Research documented (1) parents' food choices for their children and perceptions of their child's weight, (2) elementary school children's food and physical activity preferences, and (3) interventions developed by community members to promote healthy eating and physical activity among children. The results can be used to understand the most appropriate interventions to prevent children from having excess body weight in the Cree Nation of Mistissini.

An ecological approach to understanding and improving the nutrition and health of Cree children

Summary Report

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An ecological approach to understanding and improving the nutrition and health of Cree children

A Canadian Institutes of Health Research (CIHR) Funded Study

Research Report

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Background to the Research Project

Formative research from the *The Active Kids Project (The Emiyuu Ayayaachiit Awaash Project)* completed in the mid-2000s by Noreen Willows showed that Cree elementary school children in two communities in Eeyou Istchee had a very high prevalence of overweight and obesity, low physical fitness and inadequate physical activity. Many children also had low self-esteem and did not like the way they looked. Girls, as well as children who were overweight or obese, were most likely to have low self-esteem, not like the way they look, and body size dissatisfaction. Diet quality among children was poor with sweetened drinks contributing the most to energy (calories) in the diet, and snack foods contributing the most to fat intake in the diet. Fruits and vegetables, and traditional Cree foods, were seldom consumed. In contrast, restaurant and takeout meals were commonly consumed. Although traditional food (e.g., moose meat) was not consumed often by children, it made an important contribution to improving the nutritional adequacy of children's diets. The scientific papers and abstracts from *The Emiyuu Ayayaachiit Awaash Project* are in the appendix.

Rationale for the Current Research Project

The high prevalence of diabetes in the adult Cree population, and the findings from *The Emiyuu Ayayaachiit Awaash Project* that many children had excess body weight, insufficient physical activity, low fitness, diets of poor quality, and disliked their physical appearance reinforced the case for increased efforts at improving children's nutrition, activity levels and fitness while being sensitive to protecting children's self-esteem in relation to their appearance. It was important that interventions aimed at preventing childhood obesity be culturally appropriate. *An ecological approach to understanding and improving the nutrition and health of Cree children* was conducted in the Cree Nation of Mistissini to strengthen and add to information obtained in the formative assessment of children's health. Using an ecological approach, the multiple levels of influence that may contribute to childhood obesity were documented using both qualitative and quantitative methodologies. The main activities that were carried out beginning in 2010 included (1) documenting parents' food choices for their children and their perceptions of their child's weight status (2) documenting children's food preferences and usual and preferred physical activities, and (3) using the ANGELO (Analysis Grid of Environments Linked to Obesity) framework to conduct a community workshop to democratically develop and prioritize interventions to promote healthy eating and physical activity among children. The intention of these activities was to understand the most appropriate ecological levels for interventions to prevent childhood obesity in the Cree Nation of Mistissini, and to improve the evidence base for the development of effective, promising and culturally appropriate interventions.

Research Components

1. Qualitative research to document elementary school children's thoughts on healthy food and physical activity

Rationale: In March of 2010, three focus group interviews were held with twelve children in grades 4 to 6 attending Voyageur Memorial School. Focus groups were intended to elicit children's perceptions of obesity-related lifestyle behaviours (e.g., food and activity).

Method: Focus group interviews employing drawing and pile sorting activities sought to understand (1) the influence of Cree culture on children's perceptions of healthy foods and activities, (2) children's perceptions about healthy foods and activities, and (3) children's food and activity preferences. Sessions were 1 hour in length and involved children drawing pictures, talking about their pictures, and sorting their pictures into piles based on whether the picture represented "something good for you" or "not good for you".

Participant Demographics

- Twelve students from grades 4 (n=5), 5 (n=2), and 6 (n=5)
- Participating students were those who returned completed consent forms from their parents or caregivers and signed their own assent forms.
- Students from both French Immersion (n = 5) and English (n = 7) classes
- Three focus groups took place with four students per group. For all focus groups there was the presence of two facilitators from the University of Alberta (The primary facilitator,

Ashlee Pigford, a graduate student, asked questions; the secondary facilitator, David Dyck Fehderau, a research associate, took notes) and a Cree translator from the community.

