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Overweight, obesity and beer consumption

Alcohol drinking habits in Belgium and body mass index

by

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Abstract

Objective: The relationship between body weight and alcohol, particularly beer, consumption was studied in a representative sample of the Belgian population using a quantity frequency (QF) index, which measures the units of alcohol weekly consumed. The data of the health questionnaires 1997 were used.

***Design*:** A total of 10000 individuals were interviewed and, after omission of individuals younger than 15 years of age, the questionnaires of

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7809 subjects were used for analysis. The most important confounding factors reported in the literature, i.e. smoking behaviour, concern for weight, sugared drinks, snacks, milk products, fish, type of bread, use of fats, lack of physical activity, age, educational level and income, were corrected for in the analysis. We distinguished between beer, wine and strong alcoholic drinks.

Results: Results show that contribution of alcohol to the body mass index of the population is minor. For males the body mass index (BMI) and the risk for obesity increase slightly by increasing QF index. Women show a negative relation because BMI and the risk for obesity decrease with increasing QF index. In women, the relative risk for obesity decreases with increasing beer intake and the BMI decreases with increasing wine intake.

***Conclusion*:** Moderate consumption of alcohol increases slightly the BMI and risk for obesity in men and decreases the BMI and risk for obesity in women. Beer seems not to confer an increased risk for obesity and overweight. Complex gender specific effects on BMI and risk to obesity were observed and demand further exploration.

Keywords

Beer, wine, alcohol consumption, alcoholic beverages, obesity, body mass index.

Introduction

Ten to 20 per cent of the European population have a body mass index (BMI) of 30 kg/m^2 and more and are considered obese. In the US the percentage of overweight people (BMI beyond 26) reaches 39% for men and 36% for women and this figure increased with 8% over the last 30 years (1). The health risks of obesity are obvious. Hypertension, type-2-diabetes, cancer and cardiovascular diseases are more prevalent and cause more mortality in overweight individuals (2, 3). A BMI of 40 confers even a situation dangerous to life. Overweight itself and the associated diseases are responsible for a large part of the health care budget in all Western countries (4). Therefore, obesity creates a major concern in developed countries.

Ethanol accounts for 5,6 percent of the energy intake in the average US diet (5) and up to 10 percent of the total energy in alcohol consumers (6). Although alcohol seems to have the complex tendency to increase the BMI in men in contrast to women (7), depending on the pattern of intake (8), the overall, habitual consumption of ethanol in excess of energy needs probably favours lipid storage and weight gain (9, 10) and thus may contribute to obesity and overweight.

Little is known about the contribution of beer, alone or as a part of a complex alcohol intake, to overweight. An analysis of 4 cross-sectional studies showed significant differences between Northern Ireland and France with regard to patterns of alcohol consumption and life styles but the epidemiological data were not retrieved from the same population and beer was not addressed as a single factor (11). In Belgium, where more than 50 per cent of alcohol is consumed as beer and the prevalence of obesity is amongst the highest in Europe, a study relating beer to overweight and obesity is highly appropriate. This report focuses on beer and alcohol consumption in a large representative population sample and their relationship with two measures of overweight: the BMI (kg/m^2) and obesity (BMI > 30 kg/m^2). Generally recognized confounding factors (see under) are included in the statistical analysis in order to delineate the pure health effects of alcoholic beverages, particularly beer consumption.

Materials and methods

The study is based on data from a national survey on health (NSH) conducted in 1997 by the Centre for Operational Research in Public Health at the Department of Epidemiology from the Scientific Institute of Public Health – Louis Pasteur(12). The survey targets a sample of 10000 Belgians representative for the general population registered in the National Registry (RRN) and therefore reflects the population pyramid. To limit seasonal effects (e.g., flue epidemic) the NSH was spread out over a complete calendar year, January 1 to December 31, 1997. Subjects living in communities such as abbeys and prisons were excluded. The RRN was used as sampling frame. The final sampling scheme of the households and respondents is a combination of several sampling techniques: stratification, multistage sampling and clustering (13-17). In particular a geographical spread is achieved. The sample size within a province is proportional to the population size of that province.

