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Nutrition transition in a middle-income country: 22-year trends in the Seychelles

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Abstract

BACKGROUND/OBJECTIVES—There is little objective information regarding nutrition transition in African countries. We assessed trends in nutrition patterns in the Seychelles between 1989 and 2011.

SUBJECTS/METHODS—Population-based samples were obtained in 1989, 1994 and 2011 and participants aged 25–44 are considered in this study (n = 493, 599 and 471, respectively). Similar, although not identical, food frequency questionnaires (FFQs) were used in each survey and the variables were collapsed into homogenous categories for the purpose of this study.

RESULTS—Between 1989 and 2011, consumption frequency of fish (5 +/week) decreased from 93 to 74%, whereas the following increased: meat (5 +/week) 25 to 51%, fruits (1 +/week) 48 to 94%, salty snacks (1 +/week) 22 to 64% and sweet snacks (1 +/week) 38 to 67% (P < 0.001 for all). Consumption frequency decreased for home-brewed alcoholic drinks (1 +/week) 16 to 1%, but increased for wine (1 +/week) 5 to 33% (both P < 0.001). Between 2004 and 2011, consumption frequency decreased for rice (2/day) 62 to 57% and tea (1 +/day) 72 to 68%, increased for poultry (1 +/week) 86 to 96% (all P < 0.01), and did not change for vegetables (70.3 to 69.8%, P = 0.65).

CONCLUSIONS—Seychelles is experiencing nutrition transition characterized by a decreased consumption frequency of traditional staple foods (fish, polished rice), beverages (tea) and of inexpensive home brews, and increased consumption frequency of meat, poultry and snacks. Food patterns also became more varied along with a broader availability of products in the 22-year interval. The health impact of these changes should be further studied.

Keywords

nutrition transition; nutrition trends; food frequency questionnaires; Seychelles; developing countries

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

IC made the statistical analysis and led the write up of the article; PB and PMV importantly contributed to the write up of the paper; BV and AL revised the article for important intellectual content. PB had full access to the data and is the guarantor of the study.

INTRODUCTION

Nutrition transition refers to changes in physical activity, dietary patterns and nutrient intakes in relation to socioeconomic development, urbanization and acculturation. These changes have been associated with a large impact on the occurrence of non-communicable diseases.[1,2]

The Republic of Seychelles consists of 115 islands in the southwestern Indian Ocean, located nearly 1800 km east of Kenya. The majority (90%) of the population is of African descent and lives on the main island (Mahé). The Seychelles is a middle income country, with a high human development index[3] and its gross domestic product *per capita* has increased from 2288 to 10 824 US$ in 1980 and 2010, respectively.[4] Owing to rapid socioeconomic development, demographic transition and changing lifestyle in the Seychelles,[5–7] it is useful to assess trends in nutrition patterns in the population to monitor epidemiological changes and to produce adequate public health policies. Surveys conducted in 1989 and 2004 showed a marked decrease in tobacco use, stable or slightly decreasing blood pressure and cholesterol levels, but a strong increase in overweight and diabetes in adults[5] and children.[8]

Nutrition data in Seychelles is mostly limited to household expenditure surveys, food balance sheets and selected surveys[5] and, recently, an updated food composition database,[9] but no information is available with regard to trends over time. In this study, we assessed 22-year nutrition trends in the Seychelles using data from three studies conducted in 1989, 2004 and 2011.

METHODS

Sampling

Two independent population-based surveys of cardiovascular risk factors were performed in adults aged 25–64 in 1989 (n = 1081, response rate 86.4%)[5,6] and 2004 (n = 1255, response rate 80.2%).[5,6] In 2010, a population-based cohort study was conducted among adults aged 25–44, as part of a multi-center cohort study (METS, n = 471)[10] and a food frequency questionnaire was included in the second year assessment (2011) of all participants. For the 1989 and 2004 surveys, the sampling frame consisted of an age- and sex-stratified random sample of the total population based on census data.[5,6] Participants to the METS study were selected through a letter sent once to a random sample drawn from national census data (response rate <30%) completed by a convenience sample selected to include similar numbers of participants within three occupational categories (laborer, skilled manual or unskilled non manual, and skilled non manual);[10] previous surveys showed that middle-aged adults fall in fairly similar proportions among these three occupation categories.[5] For this study, analysis was limited to the participants aged 25–44 years: 493 subjects in 1989, 599 in 2004 and 471 in 2011. For 2004, weight was measured with precision electronic medical scales (Seca, Germany) and height measured with a fixed stadiometer (Seca, Germany). Weight was measured with the participants without shoes and with light garments.[11] Body mass index (BMI) was calculated as weight divided by height squared (kg/m^2). Overweight was defined as BMI ≥25 and <30 kg/m^2, and obesity as BMI ≥30 kg/m^2.

