Low carbohydrate diet (GAPS) for children with attention deficit hyperactivity disorder

Silvija Ābele, RFU2017

Study programme "SUSTAINMENT"

Supervisor:**Dace Reihmane,** Assistant Professor, RSU

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VITA BREVIS ARS LONGA

09.06.2021

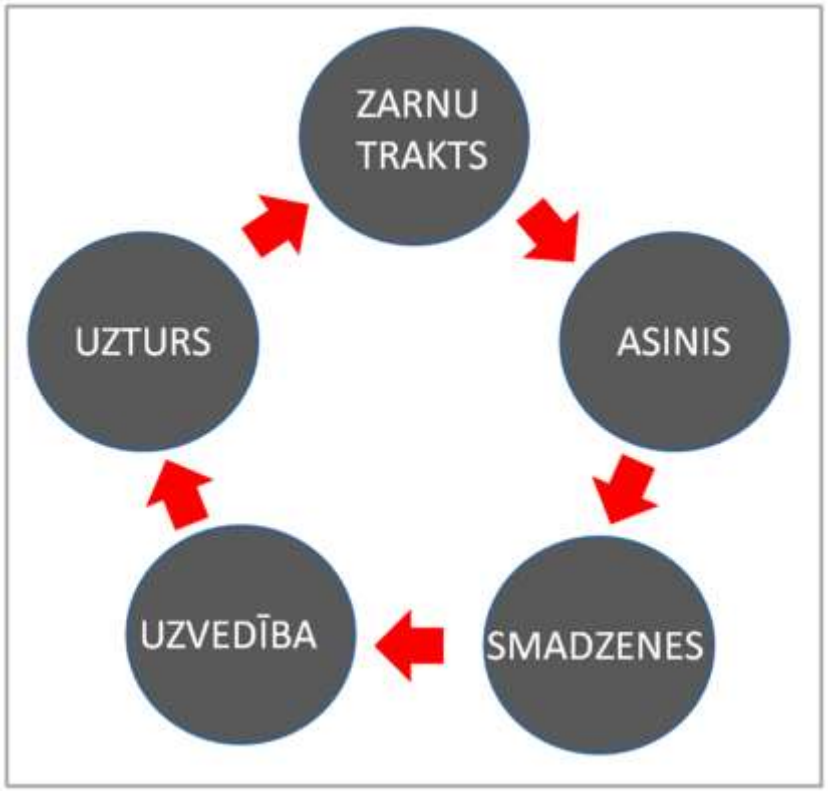
UPDATE
Attention Deficit Hyperactivity Disorder (ADHD)

- ADHD includes several types of attention disorders[1] , which are common in children with
  - excessive motor activity and inability to control impulsive behaviour → hyperactivity
  - inability to concentrate → attention deficit
- Today, 1 in 10 children (9.4%) have ADHD[1]
- ADHD more pronounced in boys than girls[1]
- ADHD is not just a neurological problem or a brain disorder
- ADHD involves the whole body of the child
- The body's biochemistry affects brain functions - behaviour, attention and learning

[1] *Centers for Disease Control and Prevention, USA,* ***2016***

UPDATE
The digestive tract and brain function

- Children with ADHD often have gastrointestinal dysfunction and an altered gut microbiome [2]
- Diet plays a key role in reducing digestive and ADHD symptoms
- Organising menus for children with ADHD can help
  - optimise digestive tract function
  - promote assimilation of nutrients
  - improve children's brain function
  - reduce symptoms of ADHD



Gut - behavioural cycle [3]

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[2] Ming et al. **2018,** Child Neurology Open, 5:1-6
[3] Wasilewska **2015,** Pediatric Health Med Ther, 6: 153-166

Study AIMS

- Investigate whether a diet based on the GAPS* dietary guidelines can reduce symptoms of attention deficit hyperactivity disorder in children
- Investigate whether the prebiotic *Happy Tummy* with Hufulac® in addition to the GAPS diet is more effective in reducing the manifestations of ADHD in children

* GAPS - *Gut and Psychology Syndrome* Diet[4]

- To prospectively evaluate the effect of 3 months of GAPS diet and humic/fulvic acid on
  - Parents' perceptions of children's ADHD symptoms
  - symptoms of ADHD in children and manifestations of chronic stress in children
  - children's digestive tract symptoms as rated by parents
  - nutrient digestion, dysbiosis and the presence of parasites in the intestinal tract, based on faecal analysis in children

HYPOTHESIS

GAPS diet may help reduce ADHD symptoms in children

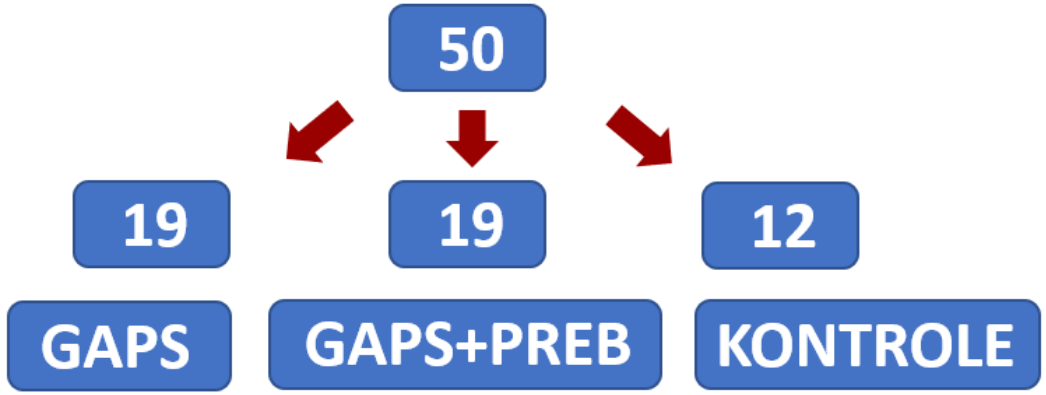
[4] *Campbell-McBride N. **2004**, Gut and Psychology Syndrome: Natural Treatment for Autism, ADD/ADHD, Dyslexia, Dyspraxia, Depression, Schizophrenia*

RESEARCH METHODS

Design

- A quantitative, prospective, case-control study of a nutrition intervention that includes
  - GAPS diet - *Gut and Psychology Syndrome diet* (GAPS) [4]
  - GAPS nutrition + Prebiotics *Happy Tummy* with Hufulac®
- Time - 3 months - 2 January - 31 March 2021
- Participants - 50 children from Latvia (49) and Sweden (1)
  - age 5-13 years
  - 16 children with a diagnosis of ADHD*/ADHD
  - 34 children with symptoms of ADHD*/ADHD, no diagn
  - 7 girls, 43 boys

