Kava Hangover and Gold-standard Science

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Abstract: Kava, a beverage drunk in much of the South Pacific, is both celebrated and controversial. It is often considered an emblem of traditional indigenous practice but also criticized for its physical effects on heavy drinkers. This article reports the results of a study wherein tests were administered to schoolteachers in Fiji to measure effects of the previous night's drinking. The tests revealed that kava intoxication seems to affect processing speed but not working memory. The authors caution that the results must be balanced by acknowledgement of kava's role in bringing communities together in support of institutions such as schools.

Keywords: kava, intoxication, education, development, cognition, Fiji

Résumé : Le kava, une boisson fort répandue dans le Pacifique Sud, est à la fois prisé et objet de controverse. On le considère souvent comme un emblème des traditions indigènes, mais on critique l'effet qu'il peut avoir sur les buveurs excessifs. Cet article rend compte des résultats d'une étude où l'on a soumis des enseignants de Fidji à des tests mesurant l'effet de la consommation de la veille. Les tests ont montré que l'intoxication au kava semble affecter la rapidité d'exécution, mais pas la mémoire de travail. Les auteurs mettent ces résultats en perspective en rappelant le rôle que joue le kava dans les rassemblements communautaires concernant le soutien à des institutions comme les écoles.

Mots-clés : kava, intoxication, éducation, développement, cognition, Fidji

Introduction

How do you measure a hangover? The question might sound whimsical, but it has serious implications. From 2006 until the present, Aporosa has conducted research on kava drinking and education in Fiji, aiming to understand how Fijian educators might resolve a paradox: drinking kava is a central feature of much Fijian socio-cultural life and a key facilitator in the running of many Fijian schools; yet, overconsumption affects teachers who are hung over and struggle to teach their students about much more than the dangers of being hung over. The obvious solution—moderation in kava drinking—is one that educators routinely fail to achieve and, in 2000, Fiji's Ministry of Education characterized excessive kava drinking by teachers as one of several factors leading to student academic underachievement (Tavola 2000:169; see also Williams 2000:187).

Kava is a local substance, but also a global commodity, and in the past three decades anthropologists have paid especially close attention to changing practices of local production and consumption associated with the global circulation of consumer products. The landmark work is Mintz's (1986) analysis of how sugar in Britain was transformed from an elite luxury to a proletarian necessity; as he argues, "the heightened consumption of goods like sucrose was the direct consequence of deep alterations in the lives of working people, which made new forms of foods and eating conceivable and 'natural,' like new schedules of work, new sorts of labour, and new conditions of daily life" (Mintz 1986:181). Sugar's natural appeal became an economic imperative and a cultural necessity through a complex set of engagements that reshaped daily lives and political economies both in Britain and around the world, from Africans shipped across the oceans as slaves to indigenous Americans dispossessed of their lands.

Sugar was not the only comestible that helped shape the modern world, as Mintz notes, and many substances classified as drugs have been vital to the development of

modern bureaucratic work structures. One reason that "'soft' drugs—chocolate, the milder strains of tobacco from the Americas, coffee and tea from the East" gained such popularity in modernizing Europe was that "they were more compatible with the emergent capitalist order" (Courtwright 2001:59). Within the Pacific, anthropologists have focused on the transnational circulation of drugs including caffeine in soft drinks (Foster 2008), tobacco (Marshall 2013) and, of course, kava, which, as the definitive scholarly work on the subject puts it, is "a sacred drug, a social drink and a cash crop" (Lebot et al. 1997:198; Lindstrom 1987). Like other drugs, kava has been tangled in local debates about how it affects productivity, which we describe in this article, and speculation about its potential value on the global market (e.g., Courtwright 2001:53–54, 59–60; Lebot et al. 1997:197; Lindstrom 2009).

