Classical Ayurvedic pharmaceutical processing of *Danti* (*Baliospermum montanum Willd.*) root: A practical approach

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ABSTRACT

Background: Ayurveda recommends different types of processing techniques for certain drugs of herbomineral origin either to increase their therapeutic efficacy or to reduce reported adverse effects, under the title shodhana samskara. Charaka samhita recommends to use Danti, categorized under semi poisonous group of drugs, only after shodhana samskara. The present article reports the changes made in physicochemical and phytochemical properties of raw Danti root after shodhan samskara (classical processing).

Materials and Methods: Danti (Baliospermum montanum Willd.) root, and other accessory ingredients like Pippali (Piper longum Linn.) fruits, Honey, leaves of Kusha (Desmostachya bipinnata Stapf.) were procured after proper authentication. Danti root were cut into small pieces (8 to 10 cm long) and Pippali fruits were mechanically powdered (mess no -80). A homogenous mixture was prepared by mixing honey with pippali powder. The roots of Danti were subjected for swedana (fomentation) being smeared with dry fruit powders of Pippali, honey and wrapped with Kusha at a temperature of 125° Celsius following the classical recommended guidelines of Charaka samhita.

Results: Light brown colour of raw Danti root changed to deep brown in processed Danti, fibrous and subjective irritation properties (perceived by olfaction) of classical processed Danti root was found to be decreased as compared to raw Danti. There were changes in the values of loss on drying, water-soluble extract, alcohol soluble extract and pH values in processed sample in comparison to raw Danti root.

Conclusion: Raw Danti root when processed through classical shodhana samskara changes its organoleptic characters and physico-chemical properties.

Keywords: Baliospermum, Danti processing, Samskara, Shodhana, Swedana.

BACKGROUND

Collection of the drug at a specific time and season following a unique processing technique, ensuring its collection as such in its official usage form, has been emphasized in Ayurveda classics in order to enhance its therapeutic efficacy as well as to get the drugs with better potency.[1] Samskara (Pharmaceutical processing) is an important concept of Ayurveda pharmaceutics. Each step of Samskara has been outlined with highest distinction at various context of Ayurveda classics. The fundamental objective of Samskara can be fulfilled through various

methods like toya-agni sannikarsha (applications of heat and water), bhavana (trituration), shodhana (purification/ processing) etc.[2] It plays a versatile role which includes removal of impurities, toxic properties and making the drug acceptable to body in prescribed dose.[3]

Delineations of various collection and pharmaceutical processing technique of different drugs, by altering its photo-pharmacological profile and removing toxic properties, are well noted in different Ayurveda texts. Certain examples of these classical pharmaceutical processing technique includes the collection of fruit pulp of Aragvadha (Cassia fistula L.) after being kept covered with sand for seven days;[4] collection of seeds of Madana (Randia dumetorum Retz.) during Pushya, Asvini or Margasiras naksyatra and its processing being tied with Kusa (Desmostachya bipinnata Stapf.) leaves, then be kept inside a heap of either barley, husk, masa, Sali type of dhanya (paddy), Kulatha or mudga for eight nights;[5] collection of root bark of Tilwaka, (Symplocos racemosa Roxb.) being impregnated with the decoction of Dashamoola kwatha;[6] processing of de-coated Lashuna (Allium sativum Linn.) is to be triturated in butter milk for three days.[7,8]

Danti (Baliospermum montanum Willd.) is a well-known ayurvedic drug attributed with plentiful medicinal properties. Acharya Charaka has narrated a special chapter of "Danti Dravanti Kalpaadhyaya'', to counter the vikashi, tikshna properties of its root,[9] has recommended a specific processing technique and preservation procedure prior to its use.[10]

Present Status

Scientific validation of classical recommended sodhana samskara procedures pertaining to therapeutic alteration of certain drugs in detoxifying and modifying its phyto-pharmacological profile has already been established. Shodhita Guggula (Commiphora mukul Hook ex Stocks- Burseraceae) inhibits the spasm produced by acetylcholine inside intestinal smooth muscles.[11] Many systemic and scientific studies have been carried out to explore the impact of shodhana samskara (purification classical processing) procedures on phytochemical profile of some poisonous plants enlisted in Ayurved. Certain examples to this context are mentioned as follows. Removal of aconitine from vatsannabha (Acontium ferox Wall) tuber, reduction of toxic contents like Strychnine and Brucine from kupeelu seeds (Strychnos nux-vomica Linn) , alteration of toxic chemical urushiol into non-toxic anacardol in case of Bhallataka (Semecarpus anacardium Linn), reduction of the toxic chemical hyosciamine and scopolamine from