*UDS - Attention Deficit Disorder



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[4] Campbell-McBride N. **2004**, Gut and Psychology Syndrome: Natural Treatment for Autism, ADD/ADHD, Dyslexia, Dyspraxia, Depression, Schizophrenia

RESEARCH METHODS

Instruments

- Assessing symptoms, digestive function and eating habits in children with ADHD
  - adapted (5) or validated (2) questionnaires - 4 times
  - respondents - parents and children
- Fecal analysis (coprogram, dysbiosis, parasite eggs) - 2 times
- Cognitive tests - www.exploro.lv platform - 3 times - data not included in the Bachelor thesis
  - visual attention
  - speed of response and processing
  - working memory

- Software - *Google Forms* (data collection), *Microsoft Excel 365* (data processing and analysis), JASP 0.14.1 (statistical data analysis)

RESEARCH METHODS

Questionnaires used in the study

- ❑ RSU Ethics Committee approval for the study (25.11.2020)
- ❑ Informed consent signed by parents of children

TO BE FILLED IN BY PARENTS

Participant selection questionnaire (62 questionnaires submitted)

- 6-GSI, *6-Item Gastrointestinal Severity Index* Gastrointestinal symptoms
- DSM-IV / SNAP-IV questionnaire UDHS assessment (80 questions)
- IOWA *Conners Rating Scale* UDS/UDHS assessment (10 questions)
- PGI-2 questionnaire Overall parental assessment

CHILDREN

- ASEBA questionnaire + Behavioural questionnaire[5] Child attention + behaviour
- CSQ-CA questionnaire Children's stress, emotions and well-being
- PACH - Nutrition[6] Children's dietary habits

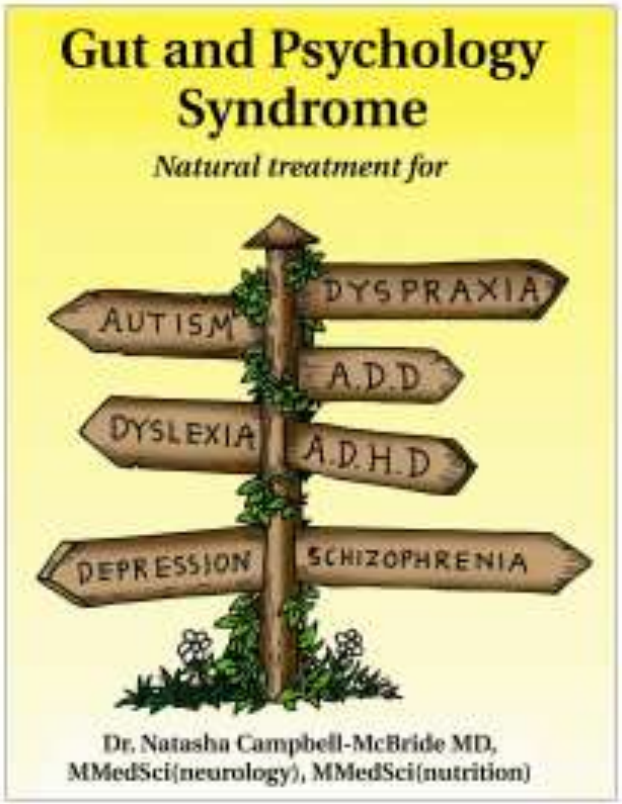
[5] *Vanags and Riekstiņa* ***2018****, Unpublished study*

[6] *Justamente et al.* ***2020****, Nutrients, 12* (12), 3818

RESEARCH METHODS

GAPS Diet

GAPS | GAPS+PREB



SOURCE [4]

COMPLEX CARBOHYDRATES

Disaccharides, Polysaccharides

- Sugar (sucrose)
- Cereals, maize, potatoes (starch)
- Unfermented cows' milk products (lactose)
- Processed food

INCLUDE [4]

- Meat/bone broth
- Acidified dairy products (kefir, yoghurt, sour cream)
- Fermented vegetables (sauerkraut)
- Good fats (olive oil, fish oil, eggs, butter, animal fats, avocado, coconut oil)
- Meat, fish
- Vegetables, fruit, berries
- Nuts, seeds

[4] *Campbell-McBride N. **2004**, Gut and Psychology Syndrome: Natural Treatment for Autism, ADD/ADHD, Dyslexia, Dyspraxia, Depression, Schizophrenia*

RESEARCH METHODS

Prebiotic *Happy Tummy* with Hufulac® GAPS+PREB

- Created in Latvia
  - specifically for the study
  - in cooperation with *Green World Solutions Ou* and Saldus Bakery
  - GAPS compliant - gluten, sugar, starch, lactose free
- Optimises the balance of micro-organisms in the gut
- Helps nutrient assimilation
- Contains natural lignophenol extract from wood lignin and black birch mushroom (chaga mushroom)
- Provides humic acid, fulvic acid, polyphenols, trace elements
- Hufulac®[7] - registered and patented in Latvia
- The study was sponsored by *Green World Solutions Ou*

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[7] *www.blackstuff.world*

RESULTS
FATE ANALYSIS
Coprogramme

- Start of the study
- 21 analyses submitted
- **Difficulty digesting nutrients**[8]
  - Proteins
  - Carbohydrates
  - Fats

REF +	REF + / -	REF + / -	REF -	REF -	REF -	REF -	REF -	REF +
Muskuļu šķiedras izmainītas	Muskuļu šķiedras neizmainītas	Stādu valsts šūnas sagremotas	Ciete šūnās	Ciete ārpus šūnām	Jodofilā mikroflora	Neitrālie tauki	Taukskābes	Ziepes
+	+				+		+	++
		+			-		+	+
+	+	+	+		+			++
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upset stomach and/or pancreatic enzyme deficiency[8]

no starch in normal faeces incomplete starch digestion associated with diseases of the small intestine[8]

bile secretion or pancreatic function Disorders[8]

