

## Weight among children born 2005-2011 in Nuuk at the time of school entry

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### ABSTRACT

The aim of this study was to explore weight status among children born between 2005–2011 at the time of their school entry in Nuuk, and separately to compare weight status between Nuuk and the rest of Greenland among children born in 2011. Study method was an observational study based on data from the electronic medical records (EMR). All children born between 2005–2011 with an address in Nuuk, and registered weight and height were included. For children born in 2011 two study populations were used: children living in Nuuk, and children living outside Nuuk. Body Mass Index (BMI) was calculated. A total of 1,616 children born in 2005–2011, with address in Nuuk between 2011–2017 were identified. 78% were included ( $N = 1,280$ : 676 boys and 604 girls, ranging from 5.4–7.6 years). Prevalence of overweight and obesity were estimated to 12.0% ( $N = 153$ ) and 5.1% ( $N = 65$ ) respectively. Among children born in 2011, the prevalence of overweight or obesity was 14.6% in Nuuk, compared to 28.8% in the rest of Greenland ( $p < 0.001$ ). The prevalence of overweight and obesity was stable for children living in Nuuk. A higher prevalence was observed among children living outside Nuuk. Continued monitoring of weight status is recommended.

**Abbreviations:** BMI: body mass index; EMR: electronic medical records; IOTF: international obesity task force; SD: standard derivation

### ARTICLE HISTORY

Received 11 December 2018  
Revised 30 April 2019  
Accepted 10 May 2019

### KEYWORDS

Overweight; obesity; body mass index; school children; Nuuk; Greenland; family medicine

## Introduction

Childhood overweight and obesity is a serious public health problem throughout the world. Obesity is associated with increased morbidity and mortality [1]. Prevention is therefore crucial. Once obesity is established, it is difficult to treat with permanent results, although lifestyle programmes can reduce the level of overweight in children and obesity in adolescent [2].

Prevalence of childhood obesity has increased at worrying rates, especially in developing countries. Overweight and obesity are related to low income and low education [1,3].

As yet, information on the long-term outcome of obesity treatment in children and adolescents is limited [2].

Among Inuit overweight and obesity have been documented to be an increasing problem both in adults and children. This has also been detected in Greenland during the last decades [4–8].

A study has shown an increase in overweight and obesity among school children in Nuuk, the capital of

Greenland, in the period between 1972 (9.6%) and 2002 (22.5%) [7].

A recent study compared obesity and overweight in children born in Nuuk, to children from the rest of Greenland, all born in 2005. This study showed that nearly one quarter of the Greenlandic children were overweight or obese at the time of school entry. No difference was observed between the two groups [9].

Childhood obesity and overweight at school entry among children in Greenland were strong predictors for overweight and obesity at adolescence [7]. Within the last few years data on height and weight among children in Greenland have been available electronically, making monitoring of overweight and obesity at the time of entering school possible.

However, it still remains unknown whether the prevalence of overweight and obesity among children in Nuuk is now rising or if there still is no difference in overweight and obesity in children from Nuuk, compared to children from the rest of Greenland. Thus, the aim of this study was to estimate the prevalence of overweight and obesity among children in Nuuk. The secondary aim was to compare

weight among children born in 2011 in Nuuk with those in the rest of Greenland.

## Methods

### Design

This study was performed as a register study based on data taken from electronic medical records (EMRs) in Nuuk, Greenland, from 2011 to 2017, and EMRs from towns and settlements throughout Greenland from 2017.

### Setting

Nuuk is the capital of Greenland. With approximately 18,000 inhabitants it is also the largest city in the country, with all the facilities one might expect from a modern metropole—including educational and health care centres. All children in Greenland are offered a minimum of 10 years of primary school education. Before and during that time, they go through routine health examinations.

A free, mandatory school system is used in Greenland. Children start school in the year they turn 6. All children must, according to regulations, be offered a routine health examination within the first 2 years of school attendance. Since 2011, a new EMR has been implemented throughout Greenland starting with Nuuk. The implementation process in all Greenland was finished in 2017, with the exception of the Upernavik district and East Greenland. Data from school health examinations were included in the EMR from 2011–2017.

### Study population

All children born 2005 to 2011 who had permanent address in Nuuk in 2011–2017, and an EMR registered weight and height, were included in the study. In addition, a second study group including all children with permanent address in Greenland born in 2011 was included. This was made possible after the implementation of the new EMR in the rest of Greenland. Children with missing data on height or weight were not included in the study.

