The intake of fruit and sweets in rural and urban Greenland – development from 1994 to 2006

Birgit Niclasen¹², Mette Rasmussen³, Ina Borup¹, Christina Schnohr³

¹ Nordic School of Public Health, Gothenburg, Sweden
² Greenland Institute of Health Research, Nuuk, Greenland
³ Institute of Public Health, University of Copenhagen, Copenhagen, Denmark

Received 24 July 2009; Accepted 22 October 2010

ABSTRACT

Objectives. The aim of this study is to explore the intake of fruit and sweets in Greenlandic schoolchildren aged 11, 13 and 15 years in villages, towns and the capital by cross-sectional data collected in 4 comparative surveys from 1994 to 2006.

Study design. Repeated cross-sectional study.

Methods. Data from the Health Behaviour in School-aged Children survey, with responses from 1,302 students in 1994, 1,648 in 1998, 891 in 2002 and 1,366 in 2006, each in the age groups of 11, 13 and 15 years.

Results. From 1994 to 2006, the odds ratio for eating fruit daily showed a decline while odds for never eating fruit increased in children living in all types of habitations. For all survey years the intake of fruit was lowest in villages and in 2006 only about 15–20% of village children consumed fruit every day. No general trends were found in the daily intake of sweets or for never eating sweets. Only 6% or less of the respondents never ate sweets. Minor age group and gender differences were seen. For sweets, children in the capital in 2006 had a lower daily use than village children.

Conclusion. Greenland is in the process of nutritional transition. The increase in the proportion of schoolchildren that do not meet the national recommendations for daily fruit consumption and the failure to reduce children’s intake of sweets is worrying. The intake of fruit was, for all years, lowest in the villages and was probably related (among other things) to cost and access. The implications of the findings are discussed.

(Keywords: schoolchildren, fruit, sweets, rural, urban, inequity)
INTRODUCTION

The globalization of the human diet is an area of growing importance. Countries such as Greenland are experiencing rapid changes in their dietary habits, and are in a process of "nutritional transition" (1). A proper diet during childhood promotes health, growth and intellectual development and may have an impact on future health status. Healthy eating is a part of the prevention of chronic diseases such as obesity, coronary heart disease, cancer, stroke, hypertension and osteoporosis (2–4).

Despite public nutrition guidelines, in most countries the burden of disease associated with poor nutrition continues to grow (5). Obesity and diabetes are among the fastest-growing diseases in the Arctic (6), and the epidemic of obesity has also reached the child population in Greenland. During the past 25 years the prevalence of overweight children has increased threefold and the age at which children are becoming overweight has decreased continuously. Furthermore, a majority of children who became overweight early in life carry that weight into adolescence (7,8).

It is necessary to gain knowledge about ongoing dietary trends in children, as well as to follow the progress of national goals, in order to shape policies and implement effective programs on healthy eating habits in children.

Greenland has 57,000 inhabitants living along the coastline in 17 small cities and 60 villages. These habitations can only be reached by boat or plane. Village people generally have a more traditional lifestyle than those in cities and are more often getting their living from small-scale fishing and hunting. Size and place of habitation is regarded as a relevant proxy for the local availability of a number of goods, including food.

Today, about 75% of the food consumed in Greenland is imported (9). Nutrition is a focus area in the present public health program (10), and the Greenlandic Board of Nutrition has made a number of nutrition policies, such as general dietary guidelines for the public. These guidelines are very similar to recommendations by the World Health Organization (5); they aim to increase the intake of fruit, vegetables and dietary fibre and to reduce the intake of saturated fat and white sugar (10). The recommended energy distribution from macronutrients is the same as in other Nordic countries (55–60% from carbohydrates, 10–15% from protein and no more than 30% from fat) (11).

Access to imported food, especially fresh fruit and vegetables, is highest – and prices lowest – in Greenland’s capital and in its larger cities. In Greenland, both fruit and sweets are imported dietary items. Both are often eaten as a snack (12), and both are well known by Greenlandic children. The Greenlandic Board of Nutrition has recommended an increase in the intake of fruit and vegetables to 400 g daily, while the recommendation for sweets intake is to cut it down to a weekly basis, or less.

The aim of this study is to explore and compare the intake of fruit and sweets in Greenlandic schoolchildren aged 11, 13 and 15 years in villages, towns and the capital by cross-sectional data collected in 4 comparative surveys from 1994 to 2006.