[8] *E. Swan Laboratory* ***2018.*** *Clinical Manual*

RESULTS
FATE ANALYSIS
Disbioze

- Start of the study
- 15 analyses submitted
- **DISBIOZE**

⬇ Reduced number of good micro-organisms

⬆ Increased number of pathogenic micro-organisms

Fēču izmeklējumi
Disbakteriozes diagnostika

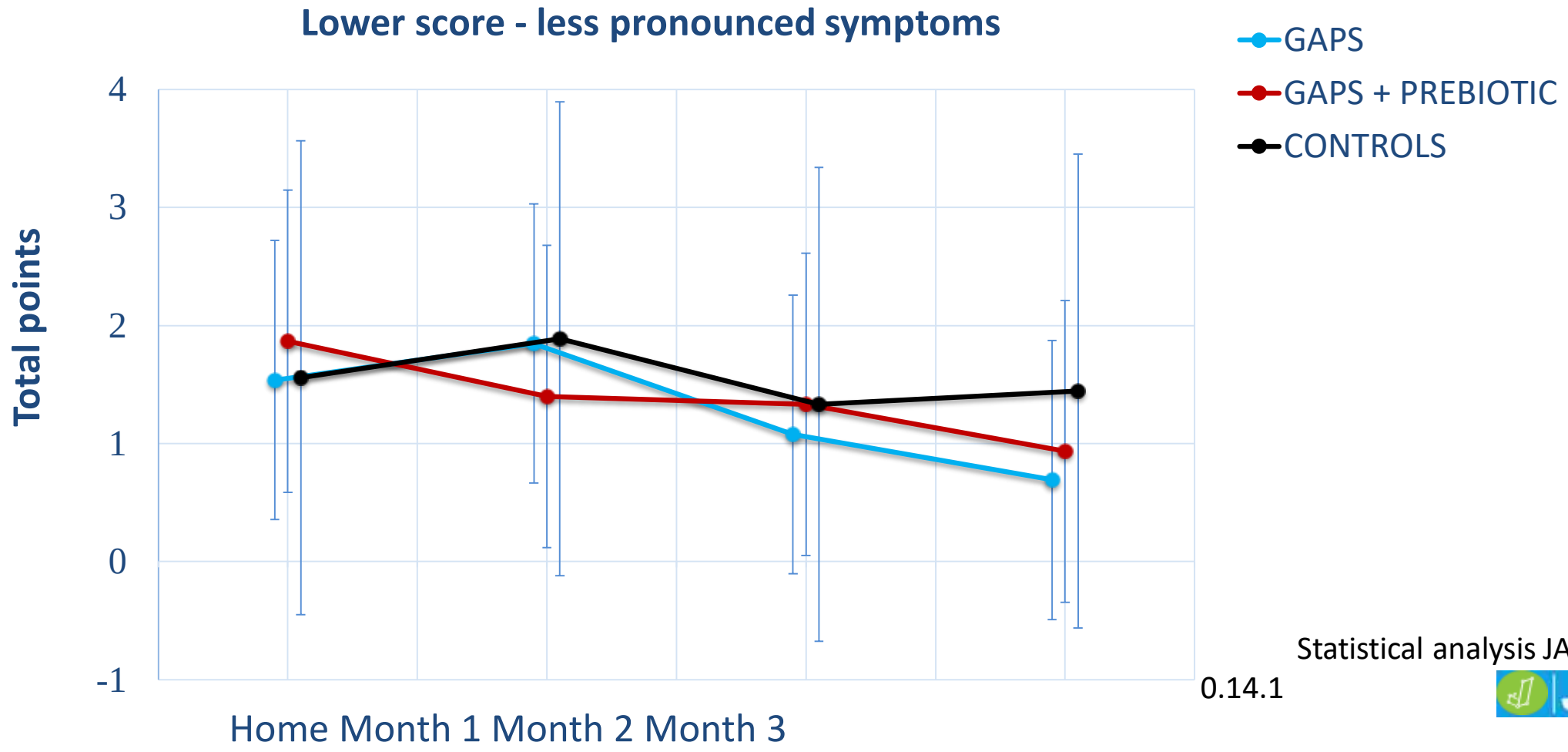
Disbioze .

Nosakāmais rādītājs	Rezultāts	Norma (kvv/g)	
		Pieaugušie	Bērni līd
Patogēnās enterobaktērijas (Salmonella, Shigella ģ.)	0	0	0
Bifidobaktērijas	$2*10^9$	10^8 - 10^9	10^{10} - 1(
Laktobacillus ģints baktērijas	$2*10^8$	$>10^6$	$>10^6$
Kopējais E.coli skaits ⬇	$1*10^6$	10^7 - 10^8	10^7 - 10^8
Laktozes negatīvās E.coli	0	$<10^5$	$<10^5$
Hemolītiskās E.coli	0	0	0
Citas nosacīti patogēnās enterobaktērijas ⬆	Klebsiella pneumoniae $1*10^6$	$<10^4$	$<10^4$
Pseudomonas ģ. bakt. un citas nefermentējošās bakt.	Acinetobacter lwoffi $3*10^5$	$<10^4$	$<10^3$
S.aureus	0	$<10^3$	0
Koagulāzes negatīvie stafilokoki	0	$<10^4$	$<10^4$
Candida ģints sēnes	0	$<10^4$	$<10^3$
Enterococcus ģints baktērijas	0	$<10^8$	$<10^7$

Kvv-koloniju veidojošās vienības.Samazināts kopējais E.coli skaits.Palielināts nosacīti -patogēn enterobaktēriju skaits. Palielināts citas nefermentējošās baktērijas skaits.

RESULTS

Gastro-intestinal symptoms (6-GSI)