A total of 1616 children were identified. Among those, weight and height at the time of entry in school was recorded in the EMR including 1280 children (676 boys and 604 girls, ranging from 5.4 to 7.6 years of age). These had a record of weight and height recorded at the time of entry in school. The remaining 21% (336 children) were either not examined or were not registered in the electronic medical record (EMR). In total, 78% (1280/1616) of eligible children were included.

## Variables

Information about gender, age at examination time, height without shoes and weight including light indoor clothing was obtained from the EMR. Body mass index (BMI) was calculated as  $\text{kg/m}^2$ . Participants were categorised into age and gender-specific weight classes based on the norms from the International Obesity Task Force (IOTF) cut-offs for child overweight, obesity and thinness for children up to 18 years of age [10,11], which permitted comparisons of results with earlier studies from Greenland [7,9,12–14], Canada [15], Denmark [16] the Nordic region [17], Australia [18,19], and the UK [19].

## Statistics

Statistical analysis was performed using SPSS version 23.0 (SPSS, Chicago, IL). Normal distributed variables were described using mean and standard deviation (SD). Test for normality were performed using QQ-plots. BMI was described using median and interquartile range (IQR). Means were compared using students t-test. Medians were compared using non-parametric test. Chi tests were used to compare proportions and chi trend tests were used to analyse for linear trends among groups. A  $p$ -value below 0.05 was considered significant. The study was approved by The Ethics Committee for Medical Research in Greenland, and the Agency for Health and Prevention in Greenland.

## Results

Age, weight, height, BMI and weight classes for boys and girls in Nuuk at school entry are listed in Table 1. The boys had a significantly higher mean height (1.22m) than the girls (1.20m) ( $p < 0.001$ ), and likewise, the boys had a higher mean weight (24.6kg) than the girls (23.7kg) ( $p < 0.001$ ).

In total, 78% ( $N = 1004$ ) of the included children were categorised as normal in weight, 12.0% ( $N = 153$ ) as overweight, 5.1% ( $N = 65$ ) as obese, and to 4.5% ( $N = 58$ ) as thin. No difference was observed in weight classes between genders.

Over time, the trends in proportion of children with available weight and height included, and the proportions of those overweight or obese are illustrated in Table 2. Throughout 2005–2011, significantly ( $p = <0.001$ ) more children were included. For the females the portion of overweight and obese seems to be declining ( $p = 0.034$ ), while no difference was observed among males.

An additional analysis of weight among all children in Greenland born in 2011 was performed. Thus, in addition to the 198 included children born in 2011 living in Nuuk, 438 children living outside Nuuk were also included. Among

**Table 1.** Distribution of age, weight, height, BMI and weight classes among boys and girls in Nuuk born 2005 to 2011 at the time of school entry.

	Female (N = 604)		Male (N = 676)		p-value*	Total (N = 1280)	
	Mean (SD)		Mean (SD)			Mean (SD)	
Age (years)	6.5 (0.38)		6.5 (0.38)		0.335	6.5 (0.38)	
Weight (kg)	23.7 (3.94)		24.6 (4.07)		<0.001	24.2 (4.00)	
Height (m)	1.20 (0.05)		1.22 (0.05)		<0.001	1.21 (0.05)	
BMI(kg/m <sup>2</sup> )	16,3 (1.83)		16.4 (2.03)		0.096	16.1 (1.94) <sup>#</sup>	
<i>Weight classes</i>		% (N)				% (N)	
Thinness	5.0% (30)		4.1% (28)		0.479	4.5% (58)	
Normal weight	77.3% (467)		79.4% (537)		0.357	78.4% (1004)	
Overweight	13.6% (82)		10.5% (71)		0.091	12.0% (153)	
Obese	4.1% (25)		5.9% (40)		0.148	5.1% (65)	
Overweight/obese	17.7% (107)		16.4% (111)		0.538	17.0% (218)	

\*Chi square test

<sup>#</sup>Median (IQR)**Table 2.** Time trend for the proportion of overweight-obese and median BMI among all children included, born between 2005 and 2011, living in Nuuk at school entry.