In this article we present the results of efforts to measure kava hangover, a project Aporosa undertook to propose recommendations to Fiji's Ministry of Education. The research faced a core challenge: randomized controlled trials are considered the "gold standard" for health research (Solomon et al. 2009); yet, such testing is next to impossible under the conditions in which kava is normally consumed. As is well established in studies of alcohol consumption, drinking has regular and measurable effects on physical and mental processes but the ways that drunkenness affects behaviour are culturally contoured (MacAndrew and Edgerton 1969) and not always testable in a laboratory. How, then, can one go beyond anecdotal evidence to obtain data about the effects of drinking—in the case of Fiji, kava hangovers—in a way that will be useful to civil and governmental groups who have expressed concern about kava's effects?

This article has three main sections. In the first, we give a brief overview of Fijian kava and its consumption. The second section presents the methods used to measure kava's hangover effects. In the third section, we offer our analysis of the results. In a brief conclusion, we emphasize the point that, although this study is not "gold-standard science," it reveals core facts about how kava is consumed and what its effects are. Such facts, we suggest, can guide the policies of organizations who maintain that overconsumption is a serious problem.

Kava in Fiji

Kava is a beverage drunk in much of Oceania. In Fiji, it is generally prepared by straining the dried, crushed roots of the *Piper methysticum* plant through water. Both the plant and the beverage are called *yaqona* in Fijian, but because *kava* has entered English usage, we will use that term in this article except where quoting others who use *yaqona*.

The formal presentation of the plant, in either its raw state or as an already prepared beverage, is integral to indigenous Fijian culture and identity (Aporosa 2011b:230–231; Singh 1981:61; Tora 1986:25; Turner 1986:209). Ritualized kava-drinking practices mediate hierarchy and equality in Fiji, bringing drinkers together in a ranked structure in which everyone participates equally in certain respects (see especially Toren 1988, 1990, 1999). Kava drinking is associated with the vital presence of non-Christian ancestral spirits, which can give it a somewhat dangerous aura (Katz 1993; Tomlinson 2004, 2007, 2009), but many members of Fiji's two largest churches, Methodist and Roman Catholic, drink the beverage frequently and enthusiastically. In Fiji's multiethnic population, kava is enjoyed by many non-indigenous groups, including Indo-Fijians, the descendants of migrants from South Asia who came to Fiji during the late nineteenth and early twentieth centuries. But it is a primary symbol of social identity especially for indigenous Fijians, many of whom consider kava to be an ingestible manifestation of their *vanua* (land, people, chiefdoms), an emblem of "Fijianness" and the Fijian way (Ratuva 2007:92–99). For many indigenous Fijians, participating regularly in kava-drinking sessions is considered a hallmark of behaviour that is *vakaturaga* (chiefly), although it is also drunk casually for hours each day, the ever-flowing lubricant of social life.[1]

When consumed in its aqueous form, kava's active properties, called *kavalactones*, dull receptors in the central nervous system, numb and slow the response time in muscles, limbs and the brain, and cause a relaxed, peaceful, lethargic feeling. This is known as kava "intoxication," although it is a significantly different experience than alcoholic intoxication (Aporosa 2011a:158–160). Unlike with alcohol, there are no aggressive feelings or euphoria during the kava intoxication experience; effects come on slowly and subtly, relaxing the muscles and bringing about a feeling of casual contentment combined, in the initial stages, with a clear-headedness that helps promote conversation (Keltner and Folkes 2005:522; Lewin 1964:223–224; Singh 2004:5).[2] When large amounts of kava are consumed, the drinker experiences double vision, imbalance and stupefaction (Cairney et al. 2002:660; Singh et al. 2004:150, 154; Thompson et al. 2004:248).

