

Fruit intake and obesity

Fruit and vegetables consumption and obesity in Brazil

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Abstract

Introduction: Obesity affects more than half of the adult population and correlates with the development of chronic and psychosocial diseases. The consumption of fruits and vegetables (FV) is a protective factor for obesity, but their consumption is often below the recommendations.

Objective: To identify the level of fruit consumption in human development cycles, as well as the data on the association of fruit consumption with excess weight in Brazil.

Methods: A non-systematic literature review on the Virtual Health Library (VHL) databases for the period 2005 to 2015. A total of 23 studies were selected in the English and Portuguese languages, according to the study design and population group. Only cohorts and cross sections studies in Brazil were selected. Appropriate FV consumption was considered to be 400 g/day or a frequency of 5 servings/day (3 servings/day of fruits), and overweight was evaluated according to each age group and development cycle.

Results: The average consumption for pregnant women was found to be 350 g/day; an inverse relationship was found between total fibre consumption and gestational weight gain. The average consumption of FV for children and adolescents has remained between 30% and 40%, consumption falling with increasing age. Vigitel data between 2006 and 2014 shows an increase in the prevalence of adequate consumption of FV for adults and seniors according to gender, age and education. Appropriate consumption tripled during this period. There was an association between fruit consumption and weight loss, increased risk of obesity, abdominal obesity, hypertriglyceridemia and presence of metabolic syndrome (SM).

Conclusions: The prevalence of adequate consumption of FV is low in all regions of Brazil and among all age groups, the highest prevalence is among women and increases with the advance of age, higher education level and higher socioeconomic status. Adequate fruit consumption correlates to weight loss and/or weight gain control of individuals.

Key words: Fruit consumption, obesity/overweight, Brazil, pregnancy, children, teens, seniors, adults.

INTRODUCTION

Obesity is characterized by the chronic accumulation of fat tissue, regionalized or widespread, a combination of genetic factors, environmental and behavioural factors¹. The National Survey on Health (NSH/PNS), shows that 57% of the population over 18 years old in Brazil presents as overweight². The Food and Nutrition Monitoring System (FNMS/SISVAN) describes the prevalence of overweight in 15% of the population under six

years of age, and there is evidence that the evolution of the median weight exceeds WHO standards, tending to overweight in a comparison between the following surveys: Familial Income National Study (FINS/ENDEF), Health and Nutrition National Study (HNNS/PNSN) and Familial Incomes Research (FIR/POF). The same is observed in other national studies such as Nutri-Brazil Childhood¹.

Excess weight has a strong correlation with the development of metabolic syndrome and other chronic diseases, increasing the risk of orthopaedic, pulmonary,

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gastrointestinal, neuroendocrine disorders, and psychosocial consequences. When this condition develops in childhood there is a high possibility of it continuing in adult life¹; and obese parents raise children prone to the same condition, given the influence and interference of behavioural epigenetics, that modulates foetal metabolism from pregnancy^{1,3}. Such relationships demonstrate the cyclical relationship of overweight and suggest the urgency and specificity of therapeutic and preventive actions⁴.

Among the protective factors for overweight, the consumption of fruit and vegetables (FV), of low calorie and low fat foods, and a high percentage of fibres, contributes to increased satiety and to reducing the total intake of food⁵. The WHO recommends a minimum consumption of FV of 400 g/day, equivalent to 5 daily servings of those foods for all age groups; national references endorse the same practices, for example, the most recent dietary guidelines of the Brazilian Ministry of Health for the Brazilian population, which recommend a minimum daily intake of 3 servings of fruit and 3 of vegetables, and the Brazilian Society of Paediatrics (BSP/SPB), which promotes the consumption of more than five daily servings for children and adolescents as a way to prevent obesity^{4,6,7,8}. Consumption data, however, show insufficient intake worldwide in all age groups. The POF⁹ reported a consumption below the recommendations in 90% of the population and there is evidence that most people do not even know the recommendations for these foods⁶.

In view of this situation, the Brazilian Ministry of Health coordinated the preparation of the 'Actions and Strategies Plan for Confronting Chronic Non-communicable Diseases in Brazil, 2011-2022', with the suggestion of goals and actions for the year 2022 that address modifiable risk factors for obesity. It is proposed to increase the prevalence of the recommended consumption of FV by 10%¹⁰. Therefore, the goal is to map the situation of fruit consumption in Brazil in the last decade during the life

cycle and to analyze the association of fruit consumption and the prevalence of overweight.

METHODS

This is a literature review of empirical bases, such as BVS (SciELO/Lilacs/Bireme/Cochrane), in the period 2005 to 2015. The search terms were used individually or combined, according to Boolean operators 'and', 'or': "Fruit", "consumption", "obesity", "overweight", "Brazil", "pregnancy", "childhood", "adolescence", "seniors", "adults".

