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Research Article

Effect of the Alpinia Zerumbet oil on the Hypertonia of Children with Cerebral Palsy

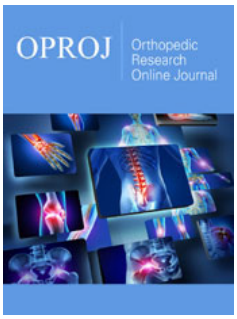
Claudia Alcântara de Torre[1,2]*, Gabriela Marasca[1,2], Miucha Gomes[1,2], Gisele Ladick[1,2], Ariane Franzese[1,2] and Raquel de Paula Carvalho[3]

[1]Centro de Apoio Terapêutico, Santos, Brazil

[2]Cerebral Palsy Persons Association of Santos (APPC), Brazil

[3]Department of Human Movement Science, Universidade Federal de São Paulo, Brazil

ISSN: 2576-8875



***Corresponding author:** Claudia Alcântara de Torre, Centro de Apoio Terapeutico, Santos, Brazil

Submission: September 25, 2024
Published: October 04, 2024

Volume 11 - Issue 3

How to cite this article: Claudia Alcântara de Torre*, Gabriela Marasca, Miucha Gomes, Gisele Ladick, Ariane Franzese and Raquel de Paula Carvalho. Effect of the Alpinia Zerumbet oil on the Hypertonia of Children with Cerebral Palsy. Ortho Res Online J. 11(3). OPROJ. 000764. 2024.
DOI: 10.31031/OPROJ.2024.11.000764

Abstract

The Alpinia Zerumbet oil acts on contractility of muscles decreasing tonus. Hypertonia is common in individuals with Cerebral Palsy (CP). This study aims to investigate if the dermal local application of Alpinia Zerumbet oil can decrease the neural hypertonia in individuals with CP. Methods: 19 individuals with CP, mean age of 18.1 years-old (DP=11.24), 14 levels IV/V and 5 I/II/III of GMFCS, with hypertonia in biceps brachii and adductors of hip. Each subject was assessed through Ashworth and Tardieu modified scales and received the dermal application of Alpinia Zerumbet oil or placebo. After 30 minutes the patient was assessed again. The application was randomized and the evaluators were blind. Same protocol was repeated after one week. Differences between angles before and after applications were calculated for angle of catch seen at fast velocity (R1) and full range of motion at slow velocity (R2), measured by a goniometer. Anova was performed. Results: Differences between angles in R1 were bigger than R2 (p=0.049) and Ziclague was bigger than placebo (p=0,012). From 32 assessments, 11 showed gains over 5^{O} in R2 and 13 in R1. Conclusion: One dermal application of the Alpinia Zerumbet oil was able to reduce hypertonia after 30 minutes. We suggest a study with the assessments longer than 30 minutes after the application to confirm these results.

Keywords: Cerebral palsy; Hypertonia; Spasticity; Alpinia zerumbet oil; Ziclague

Abbreviations: CP: Cerebral Palsy; SCPE: Surveillance of Cerebral Palsy in Europe

Introduction

Cerebral Palsy (CP) comprises a group of disorders in the development of posture and movement, causing limitation of activities due to non-progressive disorders that occurred in the brain in the fetal period or childhood. Motor disorders are often accompanied by sensory, cognitive, perceptual, communicative and behavioral disorders, as well as epilepsy and secondary musculoskeletal problems [1].

The incidence of CP ranges from 2 to 2.5 per 1000 live births in the United States [2]. It is the most common movement disorder, with a prevalence of 3.6 cases per 1,000 live births [3]. Although the prevalence of CP is not found in Brazil, it is estimated that developing countries have 7 cases per 1,000 live births [4].

The classification of CP, according to the recommendations of the Surveillance of Cerebral Palsy in Europe (SCPE) and the Collaboration Group for the Definition and Classification of Cerebral Palsy with Research Records in Europe, comprises three main groups based on neurological signs: spastic (unilateral and bilateral), dyskinetic (dystonic and choreoathetoid), and ataxic. Mixed conditions are also recognized [5]. According to the nature and type of the motor disorder, the type of muscle tone abnormality or involuntary movement observed

or elicited is usually associated with the pathophysiology of CP. Tone is assessed during a passive movement in the direction of the muscle stretching. It can be normal, increased or decreased. Hypertonia is the abnormally increased resistance seen during a passive movement imposed externally on the joint, which can be caused by spasticity, dystonia, rigidity, or a combination of these characteristics. Hypotonia, in turn, is the decrease in resistance during passive movement [6]. The spastic type is the most common and is characterized by abnormal patterns of posture and movement, increased tone - not necessarily constant -, pathological reflexes, hyperreflexia or pyramidal signs, such as Babinski's sign, and increased resistance to movement dependent on speed [5,7].

