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The Quality of Kava Consumed in the South Pacific

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In its native areas of the South Pacific the assessment of the quality of the traditional and highly respected medicinal and ritual plant, kava (*Piper methysticum* Forst., Piperaceae), is influenced by a number of complex factors. These include the choice of chemotype, the total kavalactone content, the plant parts used, the method of preparation, and the choice of fresh or dried plant material. As Western wholesalers are usually interested in optimal kavalactone contents, and not so much in traditional experience with a given cultivar, material unsuitable for daily kava drinking has entered into the commercial herb markets and has been exported. This situation might well be related to the observation of hepatic adverse events with the use of kava extract preparations. Clearly, a quality control system is needed to prevent unsuitable material from being exported.

In the Pacific, kava cultivation occupies approximately 15,000 hectares. Prior to the bans on the sales of kava preparations instituted by various countries, based on alleged liver toxicity, its export value from all kava-exporting countries in the South Pacific represented approximately $82.5 million (US dollars, USD). As a major stronghold of the local economy, kava trading contributed directly to the economic stability of the region.

The kava bans caused significant damage to the South Pacific economies, with some regions recovering faster from the unexpected economical blow than others. In Vanuatu, kava is still a major cash crop due to the importance of the local kava-drinking market, which reaches $7 million (USD) per year. Kava is the second export crop in value ($4.5 million USD in 2004), after copra (dried coconut meat) but larger than cattle meat and cocoa (*Theobroma cacao* L., Sterculiaceae). Kava is providing higher returns of investment than other cash crops. Since the ban of sales in Europe in 2001, the present market consists essentially of the countries within the region, including Fiji and New Caledonia. A part of the crop is still exported to the United States for use in herbal dietary supplements, and recently the Chinese market also showed interest in kava.

With the kava market slowly recovering, and the sources focused on few hot spots, the question of kava quality must be discussed. In fact, there are very distinct differences in kava quality which may also contribute to the debate on kava safety.

The pharmacological properties of kava have been demonstrated to result from the kavalactone content and the chemotype (plants of the same species with genetically defined phytochemical characteristics) (Lebot et al. 1992; Singh 2004). Six major kavalactones account for approximately 96% of the lipid soluble extract. They have been shown to be pharmacologically effective. There are, however, qualitative and quantitative differences in their mode of action. With respect to kavain, one of these kavalactones, the greater the kavain content, the more agreeable the kava effect is generally felt. A clear correlation appears

between traditional use and chemotype: kava types favored for daily drinking in the South Pacific are generally chemotypes rich in kavain (Lebot et al. 1992). Correspondingly, changes in batch-to-batch reproducibility of kava effects can also be expected with kava extracts in drugs and supplements not standardized to a constant kavalactone composition, especially when the exact origin of the herbal raw material is unknown to Western companies.

The 6 major kavalactones are used to define a particular kava chemotype (Lebot et al. 1992). The kavalactones have been assigned numbers according to the sequence of elution from analyses by HPLC (high-performance liquid chromatography): 1= desmethoxy-yangonin, DMY; 2= dihydrokavain, DHK; 3= yangonin, Y; 4= kavain, K; 5= dihydromethysticin, DHM; and 6= methysticin, M. Chemotypes can be identified by listing the numbers of the corresponding kavalactones in decreasing order of their proportion in the sample. This method of chemotype coding allows the indication of a “signature” of the raw material and the comparison between kavalactone composition and effect experienced on ingestion.

As a sterile plant, kava reproduces by vegetative propagation. The kavalactone composition is genetically defined (Lebot and Levesque, 1996): Different cultivars planted on the same field and on the same day will reflect the kavalactone composition of the mother plant. The same is observed for cultivars planted in locations other than their original site. There is significant cultivar variation within and between islands for kavalactone content and composition. Correspondingly, the selection of favored kava cultivars was a result of traditional experience and replanting kava cultivars with the most agreeable effect.

Kavalactone content and internal composition also vary according to the part of the plant. These differences are independent of the age of the plant. The total kavalactone concentration is highest in the roots and stumps, and progressively decreases towards the aerial portions of the plant. The kavalactone signature may vary between roots, stumps and basal stems, and these differences are maintained while the plant is aging. Thus, not only the selection of the cultivar, but also of the plant part and the geographical site of cultivation are major factors contributing to kava quality control.

Consumption of kava is nowadays common nearly everywhere in Vanuatu. In contrast to kava use in the Fijian islands, where kava is prepared from dried and pounded material, kava drinkers in the Vanuatu archipelago have preferred the consumption of fresh kava. Further local differences refer to the method of kava beverage preparation, e.g., the way it is diluted and filtered. Numerous chemotypes have been selected for diverse uses. Kava can be ingested for medicinal reasons, to treat particular symptoms, or for daily consumption as a recreational beverage. Some varieties are famous for the very subtle pharmacological effect they produce (Lebot et al. 1992).

