UNIVERSITY OF COPENHAGEN
DEPARTMENT OF NUTRITION, EXERCISE AND SPORTS

WRITTEN PARTICIPANT INFORMATION

For children and their parents who are interested in participating in the project **More2Sleep**

We would like to ask if your child would like to participate in a scientific study, with the title: **A randomised controlled trial of sleep extension to regulate body weight and improve learning in school-aged children (More2Sleep)**. The trial is carried out by a team of researchers at the Department of Nutrition, Exercise and Sports (NEXS), University of Copenhagen and the Danish Centre of Sleep Medicine, Rigshospitalet. Professor Faidon Magkos (NEXS) is the responsible Principal Investigator.

Before deciding whether your child will participate in this study, you, as parents and legal guardians, must fully understand what the trial is about and why we are conducting it.

Please carefully read this information and the pamphlet "Subject's rights in a health science research project" ("Forsøgspersoners rettigheder i et sundhedsvidenskabeligt forskningsprojekt").

You and your child will also be invited to an information meeting about the trial, where this written participant information and the participants' rights will be explained in detail. Here you will be able to ask any questions you have about the trial. You are welcome to bring along a companion, e.g. a family member or a friend, to this meeting.

If you decide that your child would like to participate in the trial, we will ask both parents/legal guardians to sign a consent form. You can sign on behalf of your partner if you have power of attorney.

Remember, that you have the right to think about it before you decide whether you want to sign the consent form.

Your child's participation in the trial is voluntary and you/they can withdraw your/their consent at any time, without giving a reason, and with no consequences to you or your child.
Thank you for your interest!

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1. More2Sleep at-a-glance

Aim

We wish to investigate the effects of sleep extension by 60-90 minutes/night on body weight regulation and learning ability in children.

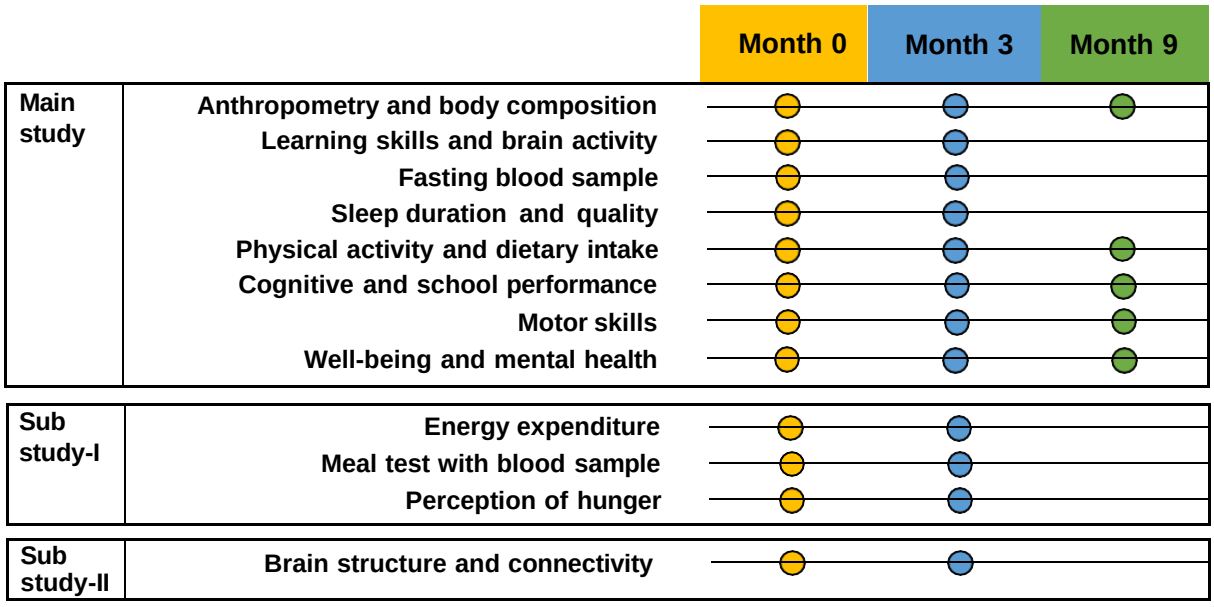
What does this project involve?

We will include 300 boys and girls aged 6-12 (inclusive range) years old, who have a BMI (body mass index) for age and sex above average and who sleep less than the recommended 9 hours/night.

Which examinations will take place?

Children will be randomly allocated (like flipping a coin) to a "sleep extension" group or a "control" group. Parents in the first group will be asked to put their kids to bed 60-90 minutes earlier at night, every weekday for 3 months (the morning wake-up times will not be affected). Parents in the second group will not change their children's sleeping habits.

Measurements will be conducted on the children and information will be collected from both the children and their parents at the beginning and the end of the 3-month intervention (see box below). Some measurements will be collected from all children ("main study"), whereas additional measurements will be collected on a voluntary basis ("substudy-I" and "substudy-II"). After the 3-month intervention, children and parents in both groups will not receive any further instructions, regardless of which group the child has been assigned to, and 6 months later (at month 9), some measurements will be repeated to evaluate the long-term effects.