CP can compromise several systems, and its treatment should be based on the primary deficiencies related to each case. The neuromuscular system may present alteration in tone, often hypertonia, which, in addition to limiting coordinated muscle action for a functional task, also causes inadequate alignment in the osteoarticular structures, compromising postural control and movement control. The continuity of joint positioning in restricted amplitudes results in shortened muscles and joints with limited amplitude. To provide and prolong adequate osteo-articular and muscular positioning, we need to guide the use of resources that facilitate this objective, such as orthoses, stabilizers for standing posture, adapted chairs, splints that keep the knee and elbow joints in extension, elastic bands that favours the positioning of a segment, etc. [8].

In spasticity, hyperactivity of L-type calcium channels associated to an inadequate regulation of these channels in spastic muscles leads to chronic enlargement of these in the sarcoplasmic reticulum [9]. From the physiological point of view, the excess calcium causes extensive injuries and changes in the contractile properties of muscles, in addition to increasing passive tension and reinforcing cross-links [10,11]. Since collagen is directly dependent on cross-links for muscle flexibility, it will reflect in a rigid muscle [12].

It is possible that morphological changes in collagen, both in the perimysium and endomysium, alter muscle mechanics, which may contribute directly or indirectly to the development of contractures, thus playing an important role in mobility problems in spastic patients [13]. Collagen has an important influence on passive muscle elasticity and force transmission between muscle and tendon [14]. It is understood that the quantity and quality of muscle collagen can influence the contractile and elastic capacity of the muscle [15]. Muscles with reduced trophism, as well as spastic muscles, show a significant reduction in the amount of type III collagen in experimental studies [16].

Fríden and Lieber [17] performed muscle biopsy in healthy individuals with spastic CP to quantify type I collagen through immunohistochemical study, finding: higher concentration of collagen present in spastic muscles. These findings corroborate the research by [18] in which the presence of type I collagen was classified as intense in the CTR group. The low concentration of this type of collagen in the FTAz and Az groups may indicate the effectiveness of the proposed treatment. The TF group, on the other hand, presented values classified as frequent of type I collagen.

Therapeutic resources with the purpose of reducing muscle tone in cases of children with CP who have spasticity may contribute beneficially to habilitation and rehabilitation treatment, such as the essential oil of Alpinia Zerumbet (Ziclague**R**). Known as a colony, due to its characteristic odor, Alpinia Zerumbet is a herbaceous plant of the Zingiberaceae family, commonly found in northeastern Brazil, popularly used as a diuretic, sedative and hypotensive [19,20]. The substance Alpinia Zerumbet has effects that act on the contractility properties of skeletal muscle fibers. Studies have observed its effects on L-type calcium channels, with consequent modulation of calcium concentration, as well as antispasmodic and basal tone relaxation activity [21,22]. The inherent properties of Alpinia Zerumbet essential oil of modulating the influx of calcium to the sarcoplasm promotes greater relaxation of the spastic muscles. The reduction of spasticity can contribute to the increase of muscle flexibility, minimizing the risk of neuromyogenic contractures, reduce the muscles imbalance between agonists and antagonists, as well as decrease the untimely co-contraction of agonists and antagonists for activities that require movement, with consequent functional gain [23,24]. This characteristic induces muscle relaxation with normalization of tone, which can be beneficial for the treatment of spasticity in clinical conditions such as CP [21,22,24].

A study by Cerqueira et al. [18] evaluate the effect of kinesiotherapy associated with the bioproduct based on the essential oil of Alpinia Zerumbet on the collagen of spastic muscle tissues. It was an experimental research carried out in with 30 rats divided into five groups of six animals: group Az (treated with the bioproduct), FT (treated with physiotherapy), FTAz (treated with the bioproduct and physiotherapy), CTR (control 1 - no treatment) and SHAN (control 2 - no spinal cord injury). Only the SHAN group was not submitted to spinal cord injury. This study demonstrated that physical therapy exercises associated with the essential oil-based bioproduct Alpinia Zerumbet proved to be effective in reversing changes in collagen thickness and organization caused by spasticity after spinal cord injury in this model. The three proposed treatments showed a reduction in collagen fiber thickening when compared to the CTR group, reaching values statistically like the SHAN group, without neural injury. A prospective, clinical and randomized study verified the effect of the essential oil Alpinia Zerumbet associated with physiotherapy in 24 children with cerebral palsy. Results showed that the essential oil associated with kinesiotherapy modulated muscle tone and led to functional gain [24]. To confirm the positive effect of the Alpinia Zerumbet on muscular tonus, this study aimed to verify whether local dermal application of Alpinia Zerumbet (Ziclague) oil to the spastic muscle decreases neural hypertonia in individuals with CP.