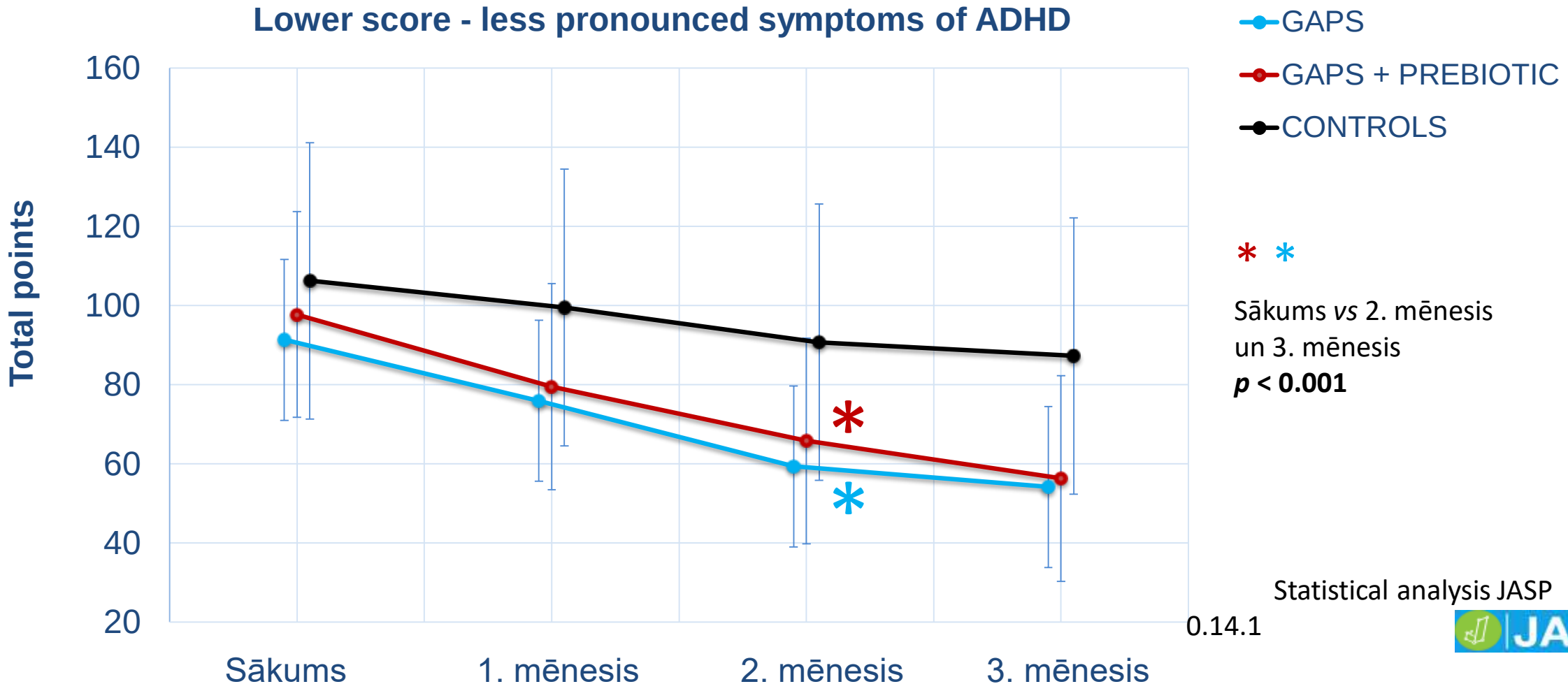


Statistical analysis JASP 0.14.1

*Repeated measures **ANOVA***

RESULTS

ADHD assessment (DSM-IV/SNAP-IV)



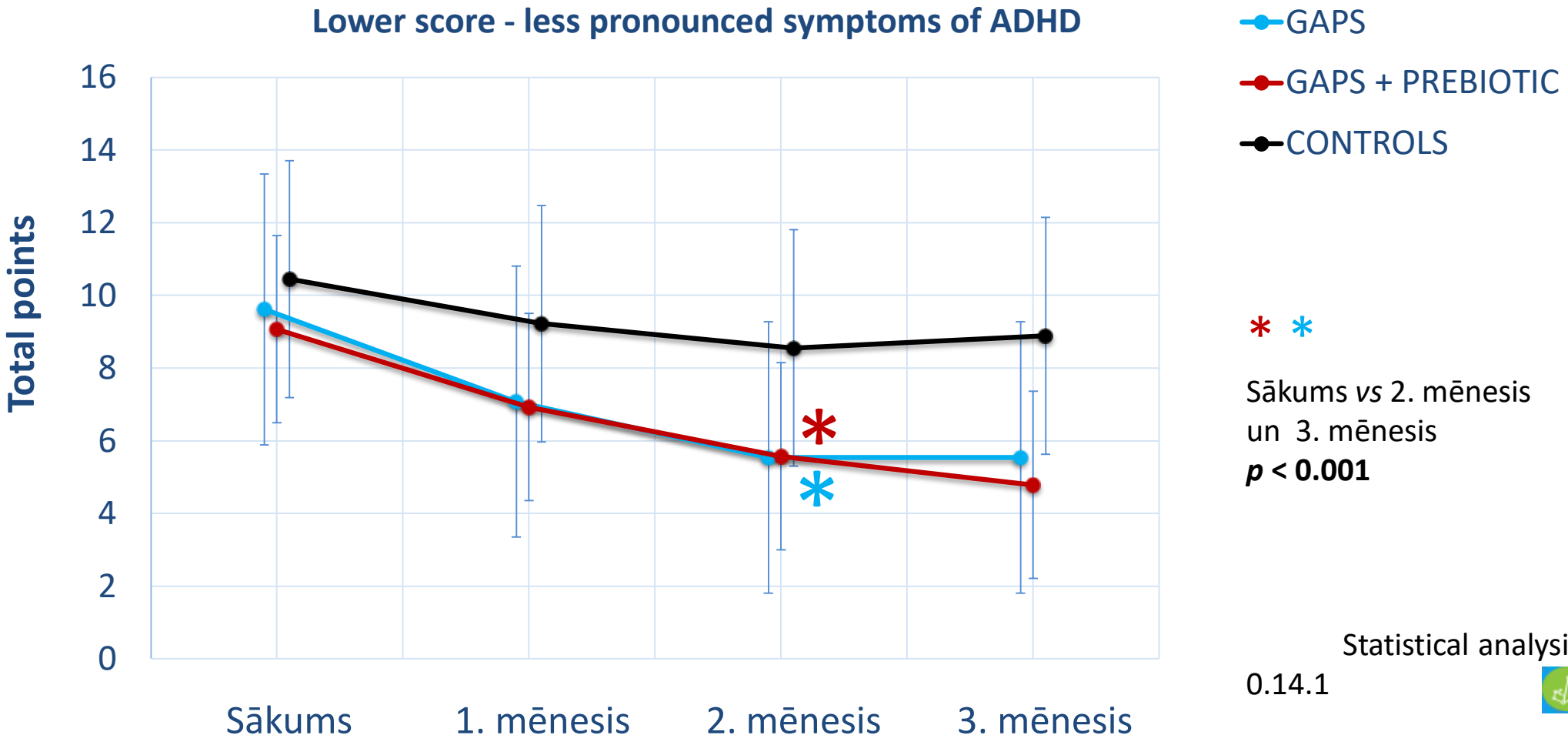
Sākums *vs* 2. mēnesis un 3. mēnesis
***p* < 0.001**

Statistical analysis JASP 0.14.1

*Repeated measures **ANOVA***

RESULTS

UDHS assessment (IOWA)