Dhatura (Datura metel Linn & Datura innoxia Mill), reduction of colchicine percentage in case of gomutra shodhita Langali (Gloriosa superba Linn) tuber and reduction of ß-asarone in Vacha (Acorus calamus Linn.) tuber are the evident outcome of impact of shodhana samskara (purificatory classical processing).[12]

Ayurveda mentions that the culminated function of an ayurvedic formulation does not merely get rendered by the presence of a single entity rather by the combined effect or action of multiple entities present in it expressed through the sidhanta (concept) of sannipata samyoga (synergistic/additive) or viyoga (antagonistic)[13] while modern pharmaceutics is mainly based upon isolation or reductionist of chemical entity approach. The comprehensive concept of ayurvedic Shodhana thought process cannot be a direct alignment to the modern pharmaceutical approach on purification, because both the system carries different logic.

Lacunae

Shodhana samskara, a specific processing technique for Danti root, prior to its use, as recommended by Acharya Charaka, has not been validated in a scientific way.

Aim of the study:

To assess the effect of shodhana samskara on various physico and phytochemical parameters of Danti root.

MATERIALS AND METHODS

Ashodhita Danti root (Raw Danti root) of 8-10cm long, leaves of Kusha (Desmostachya bipinnata Stapf.) of 15-25cm long, dry powders of fruits of Pippali (Piper longum Linn.) being passed through mesh no 80, honey and multani mitti (fulllers earth) were procured. shodhana samskara of raw Danti root was carried out by adopting the principle of Swedana (fomentation)[14] following classical guidelines.

Collection- Identification - Authentication of Materials

Danti (Baliospermum montanum Willd.) roots were first identified with the help of ayurvedic traditional healer, matching its reported classical noted characters. Then it was removed with the adherent soil to it. Subsequently, it was washed under fresh running water and dried under sun.[15] The roots samples were then authenticated in pharmacognosy laboratory of IPGT & RA and the herbarium of the sample was preserved in pharmacognosy laboratory with voucher specimen (No. PHM/6208/15-16). The collected Danti root is designated as raw Danti root. (RD). Similarly, other accessory drugs were procured like the drug Kusha (Desmostachya bipinnata Stapf.) was collected and authenticated by comparing with the reported characters with the help of taxonomist[16] and the herbarium of the same

was preserved in pharmacognosy laboratory with voucher specimen (No.PHM/6208/15-16) for future reference. Best quality dry fruits of Pippali, and multani mitti were procured from local market and Honey was collected from government run agency, for the processing of Danti root.

Equipment for Shodhana (purification procedure)

All the instruments and equipment's used in this shodhana samskara (purification procedure) was standard one and samples were prepared following standard guideline.

Procedure

Semiliquid paste, prepared by mixing honey and powdered pippali, and was smeared thoroughly around the roots of Danti. Then the resultant was wrapped tightly with leaves of Kusha and subsequently coated with multani mitti (fullers earth) soaked cotton cloth following classical guidelines of kappada mitti of thickness two angulas (3cm)[17] and subjected for open sun drying. Then the obtained dried samples were subjected for swedana (Fomentation) as per classical guidelines in the context of anukta for 1 yama (3 hours) in the context of herbal drug shodhana[18] at a temperature of 125° Celsius with the help of induction cooker.

Preparation of Sample

In first group, the wrapped kappada mitti and Kusha was removed from Danti root and then it was dried under sun. After drying, it was powdered by mechanical grinder and passed through mess no 80. To avoid manual errors and to make that processing more standardized, this same procedure had been adopted for 3 times taking three different batches. The obtained three batches were amalgamated and levelled as Classical Processed Danti Root (CPDR).

In the second group, Danti root sample was wrapped with only Kusha and subjected for swedana for 3 hours at temperature of 125° Celsius without being smeared with Pippali and Honey. This process was also adopted for three times for this group. Then the obtained resultant from each group was amalgamated and resultant was levelled as Kusha Processed Danti Root i.e. KPDR.