MediHerb, an industry newsletter produced by a company of the same name, recommends a maximum daily dose of 200 milligrams (mgs) of kavalactones (MediHerb 1994:2). This quantity is claimed to have therapeutic value without causing cognitive impairment (Mills and Bone 2005:484, 488). However, aqueous preparations in

Fiji are typically consumed in far greater quantities. For example, Duve and Prasad (1984:11) report that a "standard" *bilo* (a cup, often made from a coconut shell) of kava is usually 100 millilitres of liquid and contains an average of 247 mgs of kavalactones—already more than the recommended dose. Ethnographic sources suggest that the average rate of kava consumption within the traditional setting is six "standard" *bilo*s per hour, adding up to 1,482 mgs of kavalactones consumed per hour, more than seven times the recommended dose (Aporosa 2008b:43–44, 2011b:234; Qereqeretabua 2006). And most drinkers hardly stop after the first hour. Indeed, it is generally taboo for men to leave a kava session early and sessions can last long into the night.

Research conducted by Aporosa in 2006–07 suggested that it was common for teachers at rural schools in Fiji to consume kava for more than three hours on nights before teaching students in the classroom (Aporosa 2008b:75–77). In 2009 the survey was re-administered to 63 indigenous Fijian and Indo-Fijian teachers from 15 urban, semi-urban and rural schools. This study showed that, on average, these teachers were drinking kava for 5.8 hours on nights before teaching, a significant increase from the 2006–07 data (Aporosa 2011b:238). However, these figures do not distinguish between those who regularly consume a great deal of kava and those who habitually consume less. Moreover, on special occasions, such as funerals, the amount of drinking is much higher than during "regular" times, so a sample taken at such a ritual-heavy time would skew the numbers upward; it is possible that participants in 2009 were involved in more ceremonial activities than those in 2006–07.

In Aporosa's research from both 2006–07 and 2009, participants agreed unanimously that they experienced hangovers on mornings after they had drunk kava for several hours. They noted, however, that this kind of hangover was quite different from one following alcohol consumption (Aporosa 2011a:159; 2011b:238–239). Kava hangover was described as causing mental and physical lethargy: disruption of memory recall, a feeling of sleepiness, a lack of energy and procrastination, which encouraged a retreat from work (Aporosa 2008b:47–51, 86–88; 2010:28–29; 2011b:239). Young (1995:89) reports similar effects from his experience in Vanuatu. A travel writer describing his own experience in Vanuatu wrote that, on the one hand, kava intoxication was "nothing at all like a hangover," but, on the other hand, that two days after drinking too much he "felt like I had been mugged, taken unawares, slugged from behind ... a lingering sense that I was in a place far, far away, in a world of my own" (Troost 2006:64). In Aporosa's research, some participants said that hangover-like effects can take up to two days to subside. In 2000, the Fijian Ministry of Education expressed their concerns about kava hangovers:

> Many teachers in rural areas become involved in excessive *yaqona* consumption, with the result that they are less effective in their professional work ... *Yaqona* has an ability to sap energy and support listlessness and there can be little doubt that it substantially inhibits performance of duties in non-traditional professional environments, including the civil service and teaching. [Tavola 2000:169]

In addition to the Ministry of Education's concerns, there have been calls in the Fijian media over the past 10 years for situational bans and prohibitions on kava use. Some argue that it "negatively impacts productivity" (Baba 1996:1; see also Nagalu 2007:9; Raicola 2008:2; Ralogaivau 2009:4); others argue that its use interferes with professionalism, discipline and due diligence (Fiji Times 2008b:18; Fiji Times 2010). Some churches, too, have complained about excessive kava consumption, and some have forbidden it outright, partly because of its physical effects and partly because of its links to non-Christian ancestors (Fiji Times 2008a:2; Vulaono 2001).

Following Aporosa's study, several indigenous Fijian kava drinkers questioned him personally about the reliability of the findings, arguing at first that kava did not produce any hangover effect. Subsequent discussions revealed the reason for this denial. "See," replied an informant whose opinion echoed that of many others, "the *yaqona* is sacred so we don't want to say that the *yaqona* can be bad." The implication was that to connect this cherished indigenous substance with negative effects was to criticize something that should be beyond criticism (Aporosa 2010:31–32).

