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Binge Drinking and Total and Abdominal Excess Weight among Adolescents

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Abstract

➢ ***Introduction:***

Adolescents have presented high prevalences of excess weight and a large proportion of these overweight adolescents remain with this condition in adulthood. Also, in this group we highlight the great demand for the practice of ''binge drinking''. In view of the above, the objective of the present study is to analyze whether binge drinking among adolescents is associated with overweight considering Body Mass Index (BMI), Waist Circumference (WC) and Waist-to-height ratio (WHtR).

➢ ***Methods:***

This is a cross-sectional study, carried out in Olinda (Pernambuco, Brazil), with adolescent students of both sexes, aged between 14 and 19 years. Weight, height and waist circumference were assessed for BMI, WC , and WHtR. The data were collected from March to June of the year 2018 and typed with double entry in EpiData 3.1. The analyzes were performed in Stata software version 15.1.

➢ ***Results:***

Among the 2,501 adolescents who participated in the research, 32% of adolescents performed binge drinking in the last 30 days. The prevalence of overweight / obesity was 26.1%, 15.7% and 14.1%, when considering BMI, WC and WHtR respectively. Compared between the sexes, the girls presented a higher prevalence for both total and abdominal excess weight.

➢ ***Conclusion:***

No association was found between total and abdominal overweight with binge drinking; however, there was a significant interaction between binge drinking and sex for outcomes of total overweight by BMI (p <0.01) and abdominal obesity by WC (p <0.02).

➢ ***Implications and Contribution:***

The findings of this study deserve attention due to the high frequency of overweight and alcohol consumption among adolescents, thus bringing negative impacts on their health. It is also possible to highlight their contribution when verifying that there is an interaction between the sexes when we analyze the association these risk factors.

Keywords:- *Adolescent, Binge Drinking, Overweight.*

I. INTRODUCTION

Excess weight is still a significantpublic health problem, although government policies around the world have been trying to promote healthier behaviors linked to weight control1. Adolescents have presented high prevalences of this pathology2,3 triggering cardiovascular diseases, psychosocial problems, type 2 diabetes, insulin resistance, dyslipidemia, andarterial hypertension4. A large proportion of these overweight adolescents remain with this condition in adulthood, thus compromising their quality of life5.

Several anthropometric methods have been applied in order to detect excess weightbetter. Among the most used in population-based studies, body mass index (BMI), waist circumference (WC) and waist-to-height ratio (WHtR)are simple and low cost6. BMI is the parameter most commonly used for the diagnosis of total body excess weight, while WC and WHtR are used to evaluate abdominal obesity, associated with metabolic and cardiovascular risks7.

Adolescence is a period of construction and consolidation of behaviors and lifestyle. It is considered a critical phase of skill development, intense socialization, experimentation and the formation of the personality of the individual8. A greater vulnerability tothe adoption of risk health behaviors, such as alcohol consumption, is observed in this group9.

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Alcohol consumption observed in the young population has presented high prevalence10,11,12. In this group we highlight the great demand for the practice of "binge drinking", which is determined as the intake of five doses for boys and four doses for girls or more on a single occasion13. The practice of this risky conduct requires precaution because of its harmfulness to the organism, since there is a rapid increase of blood alcohol levels, causing negative consequences for the individual such as intoxications, neurological alterations, dependence in adult life, among others14.

Alcohol is considered toxic to the organism15 because alters metabolic pathways, such as lipid, and obtaining a preference for hepatic metabolism favors fat storage16. On the other hand, an inverse relationship between alcohol consumption and body weight gain could be explained by the improvement in the lipid profile associated with low to moderate alcohol consumption17. Thus, the mechanism that involves the relationship between alcohol consumption and excess weight is still not well understood 17,18,19.

In view of the above, the objective of the present study is to analyze whether binge drinking among adolescents is associated with overweight considering BMI, WC and WHtR.

