
# Yoga Anatomy and Physiology for Kids Aged 5-8yrs

"There are only two lasting bequests we can hope to give our children. One of these is roots; the other, wings." — *Hodding Carter*

**Dedication** – This manual is dedicated to the health and well-being of all beings, especially the little ones

CHILD ANATOMY & PHYSIOLOGY 5-8 year olds



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Created in Australia

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# LEARNING OBJECTIVES

- Comprehend the physical development of children aged 5-8 years
- To be able to understand the specific gross and fine motor developmental stages of early childhood
- Students will feel confident to be able to tailor yoga techniques of asana, mindfulness, meditation and pranayama as they apply to children aged 5-8 years.
- To be able to understand movement patterns
- To be able to understand the major muscles used in yoga asana practice and yoga techniques
- To be able to understand the nervous system and the effects of yoga on the central and peripheral nervous systems of children
- To be able to understand the general benefits of yoga on childhood digestive, endocrine, skeletal, respiratory, lymphatic and cardiovascular systems.
- The understanding of how to identify and prevent common injuries in children aged 5-8 years
- How to manage physical challenges when teaching yoga classes to children.

# INTRODUCTION

I am so excited to present this manual to you. As a registered physiotherapist, mother and experienced yoga teacher, I am passionate and dedicated towards supporting the well-being of others through the practices of yoga, mindfulness and coaching. My mission with this manual is to empower teachers with specific education to enjoy a greater level of depth, understanding and fulfilment in their lives as they branch into the specialty of children's yoga. I am passionate about empowering yoga teachers with the tools they need to effectively teach children life skills, so that they may experience greater levels of health and well-being at school and beyond.

Whether you are just beginning, or have plenty of experience teaching yoga to children, this manual is designed to support you at whatever skill level you are currently at.

INSTRUCTIONS FOR USE:

This Children's Anatomy and Physiology Manual has been created to provide an introduction to children's anatomy and physiology, as it relates the practice of yoga with children aged 5-8 years. This resource provides a brief overview of child anatomy and physiology, with an emphasis on the development of 5-8 year old children. It is intended that this manual is a basic resource that supports its readers to safely practice yoga with 5-8 year old children based on their unique physical capacities and needs. Even further, it is intended that readers will learn how yoga supports the holistic wellbeing of the child. A firm understanding of the concepts presented in this manual will allow you to tailor basic classes to meet children where they are in their physiological development. Anatomy and Physiology takes a lifetime to learn, so please be aware that the scope of this manual is intended only as a basic summary and overview of a vast subject.

Focus: Ages 5 to 8 year olds

DISCLAIMER

The advice contained within this manual is a very basic reference guide only. All care has been taken to ensure the material has been substantiated by the research cited. It does not substitute medical advice, nor should it support the diagnosis or treatment of disease or illness. Please refer students to a qualified medical practitioner if in doubt about a child's health. It takes many years to understand the

human body and delegating to a health professional is one of the wisest decisions a yoga teacher can make in the case of a health condition.

# Introduction to CHILD DEVELOPMENT

## Understanding Anatomy and Physiology in the 5-8 year old child

- This manual will primarily be an outline of the commonalities seen in the developmental stages of a child between the ages of 5 and 8 (sometimes referred to as early primary school years)
- Middle childhood brings greater levels of independence to a child's life. They can now dress themselves, catch a ball more easily, tie shoe laces and start school
- Friendships are now more important to the child as social and mental skills rapidly evolve
- This is an important period for the development of healthy confidence and self-esteem in a wide range of areas
- Children at this age are able to start thinking more about the future and can understand more about their place in the world
- Peer group acceptance starts becoming more important at this stage
- Children are able to learn better ways to describe experiences and talk about thoughts and feelings
- Have less focus on one's self and more concern for others.
- genetic, social, cultural, emotional, mental, nutritional and environmental influences will all continue to play a part in a child's development
- To ensure your classes and activities are tailored to maximise their effectiveness and to ensure that they're age appropriate, this manual will explore the unique physical developments of the early primary school aged child.
- Children aged 5-8 years-old are developing greater language and conversational skills, enjoy longer attention spans and can start to model adult behaviours as their nervous system develops.
- Enjoy the special flavours of this age group – by now a child's character is truly forming. As the saying goes 'show me the child and 7 and you'll see the man.'

### Physical Development in School-Age Children

The school-age years are a time of steady growth and development. Staying physically active during this developmental phase will strengthen the fundamental skills needed to lead a healthy and active

life as an adult. These skills include, but are certainly not limited to, agility, balance, coordination, and endurance. Learning and developing these skills will also have a tremendous impact on your child's confidence and self-esteem, as well as providing them with an ongoing sense of accomplishment and independence.

## WHY IS ANATOMY and PHYSIOLOGY IMPORTANT for YOGA TEACHERS of 5-8 year olds?

We can use our knowledge of anatomy and physiology as yoga teachers in a myriad of beneficial ways for early primary-school aged children

- It allows you to become a more precise, confident, skilful, knowledge-able and safe yoga teacher for 5-8 year olds
- It deepens your appreciation of the developmental stages of 5-8 year olds and their unique physical, mental, emotional and spiritual capacity to engage in yoga tools
- It helps you to prevent injury specific to this age group and understand the causes of common injuries and challenges seen in early to middle childhood.
- It supports you to develop and deliver age-appropriate and developmentally-appropriate activities
- To increase your understanding of the health benefits of yoga for children
- To increase your confidence, awareness and compassion when communicating with 5-8 year olds
- To support you to speak and engage with other health professionals and parents on behalf of your students to ensure their needs are being met. These health professionals may include psychologists, physiotherapists, speech and language pathologists, occupational therapists, podiatrists, specialists, paediatricians and general practitioners who will support the well-being of a child with special requirements

- To support you to teach anatomy and physiology for yoga to your 5-8 year old students to facilitate their learning and awareness about their own bodies

- To understand the anatomical differences that may exist in children of various ages

## THE SKELETAL SYSTEM

The growth of bones begins to slow down during middle childhood. There are less dramatic growth spurts and more consistent growth until puberty.