Materials and Methods

This cross-sectional clinical study was developed in accordance with the Guidelines and Regulatory Standards for Research Involving Human Beings (Normative Resolution 466/12, of the

National Health Council/MS) and was submitted to and approved by the Research Ethics Committee of UNIFESP (protocol n. 2.351.096). The study was carried out at the Therapeutic Support Center and Association of Cerebral Palsy in Santos, São Paulo, Brazil.

Nineteen individuals with CP, aged 18.1 years (SD=11.24), 14 of whom were levels IV/V of the GMFCS (Gross Motor Function Classification System) and 5 of levels I/II/III, with hypertonia in the biceps brachii and/or hip adductors participated in this study.

Individuals diagnosed with CP, with hypertonia of neural origin and the acceptance of the parents and the child himself, proven by the signing of the Informed Consent Form, were included in the study. Exclusion criteria was patients who underwent orthopedic surgery and/or botulinum toxin application in a period of less than six months.

Participants were assessed through modified Ashworth and Tardieu scales. The Modified Ashworth Scale is a measurement scale for muscle tone, performed passively by moving a joint through the possible range of motion and scoring the perceived resistance for movement on a 6-point scale ranging from 0 (no increase in tone) to 4 (parts affected rigidly in flexion or extension). The evaluation at different speeds helps to distinguish between hypertonia and muscle shortening [25,26,27,28,29]. On the Tardieu scale, spasticity is clinically assessed during passive movement at three specific speeds (V) (slow, in favor of gravity and fast), measuring the intensity and duration of the muscle's reaction to stretching (X) on a 5-point scale ranging from 0 (no resistance) to 4 (contraction or clonus), and the joint angle (Y) at which catch (resistance or interruption to movement) is observed [30,31,32]. Range of movements were calculated for the angle of interruption (catch) verified at fast speed (R1) and range of motion at slow speed (R2) measured by a goniometer.

The Alpinia Zerumbet and placebo applications were randomized, and the evaluators were blinded. Each individual received either Ziclague dermal application or placebo. The Alpinia Zerumbet was applied by a physiotherapist by means of superficial sliding as well as mineral oil for the placebo effect. After application, the patient remained at rest, without therapy for 30 minutes to wait for the effect of the application and was reevaluated by the same scales. The same protocol was repeated after a week using the other oil (Alpinia Zerumbet or placebo). Differences between amplitudes before and after the applications were calculated for the angle of interruption (catch) verified at fast speed (R1) and range of motion at slow speed (R2) measured by a goniometer.

Results and Discussion

Table 1 shows clinical characteristics of individuals who were included in this study. There were no differences in interaction between angles and applications (p= 0.265). Differences between angles in R1 were greater than R2 (p=0.049) and between Ziclague applications were greater than placebo (p=0.012). Out of 32 evaluations, 11 showed gains above 5º in R2 and 13º in R1.

Table 1:

Name	Age	Difference Between R2 Pre and R2 Post Ziclague Application	Difference Between R1 Pre and R1 Post Ziclague Application	Difference Between R2 Pre and R2 Post: placebo Application	Difference Between R1 Pre and R1 Post: Placebo Application	Ashworth Com ziclague	Ashworth Com Placebo
Marina	+R1	MSE (05° - 05°) = 0°	(100° - 70°) = 30°	(04° - 02°) = 02°	(90° - 74°) = 16°	2	2
Misael Arruda	+	MSD (46° - 20°) =26	(74° - 45°) = 29°	(44°- 44°) = 0°	(76° - 72°) = 04°	1	1
Ryan	MSE + MSD =	MSE (10° - 03°) = 07° MSD (05° - 06°) = - 01°	MSE (65° - 46°) = 19° MSD (55° - 64°) = - 09°	MSE (12° - 12°) = 0° MSD (10° - 10°) = 0°	MSE (64° - 50°) = 14° MSD (58° - 52°) = 06°	2	2
Vitor Savoy	No difference	MSE (20° - 20°) = 0°	(70° - 70°) = 0°	(20° - 10°) = 10°	(70° - 80°) = - 10°	2	2
Daniela Soares	= no difference (contracture)	MSE (20° - 20°) = 0°	(90° - 90°) = 0°	(20° - 20°) = 0°	(90° - 90°) = 0°	4	4
Vitor Rosa	No difference with placebo	MID (20° - 25°) = - 05° MIE (19° - 25°) = - 06°	MID (15° - 15°) = 0° MIE (15° - 15°) = 0°	MID (10° - 05°) = 05° MIE (20° - 25°) = - 05°	MID (10° - 10°) = 0° MIE (10° - 15°) = - 5°	1+	1+
Mariana Cecchi	+	MSD (28°-18°) = 10° MSE (36°-20°) = 16°	MSD (68°-50°) = 18° MSE (70°-56°) = 14°	MSD (30°-30°) = 0° MIE (34°-32°) = 2°	MID (70°-60°) = 10° MIE (72°-78°) = -6°	MID 2 MIE 1+	MID 2 MIE 1+
Manuela	No difference	MID (30°-28°) = 2° MIE (18°-20°) = -2°	MID (18°-20°) = -2° MIE (20°-20°) = 0°	MID (30°-30°) = 0° MIE (34°-38°) = -4°	MID (20°-28°) = 8° MIE (16°-30°) = 14°	2	2