In third group, only raw Danti roots were fomented with the help of water for 3 hours at temperature of 125° Celsius. This process was also repeated for thrice and the obtained resultants were powdered well, assembled and levelled as Water Processed Danti Root (WPDR).

In fourth group, only three batches of Raw Danti roots were taken and then these were powdered by mechanical grinder, passed

through mess no 80, amalgamated and, levelled as RD.

Graphical schematic abstract of each step of shodhana (pharmaceutical processing of Danti) has been presented in Figure 1.

Similarly, the details of procedure, in sequential manner, has been presented in Figure 2 and 3.

The four groups of test drugs, obtained at different stages of the steps followed in classical processing techniques for Danti Sodhana are presented schematically in Figure 4.

Statistical Analysis

Statistical analysis was carried out basing upon the obtained data from physico chemical parameters of all four groups. These data have been presented as mean ± standard deviation, means of results of all three batches were expressed as % w/w, n=3, Mean ± SD). Statistically comparisons were performed by putting unpaired student's t-test for all three groups as compared to RD group.

RESULTS

After shodhana, change in colour from light brown to deep brown, an increase in softness and lessened fibrous feature was observed in CPDR in compared to RD (Table 1). Greater yield (289.93gm) and greater weight gain percentage (44.96%) was found in CPDR. (Table 2). After processing, when compared to RD, loss on drying in CPDR was 5.4% and WPDR was 3.5% and in rest groups, the value of loss on drying is within in identical range. (Table 3). Ash value was decreased in case of all batches after processing. A decrease in ash value, as compared to RD, in CPDR i.e. 1.9% that for KPDR is 1.28% and that for WPDR is 0.8%. (Table 3). In CPDR, both water and alcohol soluble extractive value shows an increased level i.e. 3.5% and 6.16% respectively, in comparison to RD. In WPDR, water soluble extractive value was found to be increased by 0.5%. pH value of all samples was found in between 6 to 6.5 (Table 3).

DISCUSSION

Shodhana for Danti seems to be a less prevalent procedure in the Ayurvedic armamentarium because of lack of validation of this unexplored classical processing technique. The present work highlights the impact of Shodhana (Classical processing technique) on Danti with special reference to its organoleptic and physico-chemical profiles. Increased softness and lessened fibrous feature observed in CPDR as compared to RD suggests the possible outcome of classical recommended processing technique upon raw Danti root. Subsequently, reduced irritation was observed in CPDR which may be attributed by unctuousness of madhu (Honey). This may claim the

Table 1: Effect of classical processing on organoleptic characters of various groups of Danti (Baliospermum montanum) root powder.

Characters	CPDR	KPDR	WPDR	RD
Colour	Deep brown	Whitish light brown	Greyish brown	Light brown
Odour	Characterstic *Pippali* smell (Less irritation)	Characterstic	No Specific	Pungent (Irritation)
Touch	+++ Soft	++ Soft	Soft	Rough-Hard
Taste	Sweetish-slimish	Slimish - Bitter	Slimish	Bitter
Nature	Less fibrous	Fibrous	Fibrous	More fibrous

Table 2: Effect of *Sodhana* on yield of final weight of various groups of *Danti* (*Baliospermum montanum)* root powder after processing.

	CPDR (Avg. Weight in grams)	KPDR (Weight in grams)	WPDR (Weight in grams)	RD (Weight in grams)
Before *sodhana*	200	200	200	200
After *sodhana* and drying in sunlight	289.93	232.26	206.73	200
Net Weight gain	89.93	32.26	6.73	Nill
Percentage of Weight gain (%)	44.96%	16.13%	3.36%	Nill

Table 3: Physico -chemical parameters of root powder raw and classically processed Danti (Result expressed as % w/w, n=3, Mean ± SD)

SL.no.	Test	CPDR	KPDR	WPDR	RD
1	Loss on drying at 110 °C	14.5±1.6%	9±0.12%	12.6±0.23%	9.1±0.26%
2	Ash value(w/w)	7.5±0.42%	8.1±0.38%	8.6±0.29%	9.4±0.26%
3	Acid Insoluble ash	1.8±0.4%	2.1±0.3%	1.9±0.5%	2.2±0.4%
4	Water soluble extract	7.6±0.71%	4.1±0.52%	4.6±0.35%	4.1±0.32%
5	Methanol soluble extract	9.52±0.47%	3.32±0.63%	3.5±0.81%	3.36±0.70%
6	p.H	6.0±0.42	6.5±0.44	6.5±0.46	6.5±0.39