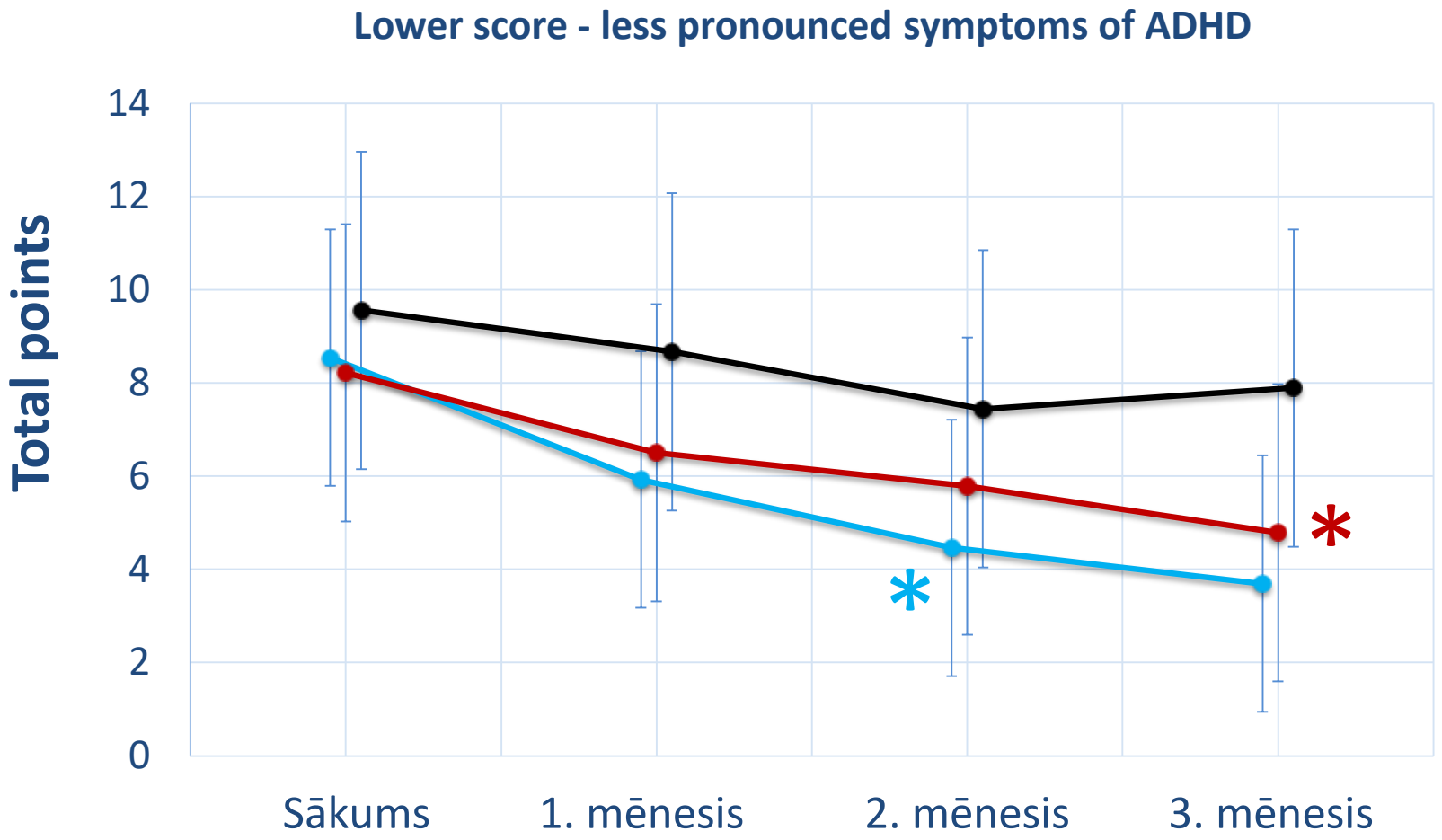
Sākums *vs* 2. mēnesis
un 3. mēnesis
***p* < 0.001**

Statistical analysis JASP
0.14.1

*Repeated measures **ANOVA***

RESULTS

Behaviour (IOWA)



GAPS

GAPS + PREBIOTIC

CONTROLS

* Sākums *vs* 3. mēnesis
***p* = 0.004**

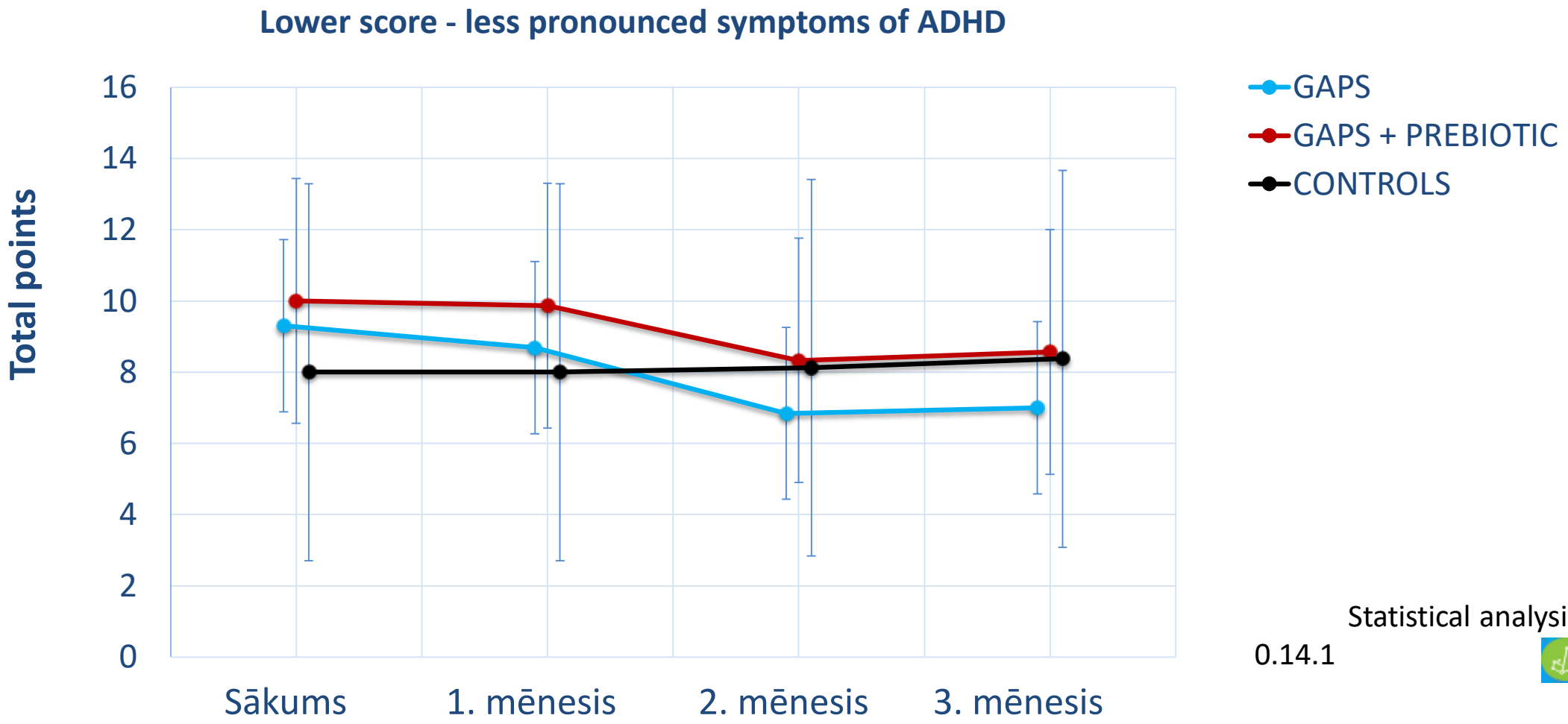
* Sākums vs 2. mēnesis un 3. mēnesis
***p* < 0.001**

