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Cohort Profile

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Cohort Profile: The Cohort of Universities of Minas Gerais (CUME)

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Why was the cohort set up?

In Brazil, noncommunicable disease (NCD) accounts for 72% of deaths, representing a serious public health concern.[1,2] In this context, the Ministry of Health proposed a strategic action plan to confront these diseases between 2011 and 2022, with emphasis on cardiovascular diseases, cancer, chronic respiratory diseases and diabetes, as well as their main risk factors—smoking, harmful alcohol consumption, physical inactivity, inadequate diet and obesity.[3]

In this context, studies have evaluated the relationship between dietary/behavioural factors and the prevalence of NCD. Thus, high consumption of fruits and vegetables has been associated with low concentrations of homocysteine, a compound involved in the development of cardiovascular and cerebrovascular diseases as well as with reduction of oxidative stress and DNA damage markers.[4,5] In turn, high consumption of red meat, a common food habit among the Brazilian population, was positively associated with central obesity, hypertriglyceridaemia, metabolic syndrome and insulin resistance.[6]

However, there is still a lack of longitudinal studies from Brazil examining the association between lifestyle and NCD which are capable of making causal inference. Thus, the Cohort of Universities of Minas Gerais (CUME) aimed to assess the impact of the Brazilian dietary pattern and nutrition transition on the occurrence of NCD among graduates and postgraduates of federal higher education institutions located in the state of Minas Gerais, Brazil. The CUME project is an open concurrent cohort restricted to a population group of alumni of universities located in the state of Minas Gerais, Brazil.

Who is in the cohort?

The cohort's baseline (Q_0) was established in 2016, having as participants Universidade Federal de Viçosa (UFV)

and Universidade Federal de Minas Gerais (UFMG) alumni who graduated between 1994 and 2014. This research was conducted in accordance with the ethical principles stated in the Declaration of Helsinki, and was approved by the Human Research Ethics Committees of the UFV and the UFMG (Protocol No. 596,741-0/2013). All participants read the informed consent form and indicated online agreement before responding to the questionnaire.[7]

In order to contact as many graduates and postgraduates as possible, the alumni association and postgraduate programmes of UFV provided the registration data of potential participants. To update information, an internet search on professional networking sites was performed. At the UFMG, the Information and Technology Directorate offered to send the research questionnaires to potential participants registered in its database.

As a disclosure strategy, a logo was created for the cohort, as well as a website and a social media page to disseminate the project. The logo comprises symbols representing the mountains of the state of Minas Gerais, and it was used on all dissemination materials, social media, reports, questionnaires and the material used by the team. Before sending the invitation, the project was publicized by means of interviews with researchers on social media and on the website of the project. The invitation to participate in the study was e-mailed to each potential participant. In addition, a registration form was made available on the cohort's website at for those graduates and postgraduates who initially did not receive the e-mail.

The filling out of the baseline questionnaire was divided into two parts. The second part was sent 1 week after the first part was completed. Five e-mail invitations without any response was considered refusal to participate in the study. Likewise, incomplete questionnaires were defined as those that the participant did not fully complete after five e-mail reminders. For the development of the questionnaire in the virtual environment, an information technology specialist was hired to configure the software and assist the research team in solving technical problems through e-mail, instant messaging and telephone. Additionally, this technician was responsible for submitting questionnaires via e-mail and exporting the data generated in a format compatible with Microsoft Excel®, containing variable labels and a frequency script.

Then, questionnaires were sent and completed between March and August 2016. In total, 4987 alumni responded to the online questionnaire. However, surveys that did not present some demographic data ($n = 516$), participants of other nationalities ($n = 19$) and residents abroad ($n = 161$) were excluded (Figure 1). After these exclusions, 4291 alumni remained in the baseline cohort, of whom 2915 (67.9%) were women and 1376 (32.1%) were men.