What do you get out of participation?

Every child will receive detailed health examinations related to their body weight homeostasis and learning abilities.

Is there any risk from participation?

There are no known serious risks from participating in the project, although we cannot exclude the possibility of unforeseen risks. When taking a blood sample, there may be mild pain and a very small risk of infection. The project has been approved by the Scientific Ethics Committees of the Capital Region by Journal-nr.: H-23063352 and follows current ethical guidelines. Information

regarding study participants is protected according to the General Data Protection Regulation/ GDPR www.retsinformation.dk.

2. Why are we doing this study?

Aim of the study

The primary aim of this project is to assess the effects of sleep extension by 60-90 min/night (achieved by going to bed earlier in the evening) on body weight regulation (adiposity) and learning ability in school-aged children who have a BMI (body mass index) for age and sex above average and sleep less than recommended for their age (≤9 hours/night).

Secondary aims include evaluating a variety of physiological processes that could explain the effects of sleep extension.

Background for the study

Overweight during childhood (i.e. having excess body weight for a given age, sex, and height) might have negative consequences for the child's physical health, mental health and well-being. Moreover, childhood overweight might continue into adulthood (i.e. overweight children are more likely to become overweight adults), which in turn has multiple long-term negative health effects and adverse social outcomes.

Observational studies consistently find an association between short sleep and obesity in all age groups and both sexes. Several mechanisms have been implicated in this association that include both biological pathways (e.g. change in appetite hormone levels) and behavioural pathways (e.g. more time being awake presents more opportunities to eat).

Obesity and shortened sleep are also associated with compromised learning abilities and suboptimal school performance at school, likely because inadequate sleep adversely affects cognitive processes such as attention, language, reasoning, decision making, learning and memory.

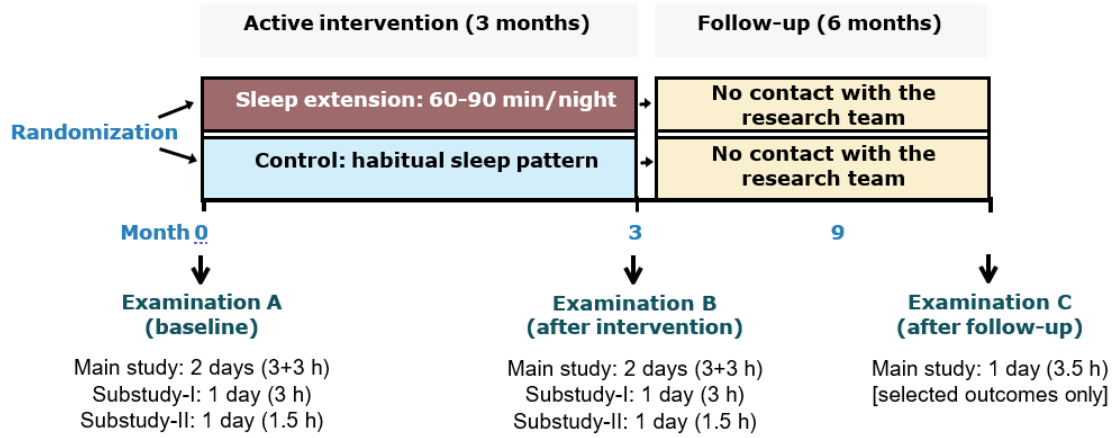
Despite the well-documented consequences of obesity for children's health and psychosocial functioning on one hand; and the strong links between insufficient sleep, obesity, and cognitive functions on the other, very few experimental studies have been conducted to examine the potential beneficial effects of sleep extension in school-aged children. In other words, we know that short sleep is linked to unfavourable health outcomes in children, however, we do not know if extending their sleep will improve these outcomes.

3. How are we going to do the study?

Study design

This will be a two-group study, lasting a total of 9 months, including 3 months of "active intervention" (sleep extension or control) and 6 months of "inactive" follow-up (no contact with the research team). A total of 300 children will participate.

The overall design of the study is summarized in the figure below.



Participants

Your child can participate if all the following criteria are met:

- Aged between 6-12 years old
- BMI for age and sex above average *(we can help you assess this if you tell us your child's height, weight, date of birth and biological sex, via phone or email)*
- Sleep less than the recommended (9 hours or less per night)
    - Sleep duration at this stage will be evaluated by parental self-report

However, your child *cannot* participate if one or more of the following criteria are met:

- Has any genetic, neurological, endocrinological or other chronic condition that affects growth, metabolism, eating behaviours, cognitive function, or body weight
- Has any sleep-related disorder
- Has a regular use of prescribed or over-the-counter medications that influence study outcomes
- Has an irregular school schedule
- If a child's parents live separately, the child is allowed to sleep at both households. However, if one of the parents does not wish to carry out the sleep intervention and follow given instructions, then the child should only sleep at their household Friday, Saturday and/or Sunday night.
- In the circumstance where the child does not speak or understand Danish, the child's parents do not have to speak or understand Danish, as long as both parties can speak and understand English.
- Participates in other research studies at the same time
- Additional exclusion criteria for the optional substudy-II include claustrophobia and having metal objects implanted in the body (e.g. pacemakers, insulin pumps, orthopedic metal plates)

These inclusion/exclusion criteria will be evaluated by the research team during the screening visit.