**Fun fact**

Only one-third of the height of a child's body increases in the trunk where-as lower limb development comprises two-thirds of the increase in height.

Although a child's bones can absorb more energy before breaking than adult's bones, they are still weaker overall. There are structural differences in a child's bone compared to adult bones making it weaker but less brittle and more pliable. Therefore, patterns of injury such as fractures are different in children to adults. Fractures common in this age group are called 'greenstick' fractures, which are a product of the bone bending like green wood and only breaking on one side.

A fracture to the growth plates in a child's bone can have long-term impacts on the bone's growth. As explored in more detail in the manual *Yoga Anatomy for Kids Aged 2-5 years,* growth plates are located at the ends of the long bones of the arms and legs. Since girls' bones mature earlier than boys', growth plate fractures are twice as common in boys. Many broken bones happen due to falls and trips, so always ensure children have support for their balance.

Growth plates will generally close by age_____

**Safety tip:** a child who is walking without the natural arm swing in one arm may be nursing a greenstick fracture, a common injury which can easily slip undetected. If you notice a child having difficulty weight-bearing through the upper or lower limbs or complaining of pain on weight-bearing, it is wise to have a diagnosis made by a general practitioner.

Early childhood is an important time for bone growth. Bones grow rapidly in both length and diameter but not as quickly as they did at the preschool age. In order for bone growth to develop, primary schoolers need to do physical activity and eat a healthy diet.

Bone is a dynamic tissue that is constantly responding to the environment, so encouraging weight bearing activity such as yoga, can help the bones to develop in strength, alignment and density. It is also important for children to consume enough calcium and vitamin D for bones to grow well

For 5-8 year-olds, the recommended daily dose of calcium is 800mg/day or three full glasses of milk. Vitamin D recommendations are 600IU with no more than 3000IU per day. (check this). Many children do not an adequate amount of vitamin D in winter, autumn or spring and many children are deficient.

(source: http://www.healthofchildren.com/S/Skeletal-Development.html#b )

**Yoga Tip:** never under estimate the benefits of controlled sunshine (with adequate hydration and sunscreen) which can support the absorption of Vitamin D. Light shade with dappled sunlight could be a fun, vitamin D friendly environment to set up your class.

(source: http://www.4bonehealth.org/education/kids-4-8-years/)

**Alignment**

Alignment issues can start to reveal themselves in primary school as the child develops habits that reinforce their posture and positioning of the skeleton. The skeleton constantly responds to forces placed upon it. It will adapt to habitual pressures, so if a child is consistently carrying a heavy school bag on one side, or consistently sitting at a poor angle to see their teacher, this may be setting them up for alignment issues.

**Yoga tip:** Yoga is a wonderful way to support the body's alignment and symmetry and offers an opportunity for the non-dominant side to gain strength and co-ordination. Children will be showing a preference for hand dominance at this stage, so work on improving the non-dominant arm strength with upper limb weight-bearing asana such as down dog.

**Ligaments**

Ligaments are still pliable and flexible in early childhood, although they

are starting to offer more support than in the preschooler years. Joints should still be protected from excessive force.

**Safety tip: *Allow a child to move within his or her natural movement pattern and never push or adjust a child with force.***

**Joint Range of Motion (ROM)**

Joint ROM is more flexible than in adults because supporting structures such as bone, ligament and muscle are still developing.

( source: Columbia University Medical Center. (2010, May 10). Pediatric spine—not just smaller—different. *Columbia University Medical Center.* Retrieved December 15, 2013 from http://www.columbianeurosurgery.org )

**Proportions**

As the child moves through developmental stages, her body proportions change significantly.