II. METHODOLOGY

A. Study Design and Sampling

This is a cross-sectional, analytical, school-based study originating from an integrated project entitled 'Oral health and modifiable health risk behaviors in adolescence - follow-up to prevent', in which it aims to investigate various risk behaviors in adolescents.

The study was conducted in Olinda, a city located in the Metropolitan Region of Recife, which represents the third largest city of Pernambuco in a territorial area (41.7Km2), the first one in the state in population density (9,063.58 inhabitants / Km2) and the seventh of the country20. In the year 2018, Olinda had 8,902 students enrolled in 33 state public schools, 2 of which were for night teaching21. The eligibility criteria for participation in the study were: students of both sexes, aged between 14 and 19 years, duly enrolled in schools of the state public day school of Olinda municipality, not pregnant and not having neuropsychomotor deficiencies that made it impossible to collect data. In this way, 31 schools were eligible, while 27 accepted take part in this study.There were7,255 students in these 27 schools. They were all invited through the ask their own assignment(older than 18 years) or have their parents'assignment(under 18 years) in the Informed Consent Form (ICF).Thus, 37.2% (2,700) returned the signed ICF,accepting to participate in this study.

The calculation of the sample was performed considering a power of 80%, a confidence level of 95% and a Prevalence Ratio of 1.4 the sample was estimated at 1532. A drawing effect of 1.2 was added to correct clustered sampling as well, 20% was added to minimize possible losses. The estimated final sample was 2,206 adolescents.

B. Data collection

This study was submitted and approved, CAAE: 76609817.1.0000.5207, in the Research Ethics Committee of the University of Pernambuco, as recommended by the National Research Ethics Commission (CONEP).

Data collection took place from March to June 2018. The questionnaire was applied in a classroom that the school made available, with the presence of the students who carried the signed ICF in the day of the collection, without the presence of any teacher or employee from school. The questionnaire was applied by a previously trained researcher and lasted approximately 30 minutes. After answering the questionnaire, the students who accepted to participate in the anthropometric evaluation were directed to a more reserved place previously prepared, so that there would not be any type of embarrassment. Weight, height and waist circumference were measured twice by trained researchers. An inter-examiner Kappa test was performed with adolescents participating in the pilot study, where a Kappa of 0.99 for height and 0.96 for WC was obtained.

The standardizations of the anthropometric measurements followed the recommendations of Lohman et al. (1988). To measure the weight, a properly calibrated digital electronic scale (CAMRY) with a maximum capacity of 150 kg was used. The adolescents were weighed barefoot, with no objects in their hands and pockets, unadorned in the head and were asked to stand still. The height was measured with a portable stadiometer (Sanny®) measuring 220 cm. The stadiometer was affixed to the wall, and the teenagers stood erect in their socks, their upper limbs attached to the trunk, their backs and heels touching them as they looked ahead. The Body Mass Index (weight (kg) / height (m) 2) was calculated by weight and height. WC was measured by means of an inextensible tape measure, with the teenager standing with relaxed abdomen, arms relaxed at the side of the body, placing the tape horizontally at the midpoint between the lower edge of the last rib and the iliac crest.

The questions regarding the use of alcohol, physical activity and food were based on U.S. Youth Risk Behavior Survey (YRBS) questionnaire, validated in Brazil by Guedes and Lopes in 201023. The sociodemographic questions were based on a similar section from the National School Health Survey (PeNSE) 24.

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C. Analyzed Variables

The dependent variables were total overweight, analyzed by BMI and abdominal obesity, analyzed by WC and WHtR. The excess of the total weight was classified according to the recommendation of the World Health Organization (2007) 27 for categorization of the BMI of adolescents specific by sex and age, using z-scores (Low BMI: <2, adequate BMI ≥ -2 and < -1; Overweight: ≥ +1 and <+ 2; Obesity: ≥ +2). For the classification of CC, the cut-off points of Taylor et al (2000) 28, adjusted for age and sex, were adopted, where: (girls: 14 years ≥77, 15 years ≥78.3, 16 years ≥79.1, 17 years ≥ 79.8, 18 years ≥80.1, 19 years ≥80.1 and boys: 14 years ≥79, 15 years ≥81.1, 16 years ≥83.1, 17 years ≥84.9, 18 years ≥86.7, 19 years ≥88.4 The Identification of abdominal obesity through (cm) and height (cm), establishing as a cutoff point for abdominal obesity values equal to or greater than 0.527. The consumption in binge drinking in the 30 days prior to the survey (yes - 1 day or more / no - no day) presented in this study as the independent variable.

