ORIGINAL RESEARCH ARTICLE

Evid Based Integrative Med 2005; 2 (4): 239-244
1176-2330/05/0004-0239/$34.95/0

© 2005 Adis Data Information BV. All rights reserved.

Transdermal Absorption of Castor Oil

Eric A. Mein, Douglas G. Richards, David L. McMillin and *Carl D. Nelson*

Meridian Institute, Virginia Beach, Virginia, USA

Abstract

Background: This study evaluated the potential for transdermal absorption of castor oil, a treatment modality recommended by Edgar Cayce and used as an alternative medical treatment. Specific epoxydicarboxylic acids are known to be excreted via the urine when castor oil is administered orally.

Objective: Comparison of the amounts of epoxydicarboxylic acids in the urine of subjects given oral and transdermal administrations of castor oil may provide evidence of transdermal absorption of castor oil and provide clues to its metabolism in the system.

Methods: Three volunteers were given castor oil, both as an abdominal hot pack and by oral administration on two separate trials. Urine samples were collected before and after administration.

Results: Oral administration of castor oil resulted in high levels of excretion of epoxydicarboxylic acids in all subjects. In contrast, the level of urinary epoxydicarboxylic acids with the external application (abdominal pack) sessions did not vary from the relatively low endogenous levels of these molecules that are normally present.

Conclusion: Castor oil is either not well absorbed through the skin or is metabolised in a way that did not have the effect of significantly increasing the excretion of the specific metabolic byproducts associated with the ingestion of castor oil.

Background

Castor oil has a long history as a medicinal agent in folk healing and mainstream medicine, with the first prescriptions likely to have been found on papyrus.[1] The primary function of castor oil has traditionally been as an oral cathartic and laxative. Castor oil is composed principally of ricinoleic acid (90%, as compared with 7% oleic acid and 3% linoleic acid), and this fatty acid was first identified in 1890 as its active component.[2] Ricinoleic acid is a C_{18}, monounsaturated (at C_{9-10}), monohydroxylated (at C_{12}), aliphatic fatty acid.

McGarey[3,4] has documented the historical applications of castor oil and noted the more recent trend for it to be applied as an external pack in its use as an alternative medicine therapy. McGarey's work relies heavily on the legacy of Edgar Cayce, an important figure in the development of holistic medicine in the modern era. The work of Cayce (discussed by Callan[5] and Mein[6]) places great significance on the healing properties of castor oil when applied externally as a pack. The typical application recommended by Cayce is that of a hot abdominal pack placed over the right side of the abdomen covering the liver, upper small intestines, cecum and ascending colon. Cayce[6] suggested this application for stimulating the liver, gall bladder and colon to help with eliminations and to treat abdominal adhesions.

Practitioners of integrative medicine have adopted the use of castor oil packs for a wide variety of conditions, particularly female reproductive problems. For example, the *Wellness Resource Guide for Medical Students*[7] suggests using hot abdominal castor oil packs for menstrual cramps. Dr Christiane Northrup recommends abdominal castor oil packs (60 minutes per session, two to four times per week) for both the treatment and prevention of cramps and pelvic pain for women experiencing these common pelvic symptoms. She cautions that the hot packs should not be used if they increase the pain or there is heavy bleeding.[8]

A recent Google search (22 February 2006) specifying "castor oil packs" as an exact phrase search resulted in about 28 700 web pages addressing this therapy, suggesting it has become a popular alternative medicine treatment. Probably the strongest advocacy for castor oil packs comes from naturopathic physicians. The American Cancer Society website states that, "Naturopathic practitioners ... and some others claim that castor oil boosts the immune system by increasing white blood cells, which help the body fight infection, and other immune cells. They also claim that castor oil helps dissolve cysts, warts, and tumours, as well as

soften bunions and corns. Other claims for castor oil include treating lymphoma, bacterial and viral diseases (including HIV), arthritis, skin and hair conditions, eye irritations, diseases of the colon and gallbladder, bursitis, multiple sclerosis, and Parkinson's disease. There is no scientific evidence to support these claims."[9]