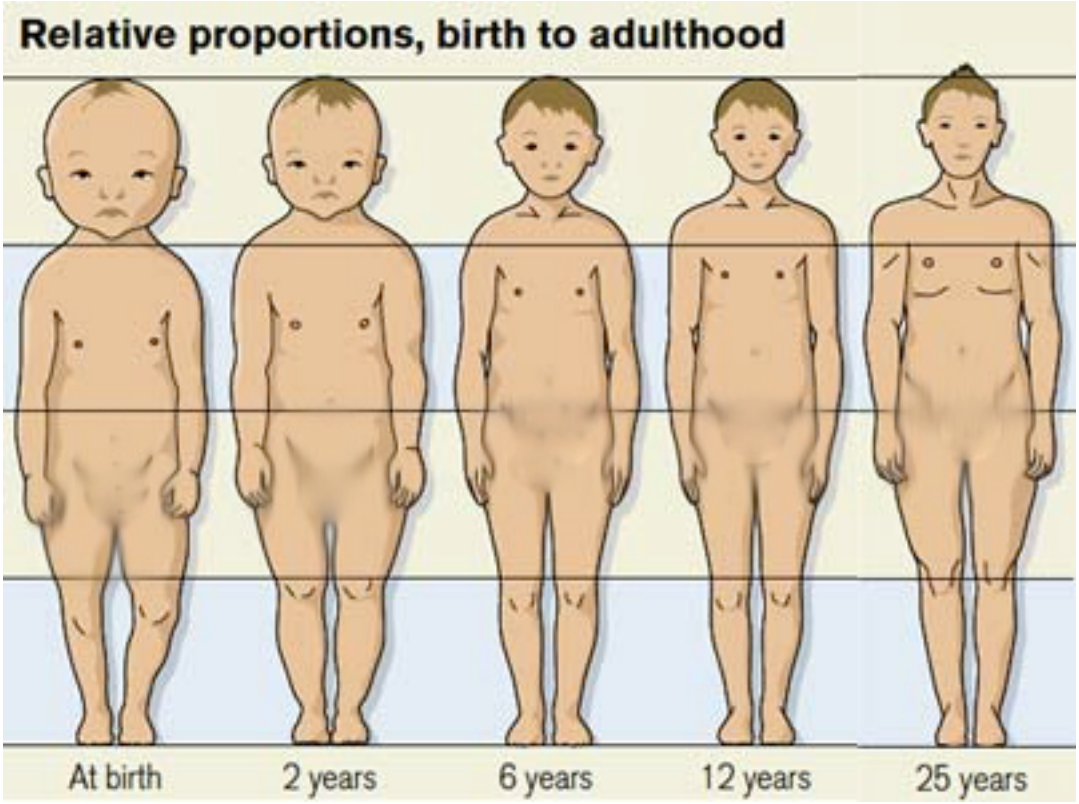


image thanks to http://www.rearfacingdownunder.com

In this age group, neck strength is weak compared to a larger sized in head in proportion. Just like in the pre-schooler age group, early primary school aged children are more vulnerable to neck injury from a

sudden head movement. Temporary or permanent spinal injury can occur if force is applied to the neck. Neck injury is more common in a 5-8 year-old child than an adult.

(source: Huelke, D.F. (1998). An overview of anatomical considerations of infants and children in the adult world of automobile safety design. *Annual Proceedings / Association for the Advancement of Automotive Medicine, 42,* 93-113. )

**Yoga safety tips**

i. in forward folds, tuck chin to chest, especially when transitioning in and out of the fold.

ii. In backbends, keep the eye gaze forward and don't allow the head and neck to move backwards (into cervical extension)

iii. Avoid yoga poses that put weight on the head like headstands. Their neck is not developed enough at this age to cope with the pressure upon it.

**The Spine**

The primary role of the spine is to create structure and stability for the upright body and to enclose and protect the spinal cord.

A child's spine is *hypermobile* as ligaments are more elastic than adults. Children tend to have underdeveloped muscles as their skeleton grows. This makes school aged children more at risk of spinal injury, especially at the neck.

(source: Columbia University Medical Center. (2010, May 10). Pediatric spine—not just smaller—different. *Columbia University Medical Center.* Retrieved December 15, 2013 from http://www.columbianeurosurgery.org )

**Safety tip: *maintain the natural curves of the spine and do not place excessive force on the spine in forward or backward bends.***

As the spine develops, a child's centre of gravity will move downwards towards the pelvis. This means that a child aged 5-8 years will be slightly more 'top heavy' than an adult and will lose balance more easily.

***Direct a child to adopt a wider base of support (ie feet hip distance apart or wider) in standing postures such as mountain pose, in order to support their balance. Do asana that is closer to the ground.***

**Summary of safety considerations when teaching 5-8 year olds**

* In forward folds, always ask children to tuck their chin into their chest when transitioning in and out of the forward bends

* In back bends, ask them to keep their eye-gaze looking forward so that they don't extend their neck or drop their head back

* Avoid yoga poses that put weight on the head

* Create a wider base of support by standing with legs wide

* Do more asana closer to the ground to support less falls

**Benefits of yoga for the skeletal system**

- promotes awareness of head and neck posture
- strengthens neck, spinal and lower limb muscles
- starts to develop bone strength and joint integrity
- builds symmetry and alignment in the developing skeleton
- encourages awareness of posture
- promotes spatial awareness of the head and neck
- strengthens the developing muscles that support the neck, when performed safely.
- can help to lengthen and decompress the lower back
- supports flexibility and strength of the muscles surrounding spine

**Yoga asana** to support growing bones and symmetry for children aged 5-8 years.

1. upward facing dog (keep gaze forward and chin tucked in)
2. flower pose (baddha konasana) – also known as butterfly pose
3. ragdoll pose (uttanasana)
4. frog pose (also known as malasana)

# THE NERVOUS SYSTEM

By the time a child has turned 5, the connections that have formed in the brain are dependent upon the variety and richness of experiences that it has been exposed to. No two brains are the same. The nervous system continues to take the role of harmonizing all the body's systems throughout childhood.
The greater the variety of experiences a child has in early childhood, the better. Yoga serves as a wonderful tool for exposing the child's nervous system to a large range of experiences of movement, breathing and focus. Yoga has the potential to help to shape a healthy and flexible nervous system, which is able to better cope with stress.

Yoga can help to balance the left and right sides of the brain and to promote cross over between the left and right sides. The left and right sides of the brain, or hemispheres, are connected by the **corpus callosum**. This structure stretches between the two hemispheres. It is responsible for managing and maintaining the integration of the left and right hemispheres. A child's corpus callosum won't become fully insulated for quick functioning until he or she is 7 or 8, making whole brain behaviors challenging.

(source: https://medium.com/@galynburke/child-development-post-3-of-3-when-your-kids-become-capable-of-certain-tasks-and-why-1c4e28be26c6)

As previously explored in the *anatomy and physiology for pre-school aged children* manual, The two cerebral hemispheres develop at different rates, with the left hemisphere developing more fully in early childhood (ages 2 to 6), and the right hemisphere developing more fully in middle childhood (ages 7 to 11). The left hemisphere predominates earlier and longer, which may explain why children acquire language so early and quickly.

Between the age of 4 and 6, a child will show a preference for being either left or right handed. A child is ambidextrous if he or she shows no preference for one hand over the other.