Caroline Chaves	16anos MID + MIE+	MiD (30°-38°) = 8° MIE (28º-40°) = 12°	MID (18°-28°) = 10° MIE (20°-36°) =16°	MID (32°-32°) =0° MIE (30°-30°) = 0°	MID (18°-20°) = 2° MiE (30°-30°) = 0°	1	1
Pedro Paulo	+	MSD (40°-32°) = 8º	MSD (60°-42°) = 18°	MSD (20°-20°) = 0°	MSD (70°-62°) = 8°	3	3

Note: Values in degrees. When it appears with (-) it has worsened. And "0" did not improve.

R2 slow; Fast R1

Discussion

According to BEZERRA (2000), Santos (2011) and Xavier Filho and Cândido (2012) demonstrated that properties inherent to the essential oil Alpinia Zerumbet (Ziclague) promotes greater relaxation of the spastic muscles. This characteristic, which induces muscle relaxation with normalization of tone, was observed in our study with a decrease in spasticity in a significant percentage of the muscle groups of the individuals who participated in our study. This study gives an alternative for decrease hipertonia without secondary negatives effects.

Conclusion

A dermal application of Ziclague was able to reduce hypertonia after 30 minutes. We suggest a study with assessments longer than 30 minutes after application to verify gains in range of motion.