However, in addition to the numerous naturopathic and alternative medicine websites that discuss castor oil packs, several hospitals include this treatment as an integrative therapy. The North Broward Hospital District (NBHD; one of the ten largest hospital systems in the US and the largest in Florida) utilises castor oil pack therapy for lung cancer patients to decrease the side effects of chemotherapy and aid the lungs in detoxification. The saturated pack is applied directly to the skin, placing a heat source (heating pad or water bottle) on top. The pack is left in place over the lungs for 30 minutes or more for 3–4 consecutive days per week.[10] Hospitals within the NBHD network also include castor oil packs for the treatment of bronchitis[11] and chronic obstructive pulmonary disease.[12]

Other US institutions known to recommend castor oil packs include: the University of Maryland Medical Center includes castor oil packs in their integrative medicine approach to pelvic inflammatory disease,[13] irritable bowel syndrome,[14] low back pain,[15] kidney stones[16] and lung cancer;[17] the Mercy Medical Center (Des Moines, Iowa) endorses castor oil packs for gallbladder disease[18] and congestive heart failure;[19] Allina Hospitals and Clinics (throughout Minnesota and western Wisconsin) recommend castor oil packs for pelvic inflammatory disease;[20] and the Baltimore Washington Medical Center endorses castor oil packs as a treatment for ulcerative colitis[21] and pertussis.[22]

Objective

Despite the popularity of castor oil, there has been little formal research on castor oil packs. One previous study looking at possible immunological changes produced by hot abdominal castor oil packs produced unclear results.[23]

In consideration of the widespread usage of castor oil packs and their increasing integration into mainstream medical settings, we decided to explore the physiology of the therapy to better understand its specific mechanism of action. As a practical matter, we were also interested in the development of a commercial alternative to the rather messy procedure by creating a disposable, presaturated pack that would be more user friendly than the traditional version recommended by Cayce. Quantification of the amount of oil penetrating the skin is an essential first step for understanding the optimal parameters with regards to the type of material, amount of heat and oil, length of session and frequency of sessions to produce therapeutic efficacy.

Although researchers have developed techniques for measuring the amount of castor oil absorbed into the system when it is taken orally, we have found no studies that have quantified the absorption of externally applied castor oil in humans. Thus, we believe our study is the first attempt to measure the absorption of castor oil administered through the skin in the form of a castor oil pack.

A previous study performed by Hagenfeldt et al.[24] provided a conceptual framework for our research design. In their study, castor oil was administered orally to three healthy volunteers. Urine was collected for several hours and analysed using capillary gas chromatography. The analysis revealed elevated levels of the products of breakdown of castor oil by the liver (specific epoxydicarboxylic acids that are normally found in urine in very small amounts). Thus, the presence of high levels of these acids is evidence for absorption and metabolism of orally administered castor oil.

Using the data and conceptual model from the study by Hagenfeldt et al.,[24] we designed a study that included both oral and external (abdominal pack) administration of castor oil. By comparing the levels of the epoxydicarboxylic acids in the urine following external and oral applications, we aimed to be able to reliably quantify the level of absorption of the oil through the skin under varied conditions relevant to clinical application of the packs.

Methods

Design

This study utilised a within-subjects design with pre- and post-intervention data collection.

Subjects

Three healthy Meridian Institute male researchers, aged 46–57 years volunteered for this project. All three participants had used abdominal castor oil packs previously and knew how to perform the procedure. None of the participants had used castor oil packs for at least 3 months before the study.

Procedures

In the first stage of the project, urine samples were collected before and during two 3-day series of abdominal castor oil packs. After a 1-week washout period in which urine samples were collected to determine clearance rate, castor oil was administered orally on two occasions (1 week apart), with urine samples collected at baseline and after the ingestion of castor oil. For the first oral

© 2005 Adis Data Information BV. All rights reserved.

administration subjects were given 2.5cc castor oil. This was increased to 15cc for the second oral administration.