(source: https://www.cliffsnotes.com/study-guides/psychology/development-psychology/physical-cognitive-development-age-26/physical-development-age-26 )

**YOGA TIPS:** children under eight will have difficulty with reciprocal

movements and high-level co-ordination and balance of the body because their brain is still developing the ability to multi-task and integrate left and right sided brain function. Reduce the difficulty of balancing poses and any poses that involve high-level co-ordination. Keep things fun and simple!

The developments of glial cells and myelin sheaths help to explain why older children may perform behaviours that younger children are not capable of.

(source: Yoga Ed. Corp (2014) 1st Ed. *Child Anatomy and Physiology Mini Yoga Manual.* Yoga Ed. Corp. Honolulu )

**Yoga Tip:** young children require constant repetition and routine to ensure the correct neural pathways are reinforced. Set up your yoga classes with a consistent rhythm and ritual to positively reinforce a child's learning.

**Yoga Tip:** If you suspect that a child is having difficulty with tasks that are simple to the other children in the class, have a conversation with his or her teacher to ensure developmental delays are detected. A referral to an occupational or physiotherapist may be required to support early intervention. The earlier therapy is implemented, the better the outcome for the child.

**Warning signs: The following is a list of signs that may require intervention or further investigation.**

1. a child displays an unusual predisposition towards wanting to touch other people or objects to a degree that is concerning or irritating to others.

2. a child has difficulty with close body contact

3. a child avoids eye contact

4. a child is very keen to avoid messy play and is irritated by textures such as sand, paint and glue

5. a child misses cues or instructions, verbal or written, more often than other children

6. a child appears oblivious to the noise around her within an active environment

7. a child is clearly distressed by loud noise and activity around her

(source: http://www.pmh.health.wa.gov.au/general/CACH/docs/manual/4%20School%20Aged%20Children/4.4/4.4.2/4.4.2.2.5_How_Children_Develop_7-8_year_olds.pdf )

**Developmental milestones**

Every stage of development is marked by increases in capacity to manage certain tasks. The following milestones are typical for these age groups.

**Five and Six year-old's milestones**

- Moves independently and negotiates any obstacles in the path.
- Manages climbing frames and small ladders
- Holds scissors properly and cuts paper with them
- may be able to write one or two letters, which appear in her name
- rides a tricycle or scooter
- can dress without assistance
- draws recognizable pictures of houses, people and cars
- can run, jump, climb, skip, jump, swing
- can throw and catch a ball
- self-confident
- can be a show-off, but also able to understand friendliness and generosity
- shows good control of emotions and emotionally stable
- has up to 3000 word vocabulary
- content to play alone for long periods but can also enjoy building and imaginative play with other children
- dependent upon adults, teachers and parents for approval
- enjoys hearing stories especially heroic adventures

- aware of how actions can impact other people and developing empathy
- seek acceptance from others
- self-awareness and decision-making centres in the pre-frontal cortex of the brain are developing well
- Loves word banter and using language creatively.
- Manage buttons, zippers, laces, and other closures
- Cut soft foods with a knife
- Tie a knot and bow
- Copy designs and shapes, letters and numbers
- Print name
- Sweep, dust, make bed
- Demonstrate right or left hand dominance
- Can colour between the lines
- Print name legibly
- Manage zipper, buttons and snaps independently
- Can catch and throw a medium-sized ball from 1.5 metres (five feet) away
- Can manage playground equipment independently, such as pumping legs on a swing
- Develop enough muscle coordination to climb, swim, and skate
- Copy a triangle
- Draw a person with six parts
- Thread small beads on a string
- Eat with a fork
- Fold paper diagonally
- Walk backward

- Walk heel-to-toe without losing balance
- Run on toes
- Hop proficiently
- Get up without using hands
- Balance on alternate feet (eyes open or closed)
- Catch a ball using hands more than arms
- Jump rope

**Yoga Tips:** "Younger children can't wrap their heads around other people feeling differently than they do," says Pamela Davis-Kean, Ph.D., associate professor of psychology at the Institute for Social Research and Center for Human Growth and Development at the University of Michigan. But now, the frontal lobes, which are the brain's centre of emotions and judgment, are hitting a growth spurt, taking his viewpoint beyond his own small daily reality. Talk about feelings during class, supporting students to identify the range of feelings and offering empathy to those who identify negative emotions. Name feelings such as anger when it arises.

It's now a great time to enhance a child's growth through music as it can improve language and social skills, according to a study in the journal *Psychological Science*. Choose music to sing along or play during yoga classes or use music to settle into relaxation at the end of the class. Use mantras as a way to bring children into harmony and be creative with song during class.

**Seven year-old's milestones**

- Active and energetic
- Physical pursuits are popular
- Can walk along narrow planks, balance on poles, use bats and balls
- Dances well
- Loses first teeth
- May be solitary for short spells and independent
- Self critical

- May be more self-reliant and steadier in emotional responses
- Distinguishes fact from fantasy
- Can become tired and irritable easily
- Reads a lot and enjoys writing stories
- Depends less on adults and asks for more specific help for tasks like homework
- Can play and carry out projects with children with some intermittent adult supervision
- Developing skills of reading, writing and simple numerical skills involving addition and subtraction
- Throw and catch a small ball well
- Move in time to the beat or rhythm of music
- Skip, gallop, dance
- **Yoga Tips:**
- The child is learning that language is not always literal, so they experiment with it," says Sarah Nyp, M.D., a developmental-behavioral pediatrician at Children's Mercy Hospitals and Clinics in Kansas City, MO. Be silly and experiment with some word-fun banter by telling children the actual Sanskrit names for asana and yoga tools. Explain what these mean and make up rhymes. The type of thinking required to create a joke is identical to what's needed to do well in science, the arts and literature. Never under-estimate what effects your word banter in class can do to support a child's language development!