The cohort included graduates and postgraduates in all Brazilian states and the Federal District. The largest concentration of participants were in the South-east region ($n = 3804$; 88.7%), followed by the Mid-west region ($n = 189$, 4.4%), North-east ($n = 166$, 3.9%), North ($n = 68$, 1.6%) and South ($n = 64$, 1.5%) (Figure 2). Interestingly, 78.1% of the alumni reported living in the state of Minas Gerais, thus making it possible to collect face-to-face data for validation studies at the research centres located in the cities of Belo Horizonte and Viçosa.

How often have they been followed up?

Having established the cohort's baseline in 2016 with UFV and UFMG alumni who graduated between 1994 and 2014 as participants, we will perform evaluation waves every 2 years in a virtual environment. We intend to apply the first follow-up questionnaire (Q_2) in 2018, and to extend the study to other universities from Minas Gerais State (Brazil); then the CUME project can be considered a concurrent open cohort.

What has been measured?

The first questionnaire sent to the participants comprised 83 questions related to lifestyle, sociodemographics, anthropometrics, biochemical and clinical data, physical activity practice, individual and family morbidity and personal history of preventive checkups. The participants were invited to report their current weight and height for further calculation of body mass index—(BMI: kg/m^2), in addition to results of the past 2 years of the following biochemical tests: total cholesterol, high-density lipoprotein (HDL) and low-density lipoprotein (LDL) cholesterol, triglycerides, glucose and systolic and diastolic blood pressure.

Data on the current use of medicines, passive and active smoking habits and alcohol consumption were collected. Binge drinking was defined as five or more alcoholic drinks for males or four or more alcoholic drinks for females on the same occasion on at least 1 day in the past month.[8] Physical activity was investigated using a list of 23 leisure activities and the time/frequency spent on them, as well as a second part that included questions about the time spent in sedentary activities.[9] Individuals with $\geq$150 min/week of moderate-intensity activity or $\geq$75 min/week of vigorous-intensity activity were considered active. Physical inactivity was defined as the absence of leisure time physical activity.[10] Questions regarding the means of commuting to work were also included.

Results of medical examinations or preventive checkups (without illness been previously diagnosed), i.e.