The covariates of this study were: physical activity - number of days with physical activity for at least 60 minutes / day in the last 7 days - (1 to 4 days / 5 or more days), (breakfast- during the last 7 days, in how many (0-2 days / 3-5 days), sex (female / male), age: (14-16 years / 17-19 years), mother's schooling (≤ 8 years old /8 years of study) and monthly family income - the minimum wage that corresponded to R$ 954.00 - (up to 1 SM per month / 1 SM or more per month).($ 240 dollar equivalent).

D. Data analysis

The results were analyzed in the statistical program Stata / IC (Stata Corp., College Station, United States) version 15.1. The independent variable of interest was the performance of binge drinking in the last 30 days (no = 0; yes = 1), while the dependent variables were the overweight / obesity indicators analyzed by BMI, WC and WHtR (Low weight / Normal weight = 0; Excess weight = 1). For the descriptive analysis of the data, the absolute and relative frequency values were used. To compare the proportions of the variables of interest according to sex, the Chi-square test was used. To analyze the association between binge drinking and excess weight, controlling for confounding factors, Poisson regression with robust variance was used28.

For each overweight/obesity indicator, three adjusted regression models were performed: model 1 (age, family income and maternal schooling), model 2 (age, family income, maternal schooling, physical activity and breakfast) and model 3 (age, family income, maternal schooling, physical activity, breakfast, and the interaction between binge drinking and sex). The interaction between binge drinking and sex was tested using Mantel-Haenszel ($p < 0.05$) for each indicator of overweight. In allanalyzes $p < 0.05$ wasadopted as statistically significant.

III. RESULTS

Among the 2501 adolescents collected, the final sample totaled 2,443 students. The reasons for loss were unwillingness to participate in the anthropometric evaluation (n = 53) and not meeting the inclusion criteria, such as pregnant women or those with physical disabilities that made it impossible to measure weight and height (n = 5).

The sociodemographic characteristics of total and abdominal excess weight, as well as alcohol consumption in binge, breakfastand physical activity of adolescents included are presented in table 1. Most of the adolescents were female (55.9%), younger (53.1%) with a family income of at least 1 minimum wage (62.1%) and having a low mother schooling(64.2%). Still, boys were older and had higher family income compared to girls ($p < 0.001$). It was observed that 32% of the adolescents performed binge in the last 30 days.

The prevalence of overweight / obesity was 26.1%, 15.7% and 14.1% when considering BMI, WC and WHtRrespectively. In the comparison between the sexes, girls presented a higher prevalence of overweight / obesity for both BMI (28.1% and 23.7%), and for WC (17.7% and 13.1%) and WHtR, 16,1% and 11.6%).

Regarding Table 2, it is observed through the Poisson regression that only breakfast was associated in all the anthropometric parameters and in all its adjusted models. Binge drinking was not associated with overweight/obesity considering all models (Table 2). However, in the model 3 for overweight / obesity evaluated by BMI and WC, the binge and sex interaction variable was associated, indicating a lower prevalence of overweight / obesity for boys who consumed alcohol.

There was a significant interaction between binge drinking and sex for outcomes of total overweight by BMI ($p < 0.01$) and abdominal obesity by WC ($p < 0.02$) (Graph 1 and 2). However, the same did not occur in the WHtR indicator ($p < 0.06$) (Graph 3).