**Eight year-old's milestones:**

- Print many words
- Write cursive
- Draw detailed pictures
- Manage any task requiring dexterity (play the piano, string small beads, fasten necklaces)
- A period of great agility and energy

- Increasingly sophisticated coordination
- Hopscotch, skipping and more precise activities are more popular
- Emotionally independent of adults largely
- Seeks acceptance from peers
- Satisfied by intellectual games
- Enjoys physical pursuits
- Good control of emotions generally
- Becomes anxious if adults are not effectively supervising
- Can do what's best for a group and submerge individual desire
- Starts to separate between boys and girls in friendship groups but still mixes
- Develops confidence in ability to reason
- Mastering the art of conversation
- Able to add and subtract in head
- The brain starts to prune certain connections to ensure streamlining of activity and focus and speed.
- With this increase in efficiency comes an uptick in self-awareness
- Starting to recognize his/her strengths
- Weight gain speeds up
- Sleeps up to 11 hours a night
- Begin riding a two-wheeler bicycle without training wheels
- Can use a pair of scissors to cut out complex shapes
- Permanent teeth begin to appear
- Improved hand-eye coordination (can bounce and catch a tennis ball)
- **Yoga tip:** At this stage, children are beginning to compare their skills to those of their friends and other kids in the class. Children

are aware of false praise at this stage and will respond best if you notice specific strengths. The experts advice is that continued exposure to failure in something a child's just not cut out for can shake confidence long-term. Set up your yoga activities so that they're easy to master with repetition and point out specific capabilities you can see within the class. Be fair and don't leave anyone out with your sprinklings of specific, honest praise. Never shame a child for being unable to complete a task that the rest of the class can do.

( sources : 1. http://www.maternal-and-early-years.org.uk/stages-of-development-5-8-years 2. http://www.parenting.com/article/brain-development-children 3.https://www.babycenter.com/303_milestones-ages-5-to-8_1517873.bc 4. https://www.babycenter.com/0_physical-development-milestones-gross-motor-skills-ages-5-to_3659044.bc )

**Yoga safety tips:**
**Raise your concerns with parents or a teacher if you notice a child -**

- is not able to jump, skip, hop or run in a coordinated way

- has uncoordinated ball skills

- gets tired easily with every activity

- has difficulty maintaining posture for extended periods

- is unable to decide which hand to use for fine motor activities

- moves with shaky or stiff movements

- has weak or stiff arms and hands

## The autonomic nervous system (ANS)

Children are old enough to begin following commands that can drastically support the nervous system in beneficial ways.

The autonomic nervous system controls the stress response, increasing blood pressure, heart rate and respiratory rate when the child is under stress. Prolonged stress will have negative effects on the child's developing nervous system.

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**Benefits of Yoga: To The Nervous System**

- encourages neurological and endocrine (hormonal) development
- encourages neuro-motor development
- decreases stress response which reduces anxiety and depression
- improves the quality and quantity of sleep

## THE MUSCULAR SYSTEM & MOTOR DEVELOPMENT

As the nervous system develops, the muscular system develops along with it.

During these early primary years, a child will gain increasing control over gross and fine motor skills.

**Safety Tips:** ensure children are never forced or pushed into a position in class. Be extra careful with partner work to ensure children don't jump upon each other's bodies when they get enthusiastic in your class! The most common time for an injury is when a child is coming out of the pose so instruct and demonstrate this with care and never rush the teaching process. It is better for children (and their muscles) to have less instruction and more demonstration as they are great imitators. It is also more desirable to have less content in a class to ensure you have a spacious delivery.

**Motor skills**

Motor skills are physical abilities or capacities.

Gross motor skills are larger muscle actions such as standing, running, jumping, hopping, turning, skipping, throwing, balancing, dancing and walking. These develop at the earlier ages.

Fine motor skills such as drawing, tying shoelaces and writing develop later than gross motor skills. Girls tend to develop faster than boys in their fine motor skills.

**Yoga tip:** be prepared for a wide variation in gross and fine motor skill level in preschoolers. Older preschoolers will be far more developed than younger ones.

Development of motor skills will be influenced by both biological (internal) and environmental (external) factors.

Balance, coordination and mobility improve as a child's nervous system develops. A process known as *myelination* occurs in muscle fibres, affecting reaction times, skillfulness and strength. This process goes on until puberty hence, fine motor skills take many years to refine and reach full potential.

**Fact:** Good body control and motor skills are important for children's knowledge development, social skills, language development and well-being, because young children use their bodies to learn.

(source: http://sciencenordic.com/girls-have-better-motor-skills-boys-do )

Yoga offers many different opportunities to observe, explore and practice motor skills and this supports motor development. Opportunities to practice movement, balance, and coordination are all part of a good yoga class.

**Benefits of yoga to the neuro-muscular system**

- develops mind-body awareness
- increases spatial awareness
- develops balance
- supports development of muscle strength
- strengthens learning and focus

## The Respiratory System

The respiratory system is still developing until 8 years of age. Air sacs that increase the lung's surface area are known as *alveoli*. Research has shown that the number of alveoli will continuously increase throughout childhood and teenage years.

(source Narayanan, M., Owers-Bradley, J., Beardsmore, C.S., Mada, M., Ball, I., Garipov, R., Panesar, K.S., Kuehni, C.E., Spycher, B.D., Williams, S.E., Silverman, M. (2012). Alverolarization continues during childhood and adolescence: New evidence from helium-3 magnetic resonance. *American Journal of Respiratory Critical Care Medicine, 185*(2), 186-191. doi:10.1164/rccm.201107-1348OC )

'Several reasons are attributed to children's high susceptibility to the harmful effects of air pollution; the growth of airways and alveoli of the respiratory system are guided through a complex chemical pathway and air pollutants are known to interfere with these pathways[4]. The airway epithelium of growing children is more permeable to air pollutants and the lung defence system is not adequately evolved. Children have a differential ability to metabolize, detoxify, and excrete environmental agents thereby making them prone to more harm[7]. A higher resting metabolic rate of oxygen consumption per unit body weight in children due to the larger surface area per unit body weight and rapid growth, as compared to adults, makes them more vulnerable. Further, children engage in more physical activity than adults which leads to a higher intake of air relative to body size[4,8].'