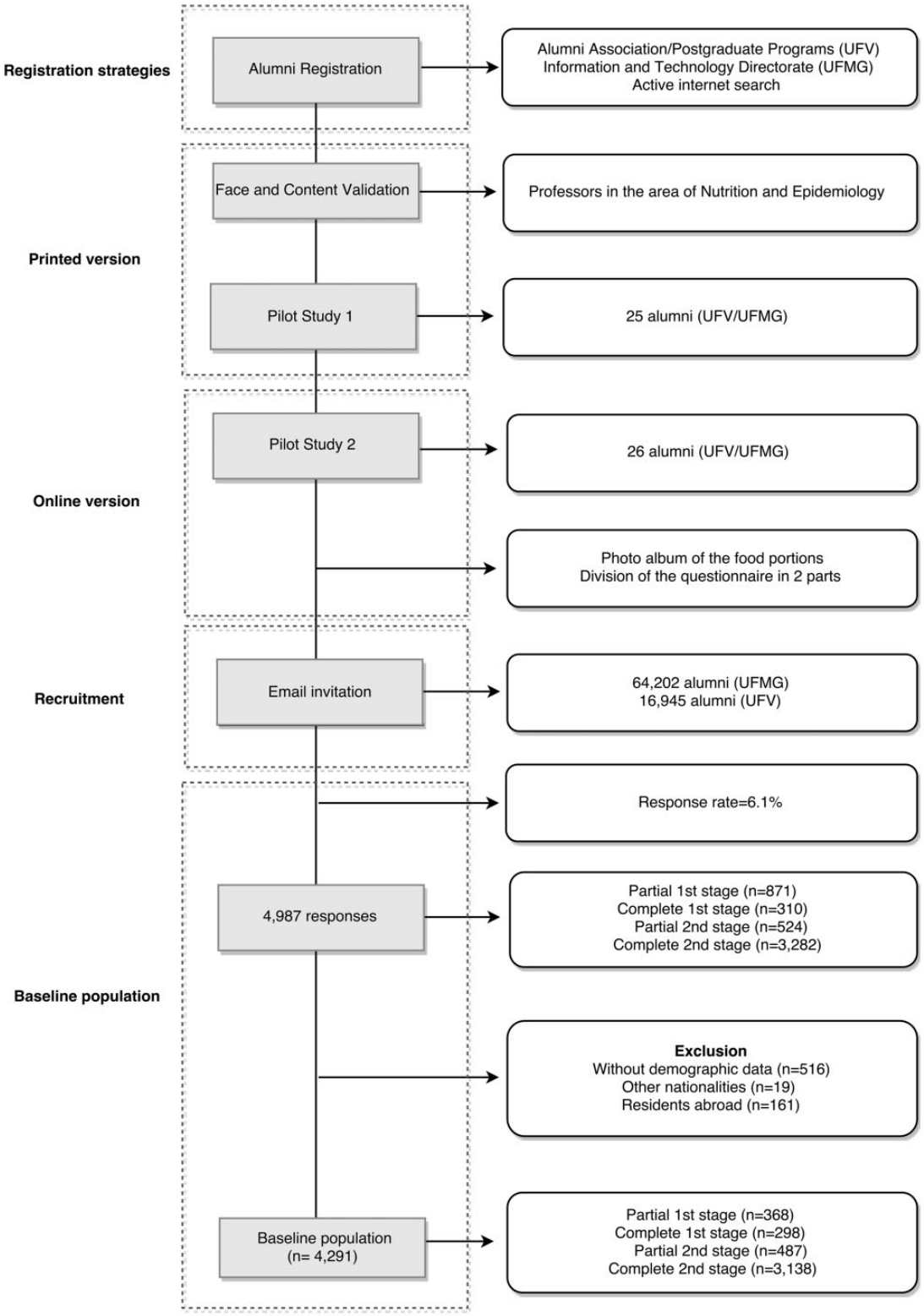

Figure 1. Flowchart of baseline data collection of the Cohort of Universities of Minas Gerais (CUME), 2016. UFMG, Universidade Federal de Minas Gerais; UFV, Universidade Federal de Viçosa.

ultrasound, endoscopy, medical review, intraocular pressure, digital rectal examination and mammography, were registered. At this stage of the questionnaire, the participant was allowed to mark more than one type of examination and provide an age range (<25, 25–39, 40–59, ≥60 years). We also investigated groups of diseases and the age group when diagnosed. The diseases investigated were cardiovascular, gastrointestinal, respiratory,

Figure 2. Distribution of the place of residence of the baseline participants of the Cohort of Universities of Minas Gerais (CUME) throughout Brazil, 2016 ($n = 4291$). North region, a: Acre, b: Rondonia, c: Amazonas, d: Roraima, e: Amapa, f: Para, g: Tocantins. Mid-west region, h: Mato Grosso, i: Mato Grosso do Sul, j: Goias, k: Federal District. North-east region, l: Maranhao, m: Piaui, n: Ceara, o: Rio Grande do Norte, p: Paraiba, q: Pernambuco, r: Alagoas, s: Sergipe, t: Bahia. South-east region, u: Minas Gerais, v: Espirito Santo, w: Rio de Janeiro, x: Sao Paulo. South region, y: Parana, z: Santa Catarina, α: Rio Grande do Sul.

renal, cancer or tumours, infections, other diseases or injuries and traffic accidents. Subsequently, family history of illness was reported. For women, diagnosis of benign disease or malignant tumour in the breast and reproductive history (gestations and the type of feeding offered to their first child during the child's first year) were also investigated. At the end of this first stage, participants received information related to their reported blood pressure and BMI as well as any cardiovascular risk identified and calculated from the Framingham Heart Study.[11]