The local definition of kava quality in the South Pacific communities reflects distinct cultural backgrounds. It can refer to a sudden feeling of being “high” or to a very gentle relaxing effect; the beverage can have a very bitter taste or a slightly spicy flavour.

In conclusion, the quality of kava depends on 5 major conditions and on their complex combination:

1) Chemotype and thus the internal proportions of the major kavalactones;
2) Total kavalactone content and thus overall kavalactone quantity;
3) Plant part used for kava preparation;
4) Method of preparation and dilution;
5) Use of fresh or dry plant material.

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The local preferences for a given chemotype are influenced by the expectations of individual kava drinkers. Different communities may be looking for different pharmacological effects in traditional kava drinking, and are thus very aware of quality differences. Sometimes an intoxicating effect is specifically looked for, whereas other users want to produce a state of happy unconcern and contentment, and facilitate conversation while staying fully alert (although this is not the intended purpose of kava-based supplements). However, with excessive quantities and especially with chemotypes too rich in DHM and DHK, drinkers can suffer from photophobia (light sensitivity), diplopia (double vision), and finally, nausea. They feel the urge to sleep; sometimes they can be found stretched out right at the place where they have drunk the kava.

For local use in kava drinking, various kava cultivars are never mixed. Likewise, ground powders from various parts of the plant (roots, stumps and/or basal stems) were never traditionally mixed together. In fact, they represent different quality grades and are sold at different prices reflecting their total kavalactone content, the roots being more expensive than pieces of stumps and basal stems. The stumps are occasionally pealed to remove the bark rich in tannins and polyphenols responsible for the bitter taste.

From a phytochemical point of view, fresh and dry kava are also very different. The chemical composition of the fresh juice is much more complex than the composition of the dry powder, as numerous acidic, volatile or enzymatic compounds are lost during the drying process. Obviously, there are more components than just the kavalactones contributing to the overall effect. For a given cultivar, two very different brews can be prepared using dried or fresh roots of the same plant.

The subtle combination of parameters, factors and conditions necessary to achieve a defined quality results in different local brews, similar to vintages of fine wines. The quality of kava could therefore be regulated by the use of geographical indicators to develop a quality system similar to the French “appellation d’origine” known for wine. This system could include the use of indicators relating to a specific village, island or country, when the morphotypes (plant types of the same species sharing the same shape features, but not necessarily the same phytochemical characteristics) and/or chemotypes are closely related to a particular geographical area.

The possibility of the use of unacceptable kava material should at least be taken into account when addressing the alleged case reports of liver toxicity. Western wholesalers and buyers of herbal raw material are mostly unaware of the complex factors influencing kava quality. The usual parameter here is kavalactone content only, regardless of kavalactone signature or traditional experience. Kava is exported as biomass (roots, stump, stem, and/or peelings), and the price of the raw material correlates with kavalactone quantity, not quality. This system is clearly inadequate for kava and leads to abuses and negative effects on the trade. Stem peelings are traditionally considered as by-products and may contain pipermethystine, an alkaloid known to be toxic to liver cells when applied *in vitro* (Nerurkar et al., 2004) (although the possible clinical significance, if any, of this finding is not yet determined; no pipermethystine was found in German-produced kava products and roots/peelings of noble kava and tudei-kava.).

Alkaloids in *P. methysticum* are found only in plant parts exposed to sunlight. This kind of plant material was never used traditionally by South Pacific communities unless thoroughly peeled – but is exported to Western wholesalers as “kava”. The former tremendous increase in kava trading led to the search for lower cost sources of raw kava material to satisfy demand, although that demand has obviously dropped considerably in recent years since the bans on

kava in several countries. Kava growing is slow, with an average maturing time of 4-5 years prior to harvesting. Some farmers tend to respond to the market demands by planting fast-growing, robust, early-maturing varieties with high kavalactone contents to satisfy biomass buyers. Unfortunately, these chemotypes are not suitable for kava drinking because of potentially unpleasant and adverse effects. After the closure of the kava markets in Europe, this kind of raw material is now locally traded within the South Pacific. Already, local consumers are expressing their complaints about bad kava quality throughout the South Pacific region. There is also the possibility that the most recent case reports of liver adverse events from New Caledonia are related to this kind of unacceptable quality "kava" (Russmann et al., 2003).

[Vincent Lebot biosketch etc. to be inserted here **TK-MF]**

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