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**HOME TO MARKET:  
RESPONSES, RESURGENCE AND  
TRANSFORMATION OF AYURVEDA FROM  
1830s TO 1920**

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## ABSTRACT

The article explores the early transformation of Ayurveda into a) a system of medicine, which has two components, one, a knowledge base and two, institutionally recognized professionals b) an industry, producing traditional medicine and related products for the market, in which one, the production system and two, the market, are important. Using the snippets of information from archival documents and secondary sources, we argue that the institutionalization of manufacturing and training were survival strategies, in the course of which a certain modernity emerged, through negotiations with modern medicine. We identify three phases in production, namely, that of no-price/no direct remuneration production within a familial mode (the first phase), a variant of petty commodity production (the second), and finally the slow entry of financial capital and mass manufacturing. We note that the structural transformation of ayurveda into an industry has a distinct trajectory, in spite of the fact that it does share important features with the experience of the transformation of traditional industries in Europe and India.

**Key words:** Ayurveda, Institutionalization, Traditional medicine, Kerala

**JEL Codes:** L65, O 43, I12, I18

## 1. Introduction

Individuals and groups produce knowledge not in isolation but, "against the background of their culture's inherited knowledge and collectively situated purposes"<sup>1</sup>. This means that knowledge is not timeless; it is moulded heavily by emergent conditions and social needs. India's strong and robust indigenous medical traditions have indeed survived precisely because they have possessed this flexibility.

The development of Traditional Indian Medicine<sup>2</sup> (TIM hereafter) in the pre-colonial, colonial and post-colonial period has been discussed within several social science disciplines quite elaborately. This theme has been discussed in terms of an 'encounter with the west' by European historians within the tradition vs. modernity framework<sup>3</sup>. Here, there were mainly two types of arguments; one in which the development (underdevelopment) of traditional knowledge systems rests upon static conceptions of culture and knowledge - wherein that designated tradition is depicted as unchanging, threatened and one which fights a pitched battle against a modernity that would at best see it buried (Leslie 1998)<sup>4</sup>. Another argument, perhaps more realistic, frames the encounter in terms of the mutual shaping of knowledge systems, designates traditional and modern. Proponents of the second argument often consider the political background and power-related implications of these changes, yet, these concerns are relatively recent, and certainly call for much more detailed analysis (Khan 2006; Banerjee 2002). It may be noted that in the historical portrayal or delineation of the emergent Indian nation-state

in the mid-20th century, the 'encounter' between 'tradition' and 'modernity' did not always figure as an uncompromisingly hostile one (Harding 1998; Adas 1990).

Here we are dealing with an equally important concern, i.e. the early production relations and how the sector has shifted from a service dominated one to an alternative pharmaceutical sector. We here discuss the events in the period from 1830s to 1920s, which is considered to be decisive in the earlier manufacturing initiatives and initial transformations. And it is to be noted that an institutional, secular and systematic dissemination of Ayurvedic medicine predominantly and other systems side by side, has happened during this period with the actualisation of the concept of Native Medical Institutions (NMIs), which emerged in the Victorian age. This period also witnessed a strong confrontation of different systems of medicines (Bala 1991).

From the 1920s onwards, there are important shifts, which we do not reflect on in this article<sup>5</sup>. The period of interest saw the beginnings of state regulation and patronage of indigenous medicine vis-à-vis the western system, more scientific codification, efforts for large scale production, growth of education, renewed importance of indigenous medicine due to low cost and easy accessibility during the war time, the acceptance of the modern mould of production, research and standardisation techniques, all of which may well have acted cumulatively to hasten ayurveda along the mass manufacturing path. This article contributes to the recent discussions of the transformation and development of TIM in general and ayurveda in particular. The recent interest in traditional knowledge writings has been fuelled by a general resurgence of interest in Indian medical history (Wujastyk 2003:Alter 2002, Habib and Raina 2004); the heightening interest into the economics of modernisation and commercialisation of traditional knowledge systems especially in the specific regime of knowledge production, ownership, and dissemination engendered within the

ongoing processes of globalization (Wilder 2000, Gupta 2001) and the like. Besides Kumar (2001), there is hardly any attempt to explore the history of traditional pharmaceutical industry in India, which has clearly experienced the shift towards industrial form in the twentieth century.

## **2. Thoughts on Related Writings**

There is both favorable and critical literature on the impact of British government on Indian medicine. In the literature, the discussion on medical imperialism and biological expedition starts even from the time of Garcia d'Orta<sup>6</sup> (Grove 1998; Kochhar 1999). His work, *Coloquios dos simples e drogas he cousas medicinais da India*<sup>7</sup>, abounds in aphrodisiac stimulants to be extracted from tropical plants and substances, and they are laconically prescribed without moralizing (Zupanov 2001)<sup>8</sup>. There have been some significant efforts to understand popular perceptions and response of traditional medicine and how they have been shaped (Arnold 1993, 2000; Kumar 1998). The strengthening of the official patronage to modern medicine during the British rule was the reason for its growth in the British period (Majumdar 1971). But the extension and support received by TIM during the earlier part of the British period should not be left unacknowledged. Indigenous medicine survived through the ages largely due to the continuation of popular support and of course, due to the voluntary efforts of individuals. Gupta (1976) contends that the initial policy of the British to allow continuous flourishing of both the indigenous and western forms of medicine was appreciable, but then shifting emphasis to western medicine alone in 1835 proved inimical to indigenous medicine. The opposition to the western medicine grew, after it was incorporated into the medical training and practice established by the junior authorities (Bala 1991). There have been some specific studies focusing on individual and group efforts for revitalization of Ayurveda, Unani and Homeopathy in India under the aegis of nationalism (Leslie (1976a, 1976b, 1992), Metcalf (1985), Brass (1972), Panikkar (1992), Arnold (2002), and Quaiser (2001)). Similarly, Prakash (1999) has used Foucault's concept of

'governmentality' to understand the history of science and the imagining of the modern Indian nation, and the application powerfully reflected the dilemmas and ambiguities of colonial state, Indian nationalism and modernity. An early attempt to integrate native and modern medical traditions can be seen in Arnold's essay on colonial medicine (2000)<sup>9</sup>.

It has been argued that in this transformation, bio-medical beliefs, practices, and substances are absorbed into the Ayurvedic practices later without necessarily disturbing its underlying paradigms of person and illness (Nordstrom 1989). Riding the wave of Indian nationalism, 20th century ayurveda was caught in the central paradox of the nationalist project, the promotion of a distinctive cultural identity through the introduction of institutions modeled on norms, which, however, had to be international. For most of the nineteenth and twentieth centuries, Ayurvedic practitioners were split into those who advocated a *suddha* (pure) ayurveda and those who advocated an ayurveda that would be integrated with the modern medical system. Increasingly, interpretations of ayurveda were shaped not only by the political contest with allopathy but also by the transnational health care trends, such as the interest in holistic medicine (Leslie 1992; Zimmermann 1992). Charles Leslie's comparative volume on *Asian Medical Systems* provided valuable insights into the whole gamut of relationships between modern and traditional medicines. Bala (1991) gives extensive importance to the role of certain powerful individuals in shaping professionalism in native medicine in Bengal. Another study identifies three major streams in the nationalist discourse in India: conformity, defiance and the quest for an alternative (Khan 2006). It shows that while the elements of conformity to biomedicine and its dominance remained more pronounced and emphatic, those of defiance were conversely weak and at times even apologetic. For Khan, the quest for alternatives, although powerful and able to build trenchant civilizational and institutional critique of modern science and medicine, could never find adequate space in the national agenda for social change (ibid.).

This brief review of the literature throws some light upon the relation of TIM and modern medicine, and the role of state in promoting/demoting the same. This chapter relates mostly to Kerala and information on Bengal, wherever the data is available, is used as a reference point. The present study makes use of the scattered snippets of information like archival documents, reports and other published and unpublished secondary materials available.

### **3. Changes in the Knowledge base: Towards Modernization**

Examining the shaping of the knowledge base of modern Indian traditional medicine, we find a strong trend towards acceptance of the accoutrements of modern science in the institutionalisation and codification of native pharmacopeias during the period<sup>10</sup>. This could be seen in line with George Basalla's widely known model describing the introduction of modern science into any non-European nation<sup>11</sup> since the tendency of the peripheral system like ayurveda was to be oriented towards the centre stage modern medicine in course of time but with slight variations. But the use of centre-periphery dichotomy does not mean that we truss the development of ayurveda into a homogenous model, but such an attempt of understanding makes it easier to spell out the trajectories broadly followed in course, and the gaps in dichotomy tells us where ayurveda keeps its identity intact.

Rostow's well-known five stages of modernisation of traditional societies precisely parallel Basalla's three stages. If Rostow's model highlights the role of economic development in the modernisation process, Basalla's model pays focal attention to the role of scientific development (Chambers; Gillespie 2000)<sup>12</sup>. It predicted that the localities peripheral to the European centre would progressively receive the ideas of western science, slowly establishing their own scientific organisations and personnel, perhaps producing along the way a few heroes of colonial science. In the final stage, a broad and independent institutional support for science would be established, thus allowing the given locality to

compete scientifically in the world of nations. This tendency of colonial science, especially in the case of ayurveda, appears to have been strengthened by the efforts of the native rulers and civil society.