Dietary intake

Dietary intake was assessed by food frequency questionnaires (FFQs). Although not identical between studies, the FFQs were designed by the same study team and most of the FFQ questions were similar in content and format. Of note, the FFQs were established by nutritionists and other experts living in Seychelles who were well aware of the unique characteristics of the local Creole food patterns. The food groups analyzed in this study

include fish, meat, fruit, salty and sweet snacks, home-brewed alcoholic beverages, beer, spirits and wine. Fish included fresh and canned fish; meat included fresh or frozen meat, processed meat products (for example, sausage, bacon, ham, corned beef, and so on) and poultry; fruit included fresh, canned and frozen fruits. Salty snacks included samosa, banana/potato/cassava chips and peanuts; sweet snacks included chocolate, biscuits, ice-cream, sweets and cakes. Home-brewed alcoholic beverages included traditional alcoholic beverages such as kalu (toddy: fermented palm tree sap), baka (fermented sugar cane) and lapire (fermented beverage made with potatoes or other carbohydrates);[12] spirits included whisky, rum, vodka and liquors.

In order to account for the slight differences between FFQs in the three surveys, the variables were combined in homogenous dichotomous categories allowing comparison between the different periods. For instance, fish and meat consumption frequencies were combined into 'on at least 5 days per week' (5 +/week, yes/no), whereas the remaining food groups and alcoholic beverages were combined into 'on at least 1 day per week' (1 +/week, yes/no).

The FFQs in 2004 and 2011 were largely comparable; hence, a more thorough comparison of the diet could be made. For this period the food groups analyzed were fish, poultry, meat, processed meat, cheese, fruits, vegetables, salad, tubers, cereal, rice, salty snacks, sweet snacks, tea, coffee, soft drink, commercial juice, home-made juice, home-brews alcoholic beverages, beer, spirit beverages and wine. The staple foods 'fish' and 'rice' were presented in six consumption frequency groups (twice per day, once per day, on 5–6 days/week, on 3–4 days/week, on 1–2 days/week and on less than 1 day/week), whereas the other food items (excluding alcoholic beverages) the 2 +/day and 1 +/day answers were combined, leading to five consumption frequency categories. Weekly consumption of food items was computed after recoding the frequency of consumption as follows: <1/week: 0; 1–2/week: 1.5; 3–4/week: 3.5; 5–6/week: 5.5; 1/day: 7 and 2/day: 14. For alcoholic beverages the consumption was combined into a single consumption frequency group 'at least once per week' (1 +/week, yes/no).

Statistical analyses

Statistical analyses were performed with Stata version 12 (Stata Corporation, College Station, TX, USA). Analyses were performed using the Cochran–Armitage χ^2 test for trends between 1989 and 2011 and using Pearson's χ^2 test for comparisons between 2004 and 2011. Comparison of quantitative (weekly consumption) data was performed using the nonparametric Kruskall–Wallis test. Multivariate analysis was conducted using analysis of variance (ANOVA). All food items were compared according to sex and age group (25–34 vs 35–44 years). Statistical significance was defined as $P < 0.05$.

RESULTS

Changes in dietary intake between 1989 and 2011

Between 1989 and 2011, fish consumption frequency decreased, meat consumption frequency increased, and the consumption frequency of fruit, salty snacks and sweet snacks also increased (Table 1). Regarding alcoholic beverages, the consumption of home brews decreased considerably, whereas the consumption of commercial beverages increased, particularly for wine and beer (Table 1). Similar trends were found within all sex and age categories.

Changes in dietary intake between 2004 and 2011

Changes in dietary intake between 2004 and 2011 are summarized in Tables 2 and 3. The consumption of the traditional staple foods (fish and rice) and beverages (tea) decreased markedly. During the same period, the consumption of salad, salty snacks, sweet snacks, home-made juice and tubers increased. No substantial changes were found for fruit, vegetables, cereals, coffee and commercial juices (Table 2). No marked differences were found within sex and age categories.