The inclusion criteria of this study guided the selection of studies that were intended to present the prevalence of fruit consumption alone or in association with the consumption of vegetables (in grams or portions/day, considering only fruit in natural form or natural fruit juices, excluding sugary drinks and artificial juices), and to correlate consumption data with the body mass index (BMI). The appropriate consumption of FV followed the recommendations of 400 g/day or a frequency of 5 servings/day (3 servings/day for fruit alone). Regarding the classification of overweight, selected articles use benchmarks according to each age group and development cycle. Only transverse character field work or cohorts studied in Brazil with the populations referred to were selected; revisions or works whose sample was representative or estimated by sample calculation were excluded.

The process for the selection of studies took place according to the following steps: 1) Reading the titles and abstracts of articles found; 2) Exclusion of foreign works and duplicates; 3) Exclusion of studies and designs with inadequate sample size; 4) Exclusion of studies not compatible with goals and 5) Reading articles entirely. 21 works were selected in the English and Portuguese language, characterized according to the design and population group: maternal (n = 3, cross-sectional cohort n = 3), transverse (n = 5, n = 1 cohort), adults and elderly (n = 8, cross-sectional cohort n = 1), and 3 official documents. The process followed is described in Fluxogram 1.

Fluxogram 1. Flow of articles

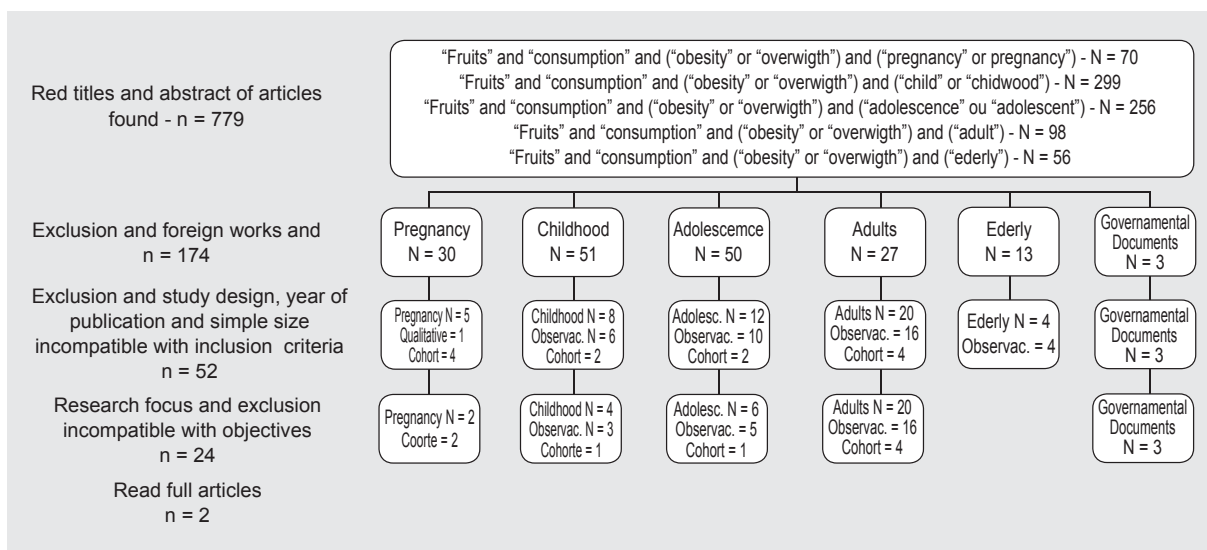


Table 1: National studies on the prevalence of consumption of fruits according to development cycle.