**(source: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4145638/ )**

**Physiology of the Breath**

The breath is made possible by the mechanical action of the diaphragm, which is a sheet of muscle that separates the abdomen from the thorax (chest).

**inhalation**

Upon inhalation, air enters the respiratory system through the mouth and nose, larynx, trachea and bronchi and the diaphragm descends. As this important muscle descends, it increases the lung volume and draws oxygen into the lung where it passes into the alveoli and surrounding capillaries and alveoli. It is then distributed to the body's millions of cells via the circulatory system.

**Exhalation**

As the diaphragm relaxes upon exhalation, it ascends. Lung volume is naturally decreased. Carbon dioxide is pumped out of the lungs as waste matter, exiting the body through the same pathway as the inhalation.

**Respiratory Development**

Younger children have a higher respiratory rate than adults at any level of exercise and at rest. More oxygenated blood is delivered to a child's

muscles because they generally have an excellent high level of distribution of blood throughout the body during exercise.

**Yoga safety tip**: Instruct students to breathe through their noses so that their nose will naturally humidify the air on an inhalation to prepare their lungs for the breath.

**Exercise-Induced Bronchoconstriction (EIB)**

Some children with asthma experience an increase in their symptoms with exercise. A certain amount of children will only experience symptoms of asthma during prolonged exercise. This is known as Exercise-Induced Bronchoconstriction (EIB). Symptoms arise after 5-10 minutes and include coughing, tight chest, shortness of breath, wheezing, and unusual fatigue.

**Yoga safety tip:** To prevent EIB, ensure you have a warm up before the asana and a cool down at the end of class. This allows their body's to slow down any rapid changes in temperature, which will affect the lungs. Always allow a child to rest if symptoms such as coughing, wheezing and shortness of breath appear. They may need their inhaler if they have one. Allow them to rest until symptoms subside. Check the temperature of the room you are teaching in and regulate it to a comfortable temperature if possible.

Deep breaths support physical relaxation and reduce nervous system stress. Deep breathing lowers stress in the body and increases relaxation. Physical effects include lower breath rate, lower heart rate, and lower blood pressure

(source: Joseph et al., 2005). (Joseph, C.N., Porta, C., Casucci, G., Casiraghi, N., Ma eis, M., Rossi, M., & Bernardi, L. (2005). Slow breathing improves arterial barore ex sensitivity and decreases blood pressure in essential hypertension. *Hypertension, 46,* 714-718. doi:10.1161/01.HYP.00000179581.68566.7d )

**Shallow breaths**

Shallow or rapid breathing can trigger the fight or flight response and increase feelings of stress and anxiety in the brain. When relaxed, the brain signals the body to take slow and even breathes.

Conscious deep breathing affects the brain. Taking deep breaths sends a soothing message to your brain to calm down and relax. The brain can then signal the body to relax.

Yoga uses a range of breathing exercises to support the relationship between the body and the mind. Consciously breathing in a quiet, gentle and even way produces healthy physiological changes in the

body. Yoga breathing exercises are capable of reducing stress, improving oxygen and energy levels.

**Benefits of Yoga to the Respiratory System**

- increases the endurance and strength of the muscles of respiration (including the diaphragm).
- Supports a child to gain control over respiration
- Increases awareness of respiratory structures
- mobilises the lungs (hence preventing secretions from building up which increases risk of chest infection)
- empowers children to control their stress, anxiety and inner state by controlling the depth of the breath. Deeper, longer breaths can help to induce therapeutic relaxation and reduce stress.

## The Cardiovascular System

The cardiovascular system consists of the heart, blood vessels, and blood. With every heartbeat, the heart pumps the blood to deliver oxygen and nutrients to every cell in the body and remove waste from the body.

Yoga can promotes heart health in children through physical exertion of asana.

( source: Woodyard, C. (2011). Exploring the therapeutic effects of yoga and its ability to increase quality of life. *International Journal of Yoga, 4*(2),

49-54. doi:10.4103/0973-6131.85485 ).

By reducing stress, yoga may improve cardiorespiratory health and fitness.

( source: Galantino, M.L., Galbavy, R., & Quinn, L. (2008). Therapeutic effects of yoga for children: A systematic review of the literature. *Pediatric Physical Therapy, 20*(1), 66-80. doi:10.1097/PEP.0b013e31815f1208 ).

While not all yoga is aerobic, yoga practices that do not increase heart rate can improve cardiovascular health. Research suggests that yoga can reduce blood pressure, lower cholesterol levels, mediate blood sugar, and/or increase heart rate variability.

( source: McCall, T. (2007). *Yoga as medicine.* New York, NY: Bantam Dell )

A regular yoga practice can have significant effects on the management of obesity, a strong risk factor for heart disease

( source: Rioux, J. & Ritenbaugh, C. (2013). Narrative review of yoga intervention clinical trials including weight-related outcomes. *Alternative Therapies in Health & Medicine, 19*(3), 32-46 ).