Table 3 shows changes in the prevalence of participants drinking at least once per week between 2004 and 2011. Prevalence of drinkers (1 +/week) increased considerably in women, whereas it remained stable in men. The prevalence of wine and spirit drinkers increased in both genders; the frequency of beer drinkers increased from 16 to 37% in women, but no significant change was found in men, who already had a very high consumption frequency in 2004. Finally, home-brew drinking decreased from 7 to 2% in men, but no change was found for women, who had a very low consumption frequency.

Dietary intake and BMI status, 2004 survey

In 2004, more than half of the participants aged between 25 and 45 years were overweight (33.4%) or obese (22.4%). Table 4 summarizes the consumption of different foods according to BMI status in the 2004 survey. As overweight and obese subjects were significantly older and more frequently women, comparisons were further adjusted for age (continuous) and gender. On bivariate analysis, obese participants consumed less rice, snacks (sweet and salty) and soft drinks than nonobese, but this difference was no longer significant after adjusting for gender and age. Conversely, no differences were found for the other foods (Table 4).

DISCUSSION

Food consumption

Overall, our results show that a nutrition transition is taking place in the Seychelles, characterized by a decreased frequency of consumption of the traditional local staple foods (fish and polished rice) and beverages (tea) and an increased frequency of consumption of meat, poultry, processed meat and snacks. These findings concur with findings in other countries experiencing nutrition transition such as South Africa,[2] Tanzania[13] or Benin.[14] These changes in dietary patterns parallel rapid socioeconomic development and urbanization in the Seychelles, with a marked spread of supermarkets, increasingly varied supply of food, and large offer of ‘take away’ businesses throughout the country. These services have a powerful role in food consumption decisions by individuals in relation to increased consumption of processed foods[15,16] but also increased fruits and vegetables supply in a country that heavily relies on food imports.

Seychelles has one of the highest fish consumptions *per capita* in the world.[9,17] Yet fish consumption decreased substantially, which may be related to time-consuming efforts to prepare fresh fish, lower availability and increasing prices owing to seasonal changes, and overfishing.[17] The decrease of rice (imported in Seychelles), which has traditionally contributed the largest share of total calories intake of most inhabitants (and still does), may relate to increasing availability of other starchy foods such as pasta, bread, and other energy-dense foods such as locally made or imported manufactured salty or sweet snacks. The consumption of tea (which is traditionally consumed with powder milk and lots of sugar) has also slightly decreased, which may relate to increased availability of sweetened soft drinks. Indeed, according to the annual report of the Central Bank of Seychelles, an 18% increase in soft drink’s production was observed in 2011.[18]

The consumption frequency of salty and sweet energy-dense snack foods increased substantially. These trends are likely driven by increased local and global production and supply of inexpensive energy dense foods, which has been linked to the worldwide epidemics of overweight, also documented in Seychelles.[5,19] Interestingly, the consumption of fruit, salad and fruit juice (mainly commercially produced) increased, suggesting that some dietary changes that occurred in the Seychelles may bring added nutritional value. The higher consumption of fruits and vegetables and of a more varied diet in general over time might be related to an increased and broader supply along with trade liberalization globally and nationally, increased availability in supermarkets, increased purchasing power of a majority of Seychelles inhabitants and high profile educational programs promoting fruit and vegetables consumption.[20]

Alcohol consumption

Drinking is an important aspect of male culture in the Seychelles[21] and excessive drinking by a substantial proportion of adults is not a recent issue.[12] Consumption patterns of alcoholic beverages changed considerably during the past two decades. For instance, the consumption of traditional home brews, which are inexpensive and accounted for half of the alcohol volume *per capita* in Seychelles in 1989,[12] has now reached very low levels. The decrease in home-brewed beverages is likely a main factor explaining the decrease in the mean alcohol intake *per capita* over time.[5,12] Still, the decrease in the prevalence of participants consuming home-brewed beverages was compensated by an increase (namely among women) in the prevalence of participants consuming other alcoholic beverages, thus leading to an overall increase in the prevalence of participants consuming alcoholic beverages. Indeed, the overall consumption of commercial alcoholic beverages did not change dramatically, although the pattern of commercial beverage drinking is changing over time, such as an increased wine consumption.[5] Home brews have been consumed mostly by persons of low socioeconomic status, who may not have the purchasing power to afford expensive marketed alcohol beverages.[11,12] The decline of home brews and the sustained consumption of other alcoholic beverages is likely related to socioeconomic development allowing an increasing proportion of the Seychelles population to afford commercial beverages, as well as increasingly powerful local and global marketing of commercial alcohol beverages,[12] as observed among youth[22] and women.[5]