If we look Ayurveda from the perspective of a peripheral scientific system, it is important to note that there are slight deviations from the trajectories Basalla has envisaged while talking about the peripheral sciences. An important example may be that the first stage of Basalla's Europeanisation, namely, the replacement or eradication of the prevailing traditional philosophies has not come off fully, though in the process of development, there has been a long-stretched-out process in which scientific validation came to be established as the determining standard of knowledge. For instance, it may be possible to argue that the history of the shaping of the modern knowledge base of ayurveda has involved the evolution of a 'scientific' taxonomy. A scientific taxonomy is fundamentally different from traditional and indigenous taxonomies, i.e., the former aims at being a globally accepted system of nomenclature and hierarchical structure, based on an elaborate system of publication, formal rules and congresses centred upon the community of modern science, while the latter evolves in the course of time, through a largely cumulative process, the stability of which may vary in space and time. So the former ensures adherence to the code of stability and universality of applications, which the latter does not (*ibid.*). However, it is not possible to argue that the earlier traditional taxonomy has been completely wiped out to make way for modern botanical and zoological classification in ayurveda. Indeed, we may find in recognised textbooks like *Ashtangasangraham*, and even in some drug labels, that both classifications are simultaneously acknowledged. At the same time, a community of knowledge has indeed shaped around ayurveda, quite similar to the modern scientific community, which communicates through journals, conferences etc. In short, the organisation and distribution of knowledge in ayurveda did not entail a community of professional physicians nor were journals or congresses of any centralised

community of professionals seem to have been in vogue, but might have broadly followed some accepted standards and improvements. To reiterate, a stable scientific taxonomy is still in place as *Ashtangasangraham*.

This is not to indicate that in the pre-modern period, ayurveda was a body of knowledge loosely codified and accessible to all. Indeed, Bala has argued that the location of ayurveda within the *brahmanical* knowledge-system, and the kind of codification that this entailed led to more rigidity and underdevelopment of ayurveda as such (Bala 1991).<sup>13</sup> Though the philosophy of practice in ayurveda did not fall in line with the religious philosophy of ancient India, a close parallel existed with the material philosophy, called *Lokayata School*<sup>14</sup>. During this time Indian medicine was largely intertwined with the religious as well as magical practices (*Mantra* and *Thanthra*). Later the increased acceptance and popularity of Buddhism facilitated the spread of ayurveda through the Buddhist missionaries. It has been argued that the monastic training system established by Buddhist disciples reflected the transition of Indian traditional medicine away from magico-religious to rational therapeutics, though not completely (Chattopadhyaya 1977). This may have been a breaking moment towards codification, given the fact that the above shift is a crucial condition for codification and professionalisation. Chattopadhyaya points out that the distinction between the 'quack' and the 'authorised healer' seems to have emerged as early as the Gupta period in ancient Indian history, from instances culled from ancient texts of *brahmins* and priests attacking 'quack' healers (Chattopadhyaya 1977). In Kerala, however, at least in the medieval period, traditional medical knowledge seems to have extended through many of the major communities located at different levels of the caste hierarchy - though only the *brahmanical* knowledge had been codified to a certain extent. The major European effort to extract botanical knowledge in the period of Dutch colonialism in Kerala, however, relied upon the expertise of a non-*brahmin*, non-*savarna vaidyan*, Itty Achuthan<sup>15</sup>.

In medieval India, the trade in medicinal plants made possible the beginning of a larger enquiry into the possibilities of herbal medicinal market. The arrival of Vasco da Gama on the Malabar Coast in 1498 accelerated the exchange of biological information and biological material particularly among Asia, Europe and the Caribbean (Grove 1998). Even at that time, the expeditions conducted were mainly considered as a part of plans for later exploitation. In the medical field, there is evidence, which indicates that TIM did influence western medicine before the latter could make any impact on the indigenous system, and it is quite evident during the Portuguese period<sup>16</sup>. The establishment of Dutch power in Cochin after the decline of Portuguese power in Malabar marked a new era in the history of colonial power, with the colonial interest in extracting and codifying botanical knowledge from local society. The landmark work was the preparation of the *Hortus Indicus Malabaricus*, a personal project of Hendrik Van Rheede tot Drakenstein, mentioned above. In northern India, especially the information from Bengal shows that state patronage existed for practitioners of traditional medicine and at different levels, but the major effort, it seems, were towards preparing a compendium and a standard pharmacopoeia or standard reference text for ayurvedic and unani preparations (Bala 1991).

Even though the British continued the colonial explorations into India's botanical wealth through the 19th century, the allopathic drug industry made an official start only in the early 20th century<sup>17</sup>. Early efforts to introduce allopathy in India were open to drug substitution, with some official pronouncements allowing local production of indigenous drugs instead of the imported allopathic drugs (Kumar 2001). There were differences of opinion among the British and national leaders about the issue of drug substitution, mainly about the economic viability of domestic production. Later, the Central Indigenous Drugs Committee of 1895 rejected the proposal of drug substitution ostensibly on the ground of economic viability. They said that Indian raw materials were

impure and adulterated and rendered them unfit for chemical processing. If such medicines were domestically produced after removal of adulteration by painful and careful processes, they still would be much more expensive than the imported drugs<sup>18</sup>. But as Kumar mentions (2001), Surgeon Major J Parker, Bombay offered a list of forty medicines, which grew abundantly in India, which would be cost efficient and perfect substitutes for imported drugs. Along with this, the call to improve the urge for efficacy of indigenous drugs was also heard. The Bengal Pharmacopoeia of 1842 and The Indian Pharmacopoeia of 1868 actually contained substitutes for practically very drug contained in the British Pharmacopoeia. But this call or message was ignored. Most of the herbal products imported at that time to India were produced from the raw material exported from here<sup>19</sup>.

Two things emerge from the preceding discussion: First, though the intentions were for very different purposes, certain discarded efforts to systematise traditional Indian medical knowledge in terms of documentation of medical knowledge or other means were already afoot in different parts of the Indian subcontinent in the colonial period. The intentions were, as Arnold (1993, p 47) points out, largely a case of "Europe taking from India whatever appeared useful to its own understanding and practice and discarding the rest as worthless or irrelevant junk". These systematisation efforts had, of course, epistemological foundations quite distinct from that of Enlightenment science. Second, the early interest of Europeans in Indian flora was as botanical as it was medical, perhaps more botanical than medical. Their interest in local drugs came largely with the efforts to expand colonial medical care; for instance, in the concern to substitute costlier imported drugs with cheaper local ones. This did not really offer genuine protection to the distinct epistemological foundations upon which the local medical systems rested. They allowed these systems to survive in a way - as founts of knowledge from which to identify drugs that could be substitutes for allopathic formulations. This brings us back to the

'mutual shaping' argument, but it is impossible to ignore the fact that the traditional systems were clearly at a disadvantage, surviving, perhaps, because of their instrumental value mentioned above. And further, it must be noted that this ambiguous situation did not exist in all parts of the sub-continent. Notably, in Kerala, by the 19th century, local rulers had already begun to support traditional medical care through financial grants. In Kerala, ample state support ensured that traditional medical knowledge, especially ayurveda, did not face a disadvantage in the 19th and the early 20th centuries.

#### **4. The Emergence of a Profession**

In the modern period, the professionalisation of training was simultaneously used as a mechanism for bringing uniform standards and hence wider acceptance to manufactured ayurvedic products; as a tool of organising the practitioners, which will be able to apply political pressure on state and central governments to influence the policies relating to ayurveda; and to efficiently defend the entrenched and hostile force of modern medicine (Brass 1972). The transformation of ayurveda on modern lines required the grounding of Ayurvedic practice in a new theoretical setting, and also the entrenchment of a new set of institutional functionaries. The oral tradition and the code of secrecy were perceived to be barriers for non-experts entering this field, and as checks upon the multiplication of expertise. These have, thus, worked as impediments to the effective growth of the sector (Habib and Raina 2004). Till the end of the 19th century the *Gurukula* system was practiced in learning and which never required any certificate in recognition of the study. The name of Guru itself was enough to act as a distinguishing credential of the disciple (Varier 2005).

In northern India, in the last phase of the ancient and during the medieval period, efforts at systematising traditional medical knowledge seem to have accelerated, judging from the fact that at least two distinct medical systems, the ayurveda, and the *unani* (the Greco-Arab system),

with two different sets of practitioners, the *Vaidyas* and the *hakims*, were recognised by the ruling authority. The sources, however, do not appear to reveal an organised system of drug production. Rulers of each local Muslim state employed several *hakims* (Unani physician) and *Vaidyas* (ayurvedic physician) and they were provided special grants. Many more people got employment in assisting them (Bala 1991). In the feudal mode of the medieval economy, the feudal intermediaries like the *mansabdars*, also employed a large number of *Vaidyas* and a few *hakims* also were employed and supported. Hospitals were occasionally established in small towns. They were another agency providing employment to traditional medical experts. According to Khan (1976), the *Vaidyas* working informally under the *mansabdars* outnumbered the physicians who managed to climb up closer to the upper echelons of state power, but they were loosely linked within an officially recognised hierarchy. In the late 18th century, the mobility of traditional medical practitioners from the local to state-level or further got stopped. It has been noted that some of them acquired huge wealth and even rose to the position of nobles, though these formed a small fraction of entire community (Zahoori 1979). But in course of time, the increasing conflict between the central power and feudatories and between different sections of societies resulted in a new imperial system in which the development of Indian medicine suffered a setback in state support, employment opportunities etc. (Bala 1991).