Methods

Unaisi Nabobo-Baba, an education scholar, has developed a "*vanua* research" framework that emphasizes a participant-observation approach mindful of Fijian chiefly protocol (2006:24–36). Within this framework, Aporosa developed the kava research project, obtaining ethical clearance from Massey University and the Fijian Ministry of Education; all participants read and signed an informed consent form translated from English into both Standard Fijian and Fiji Hindi.

Two groups, each comprising 18 indigenous Fijian and Indo-Fijian participants aged between 25 and 29 years, were selected from a total of 15 rural, semi-urban and urban primary and secondary schools across Fiji by way of a self-administered questionnaire. One of the

Table 1: Active and control participants in Aporosa's trials of 2009.

ACTIVE PARTICIPANTS		Ethnicity	Participant	School designation	CONTROL PARTICIPANTS	
Sex	Age				Sex	Age
M	29	*Indigenous Fijian*	1	Rural	M	25
M	28	*Indigenous Fijian*	2	Rural	M	26
F	28	*Indigenous Fijian*	3	Rural	F	26
M	28	*Indo-Fijian*	4	Rural	M	28
M	26	*Indo-Fijian*	5	Rural	M	27
M	25	*Indo-Fijian*	6	Rural	M	26
M	25	*Indigenous Fijian*	7	Semi-urban	M	29
M	25	*Indigenous Fijian*	8	Semi-urban	M	28
F	29	*Indigenous Fijian*	9	Semi-urban	F	29
M	29	*Indo-Fijian*	10	Semi-urban	M	25
M	25	*Indo-Fijian*	11	Semi-urban	M	25
M	29	*Indo-Fijian*	12	Semi-urban	M	26
M	25	*Indigenous Fijian*	13	Urban	M	27
M	29	*Indigenous Fijian*	14	Urban	M	26
F	27	*Indigenous Fijian*	15	Urban	F	25
M	28	*Indo-Fijian*	16	Urban	M	29
M	26	*Indo-Fijian*	17	Urban	M	29
M	29	*Indo-Fijian*	18	Urban	M	25

groups consisted of kava consumers (defined as the active group), and the other consisted of non-drinkers (the control group). The active and control groups each contained two indigenous Fijian men and one indigenous Fijian woman as well as three Indo-Fijian men from each of the three teaching environments, as detailed in Table 1.[3] Indo-Fijian women were not included, as they consume kava comparatively less often than the other groups (Schultz et al. 2007:179–180). The self-administered questionnaire sought data on kava consumption quantities and duration for the previous night, with consumption the previous night being a prerequisite for inclusion in the active group.

Two modified Wechsler Intelligence Scale (WAIS-III) subtests, standardized to a wide international demographic (Kaufman and Lichtenberger 1999:10–11), were administered to all 36 teacher-participants. The teachers were tested between 8:00 and 9:00 a.m., in order for the data to reflect the approximate time (8:30) they would usually enter the classroom. The modified measures were the Digit-Span and Digit Symbol-Coding subtests. The choice to use these particular subtests, both of which are "Processing Speed Index" tests, was influenced by the work of Groth-Marnat (2003:150), who recommends them specifically for testing concentration, short-term memory and attention.

WAIS-III subtests assess specific cognitive functions—such as mental manipulation and auditory sequencing within the Digit-Span test and psychomotor speed and visual perception within the Digit Symbol-Coding test—to inform the primary focus of each subtest. The Digit-Span subtest required participants to repeat (verbally) a series of numbers in both forward and reverse order to assess working memory, specifically short-term information retention and association (Tesche and Karhu 2000:919). The numbers, originally presented in English, were translated into Standard Fijian and Fiji Hindi as appropriate, although some participants chose to take the test in English. The second assessment tool, the Digit Symbol-Coding subtest, required participants to match and correctly draw numbered symbols within a 120-second time period. This measured the processing speed of basic information (Kaufman and Lichtenberger 1999:100–1; Zhu et al. 2004:61).[4] The test was modified by substituting two symbols inspired by indigenous Fijian art for two symbols in the original version.