Results

- Focus groups revealed that children are aware of and like foods and activities considered to be healthy.
- Children preferred foods and activities they thought were healthy.
- Children reported consuming traditional foods such as beaver, moose and goose as often as twice a week.
- Cree translation aided the interviews as children were reluctant or hesitant to express themselves in English

Food

- Children showed a preference for foods that they thought were healthy.
- The majority of children focused on fruits and vegetables in their discussions of healthy food unless prompted for examples of traditional foods, which then elicited comments about traditionally hunted meats (e.g., beaver, goose, moose).
- Most children made comments similar to the ones below in relation to foods considered healthy or unhealthy
    - E.g. Pizza is unhealthy because of 'fat', and 'lots of calories'
    - E.g. Cookies are unhealthy because of 'lots of sugar' and 'chocolate chips'
    - E.g. Moose is healthy because it gives you iron
- Traditional food
    - Most children acknowledged eating traditional food (e.g., goose, moose, beaver) as often as 'a few times a week'
    - Traditional foods were eaten with family members (often a grandmother or mother; aunts and uncles were also mentioned)
    - Moose meat comes from 'out in the woods' or 'my dad brings it home'

Activities

- Children showed a preference for activities that they thought were healthy.
- Activities were often done with friends

Health

- The school was cited as a source of health information.
    - There are cooking classes offered by the school nutritionist.
- Parents and relatives were cited as a source of information about traditional foods and activities.
- A healthy person…
    - eats fruits and vegetables.
    - runs, works out, exercises (running, jumping jacks, stretching), and dances.
    - 'Exercise is healthy because you lose weight'
- An unhealthy person…
    - eats junk, chips, junk food (pop, chips, chocolate, gum).

- sits around, plays inside (plays on computer, watches TV).

Children's perceptions of healthy and unhealthy foods

Healthy	**Unhealthy**	**Unclassified**
Non-Traditional Foods		
Cheese	Candy	Lasagna
Fruit (apple, banana, orange, grapes, strawberries, watermelon)	Chips	Poutine
Milk	Cookies	
Vegetables (broccoli, carrot, tomatoes)	Gum	
Yoghurt	Junk	
	Pizza	
	Pop	
Traditional Foods		
Moose meat		
Goose		
Beaver		
Soup		
Berries		
Fish		
Bear		

Children's perceptions of healthy and unhealthy activities

Healthy	**Unhealthy**
Basketball	Play on computer
Biking	Watching TV
Broomball	Video games
Hockey	
Skating	
Reading and writing	
Walking around	
Fishing	
Going to camp	
Hunting	
Plucking geese	
Setting snares for rabbits	
Ski-dooing ("Because you go hunting.")	

Graduate student researcher comments on the focus group process with children

- Language may have been an issue for the French immersion children; the English students offered more information.
- Directed individual interviews with children may be more useful to access information in the future than focus groups; there was very little spontaneous discussion among children in the focus groups.
    - It was very difficult to get children to provide more than one word answers.
- There may have been underlying social or cultural factor that influenced children's reluctance to voice their opinions in focus groups.
    - Before the interviews an individual who worked at the school mentioned that getting any information from the kids would be "like pulling teeth".
    - The translator made comments that the child who voluntarily offered the most information in one focus group was not from the community.
    - Based on interactions witnessed between children and other adults in the community, when in the presence of adults children don't often speak unless directly addressed; however, when children are left to play without an adult present they are much more active and engage each other. There may be social constructs around adult and child relationships in the community that create the possibility that focus groups with children are not socially/culturally appropriate in this setting.
        - It may be interesting to consider the roles of childhood in Cree culture and the interactions with adults before instigating focus group interviews again facilitated by adults. Peer interviewing might be more appropriate.
    - Gender roles may influence whether children talk together comfortably in a group – separate groups for boys and girls may be more appropriate than mixed groups even at young ages.
- Future research is recommended to further elicit children's understandings of this research topic.