In the British period, in Bengal and in other southern parts like Kerala, the courses on indigenous system had been introduced along with allopathy in some of the colleges. In 1822, the colonial rulers started a school for native doctors in Calcutta with a course of study combining indigenous and European medicine. Similar schools were proposed in Bombay and Madras. The Native Medical Institutions (NMIs), established for the combined teaching of both these medicine failed and they were abolished after a short period of life. Bala notes that the friendly co-existence of Indian and Western systems of medicine

commenced with medical training at NMI but ended in the triumph of anglicists<sup>20</sup> introducing English language and European sciences in India (Bala 1991). The government also started medical classes in 1827 in the Sanskrit College of Calcutta to teach Ayurvedic system, as well as in the Calcutta *madrassa* (Muslim educational institution) to teach the Unani system (Gupta 1979)<sup>21</sup>. But this attempt was foiled and the possible synthesis experiment was given up in 1835. This is mainly due to the protests of *Purists (suddh)* and the found inefficiency of the physicians in both the systems.

The early days of institutionalisation (see appendix for details) started by 1880s, when the first Ayurvedic College started at Thiruvananthapuram, Kerala in 1886 followed by one in Punjab in 1898 and another in Uttar Pradesh 1899<sup>22</sup>, though there were unfulfilled efforts even before, as mentioned. The instrumental attitude towards traditional medical knowledge in their efforts to compile the Bengal and Indian pharmacopoeia under the supervision of allopaths in the late 19th century clearly indicate the hostility of the British<sup>23</sup>. The British government, in terms of those associated with modern science, set the new norms for defining and disseminating ayurvedic knowledge. An important consequence was that the traditional healers, who until then were trained and practiced under the *Gurukula* system or any other local variant came to be labeled as quacks. They were forced to become the herb collectors or suppliers or distributors of medicines. Only those practitioners, who acquired a license and used drugs from the medicines acquired from branded factories, were permitted to carry on.

This process acquired considerable momentum in the beginning of the 20th century, when the project of revitalising traditional medicine gained strength through 'nationalistic concerns' in various parts of India. In Kerala, especially in Travancore, the modern state's emergent concern with the health of the population led to the support of traditional medicine, which was perceived to be cheaper, more accessible and

acceptable than modern medicine. This was also one of the factors, which accelerated the process of revitalising traditional medicine. It is also to be noted that often the initiative for training came from those mediators of traditional medicine, who started the revitalisation through industrial production. This is not surprising, precisely because a uniformly trained, accredited community of medical practitioners is a basic condition for the success of the production of medical drugs.

Thiruvananthapuram *Ayurveda Patasala* (place for learning ayurveda) was the first step towards the institutionalisation of training<sup>24</sup>. At least in Kerala, unlike other places the institutionalisation of production in its broad sense started with the institutionalisation of training. The Travancore government decided to appoint those successful students<sup>25</sup> who came out from Travancore *patasala* as physicians in populous places with grant-in-aid from government. Those students who learned under *gurukula* system were also incorporated into the new institutional system of training through a special notification<sup>26</sup>. From the first batch, 12 successful students were appointed as physicians in different parts of the state<sup>27</sup>. With a view to promote and provide incentives to ayurvedic practice and to bring the private practice under control, government had introduced the grants-in-aid system with a special notification on 14th August 1895. The rules for grants-in-aid to the *vaidyasalas* (hospitals) were passed on 11th May 1901. Based on those rules, a maximum of Rs. 35 per month was provided as grants and only qualified men would be eligible to avail that grant. While the intention of raising the *patasala* as a well-known *vaidyasala* had been mooted, to begin with in all *taluk* boundaries the qualified men were allowed to start *vaidyasalas*. This could be considered as the initiator for an official production of medicines, and was solely led by the health care concerns of the state. The medicines required by the *vaidyasalas* were provided on the request of concerned *vaidyas*. Setting the qualification in terms of western professional lines was also a negotiated move of this period.

These grants -in-aid were provided after utmost scrutiny<sup>28</sup>. Grants were provided based on certain criteria regarding the location of the institution and the staffs. The criteria included the extent of their usefulness, distance from the existing medical institutions, density of population, particularities of climate etc. (Dewan Peishkar, Southern Division chief secretary to Government No. 800/G, dated 17th July 1907) The amount of grants allotted to the *vaidyasalas* were based on a) the qualification of the medical staff b) the area and the number of persons served c) the nature and amount of equipments by way of medicines, surgical instruments etc. and d) the nature and extent of building accommodation. All physicians who received grants-in-aid were liable to keep an account disease-wise of the number of patients, and amount of return and expenditure etc. They should not report lack any necessary medicines and they were liable to inspection at any time. The medical staff of these grant-in-aid institutions was expected to hold a certificate of having passed the final examinations in the *Ashtanga hridayam* medical school (Notification from Maharaja, 14th April 1895). State funds were allotted for the building of *vaidyasalas* and they were provided with adequate supply of medicines. The intention of the government is clear from the statement of Dewan:

These institutions serve the same purpose as dispensaries of European medicines, and as the Hindu system of treatment has been so kindly recognized by the Government and public fund spent for their sake, there seems to be no reason for treating them differently in the matter of housing and medicine supply (Source: Trivandrum Regional Archives, No. 800/G, 1907).

The Travancore government intended to raise the number of *Taluq vaidyasalas* every year and to make proper arrangement for their administration. Consequently, more appointments were made to *vaidyasalas* and the number of students' intake in the *patasala* had

been increased to 25 in the second batch. *Tahasildars* were instructed to visit the *vaidyasalas* at least once in a month and to enquire about the needs and to inform if there were any malpractices<sup>29</sup>. In 1904, there were 64 grant-in-aid *vaidyasalas* all-over the state. An amount of Rs. 9614 had been spent per annum in terms of grants alone. Out of the 133395 patients who visited these *vaidyasalas*, 122673 were cured (Parameswaran Moothathu, Report to Government, 1905), Subsequently the grants in aid had shown a considerable increase in the case of ayurveda compared to modern medicine (see appendix table 2).

In contrast, state support was seriously lacking in the Malabar district, which was part of the Madras Presidency. The initiative came from a prominent ayurvedic practitioner, P S Varier, who pointed out precisely this lack before the Mohamed Usman Committee (1922), demanding greater standardisation of training<sup>30</sup>. The curriculum, which he put together initially, was an integrated one, with both allopathic and ayurvedic components (Panikkar 1995); later the curriculum shifted towards exclusive instruction in ayurveda. Varier took the initiative for bringing together experienced practitioners of ayurveda in the training centre, an effort, according to him, which the government was not ready to undertake, because of the lack of availability of experts and resources:

There are very few knowledgeable and experienced Vaidyans in Kerala today. Even if there are some, they have no facilities to train and teach disciples. There is enough reason to believe that after one more generation the conditions of ayurveda would become so critical that any effort to remedy the situation is likely to be futile. The general opinion, therefore, is that arrangements for imparting training should be made as early as possible (ibid.).

Production of drugs, he claimed, was flawed because of the fact that the collectors employed by the physicians were often ignorant of plant types and their preservation. The preparation of medicines was

also faulty (Nair1997)<sup>31</sup>. The Kottakkal Ayurvedic Patasala was conceived as a solution to these perceived lacunae in production and training; it hoped to solve them through standardising these procedures. The students were trained in manufacturing drugs as well; experience in manufacturing was made part of the training. The government recognized the Patasala students, as registered ayurvedic practitioners (ibid.). The Patasala was an effective instrument of modernising traditional knowledge, because the syllabus was continuously revised. Kottakkal took the lead in organising ayurveda conferences and publishing, including a journal, the *Arya Vaidyan*<sup>32</sup>. In case of Unani in the north, there was similar lack of support from the British and support from distinguished individuals as evident, for instance, from *Hakim Ajmal Khan's* Madrassa Tibbia College of Delhi in 1889, which was helped by the Muslim notables like Nawab of Rampur and Dacca, the then regional state (Kumar 2001).

The discussion in the two preceding sections indicates clearly that the fortunes and the trajectory of traditional medicine as a system of knowledge were distinct for different regions of the subcontinent. Unlike in Bengal, ayurveda in Kerala did not suffer a 'demotion' to a source of knowledge merely of substitutes for allopathic drugs; it however, underwent a process of modernisation - that is: of codification and professionalisation. The modernisation processes, however, were clearly different. In Travancore, the state's efforts appear to have been crucial, while in Malabar, the initiative of enterprising individuals were prominent. These collective and individual efforts unfolded in the backdrop of a larger shift towards acceptance of modern science as a universal standard for assessing all knowledge-claims. However, ayurveda accepted for some level of transition even though there were some efforts to withheld its basic principles at least in the state of Kerala, this might be because of two reasons: (1) it could claim enough instances of providing effective cure; thus its efficacy was empirically confirmable (2) it rested upon claims regarding 'traditional', cumulatively-amassed wisdom, which were particularly on the ascendant in a period of waxing

nationalist sentiment. This makes the frequency of efforts to integrate the two systems, clearly having quite distinct sorts of epistemological grounding - and their failure - understandable.

## **5. Changes in Production Relations**

The evolution of Indian industries in the 18th and 19th century can be well analysed in the framework of evolution of European industries of 17th and 18th century. In this section, we reflect upon the relevance of the framework emerging from the experience of industrial transformation of Europe for the reconstruction of ayurveda into an industry, besides converting it into a modernised system of knowledge. From available sources, it appears that in the case of the production of ayurvedic drugs, the major shifts have been from home-based production to petty-production and ultimately to large-scale manufacturing of drugs.