Statistical analysis JASP 0.14.1

*Repeated measures **ANOVA***

RESULTS

Attention (ASEBA) - filled in by children

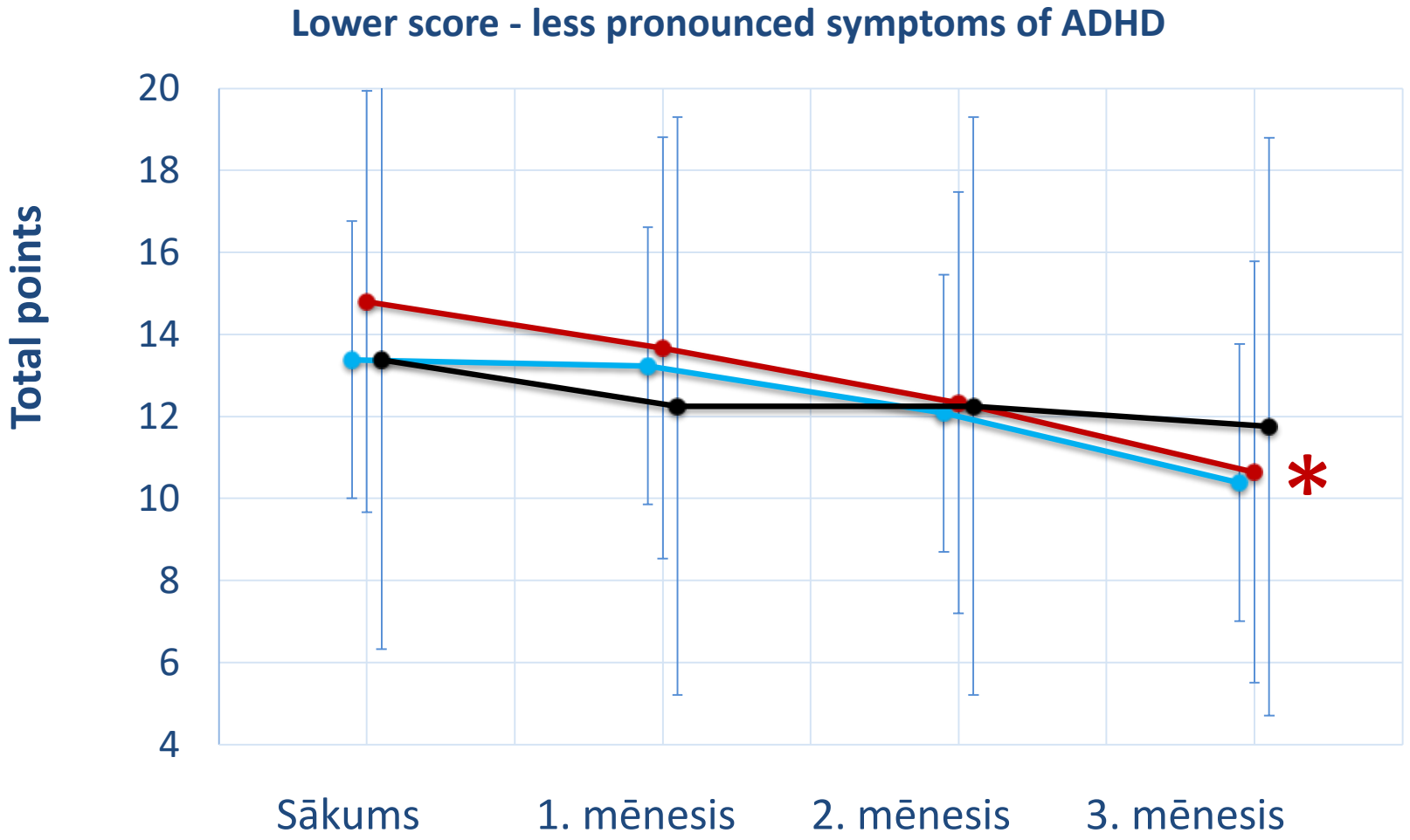


Statistical analysis JASP 0.14.1

*Repeated measures **ANOVA***

RESULTS

Behaviour[5] - filled in by children



GAPS

GAPS + PREBIOTIC

CONTROLS

* Sākums *vs* 3. mēnesis

***p* = 0.002**

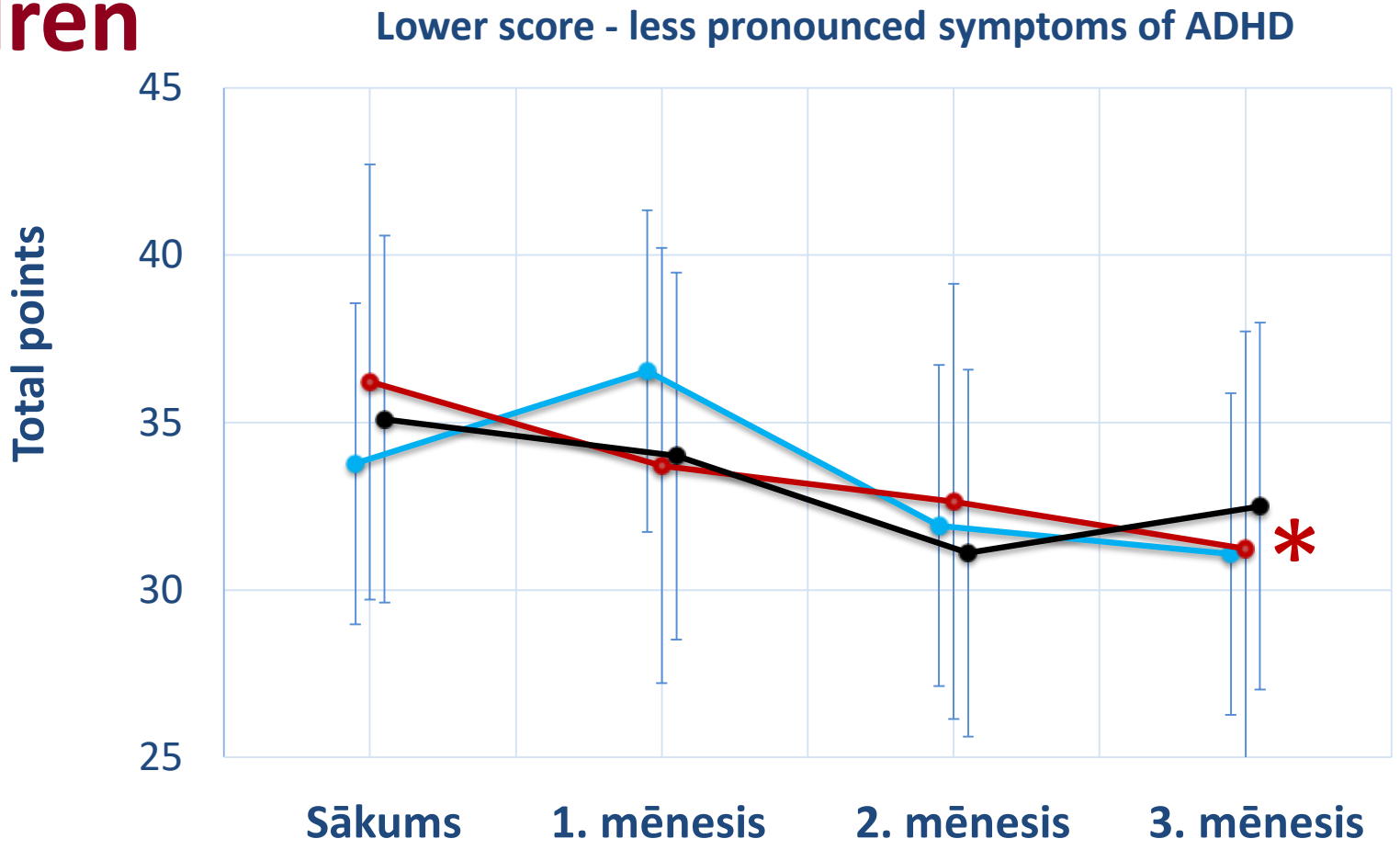
Statistical analysis JASP 0.14.1