To calculate the prevalence of diseases in the base population of the CUME project, the following criteria were considered: report of previous medical diagnosis; use of medication; and/or results of clinical, biochemical and anthropometric tests. The outcomes investigated were: obesity, overweight, hypertension, type 2 diabetes, elevated total cholesterol and triacylglycerol, and depression. Individuals who reported the diagnosis of obesity or who had a BMI $\geq 30\,kg/m^2$ were classified as obese, and those with a BMI value $\geq 25\,kg/m^2$ were considered overweight.[12] The classification of hypertension was based on

medical diagnosis, use of antihypertensive medications and systolic blood pressure values ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg.[13] Type 2 diabetes was estimated based on reports of the use of oral hypoglycaemic medications, insulin, medical diagnosis and/or fasting blood glucose ≥126 mg/dL.[14] The diagnosis of high total cholesterol (TC) was defined by the use of TC-lowering medications, medical diagnosis and/or TC ≥200 mg/dL.[15] A diagnosis of high triacylglycerol (TG) was based on reports of the use of TG-reducing medications, medical diagnosis and/or TG ≥150 mg/dL.[15] Finally, depression was defined as that diagnosed by a physician.

In the second stage, participants were asked to fill out the quantitative Food Frequency Questionnaire (FFQ) and to report their eating habits and practices. The survey was previously validated for the Brazilian population and contains 144 food items grouped into dairy, meat and fish, cereals and legumes, fats and oils, fruits, vegetables and greens, beverages and other foods.[16] Thus, each participant reported the frequency (daily, weekly, monthly or annual) of the consumption of a given food in the previous year and the portion consumed. To adapt the instrument to the virtual environment, a photo album of the food portions was provided aiming to assist in the visualization of the portions of the foods and to improve the reliability of the answers.

To elucidate the habits and food practices of the alumni, questions were asked about the consumption of visible meat fat and chicken skin, organic foods, probiotics, prebiotics, addition of salt to salad and sugar in beverages. To help subjects understand the questions related to the organic foods, probiotics and prebiotics, explanatory notes with simple language containing concepts and examples of everyday use were used. Issues relating to food environment were also addressed, such as the type of food establishment where the participant has the habit of having lunch (a la carte, self-service, university restaurants, bakeries and cafeterias), average amount spent on meals and how many blocks walked to the food establishment. Also, whether the establishment offered various options of salads and vegetables, fresh fruits and fruit salads, fresh natural juices or frozen fruit pulp-based juice, nutritional information on the preparations served and whether 300 mL of natural juice or prepared fruit juice from frozen pulp cost more than canned soda (350 mL) or a cup (300 mL) of soda.

In return for their participation, participants received a list of information on the number of daily meals eaten; consumption of fruits, greens, legumes and sodas; removal or consumption of visible meat fat or chicken skin; increased sugar in drinks and salt in salad. In addition, a specially designed newsletter was sent which included important aspects of diet including the Food Guide for the Brazilian Population, as material to be consulted online.[17]

In order to evaluate the food consumption of the participants, the consumption frequencies of each food were transformed into daily consumption, followed by grams or millilitres, and finally nutrients or compounds. For the calculation of daily intake of calories and nutrients, Brazilian tables of nutritional composition of foods were used and, in the absence of such information, the United States Department of Agriculture table was used.[18,19] Since the objective of the CUME project is to evaluate the impact of Brazilian dietary pattern and nutrition transition on NCD, participants of other nationalities residing in Brazil, residents abroad, those who did not complete the FFQ and those with estimated daily energy intake [<500 kcal/day ($n=1$) or >6000 kcal/day ($n=92$)] were excluded from the analyses.[20,21]

In order to characterize the baseline profile of the participants of the CUME project, absolute and relative frequencies of the variables of interest were presented according to gender. Statistical differences were evaluated with the chi-square Pearson test (χ^2). The values of macronutrients consumed were previously adjusted by daily energy intake using the residual nutrient method.[22] Energy and macronutrients intake were compared between men and women through a Mann-Whitney test, according to the normality of the variables, which in turn was verified by the Shapiro-Wilk test. All analyses were conducted with Stata® Software (version 13.0), with a significance level of 5%.

What has CUME found? Key findings and publications

As described in Table 1, participants of CUME project hold degrees from different fields of study, predominantly Applied Social Sciences (28.7%) and Health Sciences (26.7%). Of the total number of participants, 72.9 % had concluded some postgraduate study. At baseline, most individuals were aged between 30 and 39 years (46.5%), White (64.4%), were legally married or in a stable union (52%), received less than five times the minimum wage (49.5%) and were employed (80.5%). Regarding lifestyle, 56.5% reported binge consumption of alcohol, 8.9% smoked tobacco and 46.3% were insufficiently active or were inactive. Men and women differed in relation to all characteristics except skin colour, with emphasis on binge consumption of alcohol and smoking among men.