### **5.1 *Medicine, a no-price good: Preliminary form of Familial Mode of Production***

Usually in economic literature the model of family economy is used as a system where the productive activity is not governed primarily by the objective of maximising profit and achieving a monetary surplus. Rather, regulation of production and consumption are taken to be primarily geared towards the subsistence needs of the family and its need to maintain self-sufficiency<sup>33</sup>. In the family economy, the consumption of the members was independent of the contribution they had made to the common pool. In the first half of the 19th century to even early 20th century, we come across a large number of Ayurvedic familial production and distribution transactions without any specific demand for the price for drugs. For example, in south India, there were a large number of small dispensaries established by the *Ashtavaidyas*<sup>34</sup> at different parts of the states, where treatment was provided free of cost, because of the belief that receiving remuneration for Ayurvedic treatment would nullify the effect of the medicine (Vinayachandran 2001). At that time ayurveda was considered a service not to be remunerated, though

the production of medicine was concentrated in the physician's residence/locality. That meant that the service and production were not clearly alienated. In most cases, the physician's family served as a unit of production of medicine. Since the knowledge remained with the physician, the collection of raw materials (mostly herbs) and production of the necessary ingredients was done by the physician himself. The treatment did not seem to have brought direct remuneration. This does imply that Ayurvedic medicines were never considered as a 'commodity' to be exchanged for money or for other commodities.

At least in South India, ayurvedic service was not restricted to the brahmin community alone, but was allowed for most of the communities in *Chathurvarnya* (four different sections based on the duties they exercised). There are various documents to establish that *Ezhavas*<sup>35</sup> were considered as experts in ayurvedic treatment (Grove 1998). But there are references to indicate that *Ezhavas* were allowed to treat patients only when the Brahmin physician fails (Vinayachandran 2001). Though many communities practiced it, ayurvedic treatment was a means of livelihood only for very few castes. Some castes like *Pulayas* got inferior treatment<sup>36</sup>. Ward and Conner after their survey of Travancore and Cochin states from 1816 to 1820 and later stated that *Pulayas* received little sympathy when sick. Also Fells, an LMS medical missionary, wrote that the *Pulayas* and *Kuravas* - both lower castes - called only for the help of 'devil dancer' when they were ill<sup>37</sup>. The then existing mode of ayurvedic treatment and the preparation of medicines were suitable for the traditional village economy, which was based on the localization of services and direct or personal contact between the physician and patient. The dosage of medicines was determined in accordance with the nature and intensity of the disease, the requirement of individual cases and the demand of the specific situations (Varier 2002). In this mode of treatment, it was literally impossible to produce and keep all the medicines prepared in advance<sup>38</sup>, since the combination of ingredients might differ from person to person and would vary according to the status of illness. In

that sense, unlike other commodities, the demand could never fully be met by supply. The shelf life of most drugs was very short and hence the concept of mass production was ruled out. Usually the patients themselves prepared the medicines based on the advice of physicians<sup>39</sup>. *Namboodiris (Brahmins)*, who were scholars of *Vedas*, always, considered *vaidyam* (treatment of diseases) a slightly inferior profession, and yet generally this community took pride in knowing this medical healing (Varier 1980). In some parts of Kerala, and may be true for all India, quacks were the main curse of the system<sup>40</sup> and they dominated mainly the surgery part of ayurveda (Nagam Aiya 1906). And these practitioners were not so concentrated in any areas, but rather spread in rural areas. Two factors acted as incentives for ayurveda to remain as a free sector: one, the prestige and status enjoyed by physicians who gave free treatment; and two, state support to the talented physicians like *ashtavaidyans* through cash and land grants and tax exemptions.

**5.1.1 Demand for Ayurvedic Medicine:** The free or low cost medicine and its wide coverage made traditional medicine easily accessible to people especially in Kerala (Arnold 1993). These factors helped in creating a high regional demand for it. Localisation of goods and services in agrarian settlements had made ayurvedic medical treatment almost a domestic affair, barring some situations where the expert opinion of a master physician was essential (Varier 2002). As against this, Bengal manufacturers initiated early global marketing efforts when their counterparts in south remained passive. The increase in demand for ayurvedic medicine was mainly due to the reasons like high accessibility of physicians, wider and longer coverage in many districts, free or low costs compared to the Western medicine, growing population etc. The outbreak of cholera, small pox and many other deadly diseases specific to tropical areas like malaria, have also contributed and strengthened the demand for indigenous physicians. At the same time, the growth of modern education, higher efficacy of allopathic surgery,

state support for modern medicine, complete management of deadly diseases through modern medicine etc. were acting as impediments in its development. The cost incurred for bringing the British physicians and insufficient number of "qualified doctors" to meet the medical needs in India to the satisfaction of the colonial government allowed the indigenous system to work almost parallel in some of the places (Yunjae 2006).

In the familial mode of production, the *Vaidyas* used homemade and/or purchased raw materials, own tools, own and family labour power and to a much smaller extent wage labour. Usually the students learned under them or under their assistants. That meant that the *Vaidyas* and *Hakims* combined the functions of doctor, pharmacist and chemist. Medical education, drug preparation and drug dispensation were all falling within the extremely familial category.

The teaching and practice of medicine was confined primarily to the families of *vaidyas* and *hakims* from generation to generation. For part of the money he exchanged commodities, which is necessary to replace his means of production, i.e. new raw materials. As we had mentioned, for the petty producers it was not necessary that the commodities he purchased (exchange value) should be higher than the goods he sold: rather it could occur by chance and what really mattered was the use value of the things he purchased (Medick 1981). Barter form was then in practice. One reason for the continuation of this characteristic was that the income he earned was purely through his own and family's work effort, without utilising external labour. Though ayurvedic physicians had their initial production, for livelihood purpose they had to depend on the *pansari* (grocer) who kept the most command on villagers, forest dwellers and vendors of long acquaintance (Kumar 2001). Though the physicians hailed from different castes unhindered by any traditional barrier, in Kerala the local Vaidyas mostly belonged to *Velan* caste (Varier 2005). The evolution of division of labour must have been

instrumental in recognizing the *Velan*<sup>41</sup> as a caste of medicine men in Kerala. They looked upon medicine as a means of living. Their right was earned not by practice or learning but by birth.

The chemical side of pharmacy remained neglected for a long time<sup>42</sup> in both ayurvedic and Unani medicines. There are references to show that the ayurvedic physicians acquired great honor in both South India and North India and received considerable help from regional governments<sup>43</sup> (Kabir 2002; Bala 1991). In the mid 19th century, in Travancore at least one *vaidya* was given a grant from the Rajah; less frequently, the *vaidya* was provided with other facilities such as arrangements for supply of raw materials etc, though official rules about grants-in-aid were passed only in the latter half of the 19th century (Book No. 64, 24/2, 24/6, No. 800/g Travancore Government, 1850-1900). This probably indicated the beginnings of a shift in production relations too.

## **5.2 *Need for an Organised Production: A Move through Proto Industrial System ?***<sup>44</sup>

In the Industrial evolution literature, the domestic industrial form and rural handicraft form were interpreted as the transitional stages between home handicraft and factory. The origin and diffusion of domestic industry as a handicraft rural export industry (Schaffle 1860; Schmoller 1919) was explained primarily by the expansion of trade during the early modern period and the resulting bottlenecks of supply, which could no longer be overcome within the framework of the guild system. Schmoller had identified various historical phases of development and types of relations of production in domestic industry. Sombart's (1899)<sup>45</sup> early works radicalised the systematic approach, which Schmoller had introduced, and to him, the domestic industry was a hybrid between old and new production elements.

Till the middle of the 19th century, familial mode of production was followed in Ayurvedic system. Though state support was biased

towards modern medicine in the health care field, indigenous medicine also responded to the changing circumstances through modernisation.

Both internal and external conditions spurred on the shift in production of ayurvedic drugs from family-based production to petty-production. The external factor was the challenge from the growth of drug industry in a more organised form in Britain, and their domination over the indigenous medicine in India. The founders of drug industry in Britain were in fact the descendents of the drug makers of the eighteenth and nineteenth centuries (Breckon 1972). Three main processes turned drug making into a highly organised industry then in Britain. The first was the standardisation of drugs, which included refinement of the products, publication of the formulae and the performance of the products. The second was the advances in the field of bacteriology, pharmacology and chemistry. The third was the development of improved techniques of industrial manufacture of drugs such as vacuum distillation and new *tableting* practices, which helped to produce drugs more cheaply (Jackson 1965). Manufacture of newly invented drugs started flourishing and different firms were set up to manufacture those drugs. The British experience for commercial work in drugs - bringing them to the market for sale - was to a large extent influenced by the German pre-eminence in synthetic chemicals and the research (Bala 1991). However, this trajectory could not be followed for ayurveda, though there were suggestions from different sources that indigenous medical systems were capable of considerable expansion and improvement and could derive benefit from the association of modern medicine (Houseman, Proceedings august 1912, quoted by Bala 1991). The highly skilled and efficient Vaidyas and availability of cheap labour steered ayurveda into a low-level equilibrium trap.

The internal factor was the wide acceptance of institutionally trained ayurvedic physicians. The decline in the intake of traditionally trained physicians to government institutions and the denial of all other

support to them, though this did not apply to all parts of India, did force them in Kerala to start private practice on their own. Many traditional, self trained physicians in the southern part, especially in Kerala, also turned into manufacturers and salesmen of medicines and medicated oils and as herb collectors, while the most reputed continued as private practitioners (Kabir 2002). Technological progress and mechanisation in ayurveda at that time were also minimal and outside the system: this also helped to perpetuate the petty production.