MATERIAL AND METHODS

The present study included data from the Greenlandic part of the international Health Behaviour in School-aged Children (HBSC) survey database, which looked at 11-, 13- and 15-year-
old students in 1994, 1998, 2002 and 2006. HBSC was a cross-national survey on child and adolescent health and health behaviour that included 40 countries and regions in Europe, North America and Israel (13). The study used a series of comparable cross-sectional surveys of 11-, 13- and 15-year-old students (cluster sampling) in the participating countries with a time interval of 4 years. Data were collected with an internationally standardized, self-administered questionnaire in the classroom (14). Because of the small population in Greenland, all schools with children in Grades 6 through 11 (aged 11 to 17 years) were asked to participate. Identical sampling approaches and procedures for data collection were applied in all surveys. For all surveys, data were collected in late winter to early spring (from March to the beginning of May). Respectively, in the surveys in 1994, 1998, 2002 and 2006, 62%, 60%, 62% and 67% of schoolchildren in the participating schools completed the questionnaire (15). The study included 1,302 students in 1994, 1,648 in 1998, 891 in 2002 and 1,366 in 2006 in the age groups 11, 13 and 15 years.

**Fruit and sweets**

Fruit intake and sweets intake were measured by one item each as a part of the HBSC Food Frequency Questionnaire. The measures of fruit intake and sweets (candy or chocolate) intake in the 4 surveys were pair-wise similar. The formulation for both fruit and sweets in the 1994 and 1998 surveys was: *How often do you eat the following?* The response categories were: More than once a day; Once a day; One or several times a week; Rarely; Never. For the 2002 and 2006 surveys, the item formulation was revised to: *How many times a week do you usually eat or drink…?* The response categories were: Never; Less than once a week; Once a week; 2–4 days a week; 5–6 days a week; Once a day, every day; Every day, more than once.

For the purpose of analysis, 4 dichotomous measures were constructed; one on never eaten and one on daily intake from each of the 2 items. Never eaten was defined by the category “never” for all surveys. Daily intake was defined by “More than once a day” and “Once a day” for the 1994 and 1998 surveys and by “Once a day, every day” and “Every day, more than once” for the 2002 and 2006 surveys. To evaluate the consequences of changing measurements, alternative cut-points for the 2002 and 2006 survey were analysed as proposed by Rasmussen et al. (16). Here, daily intake also included students who reported eating fruit or sweets “5–6 days a week.” Place of living was categorized as either in the capital, in a town or in a village.

**Statistical analysis**

The analyses were performed in SPSS 15.0 multiple logistic regressions. The number of missing values was low: for fruit, 2.2%, 3.5%, 3.9% and 4.1% in 1994, 1998, 2002 and 2006, respectively; for sweets, 2.1%, 3.6%, 3.6% and 4.5%, respectively; and for living place, 0.8%, 0.0%, 0.6% and 0.0%, respectively. Missing values were excluded. Multiple logistic regressions were performed on pooled data with the independent variable being survey year. The reference group was survey year 1994. Analyses were conducted for each of the 4 dichotomous dependent variables of intake stratified for place of living and adjusted for age and gender. In a second step, the analyses were repeated stratified first by gender, then age group.
RESULTS

Table I. Proportions (95% CI) of children who ate fruit or sweets never and daily, by survey year.