With regard to alcohol consumption and overweight, the confounding factors that were dealt with are smoking behaviour, nutrition (concern for

weight, consumption of warm meals with vegetables, breakfast, sugared drinks, snacks, milk products, fish, fresh fruits, vegetables, bread, fats), physical activity, gender, age, region of residence, educational level and equivalent monthly income. In the NSH, the Quantity-Frequency index (QF) was used as a measure for the amount of alcoholic beverages weekly consumed. This index is constructed as the product of the number of days in a week that the respondent drinks alcohol and the average number of consumptions per "drink day". In the analyses we created QF indices for beer, wine and strong alcoholic beverages according to the types of spirits that was mainly consumed during the week or weekend. One consumption refers to an average of 250 ml beer, 125 ml wine and 30 ml of strong alcoholic beverages and equals on average 12 gram of alcohol. Because the BMI stabilizes from about 18 years on, cut-off points for obesity (>30 kg/m^2) can only be defined for the population older than 18 years of age. The evaluation of risk for obesity is therefore restricted to this population. For the analysis of BMI the population studied is older than 15 years of age.

As mentioned before, it is necessary to reflect the complex design of the NSH in the calculation of estimates (18). To test for independence in the two-way table, overweight and alcohol consumption levels, we used a test based on the usual Pearson χ^2 statistic. To account for the survey design, this statistic is turned into an F statistic with noninteger degrees of freedom using a second-order Rao and Scott correction (19). The alcohol related risk to obesity was investigated by means of pseudo-maximum-likelihood logistic (PML) regressions. The PML is often used on complex survey data for logit analysis, similar to the WLS method (20), and yields consistent estimates of the model coefficients under complex designs. An adjusted Wald test was used for testing linear hypotheses. Linear regression analysis assumes a model relating the variable Y BMIto a vector of variables X, $E(Y|X = x) = \alpha + x'\beta$. Estimation of β, accounting for the sample design, is done through a weighted-point-estimation method. A variance estimator for β is based on a linearization (first-order Taylor expansion). Adjusted Wald statistics were used for testing linear hypotheses. In the literature it is suggested that the relation alcohol-health is not a simple linear function, but rather J-shaped. The J-shape relationship indicates a decrease in risk between the zero and higher consumption level. For the continuous scaled alcohol intake variables we therefore assumed a quadratic relationship with the logit for obesity or mean BMI. All analyses were performed with the *Svy* commands for survey estimation of Intercooled Stata 6.0 for Windows 98/95/NT (21).

For the number of alcohol units or consumptions weekly taken, we defined the following indicator variable: Alcohol consumption level: *"Non*

– *drinker"* (<1 unit/week), *Low* (1-10 units/week for men, 1-7 units/week for women), *Moderate* (11-21 units/week for men, 8-14 units/week for women) and *High* (>21 units/week for men, >14 units/week for women). The use of separate levels for men and women was inspired by the literature to compensate for the biological differences of ethanol consumption (22).

Results

The study population was analysed with respect to the place of residence (region and province), gender, age, educational level and equivalent income of the household. The results are shown in Table 1. The average amount alcohol weekly consumed by the Belgian population (15 years and older) is 3.19 glasses (250 ml) of beer, 1.53 glasses (125 ml) of wine and 0.24 glasses (30 ml) strong alcoholic beverages and most has more than one type. Men consume significantly more beer (5.4 consumptions [95% CI = 4.8; 5.99] against 0.95 [0.8; 1.01] – $P < 0.001$) and strong alcoholic drinks (0.39 [0.21; 0.58] against 0.09 [0.05;0.12] – $P = 0.001$) than women. The numbers of glasses of wine that male or female subjects weekly drink is on average the same (1.58 [1.39; 1.77] against 1.48 [1.30; 1.65] – $P = 0.384$). Forty one percent of the Belgian population, 15 years and older, does not drink alcohol on a weekly base; 71% of this 41% does not drink beer, 78% does not consume wine and 96% does not regularly drink strong alcoholics. This does not imply that 41% of the Belgian population never drinks alcohol. In fact, the proportion of the Belgian population that did not report alcohol consumptionP during the 12 months before the interview is much lower, i.e. 15%. The proportion of people that consume alcohol (including low-alcoholic beverages) at least once a week is significantly lower among women (70% for men and 48% for women – $P < 0.001$). The proportion of female subjects that drink at least one beer weekly is lower than the proportion among male subjects (44% for men and 14% for women – $P < 0.001$). On the contrary, more women than men consume weekly at least one glass of wine (18% for men and 26% for women – $P < 0.001$). Three per cent of women and 4% of men have at least one glass of strong alcoholics a week.