2. ANGELO Framework

Rationale: The objective of this research was to conduct an action-based workshop to address childhood obesity. The workshop process was based on the ANGELO (Analysis Grid of Environments Linked to Obesity) Framework (Swinburn et al. 1999; Simmons et al., 2009) which assists community members to conduct a methodical, evidence-based scan of key aspects of their community that influence food intake and physical activity, and, consequently, obesity in children.

Methods: The workshop took place over two days. All participants were over 18 years of age and signed their own consent forms before the process began. The key question participants were looking to answer was, 'What must be done in your community to promote healthy eating and physical activity for children?' In this process participants explored community strengths and challenges in providing services, programs, and resources to tackle the issue of obesity in their community and to promote healthy living. This was done by having participants apply relevant research and community knowledge to the task of scanning their environment by four environmental types (physical, economic, policy, socio-cultural) and two environmental sizes

(the Public Domain: School and Community, the Private Domain: Home and Family). Through the exploration they identified and prioritized potential environmental areas that could promote healthy eating and physical activity. The workshop ended with developing an action plan for the priority areas that were identified.

Four researchers from the University of Alberta, trained in administering the ANGELO workshop, were present as facilitators. On day one, small and large group work resulted in the development of seven action statements to form a community action plan to prevent obesity in children based on changing the food and physical activity environments. On day two, in small groups, programs were developed for five of the action statements developed on day one using SMART objectives to ensure that the program development process was Specific, Measurable, Attainable, Relevant, and Time-bound (Round et al. 2008). Groups presented their program to the larger group, which then added ideas to it. The program for action statements identified (1) community members who should be made aware of the program, who might be involved with program planning, or who might champion the program; (2) a pre-existing program which might be modified to incorporate the action statement, or multiple pre-existing programs which might benefit from closer association; (3) required resources already in the community or needing to be procured. At the end of day two, participants completed a survey consisting of closed and open-ended questions about the workshop process.

Results: The 13 participants included directors, program managers and staff of various departments, a Band council member, and community members. All participants had an above average or excellent impression of the ANGELO workshop and found the workshop very useful or extremely useful in addressing issues of child health. Every participant felt that they could be involved in the implementation of the action plan. Two-thirds of participants identified networking opportunities as an outcome of participating. All participants indicated that they would be interested and willing to participate in a future ANGELO workshop or other activities aimed at improving children's lifestyles.

The seven statements generated as part of the community action plan appear below.

1. Create a life skills course at school that would cover topics of physical activity, nutrition, and health behaviours
2. Develop mainstream communication tools for youth and families to find out what is going on in the community (e.g., community calendar, radio programming, etc.)
3. Have a 'cooking' program(s) for families (focusing on healthy and traditional foods)
4. Have programs for families and children to teach/learn about Cree culture (e.g., camps)
5. Maintain existing exercise facilities (e.g., walking trails, ice rink)
6. Create a Child First policy in the community
7. Improve communication among departments concerning the community's facilities (e.g., gym use and availability)

From this list of priorities, participants developed actions.

- A Summer Co-operative Education Program to Teach Children (9-13 years) and youth (14 + years) to make Cree hunting and fishing tools, and tepee and tent making
- An evening cooking class every Tuesday for families with children in Grade 1

- Create a 1 year binder of recipes we would like to teach that are both traditional and healthy
- Indoor and outdoor existing physical activity facilities in Mistissini will be safe (bodily harm: i.e., sprain ankles), secure (i.e., personal safety: i.e., attacks, sexual assault), and accessible (easy to use, useable for its purpose)
- Have on-going (monthly) meetings
- Have a community (facilities) booking calendar
- Have a community newsletter
- Develop and implement a life skill curriculum for Pre-K to Secondary 5

