalence of excess weight or abdominal obesity. In addition, performing more than 75 min/week of vigorous-intensity physical activity was associated with a lower risk of obesity, while more than 150 min/week was associated with lower risk of overweight and general and abdominal obesity.

Regarding abdominal obesity, the results obtained suggest that performing less than 150 min/week of physical activity may not be enough to prevent abdominal adiposity, agreeing with other studies that indicate that it is necessary to devote between 150 and 250 min/week of vigorous-intensity physical activity to prevent weight gain effectively.

Level of education

The results of the ANIBES Study suggested that only university educational level was inversely associated with the risk of overweight and general and abdominal obesity. On the other hand, a level of education higher than primary education was associated with a lower risk of general and abdominal obesity.

These data agree with those of other scientific studies previously carried out and confirm that, in developed countries, the level of education is inversely associated with increased risk of overweight and general and abdominal obesity.

Educational level can exert its influence on health and body weight since it is related to the knowledge about health and healthy lifestyles, including dietary habits and physical activity. Furthermore, educational level is assumed to be stable throughout life and to partly reflect childhood socioeconomic conditions.

Family income

Family income certainly influences the choice of foods, but is generally associated with other socioeconomic influences, such as the educational level, which also adjust dietary habits and lifestyle.

It is noteworthy that the fact of not answering the question of family income (23.6 %) was associated with a lower risk of suffering from abdominal obesity, so it could be possible that those people that did not declare their income belonged to the group of individuals with higher income and socioeconomic level.

It is necessary to bear in mind that the questionnaire was administered face to face and some people may really have not known their income. It is also possible that those with higher incomes did not want to declare them.

Sleeping time

Sleep is also an important lifestyle factor that influences health. The average sleeping time of the population participating in the ANIBES Study was 7.46 ± 1.13 h/day, and 46.7 % sleep, at least, 8 h/day. Considering the results obtained in this study, sleeping 7 h/day or more was associated with a lower risk of suffering from general and abdominal obesity, and the risk was even lower sleeping more than 8h/day.

These data agree with other studies that found an association between shorter sleeping time and the risk of general and abdominal obesity. The association between sleep and the development of obesity may be due to the fact that individuals with shorter sleep are most likely to stimulate appetite and have more opportunities to eat. It could also be possible that a shorter sleep was associated with an unhealthier lifestyle and a higher intake of snacks or high energy-dense foods, during nighttime, when other individuals are sleeping.

More than 8 h/day		Protective effect
7-8 h/day		Protective effect
Less than 7 h/day		Increased risk
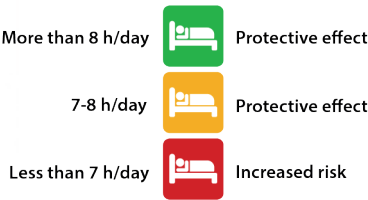
Sedentary activities

Watching TV is the most commonly reported activity during leisure time, so this time could be used as an indicator of sedentary behavior. In this sense, 65.5 % of the ANIBES population indicated watching TV quite or very often.

According to the data from the study, the higher self-perceived frequency of watching television was associated with a higher risk of general and abdominal obesity. The association is higher for abdominal obesity, since watching television "with some frequency" or very often is a significant risk of abdominal obesity, while the risk of general obesity was associated with watching television "quite frequently" or more.

These results agree with those observed in other studies. Watching television may contribute to obesity via promotion of sedentary behavior and exposure to high energy-dense food-related commercials and other programs that encourage more eating.

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This way, frequency of watching television is a risk factor for general and abdominal obesity, independent of vigorous-intensity physical activity and moderate vigorous-intensity physical activity, as suggested by other studies conducted in the adult population.

Out of the different types of sedentary behavior (computer use, reading, listening to radio/music, etc.), TV viewing seems to be the most consistently associated with adiposity markers in adults despite the co-existence of several other confounding factors (diet, smoking, physical activity, socioeconomic factors, or genetic predisposition).