Reference	Objective	Study design	Population	Variable and methods used	Results/Innovation
Maternal and child					
Santana AC (2013)	To evaluate the influence of food intake on gestational weight gain from the 2 nd quarter forward.	Cohort	195 healthy pregnant women, over 19 years old in São Paulo, Brazil	Weight gain (BMI/gestational age (Atalah curve) Food intake frequency questionnaire and 2 24h recall per quarter FV consumption in grams (g)	Average consumption per quarter (1st – ± 350g; 2nd – 350g, 3rd – 313g) below the recommendations. FV consumption was not associated with weight gain in pregnant women. Average fibre intake (±16g in all quarters) below the recommendations. Fibre consumption was associated with weight gain in pregnant women (P=0.05).
Ciochetto CR (2012)	To describe the frequency of consumption of fruits and vegetables and their association with socio-demographic variables and nutritional condition.	Transversal	356 school children in the public school system in Pelotas, Rio Grande do Sul, Brazil	BMI/Age – WHO (2007) Food Intake Questionnaire – SISVAN. Fruit consumption categorized as frequent (>5 days/week) or infrequent.	12% prevalence of no consumption in the period 42% prevalence of regular consumption of fruit There was no association between BMI and regular consumption of fruit.
Castro MBT (2006)	Describe food intake of cohort of women during pregnancy and postpartum, comparing the two periods.	Cohort	276 healthy women > 15 years old; Rio de Janeiro, Brazil	Fruit Consumption (pcs./day) during the 3rd trimester of pregnancy and 30 days postpartum Method: Food Consumption Frequency Questionnaire.	Average consumption during pregnancy (4 pcs./day) Average postpartum consumption (1.94 units/day; P<0.0001) Decrease in consumption of fruits affected the intake of vitamin C (p<0.0001)
Cagliari MPP (2009)	Evaluate frequency of food intake, anthropometry, and association with the occurrence of morbidity in the three previous months.	Transversal	112 children between 2 and 5 years old. Paraíba, Brazil	used Weight and height – criteria by NCHS (not used in this analysis) Frequency consumption of fruit (times/week) – Food Intake Frequency Questionnaire	25% fruit intake between 1-4 times/ week 75% daily fruit intake – no estimated portions Positive association between daily fruit intake and reduction in diarrhoea frequency (p=0.039).
Grillo LP (2005)	Check the nutrition of schoolchildren between 5-12 years of age in low-income families.	Transversal	579 children between 5-10 years old; Florianópolis, Santa Catarina, Brazil	Weight and height – Criteria according to NCHS (not used in this analysis) Frequency consumption of fruit (times/week) – Food Frequency Questionnaire	Inadequate consumption – 48% of the children The study did not estimate portions or describe the consumption frequency of subjects.
Rauber F (2014)	Describe food intake To evaluate the effect of an intervention with the mothers of schoolchildren throughout childhood and usual food intake	Cohort	345 children between 3-8 years old Rio Grande do Sul, Brazil	Children divided between intervention and control group, assessed at 3-4 years and reevaluated 7-8 years; 24h recall 24 held 2 times + Diet Quality Score Fruit estimated in portions grams/day	The impact of intervention with mothers was positive to 3-4 years of age, but lost in the 2nd reevaluation; Average consumption of fruits <1 serving daily in both groups Reduced consumption of fruit over the years (adequacy fell 13% in the intervention group – 16% to 3% and 7% in the control group – 10% to <3% (p <0.01).
Adolecence					
Monticelli FDB (2013)	To describe the frequency of consumption of fruits/juices and vegetables and compare them to the recommendations of the “10 steps to healthy eating”	Transversal	341 adolescents 10-12 years old Both genders Curitiba, Parana, Brazil	Questionnaire with socioeconomic and personal information LV consumption was considered appropriate frequency (≥3 times/day)	Inadequate consumption of fruits/juices and vegetables (71%) Only 3.5% of them had adequate consumption of the two groups of food The consumption of fruit/juice was not associated with variables. For vegetables there was inadequate consumption of association with the largest age group (14-19 years) (OR age 14-19 vs 11-12 age: 0.29, p: 0.04).
Toral N (2007)	To assess dietary intake and the prevalence of overweight among adolescents from public schools in Piracicaba, São Paulo, Brazil.	Transversal	420 adolescents - both genders Public system schools > 10 years São Paulo, Brazil	Questionnaire with socioeconomic and personal information Frequency consumption of fruit (servings/day) - Food Frequency Questionnaire Weight and height - Criteria according to NCHS (not used in this analysis)	Low consumption of fruits and vegetables - an average of 2.3 servings/day Approximately 28.0% of the adolescents did not meet the minimum recommendation of consumption of three servings of fruits and three servings of vegetables a day. About 73% of the sample does not consume adequate servings of fruits/day There was no relationship between adequate dietary intake and overweight.
Dumith SC (2012)	To investigate risk factors for NCDs in adolescents.	Cohort	3990 adolescents 14–15 years Sub sample: Cohort Pelotas (1993).	Clustering of risk factors: fruit consumption (frequency of servings/day), smoking, alcohol consumption and physical activity	72% of the sample did not consume fruit daily The prevalence of inadequate intake was higher in males (p <0.03) In women, low fruit consumption was associated with lower levels of physical activity (p > 0.03)