Due to lack of time, a program was not developed for the statement to increase community knowledge of children's health issues by creating a Child First Policy in the community. For the same reason, a program was not developed for a statement to develop mainstream communication tools for youth and families to find out about community activities. Three programs that were developed advanced knowledge of Cree culture. A program for a life skills course for schoolchildren was intended to increase knowledge among children of Cree values, traditions and history using storytelling by Elders, developing a Cree knowledge curriculum, and taking children into the bush for Cree teachings. To develop the course the school would partner with other community entities such as the Public Health Department, Chief and Council, Youth and Elders Councils, and the Cree Trappers' Association. A program to teach families and children about Cree culture was developed to include training organized through the Cree Trappers' Association, the Cultural Department, *Niskamoon* Organization, and the Canada Prenatal Nutrition Program (CPNP). A cooking program for families would be coordinated through the Brighter Futures Program with funding from CPNP and teachings from elders.

Discussion: The ANGELO Framework helped community members understand the factors in the community impeding or facilitating healthy behaviour choices, and develop a community-generated action plan that would be practical to implement in the community. Using the ANGELO framework, participants of this action-based workshop combined personal knowledge and experience with community and national research to dissect the broad array of environmental factors influencing childhood obesity in the community, prioritize actions to form a community-specific action plan to address childhood obesity focusing on healthy eating and physical activity, and then create programs for the actions. The priority actions identified in the Cree Nation of Mistissini to increase healthy foods and physical activity for children included increasing awareness of children's health issues among the local population and leadership, promoting nutrition and physical activity at school, developing strategies to raise community awareness about healthy activities, and improving recreation opportunities in the community. Reconnecting children and families with Cree culture was a part of programming, emphasizing the perceived value among community members of traditional Cree knowledge and practices to improving children's wellbeing. Teachings by Elders were an integral part of program plans.

Strengths and limitations of the research: Participants were very satisfied with the democratic nature of the ANGELO workshop. A greater number of workshop participants would have secured a potentially broader perspective of community knowledge and ideas and the development of programs for all action statements of the community action plan.

3. Document parent and caregiver's knowledge, awareness, and perceptions of their children's weight status and food monitoring behavior

Rationale: Parent and caregiver awareness about healthy weights and healthy eating for their children was assessed in structured individual interviews using a multi-dimensional questionnaire. The questionnaire developed by Dr. Sanou with input from Dr. Willows and Dr. Tanya Berry, from the University of Alberta, addressed three aspects of caregiver awareness that included general nutrition knowledge, perceptions about healthy weights for children, monitoring of what children eat, and caregiver readiness to change children's dietary behaviours. Parents play an important role in the formation of children's health behaviours. Understanding caregivers' perceptions about their child's weight in relation to child feeding practices has the potential to make an important contribution to the development of programs promoting healthy child weight.

Questionnaire development: The questionnaire was a cultural adaptation of the Child Feeding Questionnaire (CFQ), which is a multi-dimensional self-report questionnaire to assess parental beliefs, attitudes, and practices regarding child feeding, with a focus on obesity in children (Birch et al., 2001). Some questions for this study were directly from the CFQ; however, other questions were modified from the CFQ to simplify the language, to make it more comprehensible for individuals with English as a second language, to ensure cultural sensitivity of the interviews, and to make the questionnaire more suitable for the research. For example, a question about monitoring sugared beverages was added. The modified questionnaire was developed and pilot tested with health professionals working in the community, including a community nutritionist.

The modified Child Feeding Questionnaire (mCFQ) developed for this study was a 40-item self-reported measure of parent nutritional perceptions and practices, concerns about child weight, perceived responsibility, perceived child weight, restrictive child feeding practices, use of food as reward, pressure to eat, monitoring of child intake, and household and participant demographic information. The mCFQ also contained an artist's rendition of American Indian boys and girls used in a previous study of Cree children living in Eeyou Istchee (Willows et al., 2009). Parents were asked to select a figure that indicated their child's weight status.