**Benefits of Yoga to the Cardiovascular System**

- Increases blood flow
- Lowers blood pressure
- Lowers cholesterol levels
- Normalizes blood sugar
- Increases heart rate variability
- Lowers risk of heart disease

( source: Williams, C.L., Hayman, L.L., Daniels, S.R., Robinson, T.N., Steinberger, J., Paridon, S., & Bazzarre, T. (2002). Cardiovascular health in childhood. *Circulation, 106,* 143-160. doi:10.1161/01.CIR0000019555.61092.9E )

**The End**

## Nervous System Development

The nervous system is a complex network of nerves and cells that carry messages between the brain, spinal cord, and the rest of the body. The nervous system is divided into the central nervous system and peripheral nervous system. The central nervous system consists of the brain and spinal cord. The peripheral nervous system consists of the nerves that begin in the central nervous system and innervate the body.

The autonomic nervous system (ANS) is part of the peripheral nervous system. The ANS acts as the body's control system and is responsible for

the involuntary regulation of internal organs and glands. Within the ANS, the sympathetic nervous system and parasympathetic nervous system work in conjunction.

Sympathetic Nervous System

The sympathetic nervous system (SNS) is the body's T SNS actions requiring quick responses. It initiates a series of physiological changes in the body by releasing stress hormones (i.e. adrenaline and cortisol). Blood, oxygen, and energy are shunted to the torso, arms, A chronic psychological factors such as stress and anxiety can increase the activity of the SNS.

Parasympathetic Nervous System

The parasympathetic nervous system (PNS) is responsible for the "rest and digest" activities that occur in a body at rest or relaxation. Complementary to the sympathetic nervous system, the PNS modulates slower actions in the body to recover from stressful events. Blood, oxygen, and energy return to the digestive and reproductive organs to allow us to "rest and digest." This is the relaxation response.

Neural Development and Motor Skills

G  drawing and writing develop later. As a child's nervous system matures, his balance, coordination, and agility A

D

The rate at which a child develops locomotor skills depends on biological and environmental factors. Biological factors are determined by genetics. Environmental factors are opportunities to observe, explore, and practice skills. Yoga supports locomotor development by offering many opportunities to practice movement, balance, and coordination.

Stress

**How prevalent is stress in early childhood/primary school?**
It seems that everyday life stressors have increased in the last few decades and, certainly, we at Kids Helpline talk to a large number of children and young adults who report feeling significantly stressed and worried. A 2011 survey of 10,000 students across the country (commissioned by the Australian Scholarships Group) found that 40 per cent of students worry too much, and one-in-five have experienced an episode of depression.
**What are common stressors for kids these days? Are they**

**very different to 10 or 20 years ago?**

Today's children face many pressures from external and internal sources, for example:

- **Stress in schools** - There is a lot of pressure on students today to perform at school, and there seem to be even more pressure within the peer group. The increase in the amount of homework students receive, fear of failure, worrying about fitting in, self-identity, and bullying are some of the more common reasons for stress in schools.
- **Stress in the family** - There are many issues within a family unit that can cause stress in children, for example, parental separation, remarriage (blended family), financial problems, poverty, parental stress, coping with parents who have a mental illness and, commonly, unreasonably high family expectations being placed on children.
- **Media stress and environmental dangers -** Some children can become worried about things they hear and see on the news or by a generalised fear of strangers, burglars and street violence.

Many of the above-mentioned concerns, such as school stress, have been around for a long time. The main difference now, compared to 10 or 20 years ago, is that today's children have increased access to media. Television, internet and cell phones have contributed to the break-down of barriers that protect children from crime, violence and catastrophic events in media coverage. This exposure may contribute to, and have a significant impact on, increasing children's stress levels and their fears around safety. Cyber-bullying is another big stressor, which can be very aggressive and pervasive and often causes serious emotional distress and harm to children.

**Are there times in a child's life where they may be more likely to experience stress?**

Many internal and external factors can influence a child's susceptibility to stress. Children are more likely to experience stress in the following situations:

- Multiple stressful situations (particularly those that the young person cannot easily control).
- Transitions (life changes).
- Stress accompanying a serious illness or injury.
- Isolation or loneliness.
- Abuse (past or current).

- Parental stress (especially in mothers).

**What behaviours might you see in stressed-out kids?**

Youth of all ages, but especially younger children, may find it difficult to recognise and verbalise when they are experiencing stress. For children, stress can manifest itself through changes in behaviour. Some of those behavioural symptoms may include:

- irritability or moodiness
- withdrawing from activities that used to give them pleasure
- clinging; being unwilling to let parents out of sight
- crying
- aggressive behaviour
- regression to earlier behaviours (ie thumb-sucking or bed-wetting)
- school refusal
- unwillingness to participate in family or school activities.

**How do you know when stress levels for children are getting too much or are developing into something more concerning (like an anxiety disorder)?**

When the strain and pressure becomes too much to handle, a child can develop a range of physical, emotional or behavioural symptoms, and can even be at risk of developing an anxiety disorder or other mental health issue. Some of the following symptoms, particularly if ongoing and severe, may indicate that child could be developing an anxiety disorder:

- Persistent and excessive worry (to the point it is impacting negatively on their day-to-day functioning).
- Ongoing physical symptoms (eg stomach pain, vomiting or headaches).
- Significant sleep disturbances.
- Extreme fearfulness.
- Significant changes in eating habits (poor appetite, overeating or binging).
- Inability to control emotions (eg uncontrollable crying or aggression).
- Withdrawal from friends and family.
- Extreme behaviours or comments (ie self-harm or suicidal ideation).

**How can primary schools help student cope with stress**

Schools can be really active in supporting students to deal with stress, for example, they can:

- help students learn more about their emotions by incorporating

emotional learning into the curriculum at all levels of school
- teach students how to recognise their personal signs and symptoms of stress and develop positive ways to cope with stress (eg through healthy eating or exercise)
- create supportive, positive and safe classroom environments
- communicate more frequently with student's parents and caregivers (eg information-sharing at parent/teacher evenings)
- ensure that students get the individual support they need with learning and achieving their academic goals
- allow time for students during school hours to receive adequate exercise and have play/relaxation time
- implement anti-bullying practices and policies
- encourage students to be creative and express themselves (eg through art, sport and music)
- provide counselling and actively promote the importance of children speaking up and accessing support when stressed or worried
- develop and implement mentoring support programs in school (eg Peer Skills).