An important question is to determine the health impact of the nutrition transition in Seychelles. The dramatic 40–50% decrease in age-adjusted stroke and myocardial infarction mortality rates between 1989 and 2010[23] is likely related to improved cardiovascular risk factor levels, particularly the markedly decreased smoking prevalence[5] but some improvement in the diet may be postulated. Indeed, increased healthy nutrient intake along a more varied supply of food items over time may have contributed toward these favorable health outcomes as compared to the relatively low nutritional value of the traditional diet largely made of polished rice, fish and sugared tea. For example, thiamine deficiency was a public health problem two decades ago in the Seychelles, consistent with the low thiamine content of polished rice and fish,[24] cases of thiamin deficient cardiomyopathy were frequent in the 1980s[25] but are no longer observed. Therefore, except for the increasing prevalence of obesity and diabetes, the nutrition transition in Seychelles may have contributed to significant favorable health outcomes. Finally, the fact that no clear difference in dietary intake was found between obese and normal weight participants is likely due to the fact that older (and more frequently obese) participants still prefer traditional food items, whereas younger (and not yet obese) participants tend to consume a more westernized diet. However, a more detailed account of the impact of the nutrition transition on health outcomes is still warranted.

Limitations

This study has some limitations. First, the FFQs used were different between studies and not formally validated, which can influence the accuracy of the results. The fact that the FFQs differed between studies also reduced the amount of information available for joint analyses, as only the items and questions common to the three studies could be used. Still, the FFQs were designed by the same study team, and most of the FFQ questions were similar in content and format. Further, the FFQs of the surveys conducted in 2004 and 2011 had many items in common, which enabled a more in-depth analysis. Second, we could also not formally quantify the dietary intake in terms of macro and micronutrients, as portion sizes were not assessed. A food composition database has been established recently[9] but it remains to develop a readily usable FFQ for use in this population for epidemiological studies, which take into account the local Creole food patterns. Hence, the FFQ instruments used in the past surveys, although not quantitative, still provide useful qualitative data and information on broad trends over time. Third, only broad food items of local importance were considered in the FFQs, which limit the assessment of less frequently consumed food items. For instance, salty or sugary snacks in Seychelles include both traditional local food (for example, bread, fruit or banana chips and a variety of sweet pastries) and imported manufactured products. It can be reminded that FFQs were part of more general surveys applied to large number of persons, which limited the possibility of using long FFQ instruments. More generally, dietary changes tend to occur rapidly in transitional economies and great attention must be paid to methodological issues.[26–28] Research on dietary behaviors and trends in rapidly changing transitional economies must be able to measure increased dietary diversity, potentially larger variance in the composition of common dishes, increased use of edible oils, shifts in the structure of consumption within and between food groups, and increased consumption of processed foods.[26] Another limitation is that we limited our analysis to subjects aged 25–45, and the trends observed in the study may not necessarily apply to older persons, as new behaviors and diet habits may be adopted quicker by younger than older adults. Finally, generalization of our findings to other countries should be done with caution, particularly in the context of a small island state. However, our findings do exemplify the rapid nutritional changes that can occur in an increasingly globalized trade and market context.

CONCLUSION

Seychelles is experiencing nutrition transition characterized by a decreased frequency of consumption of traditional staple foods (fish, polished rice), beverages (tea) and inexpensive home brews, and an increased frequency of consumption of meat, poultry and snacks. There are also trends toward the intake of more varied foods (for example cereals, vegetables, snacks, dairy products) related to a broader food supply. More detailed studies are needed to examine the overall impact on health of the observed secular trends.

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REFERENCES

1. Popkin BM. An overview on the nutrition transition and its health implications: the Bellagio meeting. Public Health Nutr. 2002; 5:93–103. [PubMed: 12027297]