Reference	Objective	Population	Variable and metodos utilizados	Resultados/Inovação
Mello MVFA (2013)	Identifying obesity for risk factors (diabetes plus obesity) in primary students in the Brazilian Amazon.	Mondini L (2010) 1218 adolescents Both genders Amazônia, Brazil	Questionnaire "How's your food intake?" The Ministry of Health of Brazil Questionnaire with sociodemographic information, clinical referred anthropometric (BMI WHO 2007) and food intake (consumption of fruit servings/day).	Frequency of consumption of fruit \geq 3 servings/day in only 35% of the sample 28% prevalence of overweight The study did not compare the BMI with the consumption of fruit
Muniz LC (2013)	To assess the prevalence and factors associated with daily consumption of fruits and vegetables (FV) among adolescents from public schools.	Ramalho AA (2012) 649 young people 15-20 years Both genders Pernambuco, Brazil	Questionnaire: Daily consumption of fruits, daily consumption of vegetables, and daily consumption of both food (times/day) Considered positive outcomes that presented consumption rate \geq once a day.	About 10% (95%CI: 5.5, 14.2) of the teens reported never consuming fruit. There was no statistically significant difference between the sexes for the consumption of fruit. Daily fruit consumption: prevalence of 32.9% (95%CI: 28.3, 37.6). Among adolescents who reported consuming fruit daily, the majority (52.1%) (95%CI: 41.0; 63.1) consumes only once a day. There was no significant association with BMI
Rieth MA (2012)	Investigate fruit and vegetable intake in adolescents and its relationship with gender, age and education.	Viebig RF (2009) Study design Transversal 568 adolescents 12-19 years Both genders	Weight and height - according to WHO criteria (2007) Weight and height - Criteria according to WHO (2007) Questionnaire with socioeconomic	Prevalence of overweight in 23% of the sample Consumption of 5 servings/day of FV in only 23% of the sample Average consumption of 2 servings of fruits/day The consumption was not associated with gender.

Adults and Elderly

Amado TCF (2007)	Identify food, nutrition and health aspects in elderly women.	Transversal 106 women > 60 years Care Center for the Elderly - NAI Universidade Federal de Pernambuco, Brazil	Frequency consumption of fruit (times/week) - Food Frequency Questionnaire	Daily fruit consumption in 66% of the population The study did not estimate portions or describe the consumption frequency of subjects. The consumption of fruit was not associated with hypertension rates.
Sartorelli DS (2008)	Identifying the relationship between the consumption of fruits and weight loss.	Transversal 80 adults with overweight, Ribeirão Preto, São Paulo, Brazil	Nutritional counselling program for 6 months; Frequency consumption of fruit (times/week) - Food Frequency Questionnaire	Association between consumption of fruits and weight loss after 6 months of follow-up (β 1 [95% CI] = -0.00290 [-0005, -0001]). Increase of 100 g/day consumption of fruit represent weight loss of 300g, adjusted for gender, age, physical activity and energy intake ($p < 0.05$).
Perozzo G (2008)	To investigate the association of dietary patterns found in adult women with general and abdominal obesity.	Transversal 1026 women between 20-60 years old São Leopoldo, Rio Grande do Sul, Brazil	Frequency consumption of fruit (times/week) - Food Frequency Questionnaire Obesity criteria according to BMI Low consumption of fruit was considered the lower-fifths of the sample.	Low consumption of fruit was associated with increased risk of obesity, after correction for confounding factors (PR = 2.18; 95% CI: 1:35 to 3:53; $p = 0.001$).
Iser BPM (2012)	Describe the key risk and protective factors for chronic diseases telephone survey data from 2010 - Vigitel.	Cohort 54.339 people over 18 years Capitals of Brazil and the Federal District.	Telephone interviews The prevalence rates were stratified by gender, age and education. Fruit and vegetables classified as appropriate: five or more servings a day, on five or more days of the week.	18% of adequate intake of fruit and vegetables by the population, higher in women (20.5%) compared to men (15.4%) ($p < 0.05$). Consumption Frequency content increased with age and education
Jaime PC (2009)	To estimate the frequency of consumption of fruits and vegetables and factors associated with telephone survey data from 2006 - Vigitel.	Transversal 54.369 people over 18 years Capitals of Brazil and the Federal District.	Telephone interviews The prevalence rates were stratified by gender, age and education. Fruit and vegetables classified as appropriate: five or more servings a day, on five or more days of the week Fruit and vegetables classified as regular: >5 days of the week.	Less than half of the individuals referred regular fruit (44.1%) and vegetable (43.8%) consumption, while 23.9% reported regular consumption of fruit and vegetables together; Adequate consumption was reported by 7.3% of respondents. Fruit and vegetables varies among the cities studied was higher among women and increased with age and education.
Palma RFM (2009)	Identify association between sociodemographic, anthropometric, presence of morbidities and lifestyle with fruit and vegetable intake.	Transversal 581 healthy adults over 20 years of Japanese-Brazilian origin; Bauru, São Paulo, Brazil	fruit consumption evaluated by three 24h recalls. Analysis by adjusted logistic regression	Increased number of daily meals was associated with increased odds [OR (95% CI)]: [1.31 (1.05, 1.63)] of adequate consumption of fruits and vegetables. Increased trend of adequate consumption of fruits and vegetables among older individuals. prevalence of 40% (n = 233) consumption of > 400g/day for FV.