Therefore, according with these results, it seems advisable to increase physical activity, which include light intensity physical activity (to be determined according to the physical abilities of each individual), and decrease sedentary behavior, especially screen time, to prevent general and abdominal obesity.

Smoking habits

Even though smoking is a very harmful habit for health of smokers and passive smokers they are in contact with, this fact is associated with a lower weight.

In this study, smoking was associated with lower prevalence of both general obesity and abdominal obesity. This relationship has been already confirmed in numerous studies that have shown that smokers have less weight or BMI than nonsmokers.

Smoking could possibly be associated with lower weight and adiposity because nicotine acutely increases the levels of various neurotransmitters, suppresses appetite and consequently reduces food intake. This process likely explains why smokers tend to decrease body weight, and why smoking cessation is frequently followed by weight gain.

Weight gain associated with quitting smoking discourages many smokers to quit the habit, but with an exercise and control program of food intake, weight could be controlled and maintained, especially after some time since quitting smoking habits, with great health benefits associated.

Recommendations

Strategies for preventing and reducing general and abdominal obesity should consider improving sleeping habits and physical activity (increasing time in vigorous-intensity physical activity and decreasing time in very sedentary activities). In addition, it should also be considered the fact of addressing to the most vulnerable groups, such as those less educated.

Association of socio-demographic and lifestyle factors on prevalence of overweight. general and abdominal obesity in Spanish adults

Multivariate regression analysis

	Overweight 25 ≥ BMI < 30 kg/m^2		Obesity BMI ≥ 30 kg/m^2		Abdominal obesity WHtR ≥ 0.5	
	AOR (95 % CI)	p	AOR (95 % CI)	p	AOR (95 % CI)	p
Sex						
Women	1		1		1	
Men	**2.12 (1.62 - 2.78)**	**0.000**	**2.38 (1.70 - 3.35)**	**0.000**	**2.24 (1.73 - 2.91)**	**0.000**
Age						
18 - 40 years	1		1		1	
41 - 65 years	**2.21 (1.72 - 2.84)**	**0.000**	**3.12 (2.27 - 4.28)**	**0.000**	**4.11 (3.23 - 5.23)**	**0.000**
Region						
South	1		1		1	
Central	0.80 (0.56 - 1.13)	0.203	0.81 (0.51 - 1.30)	0.388	0.89 (0.64 - 1.26)	0.516
Atlantic	0.78 (0.53 - 1.13)	0.186	0.76 (0.46 - 1.28)	0.305	**0.64 (0.45 - 0.92)**	**0.017**
Mediterranean	0.89 (0.65 - 1.23)	0.490	1.19 (0.78 - 1.80)	0.424	0.79 (0.58 - 1.07)	0.130
Habitat size[a]						
Rural	1		1		1	
Semi-urban	0.92 (0.69 - 1.24)	0.600	1.25 (0.85 - 1.83)	0.260	0.80 (0.61 - 1.06)	0.124
Urban	0.78 (0.57 - 1.05)	0.103	1.14 (0.77 - 1.71)	0.509	0.81 (0.60 - 1.08)	0.154
Level of education						
Primary or less	1		1		1	
Secondary or medium	0.74 (0.54 - 1.01)	0.055	**0.56 (0.38 - 0.81)**	**0.002**	**0.59 (0.44 - 0.80)**	**0.001**
University or higher	**0.59 (0.41 - 0.85)**	**0.005**	**0.41 (0.25 - 0.65)**	**0.000**	**0.55 (0.39 - 0.78)**	**0.001**
Family income						
0 - 1,000 €	1		1		1	
1,001 - 2,000 €	1.00 (0.70 - 1.43)	0.998	1.11 (0.71 - 1.75)	0.643	0.88 (0.62 - 1.25)	0.467
≥ 2,000 €	1.05 (0.69 - 1.59)	0.833	0.72 (0.41 - 1.26)	0.250	0.70 (0.47 - 1.06)	0.091
No answer	0.86 (0.58 - 1.29)	0.471	0.98 (0.60 - 1.62)	0.947	**0.61 (0.41 - 0.90)**	**0.012**
Immigrant population						
No	1		1		1	
Yes	0.92 (0.57 - 1.49)	0.740	0.74 (0.40 - 1.37)	0.339	1.00 (0.64 - 1.58)	0.989
Rate of unemployment						
No	1		1		1	
Yes	0.78 (0.56 - 1.08)	0.140	1.05 (0.71 - 1.56)	0.798	1.03 (0.76 - 1.41)	0.836
Smoking status						
Non smoker	1		1		1	
Smoker	0.81 (0.63 - 1.05)	0.112	**0.60 (0.42 - 0.84)**	**0.003**	**0.72 (0.56 - 0.92)**	**0.009**