2. Vorster HH, Kruger A, Margetts BM. The nutrition transition in Africa: can it be steered into a more positive direction? Nutrients. 2011; 3:429–441. [PubMed: 22254104]
3. World Health Organization. WHO Country Cooperation Strategy 2008–2013 Seychelles. Brazzaville: Republic of Congo; 2009.
4. Seychelles: Country Brief. http://go.worldbank.org/FVHWZAW6W0.
5. Bovet P, Romain S, Shamlaye C, Mendis S, Darioli R, Riesen W, et al. Divergent fifteen-year trends in traditional and cardiometabolic risk factors of cardiovascular diseases in the Seychelles. Cardiovasc Diabetol. 2009; 8:34. [PubMed: 19558646]
6. Rossi IA, Rousson V, Viswanathan B, Bovet P. Gender and socioeconomic disparities in BMI trajectories in the Seychelles: a cohort analysis based on serial population-based surveys. BMC Public Health. 2011; 11:912. [PubMed: 22152035]
7. Campling L, Rosalie M. Sustaining social development in a small island developing state? The case of Seychelles. Sustain Dev. 2006; 14:115–125.
8. Chiolero A, Paradis G, Madeleine G, Hanley JA, Paccaud F, Bovet P. Discordant secular trends in elevated blood pressure and obesity in children and adolescents in a rapidly developing country. Circulation. 2009; 119:558–565. [PubMed: 19153270]
9. Bonham MP, Duffy EM, Robson PJ, Wallace JM, Myers GJ, Davidson PW, et al. Contribution of fish to intakes of micronutrients important for fetal development: a dietary survey of pregnant women in the Republic of Seychelles. Public Health Nutr. 2009; 12:1312–1320. [PubMed: 18986594]
10. Luke A, Bovet P, Forrester TE, Lambert EV, Plange-Rhule J, Schoeller DA, et al. Protocol for the modeling the epidemiologic transition study: a longitudinal observational study of energy balance and change in body weight, diabetes and cardiovascular disease risk. BMC Public Health. 2011; 11:927. [PubMed: 22168992]
11. Bovet, P.; William, J.; Viswanathan, B.; Madeleine, G.; Romain, S.; Yerly, P., et al. The Seychelles Heart Study 2004: Methods and Main Findings. Ministry of Health and Social Development, Victoria, Republic of Seychelles; 2007.
12. Perdrix J, Bovet P, Larue D, Yersin B, Burnand B, Paccaud F. Patterns of alcohol consumption in the Seychelles Islands (Indian Ocean). Alcohol. 1999; 34:773–785.
13. Keding GB, Msuya JM, Maass BL, Krawinkel MB. Dietary patterns and nutritional health of women: the nutrition transition in rural Tanzania. Food Nutr Bull. 2011; 32:218–226. [PubMed: 22073796]
14. Delisle H. Findings on dietary patterns in different groups of African origin undergoing nutrition transition. Appl Physiol Nutr Metab. 2010; 35:224–228. [PubMed: 20383237]
15. Popkin BM. Global nutrition dynamics: the world is shifting rapidly toward a diet linked with noncommunicable diseases. Am J Clin Nutr. 2006; 84:289–298. [PubMed: 16895874]
16. Isaacs BA, Dixon J, Banwell C. Fresh market to supermarket: nutrition transition insights from Chiang Mai, Thailand. Public Health Nutr. 2010; 13:893–897. [PubMed: 20105390]
17. Moyra A, Alain C-S. Fisheries Industry of the Seychelles: at a crossroad. Central Bank of Seychelles. 2006; XXIV:1–30.
18. Central Bank of Seychelles. Annual Report 2011. Victoria, Mahé, Seychelles: Central Bank of Seychelles 2012. www.cbs.sc/acro/AnnualReport2011.pdf.
19. Bovet P, Chiolero A, Madeleine G, Gabriel A, Stettler N. Marked increase in the prevalence of obesity in children of the Seychelles, a rapidly developing country, between 1998 and 2004. Int J Pediatr Obes. 2006; 1:120–128. [PubMed: 17907325]
20. Bovet P, Viswanathan B, Shamlaye C, Romain S, Gedeon J. Addressing non-communicable diseases in the Seychelles: towards a comprehensive plan of action. Glob Health Promot. 2010; 17(2 Suppl):37–40. [PubMed: 20595339]
21. Benedict, B.; MenBenedict, M. Women and Money in Seychelles. Berkeley, CA, USA: University of California Press; 1982.
22. Faeh D, Viswanathan B, Chiolero A, Warren W, Bovet P. Clustering of smoking, alcohol drinking and cannabis use in adolescents in a rapidly developing country. BMC Public Health. 2006; 6:169. [PubMed: 16803621]

23. Stringhini S, Sinon F, Didon J, Gédéon J, Paccaud F, Bovet P. Declining stroke and myocardial infarction mortality between 1989 and 2010 in a country of the African region. Stroke. 2012; 43:2283–2288. [PubMed: 22700529]