Castor oil packs were made of wool flannel, folded into three thicknesses and were approximately 10 × 10 inches (25.4 × 25.4cm) in size. This was well saturated with castor oil and then pre-warmed by heating it in a microwave oven for about 1 minute (subjects 1 and 3), or wrapped in a heating pad for about 10 minutes (subject 2). With the subject lying down on their back, the pack was placed on the right side of the body, extending from a little above the bottom of the sternum to about 4 inches (10.2cm) below the navel. Once applied, this was then covered with a towel or plastic sheet with a heating pad then placed on top of this. The packs were kept in place for 1.5 hours, at which time the excess castor oil was then washed off the skin. The packs were used for 3 consecutive days, which is the way they are most commonly used therapeutically.

Since the level of heat used in the abdominal castor oil pack may be a factor in transdermal absorption, three levels of heat were applied in stage 1 using electrical heating pads (50, 100 and 200 watts). The sequence of heating used in the first stage of the project is shown in table I.

Following removal of the castor oil packs, all urine was collected and volumes recorded for the next 8 hours. At the end of 8 hours, the urine was shaken and a small sample collected and sent for analysis.

All urine samples were tested for the presence and concentration of two epoxydicarboxylic acids (epoxyoctanedioic acid and epoxydodecanedioic acid) and ricinoleic acid. The urine samples were analysed by Alturas Analytics, Inc. (Moscow, ID, USA) using the capillary gas chromatography as described by Hagenfeldt et al.[24] The sequence of interventions and sampling for stage 1 is provided in table II.

The second stage of the project was essentially a focused and scaled-down version of the first stage to confirm the findings and decrease sources of error. A different laboratory (EnviroTest Laboratories, Edmonton, AB, Canada) was used to assess the accuracy of the findings in the first stage and to minimise laboratory practices as a source of variability. The highest level of heating pad (200 watts) was used for all sessions to facilitate maximum penetration of the castor oil into the skin. An attempt was made to eliminate dietary oils of a similar composition to castor oil (e.g. olive oil) at least 1 week prior to and during the second stage. Since no detectable level of ricinoleic acid was found in any of the samples in stage 1, this substance was not included in the laboratory assays for stage 2. The sequence of interventions and sampling for stage 2 is provided in table III.

Table I. Sequence of heating used in stage 1 of the project

Subject	First series	Second series
1	No heat	100 watts
2	50 watts	200 watts
3	50 watts	50 watts

Results

Results can be found in tables II and III and in figure 1.

With the oral administration of castor oil in either the amount of 2.5cc or 15cc, there was a high level of excretion of the epoxydicarboxylic acids in all the subjects, results similar to those found in the study by Hagenfeldt et al.[24] Despite the small number of data samples, both stage 1 and stage 2 showed a statistically significant difference between the oral castor oil and both the endogenous baseline levels and the post-castor oil pack samples for both epoxyoctanedioic acid and epoxydodecanedioic acid (all with two-tailed $p < 0.005$).

In contrast, the levels of urinary epoxydicarboxylic acids after the external application (abdominal pack) sessions of castor oil did not vary from the relatively low levels of these molecules present endogenously. There were no significant differences found between the endogenous baseline samples and those obtained after the application of the castor oil packs. There was also no evident trend towards significance between these values that would have suggested a difference if a larger number of subjects had been evaluated.

In addition, there was no evidence that the amount of heat used affected the outcome.

Discussion

The dicarboxylic acids that we measured are the result of fatty acid catabolism at the cellular level. Fatty acid β-oxidation in the mitochondria removes two carbons at a time from the carboxyl end of the molecule until an obstacle is reached. Then, the shortened and partially oxidised fatty acid is transported out of the mitochondrion and the other end of the molecule is oxidised by microsomal enzymes. What is unusual in this case is the generation of the epoxy group, which is relatively rare in mammalian biochemistry.[24] This occurs with ricinoleic acid because of the hydroxyl group at C_{12}. While there are low levels of endogenous epoxyoctanedioic acid and epoxydodecanedioic acid formed in the body, our data shows that even a ½ teaspoon (2.5cc) of castor oil taken orally significantly increases their formation and excretion into the urine, allowing them to serve as a marker of ricinoleic acid in the body.

We had initially hypothesised that enough castor oil would be absorbed through the skin after 1.5 hours of saturated exposure

© 2005 Adis Data Information BV. All rights reserved.