| Year     | Boys | Girls | Age group: 11 years | 13 years | 15 years | Place of living: Villages | Towns | Capital |
|----------|------|-------|---------------------|----------|----------|--------------------------|-------|---------|
| Never ate fruit | 1994 | 14.1 (11.4–16.8) | 12.6 (10.1–15.2) | 16.5 (13.0–20.0) | 15.5 (12.2–18.8) | 6.8 (4.2–9.4) | 17.7 (14.8–21.7) | 14.7 (12.3–17.2) | 6.3 (3.6–9.0) |
|           | 1998 | 11.9 (9.7–14.2)  | 9.5 (7.5–11.5)   | 15.9 (12.6–19.2) | 10.1 (7.6–12.6)  | 7.3 (5.2–9.4)  | 20.9 (16.2–26.3) | 11.2 (9.3–13.1) | 7.4 (4.9–9.9)  |
|           | 2002 | 24.4 (20.0–28.8) | 23.6 (19.9–27.4) | 30.9 (26.6–35.3) | 26.4 (21.7–31.1) | 17.4 (12.5–22.3) | 35.9 (28.0–43.8) | 20.9 (16.4–25.4) | 17.6 (11.1–23.5) |
|           | 2006 | 44.6 (40.7–48.5) | 42.6 (38.9–46.3) | 43.9 (39.3–48.8) | 46.7 (42.2–51.2) | 43.9 (39.8–48.8) | 50.8 (45.2–56.4) | 46.1 (42.4–49.8) | 30.5 (25.3–35.7) |
| Ate fruit daily | 1994 | 36.4 (32.6–40.4) | 35.8 (32.8–38.7) | 38.7 (34.3–43.1) | 42.1 (37.1–43.1) | 25.3 (18.5–32.1) | 32.6 (29.4–35.8) | 58.1 (52.5–63.7) |
|            | 1998 | 30.3 (27.1–33.5) | 28.2 (26.4–30.2) | 31.3 (29.5–33.1) | 35.5 (30.6–40.5) | 32.3 (28.5–35.6) | 21.1 (14.4–31.8) | 30.4 (27.7–33.1) | 46.6 (41.8–51.4) |
| (alternative) | 2002 | 22.3 (18.1–26.5) | 19.4 (16.4–22.4) | 23.2 (19.7–26.9) | 15.2 (10.6–19.8) | 17.6 (13.3–21.9) | 19.6 (15.6–23.6) | 24.8 (20.1–29.5) | 33.0 (28.3–37.7) |
| (alternative) | 2006 | 19.7 (16.2–23.1) | 15.3 (12.1–18.6) | 19.3 (15.6–23.0) | 14.6 (11.4–17.8) | 11.2 (8.1–14.3) | 10.9 (7.0–14.0) | 13.2 (10.8–15.8) | 23.8 (19.0–28.6) |
| Never ate sweets | 1994 | 5.4 (3.6–7.2) | 4.3 (2.7–5.9) | 6.2 (5.8–6.9) | 3.4 (1.8–5.0) | 5.2 (2.9–7.5) | 2.5 (1.8–4.9) | 5.9 (4.3–7.5) | 3.6 (1.5–5.7) |
|           | 1998 | 4.7 (3.2–6.2) | 4.1 (2.6–5.7) | 6.3 (4.1–8.5) | 2.9 (1.5–4.8) | 2.1 (0.9–3.3) | 4.4 (2.2–6.7) | 4.3 (2.1–5.5) | 1.7 (0.5–2.9) |
|           | 2002 | 3.7 (1.8–5.6) | 1.6 (0.5–2.7) | 2.6 (0.7–4.7) | 2.1 (0.6–3.6) | 3.0 (0.8–5.2) | 3.5 (0.5–6.5) | 2.9 (1.2–4.6) | 1.8 (0.4–3.2) |
|           | 2006 | 6.0 (4.1–7.9) | 3.6 (2.2–5.0) | 4.2 (2.3–6.1) | 4.5 (2.6–6.4) | 5.2 (3.0–7.4) | 5.1 (2.7–6.7) | 4.8 (3.2–6.4) | 4.3 (2.0–6.6) |
| Ate sweets daily | 1994 | 40.9 (37.9–44.0) | 39.2 (35.9–42.6) | 34.9 (30.6–39.4) | 41.3 (37.9–44.7) | 40.9 (36.4–45.4) | 43.1 (39.0–47.2) | 41.6 (37.6–45.6) | 58.2 (48.1–68.3) |
|            | 1998 | 41.3 (37.9–44.7) | 39.2 (35.9–42.6) | 34.9 (30.6–39.4) | 43.1 (39.0–47.2) | 41.6 (37.6–45.6) | 58.2 (48.1–68.3) | 40.7 (37.8–43.6) | 41.5 (36.8–46.2) |
| (alternative) | 2002 | 32.3 (27.2–37.1) | 32.5 (28.1–36.9) | 33.5 (27.4–39.6) | 36.2 (30.8–43.9) | 36.5 (31.7–41.3) | 36.7 (31.5–41.9) | 36.7 (31.5–41.9) | 36.7 (31.5–41.9) |
| (alternative) | 2006 | 34.2 (30.5–37.9) | 34.9 (32.2–37.5) | 30.9 (26.6–35.3) | 40.9 (36.4–45.4) | 43.4 (38.6–48.3) | 45.7 (40.1–51.3) | 39.7 (35.6–43.7) | 27.0 (22.0–32.0) |