These two factors, the external pressure to catch with the modern medicine and the internal pressure to find the livelihood (for the traditionally-trained physicians), coupled with technological stagnation forced the physicians to start small scale manufacturing of the indigenous medicines. So by the end of the 19th century, two different groups emerged among the practitioners of ayurveda, those who rendered medical service and others who manufactured the medicines. This move was speeded up by the low costs involved in procuring dry medicinal substances in many *bazaars* of India, as compared to those involved in receiving them from England in processed form, the medical department of Bengal has declared the indigenous drugs can be used more generally and the ones available in a crude and uncouth form be given laboratory treatment before administration (Calcutta Proceedings of 1866). This has also initiated interest for substitution and domestic production of the same. In short, this has necessitated a vague form of petty production in many parts of the country.

So, on the one hand, looming competition from manufactured allopathic drugs created the 'objective' need to move into more centralised production; on the other, demand for ayurvedic drugs went up considerably. However, the petty production that emerged suffered due to capital inadequacy, was incapable of responding to the expanded demand, and was concentrated in a few areas. Petty production was geared towards quantitative expansion, yet was insufficient to meet the

swelling demand. Meanwhile, the acceptance of the need for standardising the line of work and the production of drugs also gave a strong push towards centralised production.

### ***5.3 Entry of Capital: Late 19th and Early 20th Century***

Though there was scope for far more scientific research and consequent large-scale industrial production of indigenous drugs, lack of incentives, and absence of risk bearing entrepreneurs thwarted its occurrence. Despite the regular involvement of some persons in research like Bhan Daji<sup>46</sup>, no one took the initiative to start centralised production. The prevailing highly labour intensive production structure was inadequate for centralised large-scale production. The escape route was to attach the domestic producers more closely to the capitalistic path. Necessary modifications in terms to centralise the production processes were the solution, but the difficulty in organising such large number of scattered physicians, while successfully blocking the quacks, remained the bottleneck. If they were not done, the standardisation process and the quality of medicines would be questionable and would affect the very existence of native medicine. Another way was to initiate private investment for large-scale production on a voluntary basis, given that the state was neither willing nor possessing of adequate resources for funding it. The organisation of work processes would also have had to be rationalised. The idea of private initiative in production emerged largely because of entrepreneurial estimation that the turnover on capital could be increased and that the transaction cost could be lowered. It is true that an urgent need for large-scale production of Ayurvedic drugs was felt among the physicians at different parts of the country<sup>47</sup>. This development was very similar to the development in the textile industry in Britain during the proto industrialisation (Kriedte et al 1981 p 137). This had the additional advantage of giving a chance to exploit the scale economies. Though large-scale production of drugs had been planned, the mechanisation that followed due to the entry of capital

seemed to be problematic (There was a heated debate over the application of *suddha* and modern ayurveda, in which initially the adherents of the former view considered mechanisation to be synonymous with modernisation, and detrimental to the original ayurvedic system). Modernisation hence faced huge protest from *suddha* movement<sup>48</sup>.

In the practice of both western and traditional medicines, quacks<sup>49</sup> formed a sizeable number and the drugs they supplied were very suspect. Many unqualified practitioners, including those who had failed, resigned or were dismissed from various positions from the State service set up medical practice and shops. This affected the credibility and quality of the entire system (Ramanna 2002).

In the late 19th century, Gangaprasad Sen in Bengal chose the path of popularizing ayurvedic drugs as a better alternative to western medicine. He sold medicines according to fixed prices, introduced consultation fees, which sometimes surpassed the fees charged by allopathic practitioners, published advertisements for drugs and even exported them. He also published *Ayurveda Sanjivani*, the first Bengali journal on ayurveda. This was the first initiative for large-scale production of ayurvedic drugs in Calcutta. This enterprise became so successful that they started exporting the medicines to Europe and America (Gupta 1976). With the increased demand for drugs both inside and outside the Indian market, the existing producers started reinvesting the realized profit in the ayurvedic and indigenous drug manufacturing. Many more new entrepreneurs entered the large-scale production. Vaid Gangadhar Ray was so inspired that he set up a large scale-manufacturing unit in 1884 called N.N. Sen and Company. The realised profit was evident from Gupta's (1976) explanation that soon, one of the *Kavirajas*, Chandra Kishore Sen had become one of the richest men in the country by manufacture and sale of ayurvedic drugs. In 1898 he shifted the dispensary to Kalutola to facilitate the large scale production of drugs. Thus by 1900, the demand for ayurvedic drugs had increased sufficiently

to occupy a fair share in the country's drug market (Kumar 2001)<sup>50</sup>. By 1910, *Shakti Oushadhalaya*<sup>51</sup>, *Sadhana Oushadhalaya* and *Kalpatharu Ayurvedic Works* (all from Dhaka) were competing with one another in the market. Though the market for ayurvedic drugs had grown, the response was not encouraging for the other indigenous systems like Unani. There were actually no initiatives to undertake large-scale production. Unlike a big section of Bengali intelligentsia, which helped to set up dispensary and ayurvedic firms, the Muslim elite or clientele were not ready to help the hakims financially (Kumar 2001). Later in 1905, *Hamdard*, a small venture was started in Unani drug production and distribution, and had grown very fast in the succeeding years.

The initiative for production for the market spread to south India also. In Kerala, Dr. P.S. Varier started Arya Vaidya Sala (AVS) at Kottakkal in 1902. This not only had an economic relevance, but was an important step in the political renaissance of ayurveda in South India. Dr. Varier realized that the indigenous medicine could contest the increasing influence of western medicine only if it developed similar infrastructure. Panikkar (1992) mentions that the advertisement published on the occasion of its establishment reflected Varier's business acumen, ability for innovation and will to change according to contemporary needs. He had no hesitation in following the western example, discarding the old prejudices and thus bringing into operation a system of manufacture of medicine on modern and scientific lines and their marketing on a commercial basis (ibid.). And in the fourth year (1905-06), the sales turnover of the company rose from Rs 57000 to Rs 170000.

All these suggest that in the first decade of the 20th century, capital penetrated into production of indigenous drugs on a commercial basis surmounting the bottlenecks created by the home based and petty commodity production. One thing to be noted here is that P.S Varier received the support of the regional governments i.e. the patronage of Travancore and Cochin *Rajahs* and *Zamorin* of Calicut and also of the

professional middle class for his venture. But nowhere in India did the government take the initiative for setting up industrial production except in two drugs, morphine and quinine. It did not risk going beyond these ventures. It is to be pointed out that if there was no individual initiative for investment and the response of the civil society was not strong, the growth and expansion of indigenous drugs industry would not have been possible.

In 1905, the tentative beginnings of Unani drug manufacturing were evident albeit on a very small scale. Hamdard, now the most well known of Unani manufacturers, was started by *Hakim* Hafiz Abdul Majeed at Delhi. A few ventures were started prior to Hamdard, but reliable information about these is very difficult to get (Kumar 2001). The development of an industrialised system of indigenous medicines prevented its extinction. Since then it has remained a strong parallel sector with increased coverage in number of Indian villages successfully addressing the health care needs of the people. Despite this advance, the mechanised sector in this period mainly concentrated on ayurvedic medicine and tablets. The non-mechanised sector continued to exist alongside. The earlier innovations in the mechanised sector came in the form of improved appearance, palatability and better storing capacity for the existing drugs and consequently finding newer markets. The traditional ayurvedic *vaidyas* were still strong in the regional areas preparing and dispensing their own drugs. While the organized sector took care of the survival and growth of ayurveda and negotiated its development path as an alternative to the Western system of medicine, this traditional sector served the health care needs of many villages with equal effectiveness.

### **Periodising Production Relations:**

The discussion above describes the structure of production and the elements of transformation in production relations of indigenous medical systems. For convenience of analysis the period under study

can perhaps be divided into three segments. This does not undermine the fact that there was overlapping in the characteristics of production even in among the different segments under consideration.

- (1) *Until 1830s - Service Dominated Production:* The period before and including the 1830s was dominated by home based system in indigenous medicines, in which the medicine was never considered as a marketable good and its use value was more relevant than its exchange value. In short, there were then three types of medical transactions: type one: distribution of the service and medicine without any remuneration; type two: no remuneration for the service that physician renders, but only an inconsequential price for the medicine; and type three: home-based production and distribution of the medicines and service exactly at the price equal to cost of production - on no profit, no loss basis. The incapacity of the modern system to cater to the health care needs of a large number of villages helped the indigenous systems to remain significant throughout the period. Still, traditional medicine remained stagnant during this period because of several reasons such as the lack of institutional efforts, unhelpful policies from the state, self-preparation of the medicines by the patients, lack of professionally qualified physicians etc.
- (2) *From 1830s to 1880s- Period of Petty Commodity Production:* A number of dispensaries, which sold indigenous medicines at a lower price compared to allopathy, were started in spite of the state policy in this period remaining hostile to the indigenous system. Though large-scale production was still away from its inception, some efforts at mass production at regional

village levels are visible in the form of home outlets and temple outlets<sup>52</sup>. The *ashtavaidyas*<sup>53</sup> in Kerala had opened *Oushadhasalas* (hospitals which supplies medicines) in various parts of the state. E.T.M *Oushadhasala* was an example<sup>54</sup>. Dispensaries or units that provided *vishachikitsa* (ailment for poisoning, a preliminary form of toxicology) were common at that time. Most of the units, which were started in this period, were serving to the domestic demand. This was a period in which efforts too were undertaken for drug substitution. During this period, the protagonists of indigenous medicine acted in support of its promotion. They, for instance, funded the *Kavirajas* of Bengal to manufacture and sell indigenous drugs, which made them wealthy. This gave impetus to them to start mass production. Petty commodity systems were the major forms of manufacturing at this time. The increasing professionalisation of modern medicine generated an immediate need within the ayurvedic community to catch up in professionalism and mass production. This period might be named as the period of proto-industrialisation of ayurveda, because the efforts at mass production of drugs to cater the domestic demand were active at least in some parts of India, in the form of petty commodity production centres. This could easily cater to the local demand and hence created a niche market for these products.