24. Bovet P, Larue D, Fayol V, Paccaud F. Blood thiamin status and determinants in the population of Seychelles (Indian Ocean). J Epidemiol Community Health. 1998; 52:237–242. [PubMed: 9616410]

25. Pinn G, Bovet P. Alcohol-related cardiomyopathy in the Seychelles. Med J Aust. 1991; 155:529–532. [PubMed: 1943932]

26. Popkin BM, Lu B, Zhai F. Understanding the nutrition transition: measuring rapid dietary changes in transitional countries. Public Health Nutr. 2002; 5:947–953. [PubMed: 12633520]

27. Monteiro CA, Mondini L, deSouza AL, Popkin BM. The nutrition transition in Brazil. Eur J Clin Nutr. 1995; 49:105–113. [PubMed: 7743983]

28. Kim S, Moon S, Popkin BM. The nutrition transition in South Korea. Am J Clin Nutr. 2000; 71:44–53. [PubMed: 10617945]

Table 1

Trends in dietary intake between 1989 and 2011 in the Seychelles population aged 25–45 years, overall and by gender

	1989 *n* = 493	2004 *n* = 599	2011 *n* = 471	Test value and significance
All subjects				
Fish, 5 +/week	92.9	87.3	73.7	56.6***
Meat, 5 +/week	25.2	35.9	50.9	60.6***
Fruit, 1 +/week	48.1	91.2	94.0	360.9***
Salty snacks, 1 +/week	22.1	46.4	64.2	169.3***
Sweet snacks, 1 +/week	38.3	42.6	67.4	59.9***
Home brews, 1 +/week	15.9	3.5	1.1	94.7***
Beer, 1 +/week	37.7	35.4	48.6	6.7**
Spirit, 1 +/week	17.0	7.7	22.3	0.4NS
Wine, 1 +/week	4.7	5.8	32.9	113.3***
Men				
Fish, 5 +/week	94.7	89.6	76.4	27.0***
Meat, 5 +/week	23.2	34.4	52.7	35.6***
Fruit, 1 +/week	41.7	88.1	93.1	182.0***
Salty snacks, 1 +/week	17.5	58.9	71.8	141.6***
Sweet snacks, 1 +/week	33.8	44.4	67.3	40.8***
Home-brews, 1 +/week	29.7	7.0	2.0	83.8***
Beer, 1 +/week	66.1	59.6	62.6	1.1NS
Spirit, 1 +/week	27.6	13.0	34.0	0.02NS
Wine, 1 +/week	5.3	6.3	27.6	34.9***
Women				
Fish, 5 +/week	91.3	85.4	71.6	29.8***
Meat, 5 +/week	26.8	37.1	49.4	25.9***
Fruit, 1 +/week	53.6	93.6	94.8	179.7***
Salty snacks, 1 +/week	26.0	36.2	58.0	46.7***
Sweet snacks, 1 +/week	33.8	44.4	67.3	21.5***
Home brews, 1 +/week	4.2	0.6	0.4	14.0***
Beer, 1 +/week	13.3	15.5	37.2	32.2***
Spirit, 1 +/week	7.9	3.3	12.8	1.3NS
Wine, 1 +/week	4.2	5.5	37.2	79.9***

Abbeviation: NS, not significant.

Results are expressed as percentage of subjects consuming the indicated food item/alcoholic beverage, expressed as days per week.

Statistical analysis by Cochran–Armitage chi-square for trend $^{**}P < 0.01$; $^{***}P < 0.001$.

Table 2

Comparison of the food consumption frequency in two population-based samples of the Seychelles population aged 25–45 years, conducted in 2004 (n = 599) and 2011 (n = 453)