Allocation to study groups

Your child will be randomly allocated to a sleep extension group or a control group. You cannot select the group you want; instead, there will be 50% chance your child will be allocated to one

group or the other (i.e. like flipping a coin). This process is called “randomisation” and will take place after the baseline measurements are completed. You can only select whether your child will participate only in the “main study”, in addition to the optional “substudies”, as long as there are available places in the studies.

Duration

The “active” intervention period (sleep extension and control) will last a total of 3 months (12 weeks). This will be followed by a 6-month “inactive” follow-up, meaning that you will not receive instructions during that time, and there will be no contact with the research team. The purpose of the follow-up is to understand how sustainable the sleep extension intervention is and its effects. You and your child will be involved in the study for a total of around 10 months, incl. the information meeting, screening visit, measurement days and the follow-up period.

Examination days

Measurements from your child, obtained by a variety of physiological tests, and information from you and your child, obtained by questionnaires, will be collected before and after the active intervention (month 0 and 3). Selected measurements will be collected again after the follow-up (month 9). Refer to examinations A, B, and C in the figure on the previous page. After you have read this information material and participated in the information meeting, you can decide whether your child will participate only in the main study (the minimum requirement), or also in substudy-I or substudy-II, or in both substudies.

The measurements for the main study will span over two consecutive days (approx. 6 hours total), so you will have to visit our facilities on two consecutive mornings. The measurements for substudy-I (3 hours) and substudy-II (1.5 hours) will require separate visits to our facilities. If your child participates in both substudies, these visits can be combined in one day (which will require visiting two different locations). At month 9, after the follow-up, only selected measurements from the main study will be performed. This examination will last approximately 3.5 hours. Please note these time estimates do not include transportation.

4. What will happen if you participate? Study events step-by-step

In the following sections, the various activities which require your and your child’s participation throughout the project are explained in detail, following a chronological order.

Information meeting

You and your child will be asked to participate in an mandatory information meeting, conducted in the premises of NEXS, University of Copenhagen (Nørre Allé 51, 2200 København, or Rolighedsvej 26, 1958 Frederiksberg C), which lasts about 1 hour (not including transportation), during which you will receive information about the project, its purpose and nature, the events and examinations involved, and any other activities that are going to take place. This meeting will be held by one or more qualified members of the research team and will take place individually (if requested) or in smaller groups with up to 10 adults from the same or different families, representing 5-10 participating children. You and your child will have the opportunity to ask questions, both in the presence of others and privately. We suggest that you read this written material in advance, and discuss this project with your child, and note down any questions that might come up.

Furthermore, we recommend that you use this participant information throughout the study as a guide to the study itself, the individual examinations and the study days, if you choose for your child to participate.

Informed Consent

If you and your child decide to participate in this project, you will be required to sign an informed consent, and your child will be required to provide verbal assent. There will be options to consent for the main study, substudy-I, substudy-II or both substudies. Both guardians must provide their consent by signing. However, it is possible for one parent to give the other power of attorney to sign on behalf of both. This will be witnessed and documented by one or more members of the research team. Signing the informed consent can be done at the end of the information meeting or, if you need to think about it, at any time after the information meeting, within 1 week. You will also have the option to provide your consent electronically. Only then will your child's suitability be evaluated, according to all inclusion and exclusion criteria ("screening"). This means that there is a chance your child will not be eligible for the study, even after you have provided consent.

If you and your child decide to participate, it is possible to withdraw your consent at any time point during the study, without any consequence, by reaching out to the research team. In this instance, we will ask you to visit our facilities for an "early termination visit", which will be identical to examination B (if you withdraw during the first 3 months of active intervention) or examination C (if you withdraw during the subsequent 6 months of inactive follow-up). However, it is completely voluntary if you wish to comply with our request. The description of these visits is provided below.

In addition, there are some circumstances that may arise during the study that can make us decide to terminate your child's participation; for example, due to safety-related reasons or because of significant non-compliance (if you refuse to follow the research team's instructions). You will be given a detailed explanation if this happens.

Finally, the Principal Investigator reserves the right to terminate the study at any time. Conditions that may warrant termination of the entire study may include but are not limited to: failure of the study centres to enrol participants at an acceptable rate; new information about the intervention, at any moment during the study, causing doubt about the benefit/risk ratio; a decision at the discretion of the Principal Investigator to discontinue the study for any reason.

No study-related procedures will be performed on your child until you have given your consent.

Screening

During a visit to our facilities, we will measure your child's height, weight and collect information about their sleeping habits and medical history. This information will allow us to determine your child's eligibility. This visit will take place at our facilities at Nørre Allé 51, 2200 Copenhagen, and will last up to one hour.

Randomisation

Once eligibility is confirmed, your child will be randomised by a third-party, not involved in the conduct of the project to one of two study groups: a sleep extension group or a control group. There is a 50% chance to be assigned to one or the other group. The assigned group will be revealed to you, by the study team, after the baseline examination (visit A) is completed.