	2005	2006	2007	2008	2009	2010	2011	p-value*
Included % (N)	70.1% (155/221)	71.2% (153/215)	80.5% (202/251)	76.3% (177/232)	82.5% (189/229)	87.7% (206/235)	85.0% (198/233)	<0.001
Female	30.3% (23/76)	15.9% (14/88)	16.5% (15/91)	27.3% (17/79)	10.6% (10/94)	16.4% (14/85)	15.4% (14/91)	0.034
Male	16.7 (2.9) 12.7% (10/79)	16.0 (1.8) 16.9% (11/65)	16.1 (2.0) 9.0% (10/111)	16.1 (2.2) 16.3% (16/98)	15.8 (1.7) 33.3% (25/95)	16.1 (2.0) 19.8% (24/121)	15.7 (1.6) 14.0% (15/107)	0.160
Total	16.0 (2.0) 21.2% (33/155)	16.1 (1.9) 16.3% (25/153)	16.2 (1.6) 12.3% (25/202)	16.2 (2.0) 18.6% (33/177)	16.3 (2.4) 18.5% (35/189)	16.2 (2.1) 18.4% (38/206)	15.8 (1.8) 14.6% (29/198)	0.602
	16.2 (2.4)	16.1 (1.8)	16.1 (1.7)	16.2 (2.1)	15.9 (2.2)	16.2 (2.0)	15.8 (1.7)	

\*Chi square test for trend

children living in Nuuk, 85% (198/233) were included compared to 83% (438/529) of children living outside Nuuk ( $p = 0.455$ ). In Table 3, a comparison between children from Nuuk and children from the rest of Greenland is illustrated. It shows fewer overweight and obese in Nuuk (14.6%) compared to the rest of Greenland (28.8%) ( $p < 0.001$ ).

## Discussion

The overall prevalence of overweight and obesity was estimated to be respectively 12.0% and 5.1% at the time of school entry for children living in Nuuk, and born between 2005 and 2011. A significant higher proportion of overweight and obesity was observed in children living outside Nuuk compared to children living in Nuuk.

**Table 3.** Distribution of weight classes in Nuuk and the rest of Greenland at the time of school entry for children born in 2011.

Weight class (N)	Nuuk (N = 198)	Rest of Greenland (N = 438)	p-value*
Thinness	4.5% (9)	2.3% (10)	0.121
Normal weight	81.0% (160)	68.9% (302)	0.002
Overweight	12.1% (24)	22.4% (98)	0.002
Obese	2.5% (5)	6.4% (28)	0.042
Overweight/obese	14.6% (29)	28.8 (126)	<0.001

\*Chi square test

## Other studies

The prevalence of overweight documented in this study is quite in line with the prevalence of overweight (17%) and obesity (5–6%) reported among children in Nuuk in the early 2000s [7,12,13]. This indicates that the total amount of children above normal weight is stable at around 20% or might even be decreasing. In addition a tendency towards a decreasing proportion of overweight and obesity was observed among girls in Nuuk.

For the past few years there has been a focus on children's health in Greenland [20], and the study "Has the curve been broken?" ascertained that the use of tobacco and alcohol among Greenlandic school children was declining [21]. This could be, as well, an important factor in children's overall health, thereby stopping the increasing portion of overweight and obesity.

One of reasons for the low prevalence of overweight and obesity in Nuuk, compared to the rest of Greenland, could be associated with access to food. Food insecurity overall in Greenland, for the age group from 18 to 64 has been reported to be 11.4% [22]. It is documented in the latest population study that food insecurity is 50% lower in Nuuk than the rest of Greenland [22].

The easy access to a very varied selection of food in Nuuk, might be one of the reasons that the proportion

of overweight and obesity is similar to the rest of the Nordic countries. Furthermore, low incomes and less educated people are found concentrated in the rest of Greenland compared with Nuuk, which may also contribute to the observed disparity [23].

Physical activity among children in Nuuk was lower than among children in the rest of Greenland. 21–28% of children in towns and settlements were physical active 1 h a day, where only 16% of children in Nuuk were active 1 h a day [24]. Physical activity can therefore not support the observed difference in BMI between Nuuk and the rest of Greenland in this study.

Although different strategies (Inuneritta II) for more physical activities among school children have been made, Ingemann et al. found that the implementation has been insufficient [25].

Greenland is the world's largest island, and with extreme geographic distances come differences in culture and lifestyle that might be reflected in health-related issues. Rex et al. [9] found that boys in Nuuk have a slightly lower median BMI compared to their peers in the rest of the country, but found no significant difference in overweight among children in Nuuk compared to other parts of Greenland.