Participants: Eligible participants were adult caregivers in a formal care giving arrangement with a child between the ages of 5- to 12-years-old who lived in the caregiver's household. The caregiver could be the biological or adoptive parent, a relative other than the parent, a step-parent, foster parent, or other legal guardian of the child.

Method: A convenience sample of 65 adult caregivers completed the questionnaire. Participants were recruited by an assistant from the community hired for this project. Participants were given an information sheet to read and a consent form to complete prior to completing the questionnaire. Each participant received a $25 gift certificate.

The questions were read aloud to participants and answers were recorded by the facilitator. The local assistant was present during interviews to provide translation (Cree-English-Cree) when required. Oral administration of the questionnaire, in the presence of a community assistant, was

done to decrease error due to literacy and language barriers. Each interview took approximately 45 minutes to complete. Participants answered questions posed to them based on the youngest child aged 5- to 12-years-old who was living with them.

Preliminary Findings: As data is analyzed further correspondence will be provided.

Participant sociodemographics: A convenience sample of 65 caregivers (47 women and 18 men) participated in this study. Mean age of participants was 34.2 ± 8.1 years (range 21 to 65 years), and the mean age of the child discussed by caregivers was 6.8 ± 2.0 years with 33 being male children and 32 being female children. The majority (81.5%) of caregivers had full (61.5%) or part-time (20.0%) employment. Eighty percent of respondents stated that they did not have any chronic health conditions such as diabetes, heart disease or high blood pressure. The majority (76.9%) reported living with a partner whereas 13.8% were living alone with their child and 6.1% had other living arrangements. Household sized ranged between 2 and 11 people with most households having 5.6 ± 2.1 individuals, 3.3 ±1.7 of individuals being children under the age of 18 years old.

Caregiver perceptions about child's weight: When asked to select their child's current body size from the figures, 16.9% (n=11) of caregivers chose an underweight figure, 64.6% (n=42) chose a normal weight figure, and 18.5% (n=12) chose an overweight figure. In response to the question 'How would you rate this child's weight now?' 7.7% (n=5) perceived their child to be "underweight," 70.8 % (n=46) perceived their child to be "just right" and 21.6% (n=14) perceived their child to be "overweight." There was a high correlation between the perceived weight classification of children based on the verbal responses and the figure chosen to represent a child's weight status; therefore, caregiver's perception of child weight using the figures was included when statistically analyzing data. There was no evidence that the child's gender influenced how their weight status was perceived by caregivers. For this reason, all analysis grouped responses about children regardless of their gender.

Caregiver concern for child weight: The majority (87.7%) of all caregivers replied 'yes' to the question 'Do you believe if this child gains too much weight, they will have health problems?' Caregiver's concerns for their child's weight are reported in the table below. It can be observed that the highest level of concern was given in response to the question asking if the child's weight would cause health problems in the future. Diabetes and heart attacks were the two most common health concerns identified by caregivers.

The level of caregiver concern for their child's weight was highest for children perceived to be overweight and lowest for children perceived to be underweight. When asked, 'Do you think that this child is gaining too much weight?', 0.0% of caregivers who perceived their child to be underweight, 7.3% of caregivers who perceived their child to have a normal weight and 81.8% of caregivers who perceived their child to be overweight expressed concern. While 100% of caregivers of children perceived to be overweight were concerned about their children being overweight in the future, 64% of caregivers of children perceived to be underweight were also concerned.

Caregiver's concern for child's weight	Mean[+]	Standard Deviation
How concerned are you about this child eating too much when you are not around?	3.64	1.13
How concerned are you that this child will have to diet to maintain a good weight?	3.25	1.14
How concerned are you about this child's weight right now?	2.86	1.11
How concerned are you about this child being overweight in the future?	3.89	1.26
How concerned are you that this child's weight will cause her health problem, such as diabetes or other diseases, when she grows up?	4.22	1.00
How concerned are you about this child's weight causing her to be teased or bullied by other children?	3.81	1.27
How concerned are you that this child's weight will affect her quality of life?	3.70	1.22

[+]This is the mean of all items in a construct. Response options for each question were very unconcerned (value=1), unconcerned (value=2), neutral (value=3), concerned (value=4) and, very concerned (value=5). For example, a mean of 3.64 would imply that the majority of respondents were concerned about their child eating too much when they were not around (the option 'concerned' has a value of 4).