Examination A (baseline, month 0)

All children (main study): During two consecutive morning visits to our facilities in the **fasted state** (i.e. without your child having eaten breakfast; up to 2 glasses of water is allowed), we will measure your child's height and weight, body fat content (DXA scan), learning and memory skills, brain activity patterns, sleep duration and quality, cognitive and school performance, motor skills, dietary and physical activity habits, and various well-being/quality of life parameters. Vital signs (blood pressure, heart rate, and temperature) will be measured, and a fasting blood sample (10 mL, equivalent to about 2 teaspoons) will be collected. These visits will take place at our facilities at Nørre Allé 51, 2200 København, and will take around 3 hours on the first day and 3 hours on the second day.

Children who also participate in substudy-I: In addition to what is described above for the main study, upon arrival on the first day, we will collect a urine sample (~10 ml) from your child. At the end of the same day, your child will drink approximately 50 ml (equivalent to half a glass) of "heavy water", which is a non-invasive method to accurately measure the calories your child burns over the course of a day (i.e. so-called total energy expenditure). This method is safe to use in children. On the morning of the second day, we will collect another urine sample (~10 ml) and provide containers to collect 6 more urine samples (~10 ml for each sample) at home over the next 2 weeks. These 6 urine samples should be stored in your freezer until they are needed for a physical visit, at your convenience. On the day of the visit, the samples must be taken out of the freezer and placed in a cooler bag with cooling elements, which will be given to you, so that the samples can be kept cold.

At some point during the period when the urine samples are collected, you will be asked to visit our facilities at Rolighedsvej 26, 1958 Frederiksberg C, again with your child in the **fasted state**, to complete a meal test. This visit will involve measuring your child's resting metabolic rate (i.e. the number of calories your child burns at rest) and registering feelings of appetite/hunger before the meal. After your child has consumed the breakfast meal, your child will have his/her metabolic rate measured again and his/her feelings of appetite/hunger will be recorded. The test will approximately last for 2 hours and at the end, a blood test (10 ml, equivalent to approximately 2 teaspoons) will be obtained from an arm vein. Overall, this visit will last approximately 3 hours.

Children who also participate in substudy-II: In addition to what is described above for the main study, you will be asked to visit the Danish Research Center for Magnetic Resonance (DRCMR) at Hvidovre Hospital, Kettegård Allé 30, 2560 Hvidovre (in the MRI department, section 340). Your child does not need to be fasting for this visit. This visit will last a total of 1.5 hours. During this visit, brain structure, -activity and -connectivity will be measured by magnetic resonance imaging (MRI), which is a non-invasive imaging method with no known biological risks and is therefore safe to use in children.

3-Month active intervention

After the baseline examination is completed, the 3-month "active" intervention will begin. If your child is assigned to the sleep extension group, you will receive a behavioural intervention that will focus on putting your child to bed earlier, by 60-90 minutes every night for 3 months. This will be facilitated over a total of six counselling sessions, which can be either physical or virtual, where we will provide you with behavioural tools and techniques to help you implement this change and overcome challenges. It is important that you only change your child's sleep habits (bedtime) and do not directly change your child's food intake or physical and sedentary activities during the day.

If your child is assigned to the control group, you will be asked not to make any changes to your child's sleep pattern. You will still attend the same number and frequency of counselling sessions, however, with a focus on the child's general well-being, and the use of the tools and registrations/logs that has to be filled in during the study.

Regardless of which group your child is assigned to, you will also be asked to keep a detailed sleep diary (in weeks 0, 5 and 12 and the week before study C). You will receive automatic SMS reminders about this.

Examination B (end of the active intervention, month 3)

Examination B will take place after the end of the 3-month intervention period, and will be identical to examination A.

6-Month inactive follow-up

After the completion of examination B (month 3), you will not receive any further instructions on changing your child's sleep habits and you will not have any further contact with the research team. We call this period an inactive follow-up period. However, we encourage you to continue to put your child to bed 60-90 minutes earlier, as during the active intervention period. You will be asked to return to our facilities for another study day, 6 months later. Prior to this visit, we will send you a research watch so that a final measurement of your child's sleep and physical activity level can be made. The aim of the 6-month inactive follow-up period is to assess whether the sleep extension period and its effects on important health parameters in children have a long-term effect.

Children, who also participate in the substudy-I: After collecting 6 urine samples (~10 ml each) at home over 2 weeks, the samples should be stored in the freezer. These should be brought to a short visit during the follow-up period at your convenience. On the day of the visit, the samples should be taken out of the freezer and placed in a cooler bag with cooling elements, which will be provided to you, to keep the samples cold.

Examination C (end of inactive follow-up, month 9)

During a morning visit to our facilities, again with your child in a **fasting state** (i.e., without your child having eaten breakfast; up to 2 glasses of water are allowed), we will measure your child's height and weight, fat mass (DXA scan), vital signs (blood pressure, heart rate, and temperature), cognitive and school performance, motor skills, dietary and physical activity habits, and various well-being/quality of life parameters. No blood will be collected. This visit will take place at our facilities at Nørre Allé 51, 2200 Copenhagen, and will last approximately 3.5 hours.