Note: "n" stands for number of experiments/batches in each group and ± SD stands for Standard deviation

reduction of five phorbol ester group of chemical presence in Danti which has been reported to produce acronarcotic effect.[19,20]

Main objective of classical processing technique is to counter the Vikashi and tikshna properties of Danti making it less

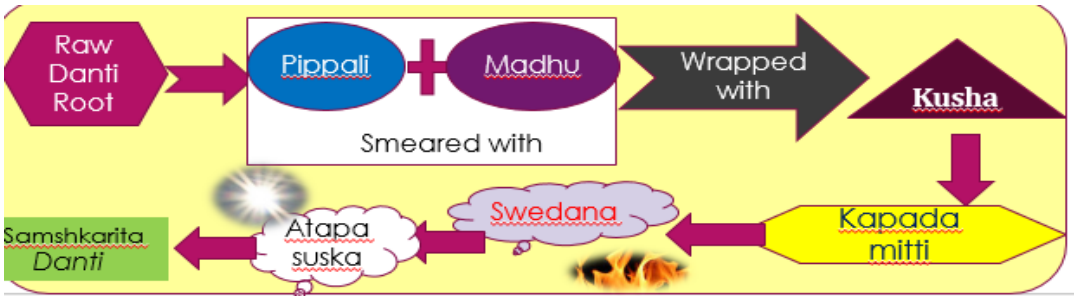

Figure 1: Graphical abstract of each step of shodhana (pharmaceutical processing of Danti root) explained in schematic manner.)

Figure 2: (a) Natural habitat of drug Baliospermum montanum Willd, (b) Sample of Baliospermum montanum Willd root preserved, (c) Natural habitat of drug Baliospermum montanum Willd root., (d) Herbarium preserved specimen of Baliospermum montanum Willd, (e) Natural habitat of drug Desmostachya bippinnata Stapf., (f) Herbarium preserved specimen of Desmostachya bippinnata Stapf.

toxic and conducive to body. Vikashi and tikshna properties are one among the ten qualities stated for visha.[21] Vikashi guna breaks the bonding between various dhatus and brings about looseness in the dhatus (dhatushaithalya)[22] and ascribed as pranaghna[23] i.e. harmful for vital organs resulting in impaired function while Tikshna guna being the attribute of fire, affects detriment to marma[24] producing irritations, burning sensation, and putrefaction inside body. By drawing a correlating approach in this study, we may assume that the Tikshna guna of Danti root may be interpreted to five phorbol ester group of chemical presence in Danti root which are both responsible for producing irritation inside body. Significant increase in weight gain in CPDR as compared to RD signals the additive weight gain due to

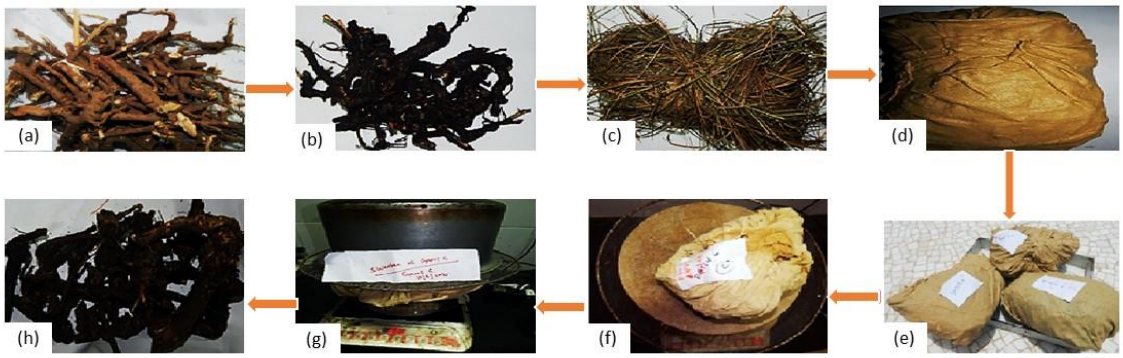

Figure 3: (a) Raw Danti root, (b) Smeared with Pippali powder and Honey, (c) Wrapped with Kusha, (d) Kapadamitti, (e) Sun drying, (f) Assembly of Shodhana, (g) Swedana in process with assembly, (h) classical processed Danti root.