Child weight and monitoring practices: The level of concern about the child eating too much when the caregiver was not around was 100% for caregivers who perceived their child to be overweight and <20% for caregivers who perceived their child to be underweight. The percentage of parents who reported regular monitoring of sweets, snack foods, and sugar sweetened beverages was higher among those who perceived their child to be 'normal weight' than those who perceived their child to be 'underweight' or 'overweight'. Monitoring of high fat foods was most common among parents of perceived 'underweight' children as indicated in the table below.

Conclusions: These findings indicate that parents may misperceive their child's actual weight status. A minority of caregivers (18.5%) reported that they perceived their child to be overweight whereas the epidemiological data from *The Emiyuu Ayayaachiit Awaash Project* showed 64 – 71% of children to be overweight or obese (Downs et al., 2008; Downs et al., 2009; Ng et al., 2006), suggesting that caregivers are underestimating child weight status. Interventions that aim to correct parental perception of child weight status may help to create behavioural changes that would prevent obesity in both caregivers and children. Given the potential adverse consequences of pediatric obesity, caregiver weight misperceptions in Mistissini could be addressed when developing programs aimed at reducing childhood obesity.

Caregiver monitoring of sweets, snacks, high fat foods, and sugar drinks by child's perceived weight status

Monitoring what a child eats.

How often do you keep track of the sweets this child eats (like candy, ice cream, and cake or pastries)?

Child's perceived weight status	Never/Seldom	Half of the time	Most of the time/Always
Underweight (n=11)	27.3%	18.2%	54.5%
Normal weight (n=42)	9.5%	21.4%	69.0%
Overweight (n=12)	8.3%	41.7%	50.0%
Total (n=65)	12.3%	24.6%	63.1%

How often do you keep track of the snack foods that this child eats (like potato chips, corn chips, or cheese puffs)?

Child's perceived weight status	Never/Seldom	Half of the time	Most of the time/Always
Underweight (n=11)	9.1%	27.3%	63.6%
Normal weight (n=42)	14.3%	16.7%	69.0%
Overweight (n=12)	16.7%	16.7%	66.7%
Total (n=65)	13.8%	18.5%	67.7%

How often do you keep track of the high-fat foods that this child eats (like poutine, French fries, fried chicken or chicken fingers)?

Child's perceived weight status	Never/Seldom	Half of the time	Most of the time/Always
Underweight (n=11)	9.1%	0%	90.9%
Normal weight (n=42)	16.7%	11.9%	71.4%
Overweight (n=12)	0%	50.0%	50.0%
Total (n=65)	12.3%	16.9%	70.8%

How often do you keep track of the sugar sweetened beverages that this child drinks (like pop, fruit punches, and slushies)?

Child's perceived weight status	Never/Seldom	Half of the time	Most of the time/Always
Underweight (n=11)	27.3%	18.2%	54.5%
Normal weight (n=42)	9.5%	14.3%	76.2%
Overweight (n=12)	0.0%	33.3%	66.7%
Total (n=65)	10.8%	18.5%	70.8%

The majority of caregivers expressed weight-related concerns for their children. Not only were caregivers of children perceived to be overweight concerned about their children being overweight in the future, but so were caregivers of children perceived to be normal and underweight. This concern may reflect the conditions in Mistissini where the majority of Cree adults are overweight or obese, and twenty percent of Cree adults older than 20 years have type 2 diabetes. With such a large population of obese adults, and various diabetes and obesity-related initiatives in place, caregivers may be exposed to various chronic disease prevention interventions and therefore be familiar with the adverse health consequences of being overweight in adulthood.