- (3) *From 1880s to 1920 - Period of Shift from Service to Industry*: This is the period in which capital entered into the production of ayurvedic and other Indian medicinal formulations. As mentioned earlier, mass production or

large-scale production had been recognised as a potent way of revitalising<sup>55</sup> the traditional system redirecting the practitioners from sulky withdrawal. This had been initiated in both the northern and southern parts of India. The investment made for this purpose came voluntarily. Many reasons contributed to this development increasing domestic demand for indigenous medicine due to the tensions created by First World War; nationalist initiatives of *Swadeshi* in the beginnings of 20th century; and realised incapacity of the modern medicine to reach out to the hands of all. The supply constraints during this time made many to think about creation of a centralized production. This did not mean that this mass production or large-scale production completely replaced the former familial mode of production. The household production and distribution remained in most of the villages. But one visible result was that the indigenous physicians started buying their medicines from these large-scale producers. Their advertisements started appearing in many Ayurvedic journals very frequently at that time<sup>56</sup>. Thus a dual market for indigenous medicine, one traditional, to cater the local demands completely, and the other, modernised large-scale production, to cater to the national and international demand has been formed in the beginning of the 20th century. These mass manufacturers confined themselves to produce traditional ayurvedic combinations suggested in the accepted texts of ayurveda. The only patent drug, which was introduced in the beginning of the 20th century, was Dabur's *Pudin Hara*. During this period the service oriented production of indigenous medicine began to get transformed into an industrial oriented production.

## 6. The Shaping of Market

The market for ayurvedic drugs also greatly benefited from the efforts of enterprising ayurvedic practitioners themselves. The vision and strategy of two prominent figures were remarkable: one, P S Varier; and two, Ajmal Khan<sup>57</sup>.

The indigenous system had started declining during that time because of various reasons such as stagnation of knowledge, ignorance of the practitioners and non-availability of quality medicine. Both large scale production and its marketing were not only perceived to act as catalysts enabling the indigenous medicine to serve a wide range of people, but also as an impressive effort to revitalize the system itself (Panikkar 1995). Varier's entrepreneurial effort was a forward-looking solution to this impending decay of the traditional system. He made the necessary adaptations to the drugs for ensuring a longer shelf life and quicker transportation. So, sale of indigenous medicine grew considerably. Initial experimented products were decoctions and medicated oils because they were very difficult preserve and commanded high local demand. The strategies of the company to get involved in the market was two fold; one, networking the products through regional outlets and distributing through native government departments; and two, stepping into the market during epidemics with a new products. Kozhikode and Palakkad branches were started within a few years of establishment. The company introduced its products in sealed bottles, which could be kept for any length with out any detriment to their efficacy and quality. While Cholera broke out in the region, he discovered '*Vishuchikari*' pills based on his own research. This brought fame for him and for his institution. This was the first step towards the success of AVS. From the first year itself the actual sales turnover exceeded the expected turnover (Rs.500 average in the first year than Rs. 300 expected). Unlike in other firms, in AVS Kottakkal, modernisation and mechanisation<sup>58</sup> were the key tools employed to cater to the market especially in classical products through innovative entrepreneurship.

Since, most of the traditional physicians stuck to their individualistic and familial moorings, and responded to the new challenges with sulky withdrawal (Kumar 2001), as we mentioned earlier, the efforts made by P.S. Varier and *Hakim Ajmal Khan* (Unani physician) had helped the indigenous system to experiment in modern lines of production and innovation in product pattern and overall palatability. This was especially, when the *Marwaris*, *Parsis* and *Gujaratis*, the well-known Indian commercial and industrial classes were indifferent to investing in the traditional drug business. This might be because of ignorance about pharmaceutical business and apprehensions of failure. This did mean that the industrial production of indigenous drugs was not started with huge capital but with a very limited finance capital, which these small initiators managed to obtain from local money market like *Kury* or *Chitty* (Indigenous money lending business). In the case of Hamdard, the initial investment made by *Hakim Majeed* was a paltry Rs. 250, raised as a loan. The nature of the source of capital might convey another difference to this indigenous medicine industry from other similarly placed industries. The external demand created by the First World War for indigenous medicine reduced the imports of drugs from Britain for some time. When the war ended, indigenous medicine export from India had risen to Rs. 30 lakhs in 1920s from Rs. 15.5 lakhs in 1908-09. But, at the same time the import (both herbal and non herbal) has spiraled up to 200 lakhs from 73 lakhs, and most of the imports were produced out of the raw materials exported from here (Kumar 2001).

Manufacturers legitimised the transformation of their business in the beginning of the 20th century from the original familial production by referring to the benefits of *division of labour*, as a next quote of a company's brochure indicates:

As it is impossible that a professor would himself compose all the books required for coaching, that a doctor would himself make all necessary surgical instruments for his

operation table, that a soldier would himself make all weapons for battles; so it is also impossible that all the medicines of Ayurvedic pharmacopoeia would be prepared by a *kabiraja*<sup>59</sup> himself. We have....made this rule that our *kabiraja* friends, who will take medicines, from us, will get a handsome commission and that their letters as well as their orders received will be kept very secret (Catalogue of *Sadhana* medicines, *Sadhana Aushadhalaya*, Quoted in Bode, 2004)

The large-scale production of drugs made the unorganised sector depend on the large scale manufacturers. Commercialisation of indigenous medicines provided a rationale for regulating the production and sale of the Ayurvedic and Unani remedies for the subsequent governments (Bode 2004). Thus by the beginning of the second decade of the 20th century, there were not less than ten Ayurvedic manufacturing firms engaged in large scale production and marketing. This might have subsequently given a justification for the later governments for more institutionalisation of the system.

Firms originally started for bio drug production diversified into the Ayurvedic drug sector by realising the huge potential of the same. In 1884, a Punjab based bio-medical physician-entrepreneur, S.K Burman, founded Dabur India Limited in Delhi. He started production and marketing mainly from British pharmacopoeia such as camphor oil against cholera and clove oil against indigestion. Though it was not started as a full-fledged Ayurvedic firm (not even now), it entered Ayurvedic market with totally different production method by producing the first patented Ayurvedic formulas such as *Pudin Hara* against indigestion and an anti-fungal remedy by the year 1900. The case of *Ring Ring* (an anti-fungal remedy) showed that the commercialisation did not confine not merely to Ayurvedic system, but covered the usual home remedies too. Another Ayurvedic firm, Zandu pharmaceuticals,

though established as full fledged firm in 1910 claims that its Ayurvedic origins dated back to 1864 when Zandu, a famous Ayurvedic physician and philanthropist of that time started initial manufacturing. Shri. Jugathram Vaidya, a grandson of Zandu, with the help from Bhavnagar prime minister, established the now existing manufacturing unit in 1910 to supply and market the Ayurvedic medicines.

Though the amount of capital invested in the production of indigenous drugs was not a substantial one, in due course, the companies achieved a corporate form. They wield considerable influence now through their innovative policies, transforming the state policies and market positioning of products and are positively responding to the consumer tastes.

## **7. Concluding Remarks: Science and Production**

As Chambers and Gillespie remarked, Europe's successful politico-economic colonisation of the world, the close integration of its institutions of knowledge and power, incorporation of local knowledge into global discourse, unique social institutions of intercultural exchanges and dialogues etc. brought a social and organisational triumph, which is being interpreted as universality of scientific knowledge (Chambers and Gillespie 2000). And it is also true that the colonial science is characterised by the entrepreneurial integration in its development process (Kumar 1991). In the case of ayurveda and other traditional medicines, especially in Kerala, the domestic community as a resurgence strategy, used codification, professionalisation, and mechanisation. While this certainly implies a rationalisation of ayurveda, this was also a necessary survival strategy for a great tradition and led to what may broadly be called a negotiated modernity. In that sense, the institutional rebuilders of traditional medicine used the framework of modern science as a model strategy, which had more probability of success at that time. This modernisation has been pursued through making the system institutional, professional

and above all, codified. This is reflected both in production and in training. While well agreeing with the argument of Kumar that<sup>60</sup> 18th century had integrated science firmly into productive mechanisms, it may be noted that the production system has had genuine growth through various stages. Though the Indian system of medicine was transformed from a home-based system of production to a localised industrial system with a petty mode, a distinctive feature was that the entry of capital into this sector was not of a corporate nature. It was obtained from the local money market and contributions of well-wishers, obviously with regional variations, as in the case of Bengal *Kavirajas*. Even the petty commodity production was in its very nascent form, because production was mostly in home outlets or in *taluk* outlets - based and concentrated in the same locality. It could be seen that there was hardly any interference of traders in the circulation of capital. The goal of the capital dominant in ayurvedic sector during the reference period was altogether different. It aimed at the revival of the system and the entrepreneurs did not belong to the entrepreneurial community, but hailed from among the physicians. In short, as a system of medicine, ayurveda displayed proximity to the development of modern science, while its mode of production had its own inimitabilities from the accepted industrial evolution framework. The initial strategies used for survival were modernisation, professionalisation, preparation for, and organisation to, capture and extend the market for ayurvedic drugs. The ultimate aim was to integrate home production to the global market.