The current population of Brazil is 207.7 million inhabitants, according to the report of the Population Count conducted by Brazilian Institute of Geography and Statistics (IBGE).[23] Since Census 2010, Brazil has been an

Table 1. Sociodemographic characteristics of baseline participants of the Cohort of Universities of Minas Gerais (CUME), according to sex, 2016

	Female		Male		Total		*P*-value*
	n	%	*n*	%	*n*	%	
Area of study ($n = 4291$)							<0.001*
Exact and Earth Sciences	258	8.9	201	14.6	459	10.7	
Biological Sciences	242	8.3	82	6.0	324	7.6	
Engineering	195	6.7	253	18.4	448	10.4	
Health	932	32.0	212	15.4	1144	26.7	
Applied Social Sciences	900	30.9	332	24.1	1232	28.7	
Agricultural Sciences	195	6.7	248	18.0	443	10.3	
Linguistics, Language Studies and Arts	193	6.6	48	3.5	241	5.6	
Age group ($n = 4289$)							<0.001*
20–29 years	821	28.2	227	20.1	1098	25.6	
30–39 years	1327	45.5	668	48.6	1995	46.5	
40–49 years	471	16.2	279	20.3	750	17.5	
50–59 years	233	8.0	103	7.5	336	7.8	
≥60 years	62	2.1	48	3.5	110	2.6	
Individual income ($n = 3480$)[a]							<0.001*
<5 times the minimum wage	1353	57.0	370	33.4	1723	49.5	
≥5 to <10 times the minimum wage	741	31.2	409	37.0	1150	33.0	
≥10 times the minimum wage	279	11.8	328	29.6	607	17.4	
Skin colour ($n = 4291$)							0.734
White	1889	64.8	876	63.7	2765	64.4	
Black/Brown	996	34.2	484	35.2	1480	34.5	
Yellow/Indigenous	30	1.0	16	1.2	46.0	1.1	
Level of education ($n = 4291$)							<0.001*
Bachelor's degree	781	26.8	381	27.7	1162	27.1	
Specialization degree	782	26.8	319	23.2	1101	25.7	
Master's degree	846	29.0	353	25.7	1199	27.9	
Doctorate/post-doctorate	506	17.4	323	23.5	829	19.3	
Marital status ($n = 4291$)							<0.001*
Legally married/stable union/other	1429	49.0	802	58.3	2231	52.0	
Single	1299	44.6	511	37.1	1810	42.2	
Separated/divorced	171	5.9	60	4.4	231	5.4	
Widowed	16	0.5	3	0.2	19	0.4	
Professional situation ($n = 4291$)							<0.001*
Full time/part time/informal	2288	78.5	1165	84.7	3453	80.5	
Student	389	13.3	135	9, 8	524	12.2	
Retired/home duties	81	2.8	28	2.0	109	2.5	
Unemployed	157	5.4	48	3.5	205	4.8	
Physical activity ($n = 4289$)							<0.001*
Inactive	764	26.2	324	23.6	1088	25.4	
Insufficiently active	662	22.7	235	17.1	897	20.9	
Active	1488	51.1	816	59.3	2304	53.7	
Smoking habit ($n = 4287$)							<0.001*
No	2372	81.4	996	72.5	3368	78.6	
Former smoker	337	11.6	199	14.5	536	12.5	
Yes	204	7.0	179	13.0	383	8.9	
Binge drinking ($n = 3130$)							<0.001*
No	947	47.0	415	37.3	1362	43.5	
Yes	1070	53.0	698	62.7	1768	56.5	

[a]Minimum wage (R$880.00 in 2016).