Caregiver child food monitoring behaviours were generally more common among caregivers who perceived their child as normal weight compared to those who perceived their child as overweight. Future studies are required to elucidate the reasons why caregivers monitor foods and the relationship to perceived child weight status.

There were limitations of this study using the modified Child Feeding Questionnaire. First, the convenience sample may not be representative of the general population of caregivers in the community. The small sample size meant that a number of associations could not be statistically explored. Actual child and caregiver weight was not measured, as researchers wanted to recruit as many participants as possible, and measurement of actual weight would have been burdensome, invasive and would have required the child to be present with the parent. For this reason, we don't know if the caregiver's perception of their child's weight status was the same as the child's actual weight status.

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Willows ND, Ridley D, Raine KD, Maximova K. High adiposity is associated cross-sectionally with low self-concept and body size dissatisfaction among indigenous Cree schoolchildren in Canada. BMC Pediatr. 2013 Aug 12;13:118.

Appendix

1. Willows ND, Ridley D, Raine KD, Maximova K. High adiposity is associated cross-sectionally with low self-concept and body size dissatisfaction among indigenous Cree schoolchildren in Canada. BMC Pediatr. 2013 Aug 12;13:118. (This open access article is free to download and read.)

BACKGROUND: Obesity and mental health problems are prevalent among indigenous children in Canada and the United States. In this cross-sectional study the associations between adiposity and body size satisfaction, body image and self-concept were examined in indigenous children in grades four to six living in Cree communities in the Province of Quebec (Canada).

METHODS: Weight status and body mass index (BMI) z-scores were derived from children's measured height and weight using the World Health Organization growth reference. Multivariate regression models that included child's age and sex were used to assess the association between (a) weight status and physical appearance satisfaction using pictorial and verbal body rating measures in 202 of 263 children, and (b) BMI z-score and self-concept measured using the Piers-Harris Children's Self-Concept Scale in a subset of 78 children.

RESULTS: Children (10.67 ± 0.98 years) were predominantly overweight (28.2%) or obese (45.0%). Many (40.0%) children had low global self-concept indicating that they had serious doubts about their self-worth and lacked confidence. About one-third (34.7%) of children did not like the way they looked and 46.3% scored low on the physical appearance and attributes domain of self-concept indicating poor self-esteem in relation to their body image and physical strength, feeling unattractive, or being bothered by specific aspects of their physical appearance. Compared to normal weight children, overweight and obese children were more likely to desire being smaller (OR=4.3 and 19.8, respectively), say their body size was too big (OR=7.7 and 30.6, respectively) and not liking the way they looked (OR=2.4 and 7.8, respectively). Higher BMI z-score was associated with lower scores for global self-concept (β=-1.3), intellectual and school status (β=-1.5) and physical appearance and attributes (β=-1.3) indicating negative self-evaluations in these areas. Despite comparable weight status to boys, girls were more likely to have lower scores for global self-concept (β=-3.8), physical appearance and attributes (β=-4.2), desiring to be smaller (OR=4.3) and not liking the way they looked (OR=2.3).

CONCLUSIONS: The psychosocial correlates of obesity are important considerations for indigenous children, particularly girls, given that poor self-concept and body size dissatisfaction negatively impact mental and emotional qualities of life.

2. Willows ND, Marshall D, Raine K, Ridley DC. Diabetes awareness and body size perceptions of Cree schoolchildren. Health Educ Res. 2009 Dec;24(6):1051-8. (This open access article is free to download and read.)