Table I shows the proportion of the 4 outcome variables by gender, age group, and place of living. Table 2 shows the proportions for the 4 outcome variables by survey year, stratified by place of living.
Intake of fruit and sweets in Greenland

Children who never ate sweets

In all survey years, only 6% or less of the children never ate sweets. For all survey years, no correlation was revealed between place of living and never eating sweets. In 1998, the youngest children were more likely to never eat sweets than older children (p=0.001). In 1998 (p=0.03) and 2006 (p=0.04), more boys never ate sweets than girls (Table I). There were no significant changes in the odds ratios for never eating sweets in either the capital, the towns or the villages in any survey year (Table II).

Children who ate sweets daily

For all survey years but 2002, children in villages were most likely to eat sweets daily (p<0.05, p=0.005, p=0.1 and p<0.001). This was also observed by the alternative cut points in 2006 (p=0.01) but not in 2002 (p=0.2). In all survey years but 1998, the youngest children were less likely to eat sweets on a daily basis (p=0.003, p=0.7, p=0.03, p<0.001). This was also observed for alternative cut points (p=0.007 in 2002 and p=0.009 in 2006). In 2002 (p=0.003) and 2006 (p=0.004), more girls ate sweets daily, including also for alternative cut points in 2006 (p=0.02) (Table I). Odds ratios showed no differences in the daily intake of sweets by survey year in villages and towns, while a significant decrease was seen in the capital, primarily in 2006. The alternative cut points showed a significantly increased odds ratio for daily intake of sweets among children in the towns in 2002 and 2006, and an increased odds ratio in the capital in 2002 (Table II).

Analyses stratified by gender showed no new consistent changes from the general pattern. The same general pattern was also found when the analyses were stratified by age group (data not shown).

Table II. Multiple logistic regression analyses (OR, 95% CI) of frequency of fruit and sweets intake by survey year, stratified by place of living and adjusted by gender and age.

|                          | Villages | Towns          | Capital         |
|--------------------------|----------|----------------|-----------------|
| Never ate fruit          | 1994#    | 1***           | 1***            |
| 1998                     | 1.21 (0.63–2.33) | 0.75 (0.57–0.99) | 1.20 (0.66–2.17) |
| 2002                     | 2.50 (1.48–4.31) | 2.11 (1.56–2.86) | 2.66 (1.52–4.63) |
| 2006                     | 4.92 (3.08–7.87) | 5.13 (4.01–6.57) | 6.32 (3.73–10.71) |
| Ate fruit daily          | 1994#    | 1***           | 1***            |
| 1998                     | 0.88 (0.48–1.62) | 0.91 (0.75–1.11) | 0.63 (0.47–0.85) |
| 2002                     | 0.61 (0.35–1.08) | 0.50 (0.37–0.67) | 0.23 (0.17–0.33) |
| 2006                     | 0.37 (0.22–0.62) | 0.31 (0.24–0.41) | 0.22 (0.16–0.32) |
| Ate fruit daily (alternative)* | 1998 | 0.89 (0.49–1.64) | 0.91 (0.75–1.11) | 0.63 (0.47–0.85) |
| 2002                     | 0.85 (0.50–1.45) | 0.89 (0.68–1.16) | 0.36 (0.26–0.50) |
| 2006                     | 0.57 (0.35–0.92) | 0.47 (0.37–0.60) | 0.34 (0.24–0.48) |
| Never ate sweets         | 1994#    |                |                 |
| 1998                     | 1.57 (0.38–6.52) | 0.76 (0.48–1.12) | 0.44 (0.17–1.12) |
| 2002                     | 1.40 (0.37–5.33) | 0.48 (0.24–0.95) | 0.51 (0.19–1.42) |
| 2006                     | 2.05 (0.67–6.33) | 0.79 80.50–1.26) | 1.18 (0.52–2.75) |
| Ate sweets daily         | 1994#    |                |                 |
| 1998                     | 1.45 (0.86–2.45) | 1.02 (0.84–1.22) | 0.91 (0.68–1.23) |
| 2002                     | 0.83 (0.53–1.31) | 0.87 (0.68–1.13) | 0.72 (0.52–1.00) |
| 2006                     | 0.86 (0.58–1.27) | 0.99 (0.81–1.22) | 0.47 (0.33–0.66) |
| Ate sweets daily (alternative)* | 1998 | 1.43 (0.84–2.41) | 1.02 (0.84–1.22) | 0.91 (0.67–1.23) |
| 2002                     | 1.31 (0.83–2.07) | 1.51 (1.18–1.94) | 1.44 (1.05–1.98) |
| 2006                     | 1.29 (0.87–1.90) | 1.39 (1.13–1.71) | 0.97 (0.70–1.43) |