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## APPENDIX TABLES

**Table 1: Ayurvedic Institutions before 1920**

Institution	Place	Year
Ayurveda patasala	Thiruvananthapuram	1886
Dayanand Ayurveda College	Jalandhar, Punjab	1898
Lalit Hari Govt. Ayurveda College	Pilibhit, UP	1899
Venkatramana Ayurveda College	Chennai, Tamil Nadu	1905
Govt. Ayurveda Medical College	Mysore, Karnataka	1908
Seth C.M Aryangala, Vaidyak Mahavidyalaya	Satara, Maharashtra	1913
Govt. Ayurveda College	Gwalior, MP	1916
J.B. Roy Govt Ayurveda Medical College	Calcutta, WB	1916
Vaidyarathnam P.S Varier Ayurveda College	Kottakkal, Kerala	1917
G.S.G Ayurveda Mahavidyalaya	Ahmed Nagar, MS	1917

Source: Varier 2005

**Table 2: Public Expenditure on Medical Institutions (in Rs.)**

Year	Govt. institutions (Western)	Grant in aid institutions (Western)	Grant in aid <i>Vaidyasalas</i> (indigenous)
1910-11	349441	12701	15421
1915-16	473133	11346	15800
1920-21	583428	18241	42628
1924-25	674241	17244	45431

Source: Travancore Annual Reports 1910-11, 1915-16, 1920-21, and 1924-25.

## Notes

1. Stevan, S (1982) *History of Science and its Sociological Reconstruction, History of Science*, 20, p 196
2. The term *Traditional Medicine* (most often synonymous to indigenous medicine) refers to ways of protecting and restoring the health that existed before the arrival of modern medicine. According to WHO, TM is "the sum total of the knowledge, skills, and practices based on the theories, beliefs and experiences indigenous to different cultures, whether explicable or not, used in the maintenance of health as well as in the prevention, diagnosis, improvement or treatment of physical and mental illnesses". While we refer TIM, we mean Indian medical systems like, Ayurveda, *Siddha*, *Unani* etc. The term 'traditional Indian medicine' used here relates to the classification of regional medical systems like Ayurveda and Unani as Bala (1991) has used. Dunn (1976) classified medical system into three categories -local, regional and cosmopolitan. Local and regional medical systems accommodate indigenous and traditional methods of healing, and are normally intercultural, although not insulated from exchange with other systems. The local medical system includes folk medicine, which consists of midwives, bonesetters; supernatural cures of various types, and other folk healers. Regional medical systems include ayurveda, Unani. Cosmopolitan system is the medical system of the West.
3. Similar debate is visible in the transformation of Chinese & Tibetan traditional medicine (Crozier 1970).
4. This assumption suggested is common to both traditionalists and modernists who view the prevalence of the pre-modern as an obstacle to the realization of an authentic modernity (Wittrock 1998)
5. Indeed, this decade marks the beginning of a separate phase, which was characterized by a) the invocation of the *Swadeshi* ideology in characterizing native medicine, which assured it an important place in the nationalist agenda b) improved organization of production, entry of more firms, and more patented products and c) the constitution of a large number of state and national committees on TIM and hence a domestic as well as external push for its development into an industry.
6. Europe's introduction to Indian plants and the drugs and to tropical diseases came from the work of the Portuguese physician Garcia d' Orta (1501-1588), who came to India in 1534 and stayed here till his death. In the mean time, he served as physician to Goa governors and also to the ruler Burham Nizam shah of Ahmad Nagar.
7. Garcia da Orta, *Coloquios dos simples e drogas he cousas medicinais da India comportos pello Doutor Garcia da Orta*, published at Goa April 10<sup>th</sup> 1563. This was the third book printed by the Portuguese in India; it was first published in English as *Colloquies on the simples and drugs of India* by Garcia da Orta, transited by Sir Clements Markham FRS (London, Henry Southern, 1913).

- 8 *Curing the Body, Healing the Soul; Jesuit Medical Mission in 16th Century India* presented in Florence at the workshop *Jesuit Intermediaries in the Early Modern World*, (11-13 Oct. 2001). Francesco Pasio to the General, Goa. Oct. 27, 1580, ARSI, Goa 47, f. 133v-134r.
- 9 To check the high levels of mortality and sickness among the company servants, British administration decided to provide cheap and effective medical care. Since, Western medicine is costly in administrating; they set up training institutions for native *Vaidyas* were to give training in western medicine. But after eleven years of service this institution has closed down and brought to an end of their friendly co-existence (for details see Arnold 2000).
- 10 Schott, Thomas (1993) "World Science: Globalization of Institutions and Participation", *Science, Technology and Human Values*, Vol.18 No.2 p 196-208.
- 11 George Basalla (1967), "The spread of Western Science", *Science*. This paper is the one, which set the initial research parameters for colonial science history. His famous essay appeared when W.W. Rostow's Stages of economic growth, published seven years earlier, was at the height of its influence. The Basalla approach to modernisation assumes the pattern that characterised scientific/economic development in the west provides a model for peripheral localities to follow. Without considerable modification this assumption is premised on the notion that pre-scientific localities today start from a similar position to Europe's before scientific takeoff hundreds of years ago and is effectively blind to both history and culture of the localities taken up for study.
- 12 Chambers DW; Gillespie R (2000) "Locality in the History of Science: Colonial Science, Techno Science and Indigenous Knowledge", *Osiris*, 2nd series, Volume 15, Nature and Empire Science and the Colonial Enterprise.
- 13 For detailed discussion see Harilal (2004)
- 14 For details of *Lokayata*, see S.N Dasgupta, *A History of Indian Philosophy*, Cambridge, 1952.
- 15 Itti Achuthan was a renowned physician of that time, born at Carrapurram; of the *Ezhava* caste, a low caste and of the name *Kolladan* and helped in the preparation of the ethno-botany of Malabar separately in Malayalam and in Portuguese language.
- 16 Though the influence in the opposite direction started only in the later 18th century when the teaching of Western medicine began in Goa in 1703, the Indian medicine had much influence on Western medicine through Garcia da Orta and other Portuguese pioneers. For details, see Gaitondonde, PD (1983) *Portuguese Pioneers in India- Spotlight on Medicine*, Popular Prakashan Pvt. limited, Mumbai.
- 17 Dharma Kumar(ed.) *The Cambridge Economic History of India* (Cambridge; Cambridge University Press and New Delhi: Orient Longman, 1982); the

pharmaceutical industry remained insignificantly small and underdeveloped that it failed to find a mention in the list of substantial industries like textiles, iron and steel, cement, paper etc, which came to stand on their feet in India between 1900 and 1947, quoted by Kumar (2001)

- 18 G. King, *Report of the Central Indigenous Drugs Committee* 1896 (Govt. of India Press, Calcutta, 1901).
- 19 The Value of soap imported to India was about Rs. 1,30,00,000 annually from the same oilseeds exported to Europe (Roy, "Growth and Development of the Chemical Industry", 1994)
- 20 *Anglicists* firmly believed that vernacular education to be worthless; literature in these languages was incomparably inferior to works in English, and to learn English concepts through another medium was not satisfactory. But *Orientalists'* sentiments did not stem from the belief that vernacular education was of equivalent benefit to English, but it was a valid system of instruction (Khaleeli 2001). In the case of medical knowledge *anglicists* firmly supported the domination of scientific knowledge and hence modernisation.
- 21 Gupta (1979) *Modern India and Progress in Science and Technology*, Vikas Publishing House, New Delhi.
- 22 Dayanand Ayurveda Medical College, Jalandhar and Lalit Hari Govt. Ayurveda College, Pilibhit, UP.
- 23 For a detailed discussion on the Ayurvedic and Unani education in the medieval and British period in India and its professionalisation efforts, see Bala 1991.
- 24 It was established in 1886 (though as a full fledged structure only in 1889). There was a dearth of efficient native physicians in Thiruvananthapuram region to teach there, and hence a native physician was appointed by government (Dewan) on Rs. 15 per month in the beginning, which was later rose to Rs. 50. This was a result of the recommendation of a committee headed by chief physician Parameswaran moothathu prior to this to study about the availability of native *Vaidyans* in the state. In 1889, he submitted a report to government stating that there were many deadly diseases prevailing in the state and that they could be cured only by resorting to *Ashtanga Hridayam* (authentic treatise of Ayurvedic medicine); and unless government took initiative or special steps, the number of persons who actually had any knowledge in this system would gradually disappear to nothing. To avoid this disquieting situation, he recommended establishment of an ayurvedic *patasala* at Thiruvananthapuram to teach *Ashtanga Hridayam*. Inhabitants of Salem also made same kind of request for an institution in Trivandrum to "impart instruction in the ancient system of native medicine subject to modifications and alterations as the scientific discoveries in Europe would make it necessary, which will help the native public of both in Travancore and out of it" (Parameswara, Aiyer, Ulloor, *Progress of Travancore under H.H. Sreemoolam Thirunal*, Dept. of Cultural publications, 1998). Based on the recommendation, Government took immediate step to start the *patasala*

in the same year. This later served as a sourcing centre for efficient physicians, who brought ayurveda on par with modern medicine.