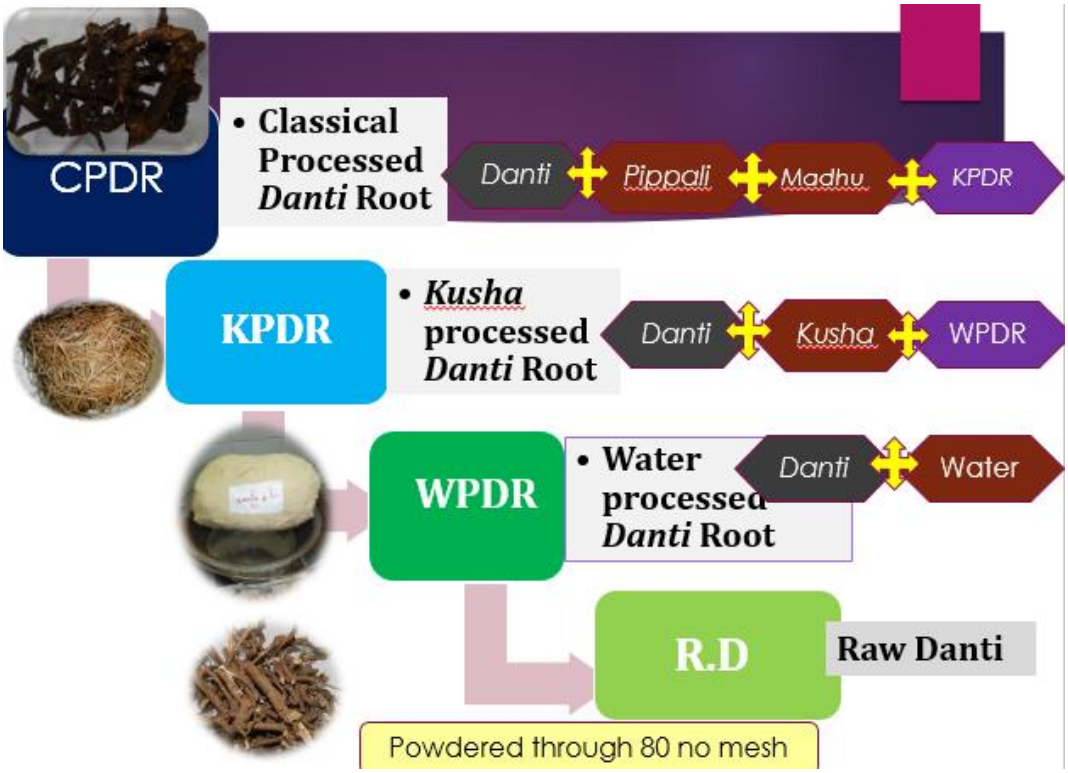

Figure 4: Test drugs

smearing of Pippali, madhu. Loss on drying signifies the considerable amount of moisture in order to control definite strength and prevent decomposition. Maximum loss on drying is found in CPDR suggesting that CPDR group was adhered to honey that is a great source of oleoresin content while increased loss of drying in WPDR group is quite obvious due to direct exposure to water. Increase in LOD in CPDR is further suggesting the increase in its biodegradable or shelf-life hour. Ash values are used to detect the presence of siliceous contamination and water-soluble salts in favour of determining authenticity and purity of drugs. Evidence of decrease of

ash value in CPDR determines that CPDR after being obtained through shodhana, there occurs addition of various organic materials like Pippali (a good source of volatile materials), honey, fragments of Kusha which may have been transformed to different level chemical moieties signalling in variation of reduced ash value and increased LOD in CPDR group. Enhanced water-soluble extractive value and alcohol soluble extractive values in CPDR denotes that CPDR is having both water and alcohol soluble agents or can be used with the vehicle of water or alcohol expecting better absorbing capacity. According to some experts, the acidic pH indicates Ushnavirya (Shiva Charan Dhyani).[25] Lower pH value in CPDR indicates more acidic in nature, which is more capable to inhibit microbes.