With respect to the BMI (kg/m^2) we find that women with low or moderate alcohol consumption have a lower BMI than women classified as "non-drinkers". This trend is not simply linear but quadratic, indicative of a J-shaped curve. For men we do not find a statistically significant rela-

TABLE 1
Description of the sample 15 years and older (not taking into account design features)

Residence	n	Sample	Belgian Population[1]
Flemish region	2806	35.93%	57.97%
Brussels	2226	28.51	9.35
Walloon region	2777	35.56	32.68
Belgium	**7809**	**100.00**	**100.00**
Gender		%	%
Male	3834	49.1	48.9[2]
Female	3975	50.9	51.1
Age		%	%
15-24	1055	13.5	15.2[3]
25-34	1523	19.5	18.4
35-44	1516	19.4	18.5
45-54	1197	15.3	15.4
55-64	1015	13.0	12.7
65-74	947	12.1	11.8
≥ 75	556	7.1	8.0
Educational level		%	
No diploma	156	2.0	
Primary education	1095	14.1	
Inferior secondary education	1376	17.7	
Superior secondary education	2409	31.0	
Higher education	2725	35.1	
Equivalent monthly income		%	
<20.000	542	7.3	
20.000-30.000	1501	20.1	
30.000-40.000	1824	24.4	
40.000-60.000	2544	34.1	
>60.000	1059	14.2	
Body mass index (kg/m^2)		mean	St. Dev.
Male	3834	25.09	3.90
Female	3975	24.11	4.57
Height (cm)		mean	St. Dev.
Male	3834	175.62	7.47
Female	3975	163.35	6.67
Weight (kg)		mean	St. Dev.
Male	3834	77.39	12.82
Female	3975	64.26	12.41
Age		mean	St. Dev.
Male	3834	45.07	17.84
Female	3975	45.93	18.87

[1] Source: NIS-01.01.1997.
[2] Based on the total Belgian population.
[3] Based on the Belgian population older than 15.

tionship between the BMI and the alcohol consumption level ($P = 0.207$, Table 2). Eleven per cent of the Belgian population, 18 years and older, are considered obese (BMI > 30kg/m^2). The percentage of obese women (10.6%) is comparable to the percentage of obese men (11.3%, *$P = 0.508$).* Table 3 shows the cross tabulation of alcohol consumption level and obesity. The proportion of obese women decreases in the groups with low to moderate alcohol consumption ($P < 0.001$). We could not find a statistical significant quadratic trend. For men the distribution of obesity is not different for higher alcohol consumption levels ($P = 0.582$).

These relationships were also confirmed by a logistic regression analysis (Table 4a). We modelled the logarithm of the odds for obesity as a function of alcohol consumption. Separate analyses were performed for males and females. Note that only subjects above 18 years of age are considered since obesity as defined beyond 30 kg/m^2 applies only for adults. In all models a linear and a quadratic term in the quantity-frequency index was included. Furthermore, all analyses were corrected with regard

TABLE 2
Mean BMI (kg/m^2) in relation to alcohol consumption level, for men and women

	Alcohol consumption level						
	Non mean	Low[1] mean	Moderate[2] mean	High[3] mean	Global n	mean	St. Dev.
Men	24.85	25.12	25.42	25.35	3834	25.11	0.09
Women	24.38	23.67	22.97	23.94	3975	23.98	0.10

[1] Low alcohol consumption is defined as 1-10 drinks/week for men and 1-7 for women.
[2] Moderate alcohol consumption is defined as 11-21 for men and 8-14 for women.
[3] High alcohol consumption is defined as >21 for men and >14 for women.

TABLE 3
Proportion of obesity (BMI > 30kg/m^2) in the study population according to alcohol consumption level, for men and women older than 18 years

	Alcohol consumption level				
	Non	Low[1]	Moderate[2]	High[3]	Total
Men					
Obese	0.10	0.11	0.13	0.12	0.11
Women					
Obese	0.13	0.09	0.04	0.09	0.11

[1] Low alcohol consumption is defined as 1-10 drinks/week for men and 1-7 for women.
[2] Alcohol consumption is defined as 11-21 for men and 8-14 for women.
[3] High alcohol consumption is defined as >21 for men and >14 for women.