- 25 In patasala, *Ashtangahridayam* has been divided into four separate sections and it should be completed within four years and the main instructor was *Vaidyan* Parameswaran Moothathu. Within a specific interval the instructor should examine the students and the marks for this exam will be added for the Final exam. Those students, who could not obtain  $\frac{1}{4}$  of the total mark, will not be provided the certificate. Scholarship scheme was implemented for the bright students in the patasala and as an incentive for the successful students Rs. 50 has been kept as prize money (Based on the Dewan's notification on *Vaidyasala* Department, 1889 and 1890).
- 26 If a student has learned *Ashtangahridayam* from another physician with the certificate from that physician he can enroll into the examination conducted by the government. But before that he has go through a screening of the committee of examiners and if it find that he has to undergo the initial courses again, the concerned persons can teach him the same.
- 27 Three of them were provided with the salary of Rs. 15 and four with Rs. 10 and the other five were appointed after a few months with the salary of Rs. 15 per month (*Vaidyasala* department Notification, August 1895).
- 28 A board of examiners was appointed consisting of Parameswaran Moothathu and Late Kochu Krishna Panikkar and based on their recommendations, grants were provided. These members were entrusted with the responsibility to submit the detailed monthly statements of each native physician. In 1897 separate rules were issued on the subject. Under this, the application for the grants-in-aid should be provided to the concerned *tahasildars* and the grants would be given to the nearest *Taluqs* if they were satisfactory in all required criteria.
- 29 *Tahasildar* can write the opinion about the *Vaidyasalas* during their visit, in the diaries kept there for the same purpose. When the *Vaidyas* send their monthly returns the extracts from this report also has to be sent and the decision on further grants will be taken on the basis of these statements.
- 30 The three indigenous systems of Ayurveda, *Siddha*, and Unani received official support from the Madras Government from the time of the 1923 *Usman Committee Report* onwards (Gary 2000).
- 31 Kizhakkedathu Vasudevan Nair (1997) *Vaidyaratnam P.S Varier: A Biography*, AVS Kottakkal p. 33.
- 32 See Kabir (2002) for details.
- 33 The determinants which underlie the familial mode of production based on A.V. Chayanov, *On the Theory of the Peasant Economy*, ed. by D.Thorner, B. Kerblay and R.E.F Smith (Homewood 1966).
- 34 A Kerala family based physician who is well versed in all eight branches of ayurveda is known as *Ashtavaidya*. The eight Branches are *Kaya* (general

medicine), *baala* (pediatrics), *graha* (astrological), *urdwanga* (above neck), *shalya* (surgery), *dhamshtra* (toxicology), *jara* (longevity) and *vrusha* (infertility). There are eighteen families of *Ashtavaidyas* in Kerala who are believed to be the torchbearers of the *Vahata* tradition. Kerala's ayurvedic history is very much related to the history of *Ashtavaidyas*.

- 35 *Ezhavas* are one of the backward castes in Kerala, who are believed to have appropriated a large chunk of indigenous medical knowledge.
- 36 Kawashima, Koji (1998) *Missionaries and a Hindu state Travancore 1858-1936*, OUP, New Delhi.
- 37 Ward and Conner (1863) *Memoir of the Survey of Travancore and Cochin States*, Sircar Press, Trivandrum, Vol.1, p 140.
- 38 Certain medicines such as those used in *visha chikitsa*, those that included metals and minerals, a whole range of medicated oils etc. could be prepared and stored. Ayurvedic literature classifies medicines into those that have be freshly prepared (herbal juices), those that could be stored for a limited time and those whose shelf life is a year or so.
- 39 There are references that patient's own production of the medicines is one of the causes of later decline of Ayurvedic medicine. Though the medicine prepared was fresh, the quality of raw medicinal plants used for preparation was suspicious (Varier 2002).
- 40 One government. official wrote to T.S. Thomson that "Quack *Vaidyans* are curses to native society....i know two or three native *Vaidyas* who practice successfully, but they are rare ..." (The Missionary Conference 1879, p. 263).
- 41 They were widely known in ancient *Tamilakam*, from the days of the earlier Tamil anthologies, as ritual dancers who propitiated the God *Murukan*, and as Black Magicians.
- 42 P. Kutumbiah (1962), "Medicine in Medieval India", *Indian Journal of the History of Medicine*, No. 7.
- 43 Travancore government appointed an Ayurvedic physician in its Durbar in 1876 and in 1889 sanctioned an annual grant of Rs. 1000 to a selected number of physicians (Kabir, 2002). Even in Mughal period, they received a grant called *auqaf* (Habib, 1963). Physicians employed at the royal court received a respectable Income in Bengal (Bala, 1991). *Ashtavaidyans* in Kerala received rent-free lands from the state (*Dhanwanthari*, 14 June 1917).
- 44 Proto industrial system is considered to be the final precondition for the start of the Industrial Revolution. It was the development of early, or "proto"-industry. In the centuries preceding the Industrial Revolution, the household became an important unit for producing goods (mostly textiles) by a process called "proto-industrialisation." As demand for goods, and particularly for cloth goods, grew, "proto-industrialisation" became pivotal to fulfilling the need for increased supply. In proto-industrialisation, which had existed since the Middle Ages, merchants lent - or "put out" - raw goods like raw

textile fibers and, sometimes, simple equipment to peasant families and these families then used their time, when not working the land, to spin, weave and prepare finished cloth, which the entrepreneurial merchant collected periodically. After paying the peasants a minimal fee, the merchants sold the products on the national, or international, markets.

- 45 Quoted in Kriedte, Medick and Schlumbohm (1981) *Industrialisation before Industrialisation*, Cambridge University Press. Schomoller introduced primary and secondary branches of domestic industry i.e. those, which were rural from the beginning, and those, which arose out of urban crafts.
- 46 *Dhan Baji*, a Maharashtrian, joined Grant Medical College in 1845 and became an assistant surgeon. In 1860 he opened a charitable dispensary with his brother. Genuinely interested in Sanskrit texts, he used his knowledge in Ayurvedic texts to investigate indigenous drugs that might provide a cure for leprosy. In the course of his research, he rediscovered an ancient medicine which met with remarkable success; but could neither scientifically test it nor could produce it in large scale (Arnold (2000), *Science, Technology and Medicine in Colonial India*, The New Cambridge History of India).
- 47 Large-scale production of Ayurvedic herbal medicines was altogether not a new concern. Historical records such as the *Huzur* office plate or the famous *Thiruvalla* inscriptions from those days, when villages oriented around temples referred to *athurasalai* (hospitals) where treatment and medicine were given to needy people. There are references to several places where the temple was a storehouse of important medicines (Varier, 2002).
- 48 The revivalist movement developed two ideological streams. The *suddha* position started from an orthodoxy that rejected the notion of modern science was anything but illusion and was the deception introduced by alien rulers. On the then current scene, however the *suddha* position admitted the need for modern state-supported and state regulated colleges, research institutes and all other institutional forms of modern medical education and practice. Partly in response to pressure from advocates of *suddha* Ayurveda, the governments of Kerala, Andhra Pradesh and several other states reduced the instruction in modern medicine in their colleges of Indian medicine. They even drew a proposal for an Asian Health Organisation on the lines of WHO (Leslie 1963).
- 49 Here quack means using fake medicinal methods that do not work and mostly intends to make money. In indigenous system, it was carried out mostly in the name of folk medicine.
- 50 The indigenous drug market was faring well. Yet the overall pharmaceutical industry remained so insignificant and underdeveloped compared to the other industries like steel, paper, cement, textile etc (Dharma Kumar 1982).
- 51 *Sakti Oushadhalaya* of Patuatuli, Dhaka is the first Ayurvedic institute in the subcontinent established by Mathuramohan Chakraborty in 1901, and is still functioning. *Sakti Oushadhalaya* has not only organized the drug industries in the subcontinent but also played an important role in maintaining

high standard of medicine for the modern society. Initially it manufactured two products: *Chavanprash and Swarnasindur*. It is committed to supply efficacious medicines so that the patients themselves publicise its effects.

- 52 Temple was the centre of specific beliefs and the information that controlled the social life in south India, especially in Kerala during this period. Christian and Muslim centres of worship later copied this tradition of Hindu temples (Varier 2005). In other words, temple outlets evolved through a historical process, when the *Ashtavaidyas* showed willingness to teach their close dependents and others who belonged to the *Ambalavasi* (those like Variers who served in temples) community under *Gurukula* system. Later outlets might have evolved from this tradition.
- 53 The *ashtavaidya* families functioned as traditional institutions for studying, teaching, practicing, popularising and extending services in ayurveda (Varier 2005).
- 54 E.T. Narayanan Mooss established this centre, where the medicines were prepared and dispensed. ETN Mooss was a member of *Thaikkattussery Ashtavaidya* family, situated in Ollur, Thrissur.
- 55 David Kopf (1970) uses the term 'revitalisation' in the sense of practical response of modernization, like, from Ajmal Khan and Varier, who tried to revitalise those parts of tradition, which is salvageable from the past.
- 56 *The All India Ayurvedic Directory* (1937), The Vaidya Sarathy, Kottayam.
- 57 A Delhi aristocrat, who played an important role in the freedom struggle, and who was also a strong propagator of Indian System of Medicine, especially Unani Medicine.
- 58 Initially, there were no large mechanisation efforts, but only organised production by the different physicians in the Malabar region assisted by a skeleton staff. The grinding machines, steam boiler and other electro mechanical equipments were installed at a later period, i.e. beginning of 1940s. Small tableting machines and preservation mechanisms facilitated the initial production because the major complaint about ayurveda at that time was that the decoctions and medicated oils could not be preserved for long.
- 59 The denotation is for Ayurvedic physicians in Bengal.
- 60 Kumar (1991) p. 9.

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