Individual scores of participants were calculated using the WAIS-III conversion tables, producing a scaled score for each (Wechsler 1997:7, 9). These scores were then averaged and compared between the active and control groups—rather than to WAIS-III's standardization norm—to "compare apples with apples" by keeping the definition of normalcy within the sample population of Fijian kava drinkers and kava abstainers. The participant selection process, based on age, gender and ethnicity, complied with norms of "probability sampling [in that] members of [the] sample have known probabilities of membership" (McCready 1996:103) in either the active or control group. Finally, the scaled scores of the active and control groups were analyzed and compared

using group statistics and independent-sample 2-tailed inter-group comparison *t*-tests within the Statistical Package for the Social Sciences (SPSS), version 17. By using this combination of methods, the tests were designed to be both methodologically sound and culturally sensitive, set within Nabobo-Baba's "*vanua* research" framework but also acknowledging local differences.

A recent review of ten clinical trials dating back to 1987 (LaPorte et al. 2011:102) had limited relevance to the present study. Seven of these 10 trials used small, pharmacologically administered doses with ingestion levels considerably less than those routinely consumed in Fiji.[5] Although participants in two of the other trials consumed kava at volumes similar to everyday Fijian users, these were also problematic. In one case, consumers were not assessed until 24 hours after use (Cairney et al. 2003a:390–391), whereas the average time period between cessation of kava drinking and commencement of teaching is six hours (Aporosa 2008b:76–78). Although the second trial assessed participants in the early morning, not all active participants had consumed kava the previous night (Mathews et al. 1988:549–550), a prerequisite for inclusion in the active group in Aporosa's study. Thus, of the 10 trials reviewed by LaPorte and colleagues (2011), only one had strong relevance for this current investigation.

Cairney and colleagues (2003b:156–158) administered saccade[6] and Cambridge Automated Neuropsychological (CANTAB) computer touch-screen cognitive tests to 11 Northern Territories indigenous Australian participants eight hours after drinking kava. The authors concluded that "intoxicated individuals in the current study showed saccade abnormalities that indicated problems with motor coordination yet their cognitive performance was equivalent to controls suggesting that despite their intoxicated state, their thought processes remained clear. Thus the predominant feature of kava intoxication is motor incoordination that is accompanied by a slight and specific visual attentional deficit." The review concludes that "the current evidence suggests that kava has non-deleterious effects on cognition during acute administration or produces reduced visual attention at higher doses during cognitive demand" (LaPorte et al. 2011:110).

These findings contrast with those of Waqainabete (2003:6), who administered two cognitive measures (both digit symbol substitution tests similar to the WAIS-III Digit Symbol-Coding subtest) to 39 active and 41 control participants at the Fiji School of Medicine. Testing was done one and one half hours after the consumption of 13 *bilo*s (cups) of kava by the active participants and again at the end of consumption, two and one half hours and 20 *bilo*s. All participants were retested 24 hours after the end of kava drinking. Waqainabete (2003:16) reported "impaired neuropsychological function" evident among the active participants at both the one-and-one-half and two-and-one-half hour marks, with improvements noted following 24 hours' cessation of kava drinking.

In Aporosa's own trials, "gold-standard" methodological procedures such as placebo-driven randomized testing were not considered—nor could they have been without violating basic cultural expectations about kava drinking. Crucially, dose standardisation was not possible as the enforcement of these would have been culturally inappropriate and would not have reflected the actual drinking experiences of most participants. The data presented here are therefore exploratory, not definitive, and will hopefully prompt further investigation.[7]

Results and Analysis

The average age for the active-group indigenous Fijians across the three teaching environments was 27.2 years; for the Indo-Fijians it was 27 years. For the control participants the average age was 26.7 for indigenous Fijians and 26.6 for Indo-Fijians. Average ages for all participants in the active and control groups were 26.7 and 27.1 years, respectively, a negligible difference that does not affect the findings.