5. Measurements and tests

5.1 Main study

Body weight and height

Your child's height and weight will be measured twice, with your child wearing underwear, a poncho, provided at the testing site, and without shoes (with you present in the room). This will be done using a calibrated digital scale and a wall-mounted stadiometer, respectively. The body mass index (BMI) will then be calculated as weight / height^2.

Body fat content

Percentage of body fat will be calculated from body composition data (fat mass, soft tissue lean mass, and bone mineral content) obtained by dual energy X-ray Absorptiometry (DXA; see photo). A whole body DXA scan lasts 10- 15 min. During the scan, your child will need to remain still on the scanner platform bed, while the scanner arm moves from the head to the direction of the toes.

Billedkreditering: University of Bristol (https://www.bristol.ac.uk/)

Dietary intake

You and your child will be asked to recall and register in a chronological order all foods and drinks consumed by your child for 3 days, using an online tool on your computer or your mobile phone. Calorie and macronutrient intakes (fat, carbohydrate, and protein) will be estimated via an online dietary assessment tool which is available in Danish (my- food24.org/da) - but also in English, German, French, Spanish, Norwegian and Arabic - and has been validated for use in children.

Physical activity and sleep

Daily physical activity and sleep-wake monitoring will be collected in real time using "actigraphy", which means "activity counting". During the 3-month active intervention, your child will wear a waterproof research watch on their non-dominant wrist at frequent intervals (at weeks 0, 5 and 12) for 24 hours a day for 1 week (7 days and 8 nights), which collects data automatically (see image).

Billedkreditering: Somnomedics (https://somnomedics.de/)

Blood parameters

Blood samples (10 ml of blood, equivalent to 2 teaspoons) will be taken and analysed for blood sugar, cholesterol, triglycerides, sex and appetite hormones, and inflammatory markers. For children participating in substudy-I, an additional blood sample will be taken 2 hours after consuming a meal.

Two EMLA patches will be given to each child for each blood sample collection, along with oral instructions at the screening visit. EMLA patches contain a local anaesthetic that can numb the skin surrounding the injection site, reducing any discomfort. Parents are to apply the patches at home, the morning prior to the examination.

Learning skills and retention ability

Learning and retention will be assessed by using a computer-based task, requiring both speed and accuracy. Performance on the task will be measured at the beginning, followed by a training session. Performance on the task will be measured again immediately after the training session to evaluate "learning" and again the next day to evaluate memory retention. Memory will be assessed by presenting your child with a list of everyday objects and animals, which they must remember immediately after seeing the list and the day after.

Cognitive and school performance

Cognitive function and school performance will be evaluated by using standardised computer/tablet-based tests of attention, working memory, processing speed, and math and reading comprehension. All these tests are commonly used in this age group.

Brain and muscle activity patterns

Brain activity patterns will be measured at rest, during learning and during cognitive performance testing by use of full-cap electroencephalography (EEG) and electromyography (EMG) (see photo). These techniques record brain electrical activity through electrodes placed in a cap, covering the head (see photo). Additionally, electromyographic recordings (i.e. measurement of electrical activity in muscles) will also be obtained from two hand muscles during practice of the learning task (see photo). These techniques are commonly used in children of this age and have no known risks.

Billedkreditering: Københavns Universitet (Bevægelse og neurovidenskab – Københavns Universitet)

Sleep quality, architecture, and patterns

Sleep quality and architecture will be evaluated at home, overnight between the first and second day of the main examination visit, by a technique called polysomnography (PSG) (see photo). During the first day of the study, you will be instructed on how to apply the electrodes to your child's head and begin recording using a tablet the same evening before your child goes to bed. Data will then be recorded automatically until you remove the electrodes from your child's head the next morning. Sleep quality will be assessed by a combination of self-reported measurements and objective measurements of e.g. sleep/wake patterns.

Billedkreditering: Somnomedics (https://somnomedics.de/)

Mental health and overall well-being

Measures of mood, tiredness/fatigue, subjective sleepiness and circadian rhythms will be collected by using questionnaires completed by your child alone or together with you, during the main visit to our facilities.

Motor skills

Motor skills will be evaluated as fine motor control in a pegboard test and handgrip strength.

Socioeconomic status

Parameters such as family income, education, employment status, as well as ethnic and immigrant backgrounds, will be collected by self-report on a demographic's questionnaire filled out at screening. You will have to answer on behalf of both you and your partner.

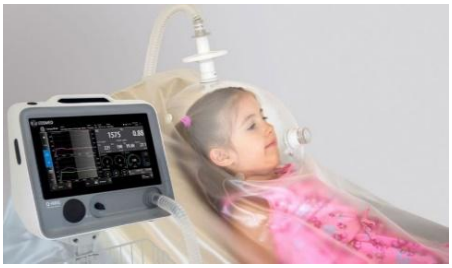
Puberty Stage

Puberty stage will be evaluated using a standardised questionnaire regarding the development of your child's genitals and pubic hair, which you, as parents, must complete for examinations A, B and C.

5.2 Substudy-I

Energy expenditure

Resting metabolic rate (i.e. the number of calories your child burns at rest), postprandial thermogenesis (i.e. the number of calories your child burns after eating a meal), and total energy expenditure (i.e. the number of calories your child burns throughout the day), will be measured by a combination of methods.