to confounding variables as described in the materials and methods section. Only the estimates for the QF index significant at the 0.05 significance level are shown. For both genders we find a statistically significant relation between the total amount of alcohol weekly consumed and the risk for obesity. For women the logarithm of the odds linearly decreases with an increasing number of units weekly consumed. The risk for obesity when drinking *x* glasses of alcohol a week equals 0.951^x times the risk compared to the consumption of less than one alcoholic drink (OR = 0.951; 95% CI [0.916, 0.988]; $P = 0.009$). For men, on the other hand, the logarithm of the odds is a quadratic function of the total amount of alcohol consumed. The relative risk increases until a QF index of about 30, where after it decreases. With respect to beer consumption, we see that the relative risk for obesity among women decreases with increasing number of beers *(x)* per week consumed according to the following function 0.940^x (OR = 0.940; 95% CI [0.887,0.997]; $P = 0.041$). The relative risk for obesity among men does not significantly change with the QF index for beer. The relative risk for obesity is independent of the amount of wine weekly consumed and this is the case both for male and female subjects. The amount of strong alcoholic beverages, on the other hand, is related to the risk for obesity among men (OR = 1.059; 95% CI [1.011; 1.109]; $P = 0.016$). The risk for obesity when drinking *x* glasses of strong alcoholic drinks a week equals 1.059^x the risk when consuming less than one spirit per week. For women we do not find a statistically significant relation between the risk for obesity and the amount of strong alcoholics consumed. Finally the model including the confounding variables and the QF indices for beer, wine and strong alcoholic beverages together, as well as their quadratic terms was considered. This model allows us to investigate the effects of the different types of alcoholic drinks consumed simultaneously. We assumed that the effects are additive, implying that the effect on the risk for obesity of for example beer intake does not depend on the weekly wine intake. The coefficients for the QF index for beer indicates than the change in the log odds for obesity with a unit increase in the QF for beer, when all other independent variables in the model are held constant. For both men and women this multiple model reduces to the model discussed in the previous sections. For men we conclude that once we have taken into account the effect of drinking strong alcoholics (and the confounding variables), the risk for obesity is independent of the amount of wine and beer weekly consumed. The OR for obesity equals 1.059 (95% CI [1.011; 1.109]) for strong alcoholics. For women we see that the risk for obesity decreases with increasing beer intake (OR = 0.940; 95% CI [0.887,0.997])). Once this effect is taken into account, the risk for obesity is independent of the weekly consumed amount of wine and strong alcohol.

TABLE 4a
Results for the logistic regression models to test the relative risk for obesity

	Coefficient	Std. Err	Adjusted Wald test F	P[1]
Male				
Alcohol consumption				
Linear term	0.0373	0.0137	7.43	0.006
Quadratic term	– 0.0006	0.0002	5.92	0.015
Strong drinks				
Linear term	0.0570	0.0236	5.82	0.016
Female				
Alcohol consumption				
Linear term	– 0.0504	0.0193	6.82	0.009
Beer				
Linear term	– 0.0614	0.0300	4.19	0.041

[1] Only those univariate results are depicted with a p value <0.05; Similar results were obtained for the 3 QF indices (beer, wine and strong alcoholics) included simultaneously (not depicted).

Also in the linear regression analyses (Table 4b), where we model the mean BMI as a function of the confounding factors and alcohol QF index, we allow for a possible quadratic relationship. Separate analyses were performed for males and females. In all analyses we corrected for the confounding variables as described in materials and methods. Only the estimates for the QF index significant at the 0.05 significance level are shown. For both genders we find a statistically significant quadratic relation between the total amount of alcohol weekly consumed and the mean BMI. For women the mean BMI first decreases until a QF index of about 50, where after the mean BMI raises through an escalating number of weekly-consumed units. For men, the mean body mass index increases with an increasing QF until about 45, from where on the mean BMI decreases as a function of alcohol intake. There is no significant relation between the average BMI of males and the amount of beer weekly consumed. Also for women, the relation with beer consumption is not statistically significant. The BMI of men is not related to the amount of wine weekly consumed. For women on the other hand we find that the quadratic term of the QF index for wine is statistically significant. The relation has the same profile as the relation between the average BMI and the total amount of alcohol weekly consumed: a decrease in the mean BMI until a QF index for wine of about 46, and a rise from that point on. For both genders, strong alcohol consumption is not significantly related with the mean BMI. Also for the mean BMI the simultaneous effects of the different types of alcohol

TABLE 4b
Results for the linear regression models for BMI

	Coefficient	Std. Err	Adjusted Wald test F	P[1]
Male				
Alcohol consumption				
Linear term	0.0314	0.0123	6.51	0.011
Quadratic term	– 0.0003	0.0002	5.27	0.022
Female				
Alcohol consumption				
Linear term	– 0.0840	0.0219	14.70	<0.001
Quadratic term	0.0008	0.0004	5.46	0.020
Wine				
Linear term	– 0.0936	0.0244	14.73	<0.001
Quadratic term	0.0010	0.0003	9.18	0.003

[1] Only those univariate results are depicted with a p value <0.05; Similar results were obtained when the 3 QF indices were included simultaneously (not depicted).

consumption were investigated. We assumed again that the effects are additive. For example, the coefficients for the QF index for wine is the change in the mean BMI for every additional unit, when all other independent variables in the model are held constant. None of the QF indices is significant in the model for the male responders. For women the multiple model reduces to the model containing the QF index for wine and the square of this term. Once this effect is taken into account, there is no relation between the mean BMI and the amount of strong alcohol and beer consumed.