IV. DISCUSSION

We found a significant interaction term between binge drinking and sex&overweight adolescents. In our best knowledge, this interaction was not investigated among adolescents. Since the public policies must be addressed differently between the sexs, our findings highlight an important discussion for the published literature.

The prevalence of overweight according to the BMI indicator was 26.1%, with 28.1% for girls and 23.7% for boys. This result was superior to the result found by Blackstone et al. (2016) 29. In this study, the authors not measured weight and height but,it were reported favoring an underestimate of the weight that may explain the lower prevalence (18.3%). Differently from what happened in a study that also used measures of weight and height and that

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adjusted the cut-off point for age and sex, which presented a prevalence similar to this study for girls (26.7%) and a little higher for boys (34.5%) 30.

Regarding CC, the total prevalence of abdominal obesity was 15.7% slightly different from the results found in previous studies: Brazil-Santa Catarina (10.6%) 31, Malaysia (11.3%) 32, China (22.0%) 33, United States (34.7%) 34. This discrepancy can be attributed, besides the variation of cut-off points, to the ethnic, cultural and socioeconomic diversity of each locality.

The United States' result showed a much higher prevalence and this may have occurred because the cut-off limits were used for the adult population-adjusted only for sex, besides hypercaloric feeding frequentin that country36. In relation to the prevalence in Malaysia and China 32,33 differences may have occurred because each research used cut-off points supported by previous local studies, with the ethnic distinction being raised among them.

The Brazilian study31, was performed in the southern region of the country and observed a lower prevalence (10.6%). The regions of Brazil present significant cultural differences, for example, in relation to sugar consumption35. The Northeast region of Brazil, mainly in the state of Pernambuco, where the present study was carried out, historically presents a sugary food culture, since sugarcane plantation was the basis of its economy for a long time35, confirming our higher prevalence of sugarcane excess weight in comparison to the result of the South region.

The result found for abdominal obesity by WHtR (11.6% boys and 16.1% girls) is close to another finding (12.2% boys and 20.5% girls) 36, which mentions the highest percentage of inherent fat in females. Most studies use a universal cut-off point for the classification of WHtR. However, the need for studies that take into account different sexes, ages and ethnicities37 has been debated in the literature, because in adolescence there are physiological changes in each age group, inherent differentiations for each sex, in addition to the fact that body composition implies differences in ethnic groups38.

Our findings showed that a third of adolescents consume alcohol in bingein line with previous studies31,39. A study with American high school adolescents found that among those who consumed alcohol, more than half practiced binge drinking (64.2%) 12. This risk behavior was similarly presented in girls and boys in the present study. Advances in the equality of different behaviors between the sexes could justify such a finding..

The relationship between overweight/obesity with food consumption and physical activity is already well discussed and elucidated40. The habit of eating breakfast is related to better food choices throughout the day, as well as a healthier diet41,that is consistent with our association between having breakfast few times a week and overweight. Regarding physical activity, no association with overweight/obesity was observed in our study, in line withCastro et al.31, although this findingis contrary to most of the previous studies42(achoqueteria q citarmaisestudosjá que vcreforçou que saotantos). The useof only one self-reported variable to evaluate the physical activity might explainthis non-association, since previous studies usedother methods more reliable, such as the following: doubly marked water, calorimetry, heart rate, pedometers and accelerometersHowever, questionnaires have proved to be the most practical, accessible and with an acceptable accuracy 43.

In our study, binge drinking was not associated with overweight / obesity when assessed by BMI in line with Huang et al. (2013) 44.In the face of the non-association, have warned of the need for a detailed investigation on the pattern of alcohol consumption, since the frequency, intensity and type of alcoholic beverage may interfere with this result.A longitudinal survey that found a positive association10 followed the transition of American adolescents from high school (18 years) to early adulthood (32 years). The same describes the importance of accompanying the repercussion of this risk behavior with the excess of weight for more time, not only in the short term, also suggesting that the age can be a confused factor.