Reference	Objective	Study design	Population	Variable and methods used	Results/Innovation
Mondini L (2010)	Evaluate the consumption of fruits and vegetables by adults and identify sociodemographic and lifestyle variables associated with the consumption of these food.	Transversal	930 participants > 30 years Ribeirão Preto, São Paulo, Brazil.	Consumption of fruits and vegetables through semi quantitative frequency questionnaire Results adjusted for age, marital status, education, family income, nutritional condition, smoking and physical activity.	Only 24% of men and 38% of women met the minimum recommendation of fruit and vegetables; Women with higher education and men who lived with partner consumed more fruits and vegetables than others.
Ramalho AA (2012)	To assess the prevalence and factors associated with regular consumption of fruits and vegetables in academics.	Transversal	863 university students over 18 years; Acre, Brazil.	Demographic and socioeconomic variables: gender, age, economic status, employment status, marital status, number of children. Frequency consumption of fruit (times/week) - Food Frequency Questionnaire Fruits categorized into regular (5 or more days a week) and irregular (4 or fewer days a week) consumption.	General prevalence of regular consumption of fruits and vegetables was 14.8% (without difference between gender) Regular consumption of fruits and vegetables increased with age (p = 0.004).
Viebig RF (2009)	Estimate the socioeconomic and sociodemographic factors associated with the daily intake of five servings of fruits and vegetables for the elderly.	Transversal	2,066 elderly (≥60 years) of low-income São Paulo, Brazil	Frequency consumption of fruit (times/week) - Food Frequency Questionnaire	About a third of the elderly (n = 723; 35,0%) than daily consume any kind of fruit or vegetable and 19.8% reported daily consumption of five or more servings of fruits and vegetables. This consumption was positively associated with income and education.

RESULTS

In general, insufficient consumption of fruits in Brazil is evidenced in all the studies presented and in all cycles of development. The main results of the selected studies, with their respective fruit consumption data, are described in Table 1.

DISCUSSION

Child population

There are a few studies on FV consumption during gestation and lactation in Brazil. In the study of Santana⁵, with 195 pregnant adult women, there was an average consumption of about \pm 340 g/day, below the recommendations in all quarters. Similar results were found in the literature cited in this study, with average consumption of 335 g/day for pregnant women. However, the low consumption was not associated with weight gain in the women, only the total fibre consumption in the diet (mean 16 g/day), which was also classified as low. A previous study conducted by Castro et al.¹¹ shows that, during pregnancy, the number of servings of fruits – specifically – consumed by 276 pregnant women in Rio de Janeiro Brazil, was satisfactory (about 4 servings/day), but that, however, was reduced by half (1.94 portions, $p < 0.0001$) when compared to the consumption in the postpartum period.

A reduction in the consumption of fruit during the period of pregnancy/lactation can contribute to a decrease in the consumption of micronutrients and fibre, important for foetal and maternal development. This factor was verified in the study of Castro¹¹, in which the reduction in the consumption of fruit in the postpartum period directly contributed to a decrease in the intake of vitamin C, for example. In addition, Baião et al.¹², in a qualitative study

with 26 pregnant women and recent mothers of low socioeconomic level in Rio de Janeiro, Brazil, analyzed dietary practices in pregnancy from the women's perspective, which classified fruits as basic items in the diet that were expendable if the economic situation was difficult, reinforcing the need for educational activities in this segment of the population.

In the study of Santana⁵, although there is no correlation between weight gain in pregnant women and the consumption of FV, there was an inverse relationship between total fibre consumption and weight gain. Various works cited by this study show a correlation between inadequate consumption of fibre and a 25% increased risk of developing obesity in the postpartum period.

FV consumption in childhood also remains low. Cagliari et al.¹³, in their study of 112 preschoolers in Paraíba, Brazil, reported the prevalence of daily consumption of fruits in 75%, without determining, however, the servings. Despite not being able to estimate the consumption of these children, it should be noted that 25% of this population did not even consume 1 portion of fruit daily. Grillo et al. (2005)¹⁴, studied 579 children in Florianópolis, to estimate just the adequacy/inadequacy of consumption based on the recommendations, and found a prevalence of inadequate consumption of 48% of those evaluated. Data from a cohort of 345 children aged between 3 and 8 years in southern Brazil¹⁵, showed the average fruit consumption to be less than 1 portion daily. The children were evaluated between 3 and 4 years, and again between 7 and 8, and only 16% and 10.5% of children between 3 and 4 years, and 2.5% and 3% of children between 7 and 8 in the intervention and control groups, respectively, reached the recommendations for the fruit consumption group ($p < 0.01$). In cross-sectional work in Pelotas, southern Brazil¹⁷ with 356 public schoolchildren, the prevalence of frequent consumption of fruit (when the foods were consumed in at

least five of the seven days preceding the interview) were 42.1%, although this frequent consumption was associated with a lower school age group ($p = 0.02$). There was no positive association, however, with the condition of overweight children. In addition, 12% consumed fruits in the 7 days evaluated prior to the interview. The Nutri-Childhood Brazil study¹⁶, a multicentre study held in 12 Brazilian cities with 3,100 children aged between 2 and 6 years, recorded the fresh fruit contribution to the intake of total fibre and vitamin C, for example, less than 5%, and 80% inadequacy of usual fibre consumption. The cohort of Rauber et al.¹⁵ – mentioned previously – clearly shows how the prevalence of adequate consumption is reduced over time (from 16% to 3%). Even the positive effect of the nutritional advice given to their mothers during the intervention period was lost by the time of the re-evaluation at 7-8 years. This development is also described by other works; and may reflect the autonomy of children about food choices over time, combined with environments where an unhealthy food supply can take the place of fruit.