During fire ritual (homa karma), Kusha (Desmostachya bippinata Stapf.) is placed on all four sides of fire to prevent /block all the negative radiations of fire. It is reported to block X-ray radiations. It was the material used by Budha for his meditation seat where he attained his enlightenment. It is believed that the leaves of Kusha block the energy produced during meditation through legs and toes.[26] The drug Kusha is reported to possess anti-diarrhoeal property.[27] One of the additional functions of Danti is to induce purgation inside body. With the presence of Kusha, the tikshnata of Danti can be controlled resulting in controlled purgative actions and also acronarcotic effect of Danti can be reduced.

Pippali and honey both are reported to possess bio-enhancer property. A bio-enhancer is an agent capable of enhancing bioavailability and efficacy of a drug with which it is co-administered, without any pharmacological activity of its own at therapeutic dose used.[28] The drug Pippali is considered to have potential to nourish the body due to its madhura vipaka.[29] Madhu (Honey) is considered as yogavahi which refers its ability to carry the properties of medicines added to it. The yogavahi dravyas are the drugs when it is added with other drugs, can act as either analogues or prodrugs and subsequently enhances the potency and pharmacological activities of former drug.[30] During classical processing technique of Danti root, Madhu (Honey) is presumed to counter the tikshna property of Danti by its snigdhaguna and enhances the effect of Danti through synergistic action. According to the principle samana pratyarabdha (‘like increases like’),[31] Madhu (Honey) has the potential to nourish our vital organs by increasing what Ayurveda terms ‘Ojas’. Since, Vikashi property of Danti is a threat to oja as properties of oja is completely opposite to the properties of visha[32] in which vikashi is an attributor to visha. With the presence of Madhu (Honey) and Pippali in processed Danti root, the function of oja dhatu inside

body can be better augmented and protected.

During the period of classical processing technique, indirect heat through swedana (fomentation) is applied at a level of mild temperature. Mild heat helps in removing impurities from Danti root gradually with entrenched amalgamation of properties of Pippali, Madhu (Honey) and Kusha to Danti while strong heat could have caused quick evaporation or deterioration of its therapeutic potential as the chances of burnt to the subject drug is conceivable.

The exact meaning of Shodhana (purification) does not imply to the mere thought of purification only rather it is imbibed with the commodious thought of Samskara by virtue of which guṇantaradhana (transformation of qualities) can be achieved through various phases like augmentation, addition, modification and replacement.

However, certain procedures are found to be run in modern pharmaceutics where the target drugs are subjected to various methods like grinding, heating, fomenting, lixiviation, elutriation, and distillation etc. which in turn removes the soluble, evaporable and washable impurities from these target drugs.[33] Ayurveda believes that target drug after purification is modified in terms of its phyto-constituent level resulting in improved outcome while modern pharmaceutical concept of purification tells us about the active load of well-explored established component only. Apart from these, this well-explored established component obtained through modern pharmaceutical concept contain some classes of moieties like alkaloid, glycoside, flavonoid, steroid etc. whose phytochemical expression remains neglected just after purification obtained through modern pharmaceutical approach as adopting a single method of isolation approach for the purpose of purification following modern pharmaceutical guidelines raises so many loopholes.[34] On the contrary, Ayurvedic Shodhana method not only removes the toxic substances from the target drug but also enhances the efficacy of the target drug by converting it into a pharmaceutically altered conventional form which in turn can be easily absorbed into the system when used internally.[35]

CONCLUSION

An increased softness, decreased fibrous nature, and lowered pH, increase in water soluble extractive value and alcohol soluble extractive value was noted in processed Danti root, when the raw Danti was passed through a typical Shodhana samskara (classical processing technique). Indirect heat applied at a level of mild temperature (125° Celsius) through swedana (fomentation) in the mentioned classical

processing technique may have facilitated in removing impurities from raw Danti root significantly with entrenched amalgamation of properties of accessory materials used in mentioned processing technique like Pippali, madhu (honey) and Kusha to raw Danti. Further, higher studies using sophisticated technologies are needed to evaluate the characterization of different components in different samples and their level of efficacy in human therapeutics.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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