Abdominal obesity, represented by WC and WHtR, also had no association with drinking in binge. Regarding WC, other studies with similar methodology also did not find this association31,45. Prospective studies could evaluate this association in the long term, since perhaps the age and the long frequency with the excessive practice of this risk behavior can also influence the abdominal excess weight. The WHtR is considered the most recently used parameter in the studies. It is seen that for the diagnosis of abdominal obesity, the use of the two anthropometric indicators, WC and WHtR, offer a better prediction, unlike the isolated analysis of only one indicator46. On the other hand, this indicator does not yet present a specific cutoff for age and sex. Among the articles studied, no study investigating the association between binge and abdominal obesity analyzed the WHtR as an indicator of overweight and obesity.

The multifactorial etiology of overweight / obesity should also be considered where this inverse relation between alcohol consumption and body weight gain could be explained due to genetic components2, variations in the individual's energy expenditure, such as their basal metabolism and changes in digestion and absorption of nutrients, configuring metabolic and neuroendocrine changes47,48. A study with twins identified an interaction between the alcohol gene and obesity, that is, a genetic variance was observed for alcohol consumption and sex, indicating a genetic protection for overweight and obesity among alcohol consumers19. However, the authors point out that gene expression interacts with external factors and that more research in the field of genetics is needed to better elucidate this gene-environment interaction.

As limitations, the present study has a transversal nature, making it impossible to attribute a causal relationship between the analyzed variables. It should be noted that although there were explanations about the secrecy of the research, adolescents under 18 years of age could only participate in the study with the Terms of Free and Informed Consent signed by the parent / guardian, which may have generated some fear that their information could be seen, resulting in non-participation of the research or omission of information regarding risk behaviors, such as alcohol consumption. In addition, the memory bias may have occurred, since some responses were conditioned to the memory of adolescents. And finally, this research was carried out only in public schools, so that it may not represent the same reality in which students from private schools live. The strengths of this study are the anthropometric evaluation, measured and non-self-reported; the use of previously tested and validated instruments with high levels of reproducibility; besides the use of three anthropometric indicators to evaluate overweight and obesity.

V. FINAL CONSIDERATIONS

It can be concluded that there was no association between binge drinking and total and abdominal overweight although it is important to highlight the interaction between alcohol consumption in binge and sex, for BMI and WC. This points to a lower prevalence of overweight among boys who consumed alcohol in binge. We suggest that this interaction be better investigated through longitudinal studies or to address genetic interactions. It should be emphasized that despite this finding, alcohol consumption should not be encouraged, even if it is low or moderate, since it is related to the pathogenesis of other diseases, besides causing irreversible damages, especially in adolescence. Actions undertaken at the school and community level, in order to subsidize better adoptions of lifestyle, as well as attenuations in the risk behavior of excess consumption of alcohol, could improve the health of adolescents.

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Variables	Total		Boys		Girls		p*
	N	%	N	%	N	%	
Age group (n 2431)							
14-16	1291	53.1	499	46.5	792	58.3	<0.001
17-18	1140	46.9	573	53.4	567	41.7	
Family income (n 2438)							
≤ 1 minimumwage	924	37.9	363	33.7	561	41.2	<0.001
> 1 minimumwage	1514	62.1	713	66.3	801	58.8	
Motherschooling (n 1987)							
≤8 yearsofstudy	712	35.8	288	33.3	424	37.8	0.035
>8 yearsofstudy	1275	64.2	578	66.7	697	62.2	
Binge drinking (Last 30 days) (n 2404)							
yes	767	31.9	340	32.1	427	31.7	0.829
No	1637	68.1	718	67.9	919	68.3	
BMI (n 2.400)							
Lowweight / Normal weight	1774	73,9	810	76,3	964	71,9	0.016
Lowweight / Normal weight	626	26.1	251	23.7	375	28.1	