Food item	Frequency of consumption						Test value and significance	Weekly consumption	Test value and significance
	<1/week	1–2/week	3–4/week	4–5/week	1/day	2/day			
Fish[a]									
2004	1.2	2.7	8.8	19.5	25.0	42.7	155.7^{***}	9.2 ± 4.4	138.6^{***}
2011	0.2	7.1	19.0	38.2	24.5	11.0		6.1 ± 3.1	
Meat									
2004	22.9	65.6	10.2	1.0	0.3	—	81.4^{***}	1.4 ± 1.1	74.0^{***}
2011	7.7	65.6	17.2	6.2	3.3	—		2.1 ± 1.5	
Poultry									
2004	14.2	64.1	19.2	1.2	1.3	—	50.5^{***}	1.8 ± 1.3	32.5^{***}
2011	3.5	65.1	23.0	4.9	3.5	—		2.3 ± 1.5	
Processed meat									
2004	40.7	40.4	10.0	3.7	5.2	—	61.2^{***}	1.5 ± 1.9	22.1^{***}
2011	20.3	62.3	10.8	2.0	4.6	—		1.7 ± 1.6	
Sweet snacks									
2004	57.4	19.0	9.2	4.7	9.7	—	74.9^{***}	1.5 ± 2.3	43.7^{***}
2011	32.5	36.2	14.3	3.1	13.9	—		2.2 ± 2.3	
Salty snacks									
2004	53.6	17.9	10.0	8.7	9.8	—	39.2^{***}	1.8 ± 2.4	17.1^{***}
2011	35.8	29.6	15.2	8.8	10.6	—		2.2 ± 2.3	
Rice[a]									
2004	1.0	1.8	3.7	2.7	28.9	61.9	12.4^{*}	11.0 ± 4.0	6.62^{**}
2011	0.7	4.0	5.1	5.5	27.8	57.0		10.4 ± 4.3	
Cereal									
2004	51.8	22.4	12.2	3.5	10.2	—	7.77^{NS}	1.7 ± 2.3	4.24^{*}
2011	44.7	28.5	12.2	4.9	9.7	—		1.8 ± 2.3	

Food item	Frequency of consumption						Test value and significance	Weekly consumption	Test value and significance
	<1/week	1–2/week	3–4/week	4–5/week	1/day	2/day			
Tubers									
2004	67.1	26.9	4.7	0.3	1.0	—	15.2**	0.7 ± 1.2	10.0**
2011	57.3	36.3	3.5	0.9	2.0	—		0.8 ± 1.3	
Vegetables									
2004	1.5	6.2	11.2	10.9	70.3	—	2.49NS	6.0 ± 1.8	0.08NS
2011	2.6	7.1	11.0	9.5	69.8	—		5.9 ± 1.9	
Salad									
2004	3.5	13.7	21.2	11.5	50.1	—	45.5***	5.1 ± 2.2	47.4***
2011	2.0	7.3	13.5	6.6	70.6	—		5.9 ± 1.9	
Fruit									
2004	8.8	17.4	20.0	8.3	45.4	—	7.11NS	4.6 ± 2.5	7.42**
2011	6.0	16.6	17.2	7.5	52.8	—		5.0 ± 2.4	
Cheese									
2004	42.7	23.5	18.2	6.5	9.0	—	21.6***	2.0 ± 2.3	0.71NS
2011	34.7	35.1	19.2	3.5	7.5	—		1.9 ± 2.0	
Home made juice									
2004	74.1	12.9	7.8	2.0	3.2	—	38.7***	0.8 ± 1.7	15.6***
2011	62.6	22.8	5.1	0.9	8.6	—		1.2 ± 2.1	
Commercial juice									
2004	37.7	20.1	19.1	3.4	19.8	—	4.56NS	3.7 ± 5.4	0.88NS
2011	36.3	19.9	16.4	2.7	24.8	—		4.0 ± 5.9	
Soft drinks									
2004	42.7	19.2	10.0	3.5	24.5	—	30.2***	4.6 ± 8.2	4.51*
2011	40.2	32.0	9.9	3.3	14.6	—		2.9 ± 5.8	
Coffee									
2004	71.4	11.1	5.0	1.2	11.4	—	1.35NS	2.1 ± 6.0	0.86NS
2011	68.7	11.0	5.7	1.5	13.0	—		1.9 ± 4.4	
Tea									

Food item	Frequency of consumption						Test value and significance	Weekly consumption	Test value and significance
	<1/week	1–2/week	3–4/week	4–5/week	1/day	2/day			
2004	16.6	4.2	5.4	2.0	71.9	—	20.8***	12.0 ± 10.4	22.1***
2011	26.3	2.6	2.4	1.1	67.5	—		8.9 ± 7.6	

Abbreviation: NS, not significant.

Results are expressed as percentage (for frequency of consumption) and as average ± s.d. (for weekly consumption). For beverages, the results are expressed in number of beverage units/week. Between year comparison of the distributions of consumption frequency by χ^2 test (for frequency of consumption) or by Kruskall–Wallis test (for weekly consumption).