Native American Indians and First Nations are predisposed to obesity and diabetes. A study was done to understand Cree schoolchildren's diabetes awareness and body size perceptions in two communities that had diabetes awareness-raising activities in the Province of Quebec, Canada. Children (N = 203) in grades 4-6 were classified into weight categories using measured heights and weights and grouped on diabetes awareness based on dichotomous responses to the question 'Do you know what diabetes is?' Children selected a drawing of an American Indian child whom they felt most likely to get diabetes and described their body size perception using a closed response question. Although 64.5% of children were overweight or obese, most (60.1%) children considered their body size to be 'just right', with 29.6% considering it 'too big' and 10.3% considering it 'too small'. A minority (27.6%) of children had diabetes awareness. These children were more likely than children without diabetes awareness to consider their body size too big (42.9 versus 24.5%) and to choose an obese drawing as at risk for diabetes (85.7 versus 63.3%, odds ratio 3.48 and 95% confidence interval 1.53-7.91). Culturally appropriate health education programs to increase schoolchildren's diabetes awareness and possibility to have a healthy body weight are important.

3. Downs SM, Arnold A, Marshall D, McCargar LJ, Raine KD, Willows ND. Associations among the food environment, diet quality and weight status in Cree children in Québec. Public Health Nutr. 2009 Sep;12(9):1504-11.

OBJECTIVE: To explore the relationship among children's diet quality, weight status and food environment in subarctic Canada.

DESIGN: In the cross-sectional study, children's BMI was calculated, diet quality was assessed using three 24 h dietary recalls and children were asked about their home food environment and source of meals.

SETTING: Two Aboriginal Cree communities in northern Québec.

SUBJECTS: Two hundred and one children in grades 4-6.

RESULTS: The majority (64.2%) of children were overweight (29.9%) or obese (34.3%). Weight status was not associated with reported restaurant meal frequency or the home food environment. The 18% of children who consumed three or more restaurant meals in the three days of recall consumed, on average, 2004 kJ (479 kcal) more energy daily than children consuming no restaurant meals and had higher intakes of fat, saturated fat, Ca and soda. Most foods contributing to energy and dietary fat were energy-dense market foods of low nutritional value such as sweetened beverages and snack foods. Only 68% of children reported often having fruits and vegetables in the home and 98.5% of children consumed less than 5 fruits and vegetables daily. Many children (42.8%) were at risk of Zn inadequacy. Only 19% of children

consumed 2 or more servings of milk daily, and the mean intakes of Ca and vitamin D were below the recommended adequate intake. Traditional game meat was consumed infrequently, but contributed significantly to Fe and Zn intake.

CONCLUSIONS: Childhood obesity in subarctic communities prevailed in a food environment typified by high-energy-density commercial foods of low nutritional value.

4. Downs SM, Marshall D, Ng C, Willows ND. Central adiposity and associated lifestyle factors in Cree children. Appl Physiol Nutr Metab. 2008 Jun;33(3):476-82.

Aboriginal children are prone to central adiposity (CA), a component of the metabolic syndrome. The objective of this study was to determine if lifestyle factors were associated with CA in Canadian Cree children. Children aged 9-12 years were classified as having CA if their waist circumference met or exceeded the 85th percentile of the NHANES III reference. Weight status was determined using the CDC growth reference, dietary intake using three 24 h dietary recalls, physical activity using pedometers, and fitness by completion of the 20 m shuttle run test. Of the 178 children (79% participation rate), 32.6% were normal weight, 23.6% were overweight, and 43.8% were obese. Half (52.2%) of the children had CA (97.4% of obese children, 35.7% of overweight children, and 2.2% of normal weight children). Waist circumference was negatively correlated with pedometer step counts ($r = -0.187$, $p = 0.012$) and shuttle run time ($r = -0.508$, $p < 0.001$). In children with CA, waist circumference was positively correlated with sweetened beverage intake ($r = 0.250$, $p = 0.016$). The odds ratio (adjusted for age and sex) for CA for children consuming 3 or more fruits and vegetables per day was 0.43 (95% CI 0.18 - 0.98), for meeting step recommendations for a healthy body weight was 0.45 (95% CI 0.24 - 0.84), and for relative fitness was 0.12 (95% CI 0.04 - 0.33). CA was prevalent in children who were overweight and obese. Preventive strategies might include promoting a healthy diet, physical activity, and fitness.