*P-values from Pearson chi-square test.

adult country, in the transition phase to becoming an old country in the year 2050.[24] Participants of the CUME study are younger, mainly women (68%), smoke less tobacco (8.9% vs 10.2%) and have a higher prevalence of heavy episodic drinking (56.5% vs 20.4%) compared with the general Brazilian population.[25] Furthermore, according to World Health Organization statistics, 49.2% of the Brazilian population does not reach the recommendations on physical activity,[26] and CUME participants have a similar activity profile.

Table 2 describes the most prevalent diseases in the population, with obesity identified in 14.9% and overweight in 40.8% of the respondents. In addition, the prevalence of hypertension was 11.6%, with high total cholesterol in 22.6% and high triacylglycerol in 12.7%; all disease was more frequent in males. Among the latest results published by the Surveillance System for Risk and Protective Factors for Chronic Diseases by Telephone Inquiry (VIGITEL) for Brazilians,[25] the increase in the prevalence of overweight in adults over the past 10 years stands out, corresponding to from 42.6% in 2006 to 53.8% in 2016. Obesity currently affects 18.9% of the population,[25] which is higher than that found at baseline in the CUME project. The prevalence of depression was 12.8% in the CUME project, being two times higher than that in the Brazilian population (5.8%), which just represents the highest prevalence in Latin America and the second highest in the Americas.[27]

CUME baseline data also show the diagnosis of chronic respiratory diseases (35.3%), cardiovascular diseases (16.3%), type 2 diabetes (3.3%) and cancer (2.2%) (data not shown). In Brazil, NCD are responsible for 72% of the causes of death, with the main causes being cardiovascular diseases (31.3%), cancer (16.3%), type 2 diabetes (5.2%) and chronic respiratory disease (5.8%).[28] Considering this national scenario, the devolvement of a longitudinal study on NCD and eating and lifestyle habits, such as the CUME project, is a crucial epidemiological strategy.

Table 2. Diseases prevalence of baseline participants of the Cohort of Universities of Minas Gerais (CUME), according to sex, 2016

	CUME							Brazil
	Female		Male		Total		*P*-value*	Total
	n	%	*n*	%	*n*	%		%
Obesity ($n = 4288$)							<0.001*	
No	2534	87.0	1114	81.0	3648	85.1		–
Yes	379	13.0	261	19.0	640	14.9		18.9[a]
Overweight ($n = 4286$)							<0.001*	
No	1955	67.2	583	42.4	2538	59.2		–
Yes	956	32.8	792	57.6	1748	40.8		53.8[a]
Type 2 diabetes ($n = 4102$)							0.011*	
No	2716	97.2	1250	95.6	3966	96.7		–
Yes	79	2.8	57	4.4	136	3.3		8.9[a]
High cholesterol ($n = 4103$)							0.007*	
No	2197	78.6	978	74.8	3175	77.4		–
Yes	599	21.4	329	25.2	928	22.6		22.6[a,**]
High triglycerides ($n = 4107$)							<0.001*	
No	2509	89.7	1075	82.1	3584	87.3		–
Yes	289	10.3	234	17.9	523	12.7		22.6[a,**]
Hypertension ($n = 4102$)							<0.001*	
No	2523	90.3	1102	84.3	3625	88.4		–
Yes	272	9.7	205	15.7	477	11.6		25.7[a]
Depression ($n = 3987$)							<0.001*	
No	2314	85.1	1164	91.7	3478	87.2		–
Yes	404	14.9	105	8.3	509	12.8		5.8[b]

[a]VIGITEL survey, 2016.
[b]WHO, 2017.
**P*-values from Pearson's chi-square test; ***prevalence of dyslipidaemia.