*$P < 0.05$;

**$P < 0.01$;

***$P < 0.001$.

[a]Food items for which were presented 6 categories of food consumption.

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Table 3

Comparison of alcoholic beverage consumption in two population-based samples of the Seychelles population aged 25–45 years conducted in 2004 (270 men and 329 women) and 2011 (203 men and 250 women), stratified by gender

	At least once per week (%)	
	Men	**Women**
Any alcoholic beverage		
2004	61.1	18.5
2011	65.0	54.6
Test value and significance	0.81^{NS}	85.8^{***}
Wine		
2004	6.3	5.5
2011	27.6	37.2
Test value and significance	40.2^{***}	92.3^{***}
Spirit		
2004	13.0	3.3
2011	34.0	12.8
Test value and significance	29.9^{***}	18.5^{***}
Beer		
2004	59.6	15.5
2011	62.6	37.2
Test value and significance	0.42^{NS}	35.8^{***}
Home brews		
2004	7.0	0.6
2011	2.0	0.4
Test value and significance	6.43^{*}	0.12^{NS}

Abbreviation: NS, not significant.

Results are expressed as percentage between-year comparison by χ^2 test after stratifying for gender.

$^{*}P < 0.05$;

$^{**}P < 0.01$;

$^{***}P < 0.001$.

Table 4

dietary intake in normal weight, overweight and obese participants, 2004 survey

Times/week	Normal (n = 265)	Overweight (n = 200)	Obese (n = 134)	Test value and significance[a]	Test value and significance[b]
Fish	9.4 ± 4.4	9.0 ± 4.4	9.0 ± 4.2	0.76^{NS}	0.66^{NS}
Meat	1.4 ± 1.1	1.5 ± 1.2	1.3 ± 1.0	1.01^{NS}	0.84^{NS}
Poultry	1.8 ± 1.2	1.6 ± 1.3	1.9 ± 1.3	6.11^{*}	2.23^{NS}
Processed meat	1.7 ± 2.0	1.4 ± 1.7	1.3 ± 1.8	2.91^{NS}	1.22^{NS}
Sweet snacks	1.9 ± 2.5	1.2 ± 2.0	1.5 ± 2.3	12.0^{**}	4.33^{*}
Salty snacks	2.1 ± 2.6	1.6 ± 2.3	1.5 ± 2.2	6.41^{*}	1.11^{NS}
Rice	11.3 ± 3.9	11.2 ± 3.9	10.1 ± 4.3	7.62^{*}	1.66^{NS}
Cereal	1.7 ± 2.3	1.6 ± 2.3	1.6 ± 2.3	0.97^{NS}	0.71^{NS}
Tubers	0.6 ± 1.1	0.7 ± 1.3	0.8 ± 1.2	2.42^{NS}	2.85^{NS}
Vegetables	6.0 ± 1.8	6.0 ± 1.8	6.1 ± 1.8	0.59^{NS}	0.04^{NS}
Salad	4.9 ± 2.3	5.2 ± 2.2	5.2 ± 2.2	4.19^{NS}	1.69^{NS}
Fruit	4.8 ± 2.5	4.4 ± 2.6	4.6 ± 2.6	2.80^{NS}	1.77^{NS}
Cheese	2.0 ± 2.4	1.8 ± 2.1	2.3 ± 2.3	4.87^{NS}	2.28^{NS}
Home-made juice	0.8 ± 1.7	0.8 ± 1.7	0.8 ± 1.6	0.29^{NS}	0.16^{NS}
Commercial juice	3.8 ± 5.8	3.5 ± 4.9	3.6 ± 5.6	0.20^{NS}	0.22^{NS}
Soft drinks	5.5 ± 9.3	4.2 ± 6.9	3.6 ± 7.5	14.3^{***}	1.13^{NS}
Coffee	2.2 ± 6.5	2.3 ± 6.1	1.6 ± 4.9	1.73^{NS}	0.49^{NS}
Tea	12.6 ± 10.6	12.1 ± 11.0	10.7 ± 9.0	2.42^{NS}	2.03^{NS}

Abbreviation: NS, not significant.

Results are expressed as average ± s.d.

$^{*}P < 0.05$;

$^{**}P < 0.01$;

$^{***}P < 0.001$.

[a] Statistical analysis by Kruskall–Wallis.

[b] statistical analysis by ANOVA adjusting for age (continuous) and gender.