# 1994 is used as reference.

* p<0.05; ** p<0.01; *** p<0.001.
DISCUSSION

Neither fruit nor sweets are part of the traditional Greenlandic diet. The most important food items in the traditional diet were sea mammals, fish and, to a lesser extent, local terrestrial animals. In the summer, some roots and berries were added. The major macronutrients were therefore fat and protein while carbohydrates only delivered a small part of the energy consumed (1). To this day, children in villages eat traditional food items such as seal and whale more often than children in the capital and in towns. Despite this, children in villages and children in less affluent families are less likely to eat in compliance with the national dietary guidelines (17).

The results of this study indicate that since 1994 increasing proportions of Greenlandic children aged 11, 13 and 15 do not eat fruit daily. The decrease in frequency of daily fruit consumption seems most pronounced from 2002 to 2006, independent of the children’s place of living. In 2006, the proportion of children in villages who had a daily intake of fruit was only 10% (15% when using the alternative cut points), and more than 50% of village children reported that they never ate fruit. The figures were more positive, although still relatively low, in the capital, where in 2006 24% and 32% had a daily intake for regular and alternative cut points, respectively. About one-third of children living in the capital never ate fruit. Further, there was a nearly threefold increase of children never eating fruit in this period. Both developments were more pronounced in the capital than in the villages, with the towns measuring somewhere in between. However, while the proportion of children with a daily fruit intake in 1994 was higher in the capital, fewer village children ate fruit on a daily basis in all of the survey years. In addition, the proportion of children who never ate fruit was highest in the villages.

The development was quite different for sweets intake. In all survey years, less than 6% of children never ate candy while about 40% ate candy every day. Only small changes were found regarding the proportions of children who never ate sweets or children who ate sweets daily from 1994 to 2006. The only positive exception was that a lower proportion of children in the capital ate sweets daily in 2006 compared to the previous survey years, although this difference disappeared when using the alternative cut points.

Thus, this study has found a major increase in the proportion of schoolchildren that do not meet the national recommendations for consuming fruit every day. Furthermore, it has shown that the goal to reduce children’s intake of sweets has not been met. The pattern of variation in the consumption of both fruit and sweets between different places of living was expected, considering local differences in the price and availability of foods, while the generally low intake of fruit was unexpected and worrying.

Sweets and fruit are, in this study, seen as contrasting dietary indicators. Fruit is healthy, but it is also expensive; fresh fruit needs delicate handling and its shelf life is short, and therefore fruit often has a low contribution margin. Sweets, on the other hand, are unhealthy but rather inexpensive, easy to handle, have a very long shelf life and have a high contribution margin. Not surprisingly, large differences are found between the capital, towns and villages in terms of the types and amount of fruit available in the stores, with the capital and larger cities having a distinct advantage (18). Sweets, on the other hand, are present even in the most remote villages.

The gender and age differences found in this study are in accordance with earlier findings on
fruit intake in the HBSC study (13,16) and in European countries (19,20). In 2001, about one-third of European children consumed sweets on a daily basis with only negligible age and gender differences (21), while Greenland was above this mean. The general finding is that girls are more likely than boys to eat fruit on a daily basis; and that older children are less likely than younger children to eat fruit on a daily basis. Taste preferences have been found to be the strongest mediator of gender differences in the intake of fruit (20). Regardless of age and gender, sweets are among the food items that are most liked by children (22).

Ability- and opportunity-related factors such as knowledge, self-efficacy, parental influence and accessibility are also associated with the likelihood of daily fruit intake (20). The World Health Organization has stated that trade dynamics have a potential negative impact on food supply, especially in disadvantaged groups (5). The daily consumption of fruit in nearly all HBSC countries was lower in children from less affluent families (13). Similarly, in Greenland, less fruit is consumed in less affluent municipalities (1). No investigations have been made into children’s perceptions of healthy food availability in Greenland, but youth in the Canadian Arctic describe an absence of control over choices for healthy eating and barriers such as economic and practical access to healthy foods (23).