CC(n 2.420)							
Lowweight / Normal weight	2041	84.3	927	86.9	1114	82.3	0.002
Lowweight / Normal weight	379	15.7	140	13.1	239	17.7	
RCE (n 2.438)							
Lowweight / Normal weight	2094	85.9	951	88.4	1143	83.9	0.002
Lowweight / Normal weight	344	14.1	125	11.6	219	16.1	
Physicalactivity (n 2.407)							
0-5 days	2117	87.9	869	82.1	1248	92.6	<0.001
6 days	290	12.1	190	17.9	100	7.4	
Breakfast (n 2.337)							
0-2 days	825	35.3	303	29.6	522	39.8	<0.001
3-5 days	417	17.8	186	18.2	231	17.6	
6 ormoredays	1095	46.9	535	52.2	560	42.6	

* Chi-square of Person for comparison between boys and girls (p <0.05)

Table 1:- Distribution of adolescents by sex and socioeconomic factors, Binge drinking, physical activity and BMI, CC and CER.

Variables	**IMC**			**CC**			**RCE**		
	Mod. 1	Mod. 2	Mod. 3	Mod. 1	Mod. 2	Mod. 3	Mod. 1	Mod. 2	Mod. 3
	PR (IC 95%)	PR (IC 95%)	PR (IC 95%)	PR (IC 95%)	PR (IC 95%)	PR (IC 95%)	PR (IC 95%)	PR (IC 95%)	PR (IC 95%)
Binge	0.91 (0.775-1.074)	0.90 (0.767-1.073)	1.07 (0.871-1.322)	0.96 (0.774-1.205)	0.99 (0.795 1.249)	1.25 (0.962-1.648)	0.92 (0.733-1.167)	0.95 (0.750-1.207)	1.10 (0.828-1.476)
Sex	1.13 (0.974-1.325)	1.08 (0.924-1.274)	1.04 (0.869-1.263)	1.36 (1.099-1.701)	1.32 (1.052-1.662)	0.93 (0.717-1.229)	1.39 (1.109-1.109)	1.37 (1.080-1.748)	0.83 (0.623-1.106)
Binge/ sex	-	-	0.65 (0.460-0.924)	-	-	0. 50 (0.305-0.828)	-	-	0.66 (0.397-1.100)
age	0.94 (0.0801.0955)	0.92 (0.789-1.078)	0.92 (0.790-1.077)	1.19 (0.965-1.473)	1.18 (0.951-1.466)	1.18 (0.952-1.466)	1.47 (1.179-1.842)	1.46 (1.162-1.835)	1.46 (1.166-1.840)
Family income	1.00 (0.863-1.169)	1.02 (0.873-1.191)	1.02 (0.877-1.196)	0.99 (0.808-1.227)	0.99 (0.807-1.236)	1.00 (0.812-1.244)	1.06 (0.854-1.323)	1.08 (0.866-1.354)	1.08 (0.866-1.354)
Mother'sschooling	0.92 (0.78551.073)	0.91 (0.774-1.071)	0.904 (0.769-1.063)	0.89 (0.720-1.118)	0.90 (0.723-1.133)	0.89 (0.715-1.118)	1.01 (0.806-1.264)	1.05 (0.841-1.328)	1.04 (0.833-1.314)
Physicalactivity	-	0.85 (0.679-1.065)	0.83 (0.683-1.071)	-	1.00 (0.713-1.425)	1.01 (0.721-1.435)	-	0.86 (0.618-1.222)	0.87 (0.623-1.231)
Breakfast	-	1.33 (1.125-1.585)	1.33 (1.125-1.583)	-	1.15 (1.028-1.305)	1.34 (1.056-1.699)	-	1.08 (0.958-1.232)	0.97 (0.703-1.348)

Table 2:- Poisson regression to analyze the association between socioeconomic variables, binge drinking, physical activity and breakfast with BMI, CC and RCE.