In relation to studies that found no association between fruit consumption and excess weight⁷, it is worth mentioning that such results may be due to limitations in the statistical variables used and sample size.

Adolescence

Several studies have shown low consumption of FV at between 15 and 24 years, with a lower consumption frequency of 4 times a week for around 50%. Prevalence under 30% has been reported in studies with teenagers independent of age and methods for evaluating consumption^{7,9,17,18,19}. Two studies that evaluated 341 teenagers between 11 and 14 years in public schools in Curitiba⁹ and 431 adolescents with an average of 12 years of age in public school of Piracicaba (SP)²⁰, observed a prevalence of 29% and 28% of fruit consumption of more than 3 servings per day, respectively. The traditional cohort of Pellets²¹ showed that only 28.2% of 3,990 adolescents evaluated (between 14 and 15 years)

consumed at least 1 serving of fruit daily. Mello et al.²² verified, with 1,218 adolescents with an average of 12 years in Amapá, northern Brazil, a 35% prevalence of adequate consumption of fruit. A study conducted with 624 adolescents between 14 and 19 years in public schools in Pernambuco²³ showed a prevalence of just 7%. Analysis of POF²⁴ demonstrates that the banana was the only fruit included in a list of 20 most commonly eaten foods among teenagers, with a 12% prevalence of daily consumption (last position on the list).

The study conducted in Piracicaba²⁰ found no association between fruit consumption and overweight, but analyses were carried out using criteria of obesity prior to the current WHO recommendations. The SOFT study¹⁹, performed with 578 teenagers between 12 and 19 years old of Rio Grande do Sul also found no association between BMI and isolated fruit consumption (the average consumption of the population was 2 daily servings, with 25% prevalence of adequate consumption). However, the authors point out that most studies that present an inverse relationship between fruit consumption and BMI and adolescent adiposity have samples of larger size and with quantitative ratings (g/day). This method is not used by most studies conducted in Brazil.

Adults and elderly

The Surveillance of Risk and Protective Factors for Chronic diseases (Vigitel) is a cross-sectional study representative of the adult and older population, with about 54,000 telephone interviews in 27 Brazilian state capitals annually, and is used as a monitoring tool by the Brazilian Ministry of Health about the goals proposed for the year 2022¹⁰. Comparing the data available between 2006 and 2014^{25,26,21} as shown in Figure 1, there was an increase in the prevalence of adequate consumption of fruits and vegetables, both in the general population and when stratified by gender, with women maintaining a higher consumption pattern over time. In Vigitel survey²⁷, the major frequencies were found

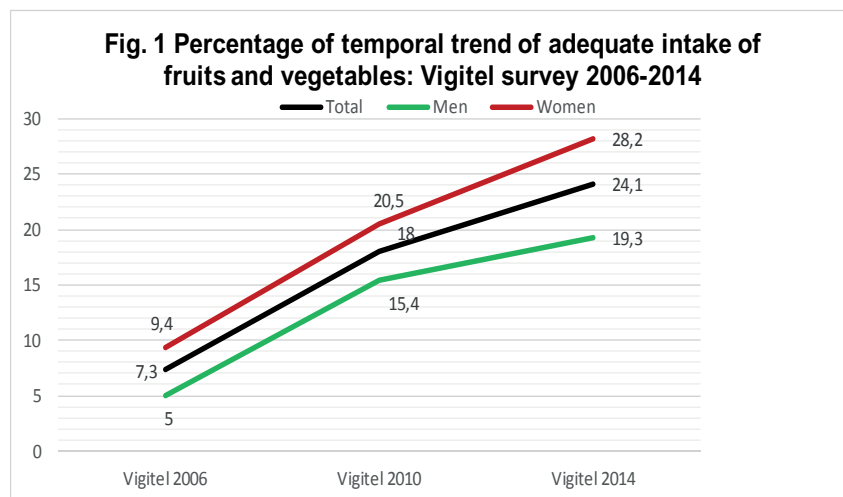


Figure 1: Model of influential factors in consumption habits across lifespan.