Discussion

In this study we investigated the relationship between body weight – once as a continuous variable (BMI) and once as a binary variable (obesity) – and alcohol, particularly beer, consumption in the Belgian population. The relationship between beer consumption and BMI indeed is poorly understood due to the absence of studies in large populations. The Belgian population, with a large percentage of obese and overweight individuals and relatively high beer consumption, creates a unique opportunity to study this relationship. It should be noted that obesity (BMI > 30kg/m^2) is a serious problem: 11% of the Belgian population, 18 years and older, is obese and that figure is amongst the highest in the world (1). In addition,

obesity is an intermediary state towards various kinds of chronic diseases as type 2 diabetes, hypertension, cardiovascular diseases, cancer and other chronic diseases indicating that this kind of research is mandatory. Numerous lifestyle factors can account for a change in body weight, therefore we included a large set of generally recognized confounding variables (23-25).

We used the QF index, which measures the units of alcohol weekly consumed and the study was cross-sectional. A drawback of this design is that the respondent is asked to quantify his usual drinking habits and that rare, seasonal or exceptional drinking moments (binge drinking) are often not taken into account. Although alcohol consumption was part of the written questionnaire, one has also to be aware of the sensitivity of the topic and the tendency to under report the amount of alcohol intake. This phenomenon is extensively studied by others (26). Because of legal, ethical and methodological reasons only subjects older than 15 years needed to complete the questions with respect to alcohol consumption. Although the limitations of cross-sectional studies are well recognized by epidemiologists (27, 28), useful information emerges when all predictable confounders are considered in a meticulous statistical analysis of a large representative sample and when the endpoints, as in this study BMI and obesity, are clearly defined. We also distinguished between beer (not including low alcoholic beer or table beer), wine (wine, liquors) and strong alcoholic beverages (gin, cognac, whisky, gin, vodka, long-drinks, cocktails) in the same population.

To our knowledge, this is the first population-based study on beer consumption in a large sample of males and women wherein obesity and overweight is prevalent. A former comparison of 4 cross-sectional studies between Northern Ireland and France already showed differences between patterns of alcohol consumption and lifestyle factors in two male populations (10). Another study was undertaken in inn keepers and hotel managers (29). None of these reports however were population based nor were they focused on beer consumption.

For both genders the BMI and the risk for obesity are not independent of the QF index for alcohol consumption although the slope of the change is quite small and the relationship is complex. For males the mean BMI and the relative risk for obesity increases within an increasing QF index. In contrast, for women the risk for obesity and BMI decreases. Here the relationship is more complex and a J-shape curve is observed. Although the effect might seem to be quite small (up to 4% change in BMI in women), one has to consider that the nutritional factor, alcohol, is only one item in

a multipart nutritional pattern. The magnitude of the effect of alcohol on BMI is remarkably comparable to the findings of others (6, 7).

Of particular interest was the effect of beer consumption because this indeed is the main alcohol containing drink in the Belgian population. In males beer consumption, analysed as a single factor or as a component of a complex drinking pattern, showed no influence on risk to obesity and BMI. In women, the beer consumption did not influence mean BMI but decreased the risk for obesity significantly. To our knowledge, these findings have not been observed before.

Because several epidemiological studies yield results at odd with the known metabolic fate of ethanol in humans the correlations between alcohol consumption and weight is difficult to interpret and several considerations have to be made. Obviously simple metabolic and thermogenetic factors do not account entirely for the alcohol-body weight association. Numerous investigations provide strong evidence that alcohol intake is at least partly additive to food energy over a wide range of drinking patterns. Data, emerging from dietary studies, appetite studies in metabolic laboratories and behavioural studies in free-living people, suggest, as in this study, that moderate alcohol consumption however is associated with a complex down-regulation of energy intake from other foods (30). Even when confounders like age, smoking, social class, education and physical activity are taken into account the relationship remains multifaceted.