Our study found a difference in prevalence of obesity and overweight between Nuuk and the rest of Greenland, in contrast to the results by Rex et al. [9]. This could be a result of uncertain estimates because both comparisons included only one birth year. In 2005 only 70% were included compared to 85% in our study—both cases dealing with small numbers, which may lead to further investigations before any certain conclusion can be made. However, the observed difference may also be a result of increasing differences between Nuuk and the rest of Greenland.

The actual prevalence of overweight and obesity reported at school entry in Nuuk in this study is much lower than reported among Inuit children from Nunavut. Egeland et al. [15] used data derived from the Nunavut Inuit Child Health Survey 2007–2008, including 388 or 26% of the 3 to 5 year old Inuit population. 67% of the 3–5 year olds were found overweight (39%) or obese (28%) [26]. The authors related overweight and obesity to the very high frequency of food insecurity found [15].

In 2018 the latest growth charts of Greenlandic children were published, the conclusion was overall linear growth, weight and head circumference exceeds the WHO growth standards but were closer to the Danish charts [27]. Therefore comparison with Nordic countries is highly relevant.

The prevalence of overweight and obesity in Nuuk is similar to the prevalence in Denmark.

A 2011–2012 study involving 2760 Danish children at school entry in the suburbs around Copenhagen reported 16.6% were overweight and 4.2% were obese [28].

The portion of overweight and obese among 7–12 year old children is reported to be different in the Nordic countries thusly [17]: Denmark 11.6%, Finland 17.2%, Sweden 16.8%, Iceland 20.0%, Norway 16.7% and the Nordic region 15.4% [17]. The results from Greenland showed that 17.4% were overweight and obese, which is very similarly to the rest of the Nordic countries, despite the difference in age at the time of measuring.

Children age 4–5 years in the UK in 2018 were reported to be at 13% overweight and 9.6% obese; these number increased to 14.3% overweight and 20.0% obese for children aged 10 to 11 years [29]. Compared to our study, children of median age 6.5 years old, were reported to be at 12.0% overweight and 5.1% obese, supporting the fact that Nuuk as metropole is doing as well or even better than some other metropolises from Europe regarding weight issues.

In Australia, around one in four children aged 5–17 are overweight or obese, comprised of 20.2% overweight and 7.4% obese [30]. In 2010, the prevalence of overweight or obese among school children aged 5–16 years was 29.0% compared to 22.7% for non-aboriginals [18]. Another study found that 18.1% were overweight and 5.3% were obese among aboriginal people aged 5–9 years in remote Australia [19]. This shows a significantly higher portion of overweight and obese among the Indigenous Native population compared to their non-Indigenous counterparts.

This could be explained by ongoing concerns with poverty, food insecurity and colonialism, issues that could be risk factors among Inuit in the small towns and settlements outside Nuuk as well.

To compare proportion of overweight among indigenous native children in same age group as in our study, another study found that 18.1% were overweight and 5.3% were obese among aboriginal people aged 5–9 years in remote Australia in 2010 [19]. Our study with data from 2017 found a proportion of overweight and obese among children from outside Nuuk as 22.4% and 6.4% respectively. This difference support the need of more focus on health among the children outside Nuuk.

### **Strengths and weaknesses**

The major strength of the study is that 78% of eligible children in Nuuk were included children, and our data could be identified electronically. The protocol of this study was designed to allow a comparison with previous studies from Greenland and abroad [9,13,14].

The main limitation is the small population available, and an annual comparison must be taken with great

reservation due to wide fluctuations in the small population. Unfortunately EMR data on children outside Nuuk were only completed for 2017, limiting the strength of our comparison.

## Conclusion

In conclusion, we observed a stable prevalence of overweight being overall at 12.0% and for obesity at 5.1% for children in Nuuk at school entry born between 2005 and 2011. However, a significant, higher percentage for children from the rest of Greenland seems to indicate more overweight and obesity outside Nuuk. Continued up-to-date monitoring of child weight based on data available in the EMR is recommended. We recommend continuing the monitoring of children's weight at 5 year intervals in Nuuk, and in the rest of Greenland, as well as the permanent use of the Inuretta II strategies, to make children exercise at least 1 h a day, to prevent overweight and obesity.

## Acknowledgments

We would like to express our sincere gratitude to Government of Greenland Department of Health, and to the Greenland Research Council for funding the project.

Thanks to Jim Milne for English proof reading.

## Disclosure statement

No potential conflict of interest was reported by the authors.

## Funding

This work was supported by the Greenland Research Council; Government of Greenland Department of Health.

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