Table II. Sequence of interventions and sampling for stage 1 (all results are expressed as total acids [μg/mL × urine volume]). Blank cells indicate no samples collected or analysed after that activity

Day(s)	Activity	Sample number	Subject 1			Subject 2			Subject 3		
			E1	E2	R	E1	E2	R	E1	E2	R
1		1	234	290	ND	341	339	ND	629	783	ND
2	CO pack 1										
3	CO pack 2										
4	CO pack 3	2	254	241	ND	244	157	ND	1 616	2 144	ND
5											
6											
7											
8											
9	CO pack 4	3	198	153	ND	760	128	ND	589	622	ND
10	CO pack 5										
11	CO pack 6	4	507	713	ND	527	221	ND	365	384	ND
12		5 (subject 1)	596	470	ND						
13		5 (subject 2)				498	275	ND	515	710	
14		5 (subject 3)									ND
15–22	Washout										
23		6	604	803	ND	178	262	ND	309	353	ND
24	2.5cc CO	7	2 915	30 240	ND	11 610	31 050	ND	14 523	50 505	ND
25–30	Washout										
31	15cc CO	8	4 973	103 350	ND	7 328	32 640	ND	38 700	86 940	ND

CO = castor oil; **E1** = epoxyoctanedioic acid; **E2** = epoxydodecanedioic acid; **ND** = not detected; **R** = ricineolic acid.

over a 100 square inch (645 cm^2) surface aided by the use of heat that we would be able to measure increased epoxyoctanedioic and epoxydodecanedioic acids in the urine. There are several possibilities for why this did not prove to be the case.

First, the castor oil may not be absorbed well through the skin. The hydroxy group on the ricinoleic acid makes the oil more polar, giving it limited solubility in petroleum solvents but making it soluble in alcohol (ethanol) and other polar solvents. Baynes and Riviere[25] used radiolabeled ^{3}H-ricinoleic acid in mineral oil or polyethylene glycol (PEG)-200 to evaluate permeability in porcine skin. After 8 hours of exposure, a maximum of 16% of the dose could be detected in the stratum corneum and 5% of the dose could be detected in the skin, but only 0.3% had actually been absorbed. Song et al.[26] compared ricinoleic acid with oleic acid (the main fatty acid in olive oil), both mixed with propylene glycol, for effectiveness in increasing the permeation of hydrocortisone

Table III. Sequence of interventions and sampling for stage 2 (all results are expressed as total acids [μg/mL × urine volume])

Day(s)	Activity	Sample number	Subject 1		Subject 2		Subject 3	
			E1	E2	E1	E2	E1	E2
1		1	2 415	360	4 079	184	5 593	528
2	CO Pack 1	2	1 204	131	3 150	200	1 760	219
3	CO Pack 2							
4	CO Pack 3	3	4 704	441	2 622	193	2 464	212
5		4	1 863	207	8 257	590	4 034	548
6–13	Washout							
14		5	2 329	306	1 956	96	5 886	635
15	2.5cc CO	6	75 313	44 602	40 803	12 820	84 700	45 850

CO = castor oil; **E1** = epoxyoctanedioic acid; **E2** = epoxydodecanedioic acid.

© 2005 Adis Data Information BV. All rights reserved.