	Overweight 25 ≥ BMI < 30 kg/m²		Obesity BMI ≥ 30 kg/m²		Abdominal obesity WHtR ≥ 0.5	
	AOR (95 % CI)	p	AOR (95 % CI)	p	AOR (95 % CI)	p
Vigorous physical activity						
< 75 min/week	1		1		1	
75 - 149 min/week	0.72 (0.44 - 1.16)	0.178	**0.43 (0.21 - 0.87)**	**0.019**	0.73 (0.46 - 1.17)	0.190
150 - 299 min/week	**0.64 (0.42 - 0.96)**	**0.032**	**0.39 (0.22 - 0.69)**	**0.001**	**0.55 (0.37 - 0.81)**	**0.003**
≥ 300 min/week	**0.66 (0.46 - 0.96)**	**0.029**	**0.31 (0.18 - 0.54)**	**0.000**	**0.48 (0.34 - 0.70)**	**0.000**
Moderate-vigorous physical activity						
< 150 min/week	1		1		1	
150 - 300 min/week	0.79 (0.52 - 1.21)	0.279	1.16 (0.70 - 1.92)	0.564	0.88 (0.60 - 1.31)	0.540
≥ 300 min/week	1.24 (0.88 - 1.74)	0.219	1.07 (0.71 - 1.61)	0.735	1.10 (0.80 - 1.52)	0.561
Time watching TV						
Never or almost never	1		1		1	
Low frequency	1.16 (0.58 - 2.32)	0.681	1.51 (0.48 - 4.77)	0.481	1.83 (0.92 - 3.64)	0.084
Frequently	1.28 (0.66 - 2.49)	0.468	2.09 (0.71 - 6.17)	0.181	**2.15 (1.12 - 4.15)**	**0.022**
Quite often	1.53 (0.80 - 2.91)	0.197	**3.33 (1.17 - 9.45)**	**0.024**	**2.76 (1.46 - 5.21)**	**0.002**
Very often	1.74 (0.89 - 3.38)	0.105	**4.92 (1.70 - 14.23)**	**0.003**	**3.22 (1.67 - 6.19)**	**0.000**
Sleep time						
< 7 h/day	1		1		1	
7 - 8 h/day	0.87 (0.62 - 1.23)	0.443	**0.60 (0.39 - 0.93)**	**0.022**	**0.54 (0.39 - 0.76)**	**0.000**
≥ 8 h/day	0.77 (0.56 - 1.08)	0.128	**0.51 (0.34 - 0.77)**	**0.001**	**0.48 (0.34 - 0.66)**	**0.000**

Abbreviations: BMI: Body Mass Index; CI: Confidence Interval; AOR: Odds ratio adjusted for all other variables in the table. The reference category for overweight and obesity is BMI < 25 kg/m². and for abdominal obesity is WHtR < 0.5.
[a] Habitat size: rural populations: 2,000-30,000; semi-urban: 30,000-200,000; urban population: over 200,000 inhabitants.

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The final protocol of the ANIBES scientific study was previously approved
by the Clinical Research Ethics Committee of the Autonomous Region of Madrid (Spain).