among men, in Vitória (23.5%), Florianópolis (23.4%) and Porto Alegre (23.4%) and, among women, in the Federal District (36.6%), Florianópolis (35.6%) and Belo Horizonte (34.8%). The lowest frequencies in men occurred in Belém (13.4%), Rio Branco (13.7%) and Manaus (14.0%) and, in female, in Rio Branco (17.4%), Belém (19.3%) and Maceió (19.8%). Such frequencies of consumption showed a tendency to increase with age and schooling in all groups. It can be said, therefore, that the consumption trend for FV among individuals older than 18 years increased by 20% between 2010 and 2014, reaching the goal proposed by the Brazilian Ministry of Health¹⁰. In comparison to data from the year 2006, adequate consumption of fruits and vegetables tripled, although this still represents a minority of the population. Several other studies with adult populations describe a similar prevalence of fruit consumption, as well as its relation with age and sex^{28, 29, 30}.

Specifically in relation to data on the elderly, evolution follows similarly: in 2006²⁵, the prevalence of adequate consumption was 12% in this age group, increasing to 22% in 2010²⁶ (25% in women and 17% in men) and 26.8% in 2013²⁷ (29.4% and 22.7% in women and men respectively). POF data 2008/2009²⁴ corroborate these findings: banana was the only fruit included in the foods commonly consumed by the elderly and only this age group included a second fruit. In the fourth quartile, the prevalence of daily consumption of bananas was only 20% for seniors and 15% for adults.

Another study conducted with a sample of 106 elderly in Recife³¹, showed 34% with infrequent fruit consumption (considered not daily), but not evaluated, and of 66% of the population that consumed fruits daily, there was an intake in sufficient quantities to achieve the recommendations. No comparisons were carried out with the

BMI of elderly people. Viebig et al. (2009)³² also found similar results for intake among 2,066 elderly residents in Sao Paulo: only 19.8% reported daily consumption of five or more servings of FV. The study also cites other literature results, with reports of adequate consumption in about 20% of the elderly population only in the city of São Paulo. It is important to note that of the elderly people who ate fruits and vegetables daily, 45.2% did not reach the quantitative recommendations for these foods.

With regard to the relationship of consumption of fruits with being overweight, Staff et al.³³ found an association between fruit consumption and weight loss in 80 adults (β_1 [95% CI] = - 0.00290 [-, - 0.001 0.005]) after 6 months of nutritional monitoring, concluding that an increase of 100 g/day in fruit consumption represents 300 g weight loss after the intervention period adjusted for sex, age, physical activity and energy intake ($p < 0.05$). A research study carried out with 1,026 adult women from southern Brazil³⁴ found that low consumption of fruit was associated with increased risk of obesity (RR = 2.18; 95% CI: 1.35-3.53; $p = 0.001$). Additionally, a study⁶ of 636 adults demonstrated that adequate consumption of fruits was protective for abdominal obesity (OR: 0.77; IC: -0.93 0.38), hypertriglyceridemia (OR: 0.76; IC: 0.35 -0.96) and presence of SM (OR: 0.78; IC: 0.39 -0.96).

Cyclical influences on consumption

The evidence and associations that try to explain the low consumption of fruits in different groups converge on the argument that the habits acquired by the previous generation are passed on to the next, and so from childhood to adolescence, adulthood and aging, and again to the next generation, as suggested by Figure 2. The current literature is already quite consistent about the transmission of the olfactory and taste characteristics of the mater-

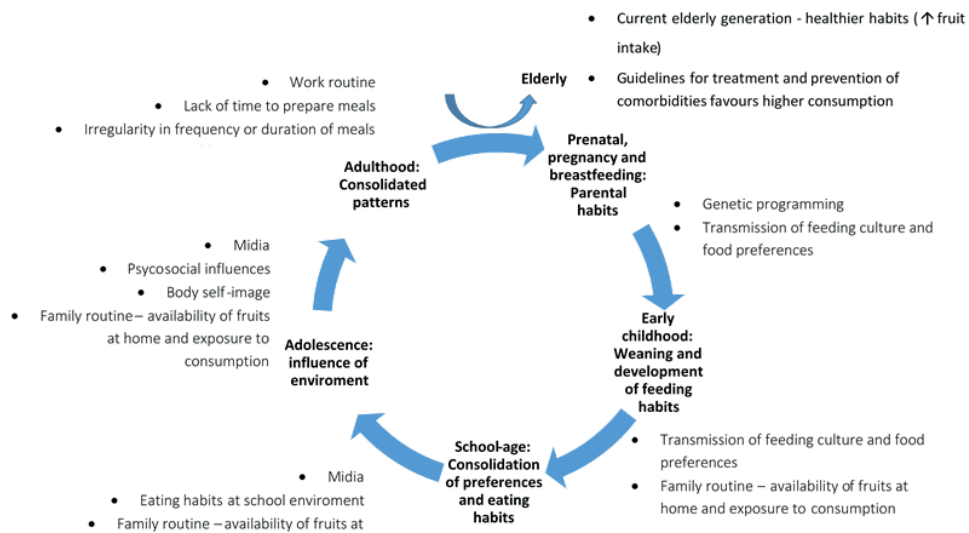


Figure 2: Model of influential factors in consumption habits across lifespan

nal diet via amniotic fluid – from the second quarter, when foetal gustatory and olfactory gestational receptors develop – and breast milk³⁵. Several studies have shown that regular and frequent exposure of the mother to FV favours