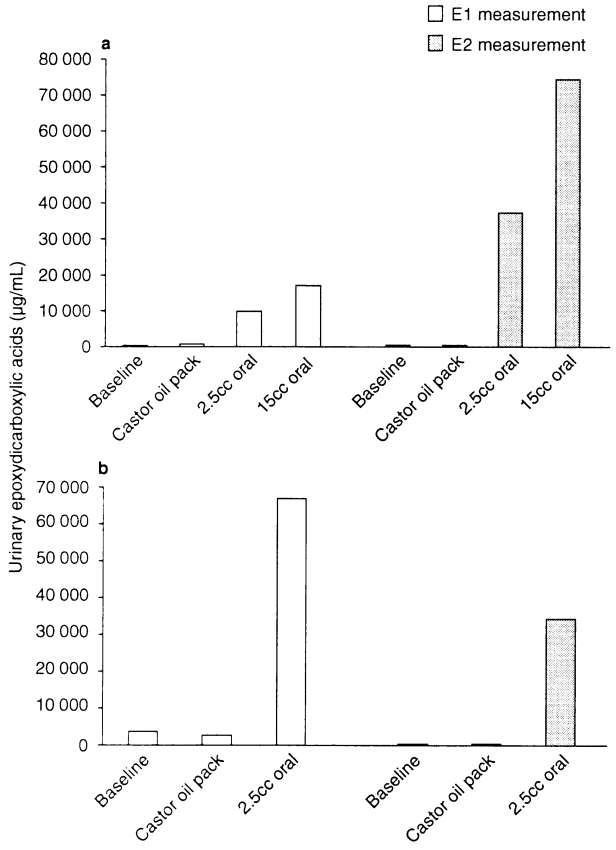

Fig. 1. Urinary epoxydicarboxylic acids: (**a**) stage 1 and (**b**) stage 2. **E1** = epoxyoctanedioic acid; **E2** = epoxydodecanedioic acid.

across hairless mouse skin *in vitro*. The oleic acid markedly enhanced the transdermal flux of hydrocortisone compared with propylene glycol by itself (approximately 980-fold) while the ricinoleic acid had minimal impact (an approximately 1.4-fold increase).

A second possibility is that the ricinoleic acid was absorbed through the skin but was efficiently stored in subcutaneous fat and, thus, not readily available for metabolism. However, if this were the case, it would be unlikely for the castor oil to play a therapeutic role in changing the function of abdominal organs.

Another possibility is that it was absorbed and processed more slowly, not creating a spike in the epoxydicarboxylic acids. However, in stage 1 we collected urine for analysis for up to 3 days after a series of castor oil packs and did not see any increase in their values.

Finally, it is possible that castor oil that is absorbed through the skin is processed through another biochemical pathway or physiological process. As an example of the latter, McGarey[3,4] hypothesised a vibrational or subtle energy effect (as opposed to biochemical) for how the castor oil affects the body.

Conclusion and Future Directions

The failure of our study to identify a biochemical pathway for the absorption of topically applied castor oil is problematic at both a basic science and clinical level. Further evaluation and testing needs to be carried out before fully concluding that castor oil used as an abdominal pack is not absorbed. One possibility for further inquiry would be to use radiolabeled ricinoleic acid or castor oil. If its byproducts are not found in the urine then it would be very unlikely that the castor oil crosses the skin barrier. If it is found, then it may be metabolised in a way not yet understood. Further testing might also be needed to exclude a therapeutic effect even if the castor oil is not absorbed (e.g. McGarey's subtle energy hypothesis).

Future studies should focus on therapeutic efficacy for the large range of disorders for which castor oil packs are currently being utilised. If therapeutic efficacy is established for a particular disorder, the results may provide clues with regard researching the mechanism of action that was the focus of this study.

Acknowledgements

Financial support for this research was in part donated by the Association for Research and Enlightenment. The authors have no conflicts of interest that are directly relevant to the content of this study.