References

1. Rosenbaum P, Paneth N, Leviton A, Goldstein M, Bax M, et al. (2007) A report: the definition and classification of cerebral palsy. Dev Med Child Neurol 49(Suppl.109): 8-14.
2. Surveillance of Cerebral Palsy in Europe (SCPE) (2000) Surveillance of cerebral palsy in europe: a collaboration of cerebral palsy surveys and registers. Dev Med Child Neurol 42: 816-824.
3. Yeargin-Allsopp M, Van Naarden Braun K, Doernberg NS, Benedict RE, Kirby RS, et al. (2008) Prevalence of cerebral palsy in 8-year-old children in three areas of the United States in 2002: A multisite collaboration. Pediatrics 121(3): 547-54.
4. Fonseca LF, Xavier CC, Pianetti G (2011) Encefalopatia crônica (paralisia cerebral). In: Fonseca LF, Xavier CC, Pianetti G (Eds.), Compêndio de neurologia infantil. (2nd edn), Medbook, Rio de Janeiro, Brazil, pp: 669-679.
5. Cans C, Dolk H, Plat MJ, Colver A, Prasauskiene A, et al. (2007) Recommendations from the SCPE collaborative group for defining and classifying cerebral palsy. Dev Med Child Neurol 49(Suppl. 109): 35-38.
6. Sanger TD, Delgado MR, Gaebler-Spira D, Hallett M, Mink JW (2003) Classification and definition of disorders causing hypertonia in childhood. Pediatrics 111(1): 89-97.
7. Torre CA (2007) Etiology of cerebral palsy at the association of cerebral palsy patients in santos. Arquivos Brasileiros de Paralisia Cerebral 2(6): 8-13.
8. Torre CA (2015) Tratamento neuroevolutivo - conceito bobath. In: Bandeira de Mello Monteiro C, Abreu L C e Valenti VE (Eds.), Paralisia Cerebral Teoria e Prática, São Paulo, Brazil, pp: 295-320.
9. Smith LR, Pontén E, Hedström Y, Ward SR, Chambers HG, et al. (2009) Novel transcriptional profile in wrist muscles from cerebral palsy patients. BMC Medical Genomics 2(44): 10-30.
10. Gordon AMH, Honsher E, Regnier M (2000) Regulation of contraction in striated muscle. Physiological Reviews 80(2): 853-924.
11. Helping C, Lederer WJ (2008) Calcium Sparks. Physiol Rev 88(4): 1491-1545.
12. Franken M (2010) Flexibilidade: aspectos fisiológicos e fatores limitantes. Edf Esp 15(148): 1-6.
13. Dietz V, Sinkjaer T (2007) Spastic movement disorder: impaired reflex function and altered muscle mechanics. Lancet Neurol 6(8): 725-733.
14. Lieber RL, Fridén J (2002) Spasticity causes a fundamental rearrangement of muscle - joint interaction. Muscle Nerve 25(1): 265–270.
15. Booth CM, Cortina-Borja MJF, Theologis TN (2001) Collagen accumulation in muscles of children with cerebral palsy and correlation with severity of spasticity. Developmental Medicine & Child Neurology 43(1): 314-320.
16. Urso ML, Scrimgeour AG, Chen Y, Thompson PD, Clarkson PM (2006) Analysis of human skeletal muscle after 48 h immobilization reveals alterations in mRNA and protein for extracellular matrix components. J Appl Physiol 101(4): 1136-1148.
17. Fríden J, Lieber RL (2003) Spastic muscle cells are shorter and stiffer than normal cells. Muscle & Nerve 26(1): 157-164.
18. Cerqueira FL, Albuquerque Junior RL, Zini CA, Caramao EB, Cândido EAF (2015) Effects of kinesiotherapy associated with a bioproduct based on Alpinia zerumbet essential oil on collagen in spastic muscle tissues of post-spinal cord injury rats. Interscience Place. International Scientific Journal 10(4): 7.
19. Cândido EAF, Xavier-Filho L, Maia MON, Figueiredo AEL, Querino LS, et al. (2010) Long-term effect of medicine based on the essential oil of Alpinia speciosa Shum, Zingiberaceae (Ziglague) in pyramidal syndrome. Brazilian Journal of Physical Therapy 14(2): 104-104.
20. Cândido EAF, Freitas MM, Cândido JF, Cerqueira FL (2013) New technological alternative for medication aimed at spasticity. Ibero-American Journal of Environmental Sciences, Aquidabã 4(2): 119-126.
21. Bezerra MA, Leal-Cardoso JH, Coelho-de-Souza AN, Criddle DN, Fonteles MC (2000) Myorelaxant and antispasmodic effects of the essential oil of Alpinia speciosa on rat ileum. Phytotherapy Research 14(7): 549-51.
22. Santos BA, Roman-Campos D, Carvalho MS, Miranda FMF, Carneiro DC, et al. (2011) Cardiodepressive effect elicited by the essential oil of Alpinia speciosa is related to L-type Ca^{2+} current blockade. Phytomedicine 18(1): 539-543.
23. Scalzo PL, Souza ES, Moreira AGO, Vieira DAF (2010) Quality of life in patients with stroke: physiotherapy clinic. Neuroscience Magazine 18(2): 139-144.
24. Xavier-Filho L, Cândido EAF (2012) Feasibility of using Alpinia zerumbet essential oil in optimizing physiotherapeutic treatment in spastic cerebral palsy. Arq Bras Neuricir 31(3): 110-115.
25. Scholtes VA, Becher JG, Beelen A, Lankhorst GJ (2006) Clinical assessment of spasticity in children with cerebral palsy: a critical review of available instruments. Dev Med Child Neurol 48(1): 64-73.
26. Clopton N, Dutton J, Featherston T, et al. (2005) Interrater and intrarater reliability of the Modified Ashworth Scale in children with hypertonia. Pediatr Phys Ther 17: 268-73.

27. Skalsky A (2016) Spasticity: the need for objective assessment. Dev Med Child Neurol.

28. Damiano DL, Quinlivan JM, Owen BF, Payne P, Nelson KC, et al. (2002b) What does the Ashworth scale really measure and are instrumented measures more valid and precise? Dev Med Child Neurol 44(2): 112-118.

29. Bohannon RW, Smith MB (1987) Interrater reliability of a modified Ashworth scale of muscle activity. Phys Ther 67: 206-207.

30. Ward AB (1999) The use of botulinum toxin type A in spastic diparesia due to cerebral palsy. Eur J Neurol 6: S95-S98.

31. Haugh AB, Pandyan AD, Johnson GR (2006) A systematic review of the Tardieu Scale for the measurement of spasticity. Disabil Rehabil 28(15): 899-907.

32. Sposito MMM, Riberto M (2010) Assessment of the functionality of children with spastic cerebral palsy. Acta Fis 17(2): 50-61.