faster acceptance of these foods during the supplementary feeding of children and reduces the frequency and severity of feeding difficulties up to the age of seven years^{35,36,37}. It has already been demonstrated that consumption and ex-

posure to FV in this phase can have an effect on epigenetic aspects related to smell and taste, including perceptions of bitter/sweet/umami flavour and, in the future, influencing their food preferences^{35,38}. In addition, from the second quarter, gestational maternal excessive weight gain is associated with an increase in BMI, fatness, inflammation, blood pressure and lipid profile in children younger than nine years¹. If FV consumption has a significant contribution in the total consumption of dietary fibre, and fibre consumption on weight gain, one could assume that the lower the fruit consumption, the stronger would be the risk association.

The lack of exposure to food is considered, therefore, a barrier to consumption among children and adolescents, mainly. As for adults, FV consumption is influenced by the availability of such foods at home. However, the availability of these foods during this phase depends on family income, parental education and family routine, and families whose parents work away from home tend to have lower rates of consumption^{9,18,19,23}. In addition, family, media habits and school meals are also strong influencing factors: there is evidence that snacks available in school vending machines were negatively associated with the consumption of fruit by teens¹.

In relation to adults and seniors, the POF²⁴ showed that women and older individuals with higher education

presented more adequate consumption of fruits and vegetables, which may be associated with greater access to information and greater concern for health in this stratum of the population. Evidence suggests that younger individuals, single or living alone, and who spend most of the day working outside the home, have inadequate food consumption as a result of the lack of time for preparing vegetables, irregularity in frequency and mealtimes and poor availability of fruits in their working environments²⁸. Some authors suggest that, for elderly individuals, the greater prevalence of adequate consumption can be influenced by healthier habits acquired in the past, prior to the current phenomenon of industrialized food, and by following guidelines received from health professionals, according to the overload of risk factors and the presence of comorbidities.

This review presents limitations, such as the absence of a systematic review of the bases and the difficulty in comparing the data, due to the different methodologies used by the studies selected and the lack of methodological standardization for the measurement of fruit consumption. However, it contributes to the field of public health by compiling data on consumption in all cycles of development and opens space for reflection about eating habits extended by subsequent stages of life, and for the development of action plans that seek to educate the population about such habits.

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Resumo

Introdução: A obesidade atinge mais da metade da população adulta brasileira e se correlaciona com o desenvolvimento de doenças crônicas e psicossociais. O consumo de frutas, legumes e verduras (FLV) é fator de proteção para obesidade, porém seu consumo está frequentemente abaixo das recomendações.

Objetivo: Identificar a situação de consumo de frutas no Brasil nos ciclos de desenvolvimento humano, bem como dados de associação do consumo com excesso de peso.

Método: Revisão de literatura não sistemática nas bases de dados BVS, do período de 2005 a 2015. Foram selecionados 23 trabalhos em língua portuguesa e inglesa, segundo desenho e grupo populacional. Foram selecionados apenas cortes e cortes transversais realizados no Brasil. Foi considerado consumo de FLV adequado de 400g/dia ou frequência de 5 porções/dia (3 porções/dia de frutas), e excesso de peso segundo cada faixa etária e ciclo de desenvolvimento.

Resultados e discussão: O consumo médio encontrado para gestantes foi de 350g/dia. Foi encontrada relação inversa entre o consumo de fibras totais e o ganho ponderal gestacional. A média de consumo adequado de crianças e adolescentes se manteve entre 30 e 40%, com redução de consumo conforme aumento da idade. Dados da Vigitel entre 2006 e 2014 demonstram aumento na prevalência de consumo adequado de FLV por adultos e idosos conforme sexo, idade e escolaridade. O consumo adequado triplicou neste período. Houve associação entre o consumo de frutas e a perda de peso, risco aumentado de obesidade, obesidade abdominal, hipertrigliceridemia e presença de SM.

Conclusões: Há evidências de baixas prevalências de consumo adequado de FLV em todas as regiões do Brasil e grupos etários, maiores entre as mulheres e conforme o avanço da idade, escolaridade e nível socioeconômico. O consumo adequado de frutas se correlaciona à perda de peso e/ou controle do ganho ponderal dos indivíduos.

Palavras chave: Frutas, consumo, obesidade/excesso de peso, Brasil, gestação, infância, adolescência, idosos, adultos.