The gender difference has already been noted in other studies (6, 7). Because concern for weight was included amongst the confounders, this factor seems not to explain entirely the difference between men and women. Differences in psychosocial (31), metabolic (32) and lifestyle factors (33) might account for the gender effect in general but the exact weight of each of these factors has to be further examined.

The differences in type of alcoholic beverage confer a change in BMI and risk to obesity. The risk for obesity among men increases with escalating consumption of strong alcohol. For women the relative risk decreases with increasing beer intake and the BMI decreases with increasing wine intake up until about 46 glasses a week. This observation is also a point of considerable interest for further research and seems to indicate that behavioural or lifestyle factors may be important in the choice of the type of drink and are not taken up by the survey. Particularly for women, one may ask who drinks beer and wine and to what type of lifestyle it fits? For this difference in behaviour a more detailed questionnaire has been developed and is now considered for further study.

Conclusion

Beer consumption in Belgium seems not to be related to higher BMI and increased risk to obesity. Because of the cross-sectional design of the study and the complex dietary pattern and life style of the population these results have to be interpreted with reserve. Also the gender difference indicates that the relationship between beer and alcohol consumption and risk to overweight is complex. Further research remains mandatory.

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Résumé

La relation entre la consommation d'alcool, en particulier la bière, et l'obésité a été examinée dans un échantillon représentatif de la population belge en utilisant un index de Quantité-Fréquence (QF) comme mesure de la quantité hebdomadaire de boissons alcoolisées consommées. Au total, 10000 individus ont pris part à l'étude, mais les analyses ne portent que sur les personnes de 15 ans et plus, soit 7809 personnes. Les facteurs confondants les plus souvent rapportés dans la littérature, comme le tabagisme, la préoccupation pour son poids, les boissons sucrées, les snacks, les produits laitiers, le poisson, le type de pain, les graisses alimentaires, l'activité physique, l'âge et les facteurs socio-économiques, ont été introduits dans les analyses. Nous faisons une distinction entre la bière, le vin et les alcools forts. Les résultats montrent que la contribution des boissons alcoolisées à l'indice de masse corporelle (BMI) de la population est mineure. Chez les hommes, le BMI et le risque d'obésité augmentent avec l'index QF global. Chez les femmes, la relation est négative, à savoir le BMI et le risque d'obésité diminuent lorsque l'index QF global augmente. Chez

les femmes, on note aussi que le risque d'obésité tend à diminuer avec une consommation plus importante de bière (mais pas avec le vin ou les alcools forts), et que le BMI décroît avec une consommation croissante de vin. En conclusion, une consommation modérée d'alcool est liée à une augmentation du BMI et du risque d'obésité chez les hommes, alors qu'elle est liée à une diminution du BMI et du risque d'obésité chez les femmes. Cet effet spécifique du sexe sur la relation entre la consommation d'alcool et le poids (BMI et obésité) doit faire l'objet d'une investigation scientifique plus approfondie.

Samenvatting

De relatie tussen lichaamsgewicht en alcohol, voornamelijk bier, consumptie werd bestudeerd in een representatief staal van de Belgische bevolking door middel van een kwantitatieve frequentie (QF) index, waardoor de wekelijks alcohol inname in eenheden wordt weergegeven. Een totaal van 10000 personen werden ondervraagd en, na exclusie van personen jonger dan 15 jaar, 7809 vragenlijsten werden onderzocht. De meest bekende covariabelen uit de literatuur zoals rookgedrag, bezorgdheid omtrent gewicht, frisdranken, snacks, zuivelprodukten, vis, type van brood, vetinname, fysieke activiteit, leeftijd en socio-economische factoren, werden in de studie opgenomen. We maakten onderscheid tussen bier, wijn en sterke alcoholische dranken. Alcoholische dranken hebben weinig invloed op de lichaamsmassa index (BMI). Voor mannen is de toename in BMI en het risico voor obesitas proportioneel aan een stijgende QF index. Vrouwen vertonen een negatieve relatie doordat de BMI en het risico voor obesitas dalen naargelang de QF toeneemt. Voor vrouwen daalt het risico voor obesitas met stijgend bierverbruik en daalt de BMI bij toenemende consumptie van wijn. Een matige alcoholconsumptie laat de BMI en het risico voor obesitas toenemen bij de man en afnemen bij de vrouw. Bier lijkt geen invloed te hebben op het risico voor obesitas noch op overgewicht. Het complexe verschil tussen beide geslachten nodigt uit tot verder onderzoek.

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