Table 3. Daily intake of calories and macronutrients of baseline participants of the Cohort of Universities of Minas Gerais (CUME), according to sex, 2016

	CUME				Brazil[a]	
	Female $n = 2136$	Male $n = 909$	Total $n = 3045$	*P*-value*	Female	Male
Energy intake (kcal/day)	2130 (1683–2678)	2524 (1993–3225)	2242 (1755–2857)	<0.001*	1710	2163
Carbohydrate (EI %)	47.7 (42.7–53.2)	46.4 (40.9–51.9)	47.3 (42.1–52.7)	0.214	56.2	54.8
Protein (EI %)	17.3 (15.0–19.8)	17.6 (15.3–19.8)	17.4 (15.1–19.8)	0.227	16.4	16.9
Lipids (EI %)	33.1 (28.9–37.1)	33.3 (29.1–37.2)	33.1 (28.9–37.2)	0.002*	27.5	27.2
Saturated fat (EI %)	11.4 (9.6–13.3)	11.7 (10.0–13.5)	11.5 (9.8–13.4)	0.514	9.7	9.2

Data are median (25^{th}–75^{th} percentile). All values presented are energy adjusted.
EI, energy intake.
[a]Average daily energy and macronutrients consumption according to sex and age (19-59 years) [Brazilian Family Budgets Survey (2008–09)].
*P-values from Mann-Whitney test.

FFQs to assess food consumption and nutrient intake were returned by 3045 alumni, 2136 women (70.1%) and 909 men (29.9%). Table 3 presents the description of daily energy intake and macronutrients in the CUME and Brazilian populations.[29] We found that only the total energy intake and lipids differed between the sexes, being greater among men.

Due to the nutrition transition experienced by Brazilians and its association with the incidence and prevalence of NCD, the food consumption profile of the baseline participants of the CUME project was analysed. The daily energy intake (median) of the study population was 2242 kcal/day, being 47.3%, 17.4% and 33.1% of energy intake from carbohydrate, protein and lipids, respectively. Comparing with data from the Brazilian population, the participants of both sexes in our cohort study had a higher consumption of energy and lipids (Table 3). Further, the median intake of saturated fat among the alumni was 11.5%, which is a value higher than the recommended value for adults without NCD (<10% of daily energy intake), and for those who already have some NCD (<7% of daily calorie intake).[30]

In addition, the younger and more educated population of the CUME project, as previously presented, seems to present distinct dynamics in the occurrence of NCD. Thus, the longitudinal results of the CUME project will be of great importance in elucidating the temporal relationship between dietary patterns and NCD in this growing population group in Brazil.

What are the main strengths and weaknesses?

The main strengths of this study involve the longitudinal design that enables evaluation of associations between diseases and exposures. Also, this study uses an online platform, which has been a growing line of research in the field of nutritional epidemiology.[31,32] Apart from the lower cost of the online platform compared with the printed version, it allows flexibility as to day and time to fill the questionnaire, which may favour the recruitment of participants from different locations, as verified by this project.

The main disadvantage is that CUME is an open concurrent cohort restricted to a high educational-level population group. Therefore, this particular sample cannot represent the Brazilian population. However, the inclusion of individuals with high educational levels in this study is fundamental to providing reliable exposure data and outcomes, as well as to verifying how these highly educated individuals behave over time.

Can I get hold of the data? Where can I find out more?

The CUME project is conducted by the Universidade Federal de Viçosa and Universidade Federal de Minas Gerais, Brazil. Further information can be obtained at [http://www.projetocume.com.br] and [projetocume@gmail.com].

Profile in a nutshell

- CUME is an open concurrent cohort restricted to a high educational-level population group. Initiated in 2016, CUME reached graduates in all Brazilian states and the Federal District. A total of 4291 alumni were eligible for the baseline data collection, mostly women (68%), young adults (72%, 20-39 years old) and postgraduate degree holders (80%).
- The cohort consists of waves of evaluation that will occur every 2 years in a virtual environment.
- Among the participants, 40.8% reported being overweight, 22.6% had high total cholesterol, 11.6% had hypertension and 3.3% had type 2 diabetes; all of these frequencies were lower compared with the general Brazilian adult population. However, CUME baseline participants already have chronic diseases, although they are younger and have a higher educational level than the general population, demonstrating the importance of the epidemiological scenario of these groups of diseases in Brazil.
- The prevalence of depression (12.8%) in our study was two times higher than the national prevalence (5.8%), which could be related to the contemporary lifestyle of our participants marked by an exhausting work routine, physical inactivity, binge drinking and unhealthy eating habits (e.g. saturated fat intake), despite their greater access to information and health services.

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