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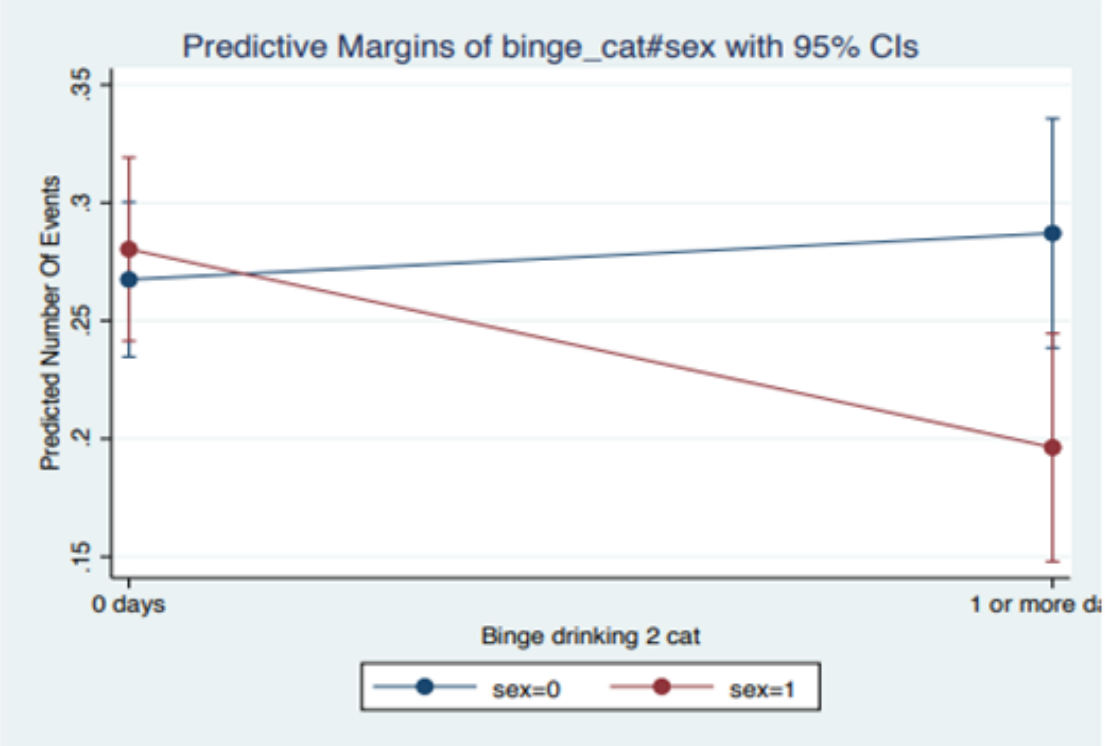
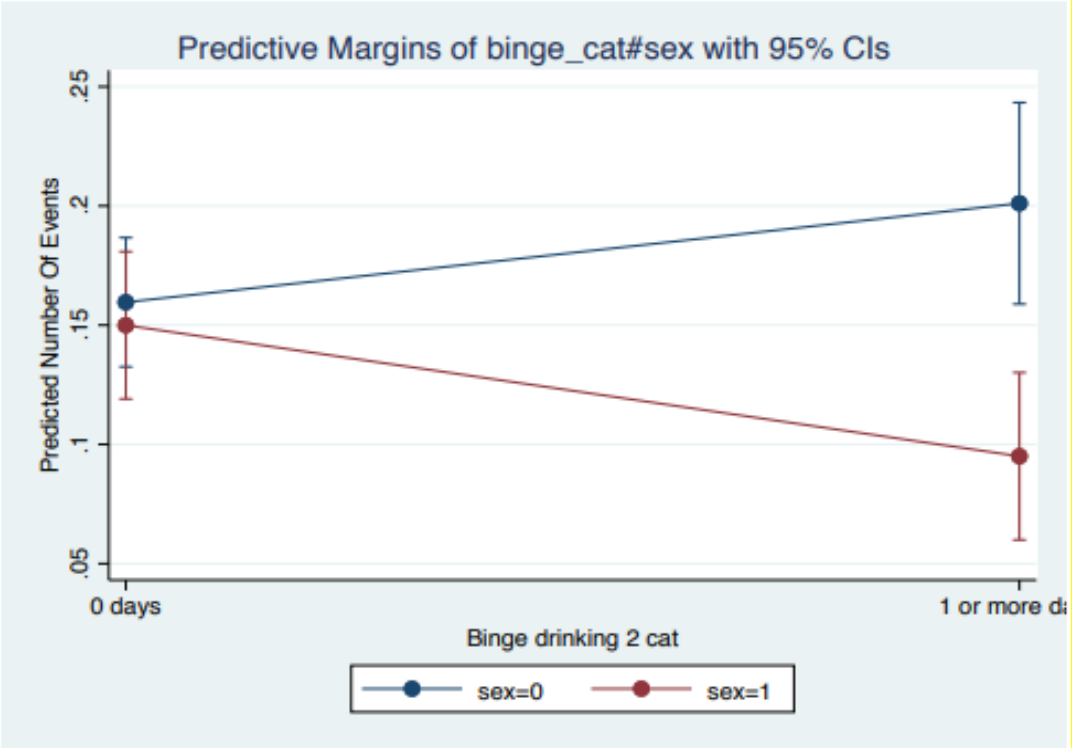