Billedkreditering: Cosmed (https://www.cosmed.com/)

Resting metabolic rate and postprandial thermogenesis will be measured by a method called indirect calorimetry during fasting and at 1 and 2 hours after eating a meal. On each occasion, this involves breathing normally for 25 min under a clear plastic hood (see photo).

Total energy expenditure will be measured by the "heavy water" method. This involves drinking a dose (50 mL) of water enriched with two heavier isotopes – a natural variation of the normal forms of oxygen and hydrogen. These isotopes of oxygen and hydrogen are stable (i.e. not radioactive) and are normally present in nature (including the human body) in very small amounts and are safe for use from infancy onwards. Urine samples (~10 mL each) will be collected to measure the concentrations of these isotopes before (natural occurrence) and after dosing (2 samples in our facilities, during examination A, and 6 more samples at home over the subsequent two weeks).

Sensations of appetite/hunger

Self-perceived perceptions of appetite/hunger will be obtained by using an image-adapted scale for school-aged children, before (fasting state) and again at 1 and 2 hours after (fed state) consuming a meal. Your child will be asked to point to an image that reflects how hungry or full your child feels.

5.3 Substudy-II

Brain structure, activity and connectivity

Anatomy of the brain will be evaluated by magnetic resonance imagining (MRI; a scanning device creating a magnetic field; see photo). Your child will be accustomed to the scan environment in an MRI simulator (~30 min). MRI is a non-invasive imaging method with no known biological hazards and is safe to use in children.The scanning protocol we use has been well tolerated by children in previous studies. The scanning will last up to 50 minutes and the total visit will last about 1.5 hours. Your child will be allowed to watch a movie during the process.

Billedkreditering: Getty imagines (https://www.gettyimages.dk/)

6. Research biobank

A research biobank will be set up in the context of the current trial. Its purpose is to store biological material from the trial (blood and urine samples) until it is analysed (estimated by 31 December 2031). After that time, the research biobank will the destroyed. A maximum of 20 mL of blood (from all children; main study) or 40 mL of blood (from children who participate also in substudy-I) will be collected and stored. In addition, 8 urine samples (total ~16 0 mL) will be collected twice from those children who participate in substudy-I. Collected biological material will be post-processed and stored in the freezer until further analysis. The research biobank is maintained at -70°C freezers at the Department of Nutrition, Exercise and Sports (NEXS), University of Copenhagen. Biological material will be analysed at NEXS and in other laboratories in Denmark and Europe. Urine will be analysed in a laboratory in the Netherlands; and excess urine will be discarded. Everything will be performed according to the Data Protection Act and the General Data Protection Regulation (GDPR). If it becomes relevant to send samples for analyses to laboratories in countries outside the EU, where the GDPR does not apply, this will be notified as an amendment to the protocol filed with the Ethical Committee and the transfer of sample will take place in compliance with the Data Protection Regulation Chapter V.

The biological material will be coded with a participant number, study number, and visit number. This means that all samples will be coded and handled in such a way that they cannot be traced back to your child without a key. The key will be kept under special protection and only accessible to authorised personnel. The key will be stored until 10 years after the last participant has completed the last day of the study (estimated to be December 31, 2036) and will be destroyed after this date.

If you wish to donate any leftover biological material (only blood) to a biobank, for possible future research use, we will ask you to give a separate written consent for this and the transferred biological material will be destroyed within 15 years after the last participant in the study has completed the last day of the study (May 2041). You will receive independent information about the biobank's content, location, how and when material from the biobank may be used in accordance with applicable law. The use of leftover biological material in future research will also be in accordance with the Data Protection Act and the General Data Protection Regulation (GDPR). If you decide not to contribute to this biobank, any biological material left will be destroyed.

It is entirely up to you to donate your child's leftover biological material to the future research biobank and if you do not want to consent to this, it will not affect your child's participation in the current trial. If the material is used for future research, a new approval must be obtained from the Scientific Ethics Committees of the Capital Region of Denmark, just like the current study. Also, a new consent from you will generally be sought, but the committee may grant dispensation.

The Research Biobank and the Biobank are both registered at the University of Copenhagen on statutory register that must be available to the Danish Data Protection Authority.

7. Ethical considerations and data handling

The independent ethics committee of the Capital Region has reviewed and approved this study (De Videnskabsetiske Komiteer, Region Hovedstaden, Journal-nr H-23063352, Date: 01-02-2024).

All data and other personal information, including biological material (blood and urine), that we collect during the study, will be treated confidentially and only by people associated with the study, who are therefore bound by confidentiality. Persons from the authorities who supervise health scientific trials must have access to all data if they carry out an inspection of the trial. By consenting to participate, you also give permission for these people to have access to your and your child's data, if requested. These people are also subject to confidentiality.

Should you choose to withdraw your consent during the trial, you should know that any data from your child, already collected will be included in the data analysis. Your or your child's name will not appear on any material and will instead be assigned a participant number or ID. Likewise, names or other identifying information will not appear in any reports or other publications of results from this study.