References

1. Gaginella TS, Phillips SF. Ricinoleic acid: current view of an ancient oil. Am J Dig Dis 1975; 20 (12): 1171-7
2. Watson WC, Gordon RS, Karmen A, et al. The absorption and excretion of castor oil in man. J Pharm Pharmacol 1963; 15: 183-8
3. McGarey WA. Edgar Cayce and the Palma Christi. Virginia Beach (VA): Edgar Cayce Foundation, 1970
4. McGarey WA. The oil that heals. Virginia Beach (VA): A.R.E. Press, 1993
5. Callan JP. Holistic health or holistic hoax? JAMA 1979; 241: 1156
6. Mein E. Keys to health. New York: Harper & Row, 1989
7. American Medical Student Association (1997). Wellness resource guide for medical students. 5th ed. [online]. Available from URL: http://www.amsa.org/pdf/wellness.pdf [Accessed 2006 Feb 22]
8. Northrup C. The wisdom of menopause. New York: Bantam Books, 2001
9. American Cancer Society (2006). Castor oil [online]. Available from URL: http://www.cancer.org/docroot/ETO/content/ETO_5_3X_Castor_Oil.asp?.sitearea = ETO [Accessed 2006 Feb 22]
10. North Broward Hospital District (2002). Lung cancer [online]. Available from URL: http://www.browardhealth.org/13548.cfm [Accessed 2006 Feb 22]
11. North Broward Hospital District (2002). Bronchitis [online]. Available from URL: http://www.browardhealth.org/13542.cfm [Accessed 2006 Feb 22]
12. North Broward Hospital District (2002). Chronic obstructive pulmonary disease [online]. Available from URL: http://www.browardhealth.org/13558.cfm [Accessed 2006 Feb 22]
13. University of Maryland Medical Center (2004). Pelvic inflammatory disease [online]. Available from URL: http://www.umm.edu/altmed/ConsConditions/PelvicInflammatoryDiseasecc.html [Accessed 2006 Feb 22]
14. University of Maryland Medical Center (2004). Irritable bowel syndrome [online]. Available from URL: http://www.umm.edu/altmed/ConsConditions/IrritableBowelSyndromecc.html [Accessed 2006 Feb 22]

© 2005 Adis Data Information BV. All rights reserved.

15. University of Maryland Medical Center (2004). Low back pain [online]. Available from URL: http://www.umm.edu/altmed/ConsConditions/LowBackPaincc.html [Accessed 2006 Feb 22]
16. University of Maryland Medical Center (2004). Kidney stones [online]. Available from URL: http://www.umm.edu/altmed/ConsConditions/Urolithiasiscc.html [Accessed 2006 Feb 22]
17. University of Maryland Medical Center (2004). Lung cancer [online]. Available from URL: http://www.umm.edu/altmed/ConsConditions/CancerLungcc.html [Accessed 2006 Feb 22]
18. Mercy Medical Center Des Moines (2001). Gallbladder disease [online]. Available from URL: http://www.mercydesmoines.org/ADAM/AlternativeMedicine/ConsConditions/GallbladderDiseasecc.asp [Accessed 2006 Feb 22]
19. Mercy Medical Center Des Moines (2001). Congestive heart failure [online]. Available from URL: http://mercydesmoines.org/ADAM/AlternativeMedicine/ConsConditions/CongestiveHeartFailurecc.asp [Accessed 2006 Feb 22]
20. Allina Hospitals and Clinics (2004). Pelvic inflammatory disease [online]. Available from URL: http://www.medformation.com/ac/CAM.nsf/consconditions/PelvicInflammatoryDiseasecc.html [Accessed 2006 Feb 22]
21. Baltimore Washington Medical Center (2005). Ulcerative colitis [online]. Available from URL: http://health.northarundel.org/patiented/articles/how_symptoms_managed_000069_8.htm [Accessed 2006 Feb 22]
22. Baltimore Washington Medical Center (2005). Pertussis [online]. Available from URL: http://health.northarundel.org/altmed/ConsConditions/Pertussiscc.html [Accessed 2006 Feb 22]
23. Grady H. Immunomodulation through castor oil packs. J Naturopathic Med 1997; 7 (1): 84-9
24. Hagenfeldt L, Blomquist L, Midtvedt T. Epoxydicarboxylic aciduria resulting from the ingestion on castor oil. Clin Chim Acta 1986; 161: 157-63
25. Baynes RE, Riviere JE. Mixture additives inhibit the dermal permeation of the fatty acid, ricinoleic acid. Toxicol Lett 2004; 147: 15-26
26. Song FS, Lau-Cam CA, Kim KH. Monohydroxylation and esterification as determinants of the effects of cis- and trans-9-octadecenoic acids on the permeation of hydrocortisone and 5-fluorouracil across hairless mouse skin in vitro. Int J Pharm 2001; 212: 153-60

Correspondence and offprints: Dr *Eric A. Mein*, 2712 Spigel Drive, Virginia Beach, VA 23454, USA.
E-mail: emein@cox.net

© 2005 Adis Data Information BV. All rights reserved.