Graph 1:- Interaction of BMI with alcohol consumption according to the Mantel-Haenszeltest

* p-valor: 0.001



Graph 2:- Interaction of CC with alcohol consumption according to the Mantel-Haenszel test

* p-valor: 0.02

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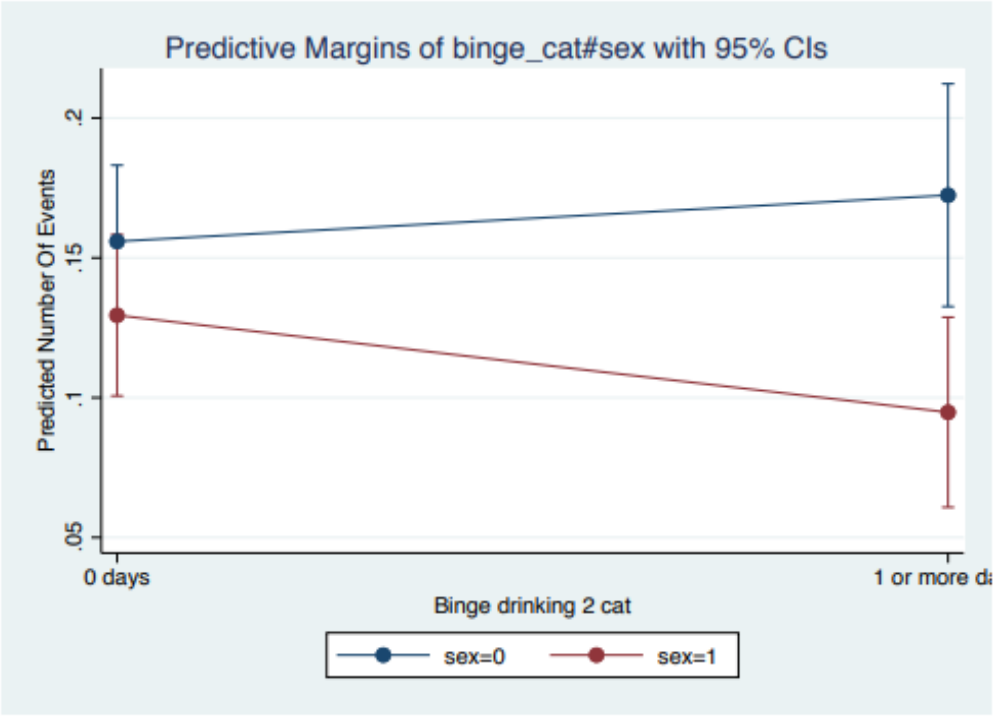

Graph 3:- Interaction of the RCE with alcohol consumption according to the Mantel-Haenszel test

* p-valor: 0.06