Separate from this participant information, you will receive both verbal and written information about the processing and storage of both data and biological materials and biobank.

The data relating to participants of health research studies is protected under the Data Protection Act and the General Data Protection Regulation/GDPR (see www.retsinformation.dk). The project is registered at the University of Copenhagen on statutory register to the Data Protection Authority.

8. Are there any risks associated with participation in this study?

Participation in a clinical research study interferes with everyday life, particularly for families with small and younger children, as it requires time to be set aside to comply with the procedures of the study, and some procedures may be associated with a risk.

Overall, no serious risks are expected from participation in this project, although we cannot exclude the possibility of unforeseen risks. Similar studies have been conducted previously in children and adolescents - both with respect to the nature of the intervention (manipulation of sleep duration) and with respect to the measured outcomes (body weight and composition by dual-energy X-ray absorptiometry, cognitive function/school performance by standardized tests, brain structure and activity by functional MRI, energy expenditure by indirect calorimetry

and doubly-labelled water, sleep and physical activity by accelerometery) - without noticeable risks or adverse events.

Blood samples

Collection of data in the present study involves venous blood sampling. A minor risk of slight pain during injection of the needle is present, and the procedure may leave a minor bruise at the place of injection. This will disappear within one to two days. The blood samples will be taken by staff who are trained or have extensive experience in taking blood samples from children. You will be provided with local anaesthetic patches to apply on your child's arms in the morning.

Dual energy X-ray Absorptiometry (DXA scanning)

A DXA scanner will be used for the assessment of body composition, 3 times during the study, once at every visit (baseline, after the 3-month intervention, and after the 6-month follow-up). The scan is an X-ray examination, but the amount of ionising radiation the children will be exposed to is very small and accounts for only 0.011 mSv for a whole-body DXA scan. As a comparator, the radiation during a chest X-ray is 0.1 mSv, and in Denmark the yearly background radiation is 3 mSv, which accounts for daily radiation of 0.008 mSv. This translates to a radiation exposure equivalent to about 33 hours of exposure to the natural background radiation on Earth. For adults, the increase in risk of radiation-induced cancer is 5 % per 1 Sv, hence the increase in risk associated with a whole-body DXA scan is 0.000055%.

Heavy water

This method is safe for use in humans of both sexes and all ages, including infants. This method uses "heavy" water, i.e., water enriched with two stable (i.e. not radioactive) isotopes of oxygen and hydrogen, which are normally present in nature and the human body. When a dose of "heavy" water is ingested, the level of the specific isotopes in the body's water content temporarily rises to about 1/600 (i.e. 0.17%) of the level where there would normally be concerns about side effects or toxicity. The dosage of "heavy" water consumed in connection with this study is therefore within a safe limit.

Magnetic resonance imaging (MRI)

MRI is a safe medical imaging procedure that can be conducted even on a daily basis for diagnostic purposes. The MRI scanner is a powerful magnet that creates images of the body's tissues and internal organs using radio waves. Therefore, there is no radiation-associated risk with individual or repeated scans. Before scanning, children will be accustomed to the scan environment in an MRI simulator. Since MRI involves exposure to a magnetic field, it is important that children bring no jewellery or other metal into the scanner. It is also important that they have no implanted metallic objects in the body (e.g. pacemakers, insulin pumps, pace- makers, orthopaedic metal plates). The scanner is noisy and therefore, children will be provided with earplugs and earmuffs. To undergo MRI scanning, your child must not suffer from claustrophobia as your child's head will be fixed with a brace to avoid movement of the head, and there is limited space in the scanner.

In this project, the scan is not used for diagnostics, but since we see an image of the anatomical structure of your child's brain, in rare cases we may find some abnormal changes that were not previously known and that may have health significance. It is the practice of the

MR Research Section to inform about such findings, which means that in this case you will be contacted by the medically responsible doctor in the study. You will be informed about the finding and that information about the finding will be passed on to your family doctor and/or relevant hospital department (GDPR information). However, it is emphasised that the MRI scan conducted as part of the study is not performed as an actual diagnostic scan or health check. It therefore cannot be ruled out that a diagnostic scan would have revealed abnormalities that we cannot see on a research scan.

Other risks

Detailed, objective information on the whole spectrum of daily behaviour's - including sleep and physical activity - will be collected by a wrist-worn waterproof device (actigraphy) which may cause some irritation of the skin or even interfere with some activities of daily living.

There are no risks associated with electroencephalography (EEG), electromyography (EMG), and polysomnography (PSG). In very rare cases, there may be temporary irritation from the electrodes used for the measurements. Some children may experience some minor physical discomfort during EEG. When the electrodes are prepared for placement, it is necessary to use a cotton swab to move the hair away from the electrode and to clear the skin, to achieve optimal contact between the scalp and the electrode. There may be a slight and temporary reddening of the skin from this procedure. A conducting gel will be used to optimise the scalp-electrode contact and, although these gels are hypoallergenic, they can in rare cases result in allergic reactions. A small skin test will be performed before commencement the actual measurement to minimise this risk. If the child is allergic to the electrodes of the EMG or PSG, the measurements will not be performed.

The EMLA patch may cause redness and itching where the patch has been applied. This skin irritation disappears after a few hours.