*Repeated measures **ANOVA***

[5] *Vanags and Riekstiņa **2018**, Unpublished study*

RESULTS

Emotions (CSQ-CA)[9] - to be completed by children



GAPS

GAPS + PREBIOTIC

CONTROLS

* Sākums *vs* 3. mēnesis

***p* = 0.036**

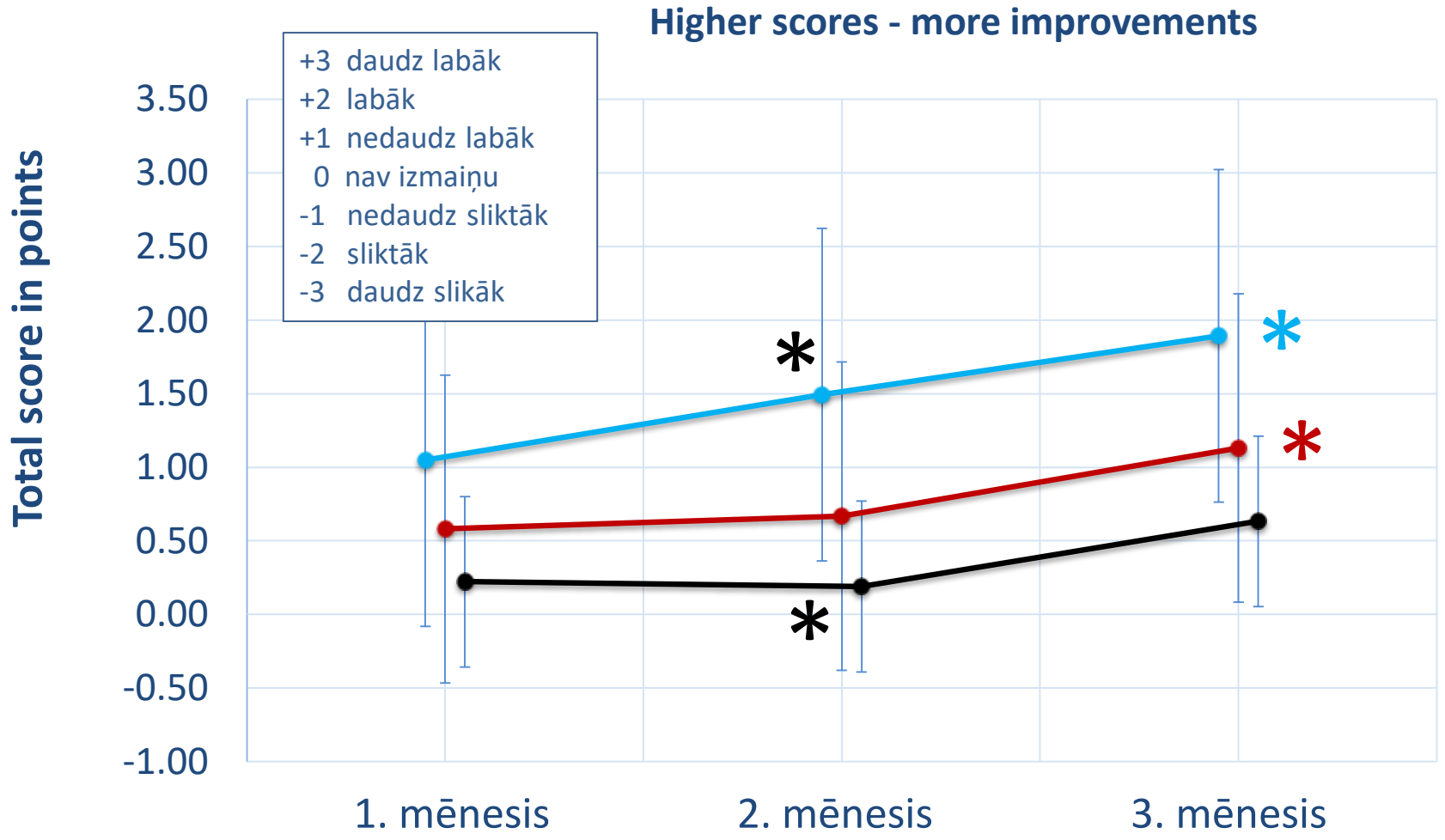
Statistical analysis JASP 0.14.1

*Repeated measures **ANOVA***

[9] de Bruin et al. **2018**, Child Ind Res 11, 1389-1406

RESULTS

Parent Global Assessment (PGI-2)