Both fruit and sweets are eaten as snacks. However, it seems that while other dietary items have outsold fruit, sweets have kept their place among children’s favourite foods. The future will show whether an intensified focus on healthy eating will change this balance. Still, large efforts are needed to achieve the intended compliance with national dietary guidelines and to make “the healthy choice the easy choice” (24) regarding food preferences in Greenlandic children. Health and food habits are established during childhood. This study has indicated that dietary tradition, lack of availability and low affordability might be walking hand in hand. It has also indicated that village children are the most vulnerable to an unhealthy diet. The intake of fruit is still highest in the capital where the highest availability of fruit is also found. Meanwhile, household incomes in most villages are lower than those in the nearby towns. Village children therefore have both the lowest availability and the lowest affordability of fruit and other kinds of costly imported food items. They also are frequently less privileged regarding other sociodemographic factors, education and access to health care (25).

Unhealthy eating habits in village children are therefore threatening to widen the existing health gap between privileged and less-privileged children in Greenland.

Some north-European countries with a traditionally low fruit and vegetable intakes have succeeded in increasing their schoolchildren’s intake of fruit (16,19). A trend of decreasing fruit consumption has recently been followed by an increase in Denmark, apparently as a result of a large, official campaign (16). In children, changes in the intake of fruit and vegetables have been found to precede changes in tastes regarding these foods (26). A study from Iceland pointed to interventions on both environmental factors, such as availability, and personal factors, such as self-efficacy and knowledge on nutrition (27). Components of such forms of interventions may be relevant to implementations in a Greenlandic setting.

Limitations
The validity of self-reported dietary assessment methods among adolescents has been found to vary in the literature (28). A validation study of the HBSC FFQ showed high test-retest reliability.
Intake of fruit and sweets in Greenland and acceptable validity when compared with data from a 24-hour food behaviour checklist and a 7-day food diary (29). No studies exist about Greenlandic children's perception of food intake or dietary recall studies.

The surveys were performed as a part of the same ongoing study with repeated data collections, but the dietary indicators in the measurement tool were different in the pair of surveys in 1994 and 1998 than for the pair in 2002 and 2006. The variation of the item formulations and response categories between surveys might have introduced bias. The assessment of trends over time requires that data are measured with an identical measurement tool in all surveys, and even small changes in an item may result in different response distributions (30). Pair-wise comparisons between the 1994 and 1998 surveys and the 2002 and 2006 surveys were unproblematic. The decrease in daily fruit intake that was observed both from 1994 to 1998 and from 2002 to 2006 suggests that the identified trend in the prevalence of daily fruit intake over the full survey period (1994 to 2006) was not caused by changes in the applied instrument alone. However, both in this study and as pointed to by Rasmussen et al. (16), findings indicated that a proportion of the pupils who said that they consumed the food items in question 5–6 days a week would instead classify themselves as daily consumers when the earlier format of answer categories was used. To study the consequences of these potential biases, this study also analysed an alternative cut-point for the 2002 and 2006 items, which included intake of fruit 5–6 times per week in the category of daily intake. Still, there is a risk that the change in the item's wording reduced the comparability of data from before and after 2002 more than can be accounted for by this choice of cut-point. On the other hand, the launch of large media campaigns for the national dietary guidelines in 2005 and 2006 may have caused increased awareness and an overestimation in reported intake of fruit due to changes in children's perceptions of their fruit intake and of what should be reported.

Conclusion
The study revealed a substantial decrease in the daily intake of fruit and nearly no changes in the daily intake of sweets in Greenlandic children between 1994 and 2006. It also found that village children had the least frequent fruit intake. This development was observed despite recommendations and campaigns on healthy eating across the country. A sound first step in increasing fruit intake might be to enhance the availability of low-cost fruit to Greenlandic children. This could be done as part of a new national school meal system or through other general arrangements. Generally, subsidence is needed in the early stages of such programs. As well, more health education in the curriculum for more years during primary school might reduce sweets intake among children. Other measures could include higher taxes on sugar and even the prohibition of sweets in schools, with recognition of the fact that the effects of the latter have been questioned (31).

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Birgit Niclasen, MD, Dr Publ Health student
P.O. Box 7011
3905 Nuussuaq
GREENLAND
Email: niclasen@greennet.gl