**How can parents help their kids cope with stress?**

It is important for parents to teach kids to recognise and express their emotions, and to use healthy ways to cope with the stress they experience. Parents can:

- regularly spend calm and relaxing time with their children
- listen to their children and encourage them to talk about their feelings and worries
- provide a safe and nurturing family environment
- encourage physical activity and healthy eating habits
- use positive encouragement and rewards instead of punitive measures
- avoid being critical and negative towards their children
- show active interest in their children's activities and hobbies and participate when possible
- demonstrate active interest in their children's school progress and support them with their learning and homework
- monitor their children's access to media and ensure they are aware of safe online practices
- support their children if they are exposed to bullying
- manage their own stress and be a positive role model
- avoid over-scheduling children and allow them free time to play,

read, listen to music or just 'veg–out'

- help build children's sense of self-worth by recognising their achievements and avoid placing unrealistic expectations on them

seek professional help if signs of stress do not decrease.

( source: https://www.kidsmatter.edu.au/health-and-community/enewsletter/how-kids-experience-stress )

Stress has a widespread negative effect on your health and well-being. Stress can adversely affect your body, thoughts, feelings, and behavior. Stress-related conditions include ulcers, fatigue, headaches, sleep problems, anxiety, lack of motivation, irritability, and sadness. Left unchecked, chronic stress can contribute to more serious health conditions such as diabetes, heart disease, and obesity (Ratey, 2008).

The relaxation response is a physical state of rest that mediates the effects of stress. The body's relaxation response includes decrease in heart rate, blood pressure, breathing, metabolism, and muscular tension.

Preliminary studies suggest that yoga may relieve stress and anxiety (Li & Goldsmith, 2012; Birdee, Yeh, & Gardiner, 2009). Yoga's effects on stress can be explained by a couple of mechanisms. First, yoga combines an active practice with relaxation. Research has shown active practices followed by relaxing practices trigger deeper relaxation than relaxing practices alone (McCall, 2007). Second, yoga may modulate the physical effects of stress by reducing perceived stress and increasing self-compassion. This may help the mind deal with stress more effectively and lessen its toll on the body (Gard et al., 2012).

Sleep

Sleep is vital to the repair and healthy development of the body and brain. It enhances memory, learning, attention, and emotional regulation. Sleep deprivation in children can result in poor school performance, low S G &

Built-up waste and toxins are cleared from the brain during sleep (Xie et al., 2013).

The quantity and quality of sleep changes as children grow. Sleep problems are common in children. Many M G

Naps count towards total sleep time! Children typically require from eight to ten hours a sleep in a day, but it doesn't have to be in one

session.

tiring the body and mind, increasing overall relaxation, and equipping children with relaxation tools to fall asleep. Studies have demonstrated that a regular yoga practice can improve sleep quality by decreasing sleep onset (Khalsa, 2004).

## Benefits of Yoga: The Nervous System

• Encourages locomotor development • Decreases stress and anxiety • Improves sleep quality and quantity

Your child's brain directs and programs the growth of everything in the body. Thanks to explosive advances in neuroscience and technical equipment that lets scientists actually see inside the human brain, we know a great deal about how this central organ grows and develops.

It's easy for children to learn, especially from about age 3 to age 6 — not just academics, but social rules, dinosaurs' complex names, how to play sports and games, directions, how to work gadgets, what goes where.

The impulse control and judgment parts of the brain, however, develop later in the school years and aren't completely activated until after adolescence.

Learning is a process that continues throughout life. During the school years, the brain works in concert with the growing body to focus on the development of certain kinds of learning.

For example, while language-related synapses in the brain grow mainly in the first three years, learning to speak and understand new words, and eventually write them, happens throughout the school years, especially up to age 10. Basic motor skills continue to develop through about age 12.

( source: https://www.babycenter.com/0_your-childs-growing-brain-ages-5-to-8_3659070.bc )

## The Effects of Yoga on the Nervous System

http://www.aboutkidshealth.ca/En/HealthAZ/DevelopmentalStages/Sc

hoolAgeChildren/Pages/default.aspx all notes from resource below

**Positive Age-appropriate Teaching tips**

- recognize specific accomplishments for each child in class
- support children to take responsibility for themselves by asking them to assist the class
- talk about respecting others and encourage them to help others in need
- support children to set their own achieve-able goals
- help children to learn patience by letting others go first, lining up in class and to finish tasks before completing the class
- Use discipline to guide and protect your child, rather than punishment to make him feel bad about himself. Follow up any discussion about what not to do with a discussion of what to do instead.
- Praise a child for good behavior. It's best to focus praise more on what your child does ("you worked hard to figure this out") than on traits she can't change ("you are smart").

## The Respiratory System

In a resting child, breathing should be quiet and effortless. The respiratory system is responsible for supplying all the cells of the body with oxygen through the breath, so healthy breathing is essential for the wellbeing of all other functions. In pre-schoolers, the respiratory system is still developing (and will continue up until 8 years of age).

## The Urinary System

### Dehydration

A child's body holds a higher percentage of body water and has a larger surface area-to-mass ratio than an adult's. Children also have higher metabolisms than adults. These factors put children at higher risk for dehydration. The risk increases if a child exercises in hot weather. Encourage a child to drink water before and after yoga.

Dehydration occurs when a person loses more fluids than she takes in. The easiest way to avoid dehydration is to drink water throughout the day, especially before and after exercise.