These are no risks associated with the behavioural tests for cognitive abilities, motor skills or school performance, and the filling of the various questionnaires.

9. What are the benefits from this study?

For science and society

This project has the potential to provide definitive evidence on the effects of sleep extension in children's health and well-being. The impact of this research is multidimensional. In terms of research, this project will represent a milestone and a reference point for future studies of sleep manipulation in the fields of childhood obesity, neurophysiology, and cognitive function. In terms of clinical practice, this project has the potential to help develop sleep-based treatment strategies or inform future sleep recommendations for school-aged children who are short-sleepers. Perhaps more importantly, in terms of societal impact, this project will provide an easy way for parents to improve their children's body weight status, learning abilities and school performance, which is something that will accompany them for the rest of their lives.

For you and your child

Aside from the above contributions to the advancement of science and the bettering of society, there are also some direct gains for you and your child. All children will receive a thorough and

detailed assessment of a variety of physiological and cognitive processes. These include, but are not limited to, an evaluation of body composition; an evaluation of the cardiometabolic risk factor profile; sleep duration, energy intake and expenditure (i.e. calories consumed and burned); an evaluation of learning ability and memory retention. Please note that this information has value only in research settings and cannot be used by you or a medical professional to drive clinical decisions.

In addition, there will be compensation for you and your child, corresponding to the time and effort that your child and your family invest.

- After completing the 3 study rounds in the main study (A, B and C), your child will receive a flexible gift card of 250 DKK per study round. The number of gift cards will therefore depend on the number of completed study rounds.
- After completing the 3-month active intervention (completion of study round B) in the main study, your child will receive a commercial smartwatch (estimated retail price of 500 DKK). In the event that the study is terminated early or if you withdraw before study round B (the end of the active intervention), your child will not receive the smartwatch.
- If your child participates in one or more of the substudies, upon completion of both study rounds (A and B), he/she will receive a flexible gift certificate of DKK 750 for each study (i.e. if your child completes both “sub-study I” and “substudy-II” you will receive a gift certificate of DKK 1500). In the event that the substudy is terminated early or if you withdraw before study round B, your child will not receive this/these gift certificates.

The smartwatch and the gift certificates are taxable, and you must report the value of these to the Danish Tax Agency.

10. Insurance and complaints

Participants are covered by the Occupational Injuries Insurance Act (cf. LBK no. 977 09/09/2019) in accordance with the insurance conditions in force at the University of Copenhagen. Throughout the project, you will be covered by the Act on Complaints and Compensation in Health Care (cf. LBK no. 995 14/06/2018, www.retsinformation.dk).

11. Project economy

More2Sleep is initiated by Professor Faidon Magkos, NEXS, University of Copenhagen, and is funded by the Novo Nordisk Foundation (~25 million DKK). The amount for the project is deposited in an independent research account, which is subject to public audit. The funding includes salaries for project staff as well as for consumables and project execution. The funder has no influence on the execution of the project, analysis of samples, interpretation of the results, or publications arising from this study. None of the researchers and project staff have financial associations with the funder.

12. Publication of results

This study is registered at www.clinicaltrials.gov, an international registry database of human clinical studies (Ref no NCT06341179). The results of the study, whether positive, negative, or inconclusive, will be published in peer-reviewed international journals and at scientific meetings. When the results are published, it will not be possible to identify you or your child in any way.

13. Participation in More2Sleep

If, after reading this information, you are interested in your child participating in this project, you must attend a non-binding information meeting at our facilities together with your child. Your child can participate in the project only if both of you have attended the information meeting. These meetings may be conducted individually (if requested) or with up to 10 adults from the same or different families, representing 5-10 children's participants (i.e. you can bring along your partner or a close friend). At that meeting, you will receive detailed information about the project and will have the opportunity to ask any questions you may have.

If, after the information meeting, you still wish for your child to participate in the project, you must sign a written consent form, and your child must assent verbally. Both should be witnessed and documented by a member of the research team, who will also give you a copy of the consent form. You have the right to take more time at home (up to 1 week) to think about the study before signing. By signing, you give your consent for your child to participate in the study. Participation is voluntary and you and your child may withdraw consent at any time without any explanation and with no consequences.

At the information meeting and during the study visits, you will meet people employed at NEXS (University of Copenhagen), Danish Center of Sleep Medicine (Rigshospitalet) and possibly the Danish Research Center for Magnetic Resonance (Hvidovre Hospital) if your child opts to participate also in substudy-II. All members of the staff have previously been involved in conducting trials with children using these methodologies. In addition, students at various levels (bachelor, masters, doctorate) may be involved and will have been thoroughly trained in the procedures of the trial.

We hope that this information has given you enough insight into what it means to participate in the project More2Sleep, and that you are interested in hearing more at an information meeting. We also ask you to read the attached document "Subject's rights in a health science research project" ("Forsøgspersoners rettigheder i et sundhedsvidenskabeligt forskningsprojekt") and "Consent form for the processing of personal data and biological material" (GDPR).

14. If you want to know more

If you wish your child to participate in More2Sleep, or if you have any further questions or would like more detailed information, please contact us!

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