GAPS

GAPS + PREBIOTIC

CONTROLS

* 1. mēnesis *vs* 3. mēnesis
***p* < 0.001**

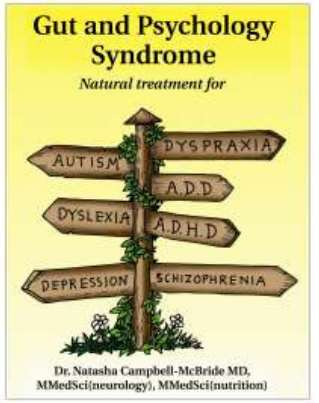
* 1. mēnesis *vs* 3. mēnesis
***p* = 0.006**

* Kontrole 2. mēnesis *vs* GAPS 2. mēnesis
***p* = 0.020**

Statistical analysis JASP 0.14.1

*Repeated measures **ANOVA***

CONCLUSIONS



- **3 Month GAPS and GAPS + Prebiotic *Happy Tummy* with Hufulac® nutritional intervention significantly reduced ADHD symptoms in children as assessed by parents**
- 3 Month GAPS + Prebiotic *Happy Tummy* with Hufulac® nutritional intervention reduced symptoms of ADHD and chronic stress in children
- No statistically significant changes in gastrointestinal symptom reduction were observed within and between groups during the 3-month GAPS and GAPS + Prebiotic *Happy Tummy* dietary interventions, but the relative mean symptom reduction in the intervention groups was 50%
- Fecal analysis confirmed that children with ADHD had suboptimal gastrointestinal function, with intestinal dysbiosis and difficulty digesting macronutrients
- Prebiotic *Happy Tummy* with Hufulac® had no positive effect on the reduction of ADHD symptoms in children in addition to the GAPS diet
- **The GAPS diet can be a safe and effective approach to relieve ADHD symptoms in children**

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Low Carbohydrate Diet (GAPS) for Children with Attention-Deficit/Hyperactivity Disorder (ADHD)


KNOWLEDGE FOR USE IN PRACTICE 2021

CERTIFICATE

Silvija Abele

RIGA STRADIŅŠ UNIVERSITY INTERNATIONAL RESEARCH CONFERENCE ON MEDICAL AND HEALTH CARE SCIENCES

«Knowledge for Use in Practice»

Low carbohydrate diet for children with attention-deficit/hyperactivity disorder

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25.03.2021

RSU RESEARCH WEEK 2021

GAPS = HEALTHY and SPIRITUAL REFLECTIONS

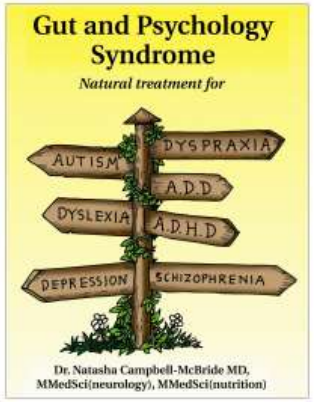
- the child's behaviour has improved, and their judgement and concentration
- the boy has become calmer in everyday life, tries to smooth things out more on his own
- have a slightly easier time learning - try harder
- the greatest gain is the knowledge and pride in a son who, with such a sense of responsibility, was able to abstain until the last day from so many things he craved every day

- a huge benefit is the healthy diet we learnt during this time
- it was also a great benefit for the whole family, as everyone's health improved
- Healthy eating now plays a much more important role in our daily lives, and looks set to stay

Photo from the GAPS group for children with ADHD (Fo

ACKNOWLEDGEMENTS

- **Children and their families involved in the study**
- Supervisor Dace Reihmane, Assistant Professor, RSU
- Aivis Vegers, Dainis Batraks and Valdis Rupmejs (*Green World Solutions Ou*)
- Toms Blumbergs (Saldus Maiznieks)
- Clinical psychologist Edmunds Vanags
- Reviewer Dr Laila Meija, RSU asoc. prof.
- GAPS author *Dr Natasha Campbell-McBride*
- For the Commission, the audience and the viewers



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microbiome health

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EXPLORO.LV

Reviewer's question N1: How would you explain the pathogenesis of the possible positive effects of products such as meat broth, coconut oil, animal fats?

Meat/bone broth

- Supplies what is needed to repair *leaky gut*
  - amino acids
  - collagen
  - glucosamine
  - chondroitin sulphate
  - hyaluronic acid
  - fat
  - vitamins
  - minerals
  - electrolytes
- Supplies nutrients to bones, cartilage, connective tissue, skin (collagen)

Coconut oil

- Unique combination of fatty acids - many health benefits
- MCT - medium-chain fatty acids (triglycerides)
  - does not require digestion
  - immediately in the liver
  - are quickly used for energy or converted to ketones
  - positive effects on brain function
  - promotes fat metabolism
- Antimicrobial effect
- Beneficial effects on heart health

Animal fats

- Contains 40-60 % saturated fatty acids
  - in cell membranes (50 %) provides the strength to perform functions
  - Involved in the formation of tissue structures
  - Involved in NS and brain function
  - Source of fat-soluble vitamins (KEDA)
  - butter - KEDA vitamins, lecithin, Se, Zn, iodine
  - importance for bone health (together with Ca and P)
  - involved in lung function, kidney function, hormone synthesis
  - heart-healthy stearic acid (C18), palmitic acid (C16)
- The role of saturated fatty acids in health is reviewed
  - *PURE study* [10] - 10 years, 17 countries, 154 K
  - *42 European countries study* [11] - *Food consumption vs statistics of CVD*

[10] *Dehghan et al.* ***2017***, *The Lancet, 390(10107):2050*
[11] *Grasgruber et al.* ***2016***, *Food & Nutrition Research, 60:31694*

Reviewer's question N2

Do you plan to work with medical professionals involved in the treatment of such children?

- I am certainly and gladly open to cooperation if there are medical professionals willing to start such cooperation with the aim of helping children with ADHD/UDS

LEADERSHIP
GAPS diet (N=38)