Using Duve and Prasad's figure of 247 mgs of kavalactones per "standard" *bilo*, together with the ethnographic data on estimated *bilo* intake rates per hour discussed above, kava consumption volumes were calculated for active participants using data from the self-administered questionnaires. This showed that Indo-Fijian teachers in the semi-urban areas consumed the least on the night before testing, averaging 4.8 hours of drinking for an estimated 29 *bilo*s and 7,714 mgs of kavalactones. The heaviest drinkers were the Indo-Fijian teachers in rural locations, who averaged 8.6 hours for 52 *bilo*s and 13,832 mgs of kavalactones—almost 70 times MediHerb's daily recommended dose. When the combined averages for both ethnicities across the teaching environments are considered, rural teachers are the heaviest consumers at 7.1 hours, followed by urban ones at 5.6 hours and semi-urban ones at 4.9 hours. Total consumption hours for all consumers was calculated, showing that on average the surveyed participants consumed kava for 5.9 hours on the night before cognitive testing. A breakdown of this data by ethnicity and teaching environment is presented in Table 2.

Table 3 presents the results of a group statistics *t*-test analysis using the Digit-Span subtest raw and scaled score data (the test in which participants were asked to repeat a series of numbers in both forward

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Table 2: Average kava consumption of active participants by ethnicity and school location on the night before cognitive testing.

Ethnicity	School designation	Kava consumption previous night		
		Consumption hours	Estimated *bilos* consumed	Estimated kavalactone ingestion
Indigenous Fijian	Rural	5.6	34	9,044 mgs
Indo-Fijian	Rural	8.6	52	13,832 mgs
Combined ethnicities	Rural	7.1	43	11,438 mgs
Indigenous Fijian	Semi-urban	5	30	7,980 mgs
Indo-Fijian	Semi-urban	4.8	29	7714 mgs
Combined ethnicities	Semi-urban	4.9	29.5	7,847 mgs
Indigenous Fijian	Urban	6.6	39	1,0374 mgs
Indo-Fijian	Urban	4.6	28	7,448 mgs
Combined ethnicities	Urban	5.6	33.6	8,911 mgs

Table 3: Group statistics *t*-test analysis using the raw and scaled score data for the active and control participants assessed with the Digit-Span subtest.

Score analysis	Participants	*N*	Mean	Standard Deviation	Standard Error Mean
Digit-Span raw score	Control	18	16.67	2.931	.691
	Active	18	16.22	3.703	.873
Digit-Span scaled score	Control	18	9.44	2.093	.493
	Active	18	9.17	2.550	.601

Table 4: Independent samples (2-tailed inter-group comparison) *t*-test showing the amount of difference between the control and active Digit-Span subtest scaled score mean values.

	t-test for Equality of Means			
	Degree of freedom	*p*-value significance (2-tailed)	Mean difference	Standard Error difference
Digit-Span scaled score	34	.723	.278	.777

and reverse order). The raw score is the value obtained directly from the scoring sheets; raw scores were converted to scale scores using WAIS III conversion tables. This conversion provided the numerical values used in the independent samples *t*-test (which will be discussed shortly). As the table shows, the control group answered, on average, 16.67 correct questions; the active participants answered 16.22 or, 0.45 fewer. The mean difference within the scaled score range is 9.44 for the control and 9.19 for the active group (0.27 points lower).

Table 4 shows the results of an independent samples *t*-test on the scaled score mean of the control and active groups who were assessed with the Digit-Span subtest data. The descriptor "degree of freedom" equals the "sample size minus [any] constraints" (Petrie and Sabin 2000:28) and "relate[s] to the number of observations that are free to vary" (Field 2009:37). For the purposes of this study, the critical figure is the *p*-value of 0.723, also known as the probability or "significance (2-tailed)" value.

Tables 5 and 6 turn to the other batch of data, the results of a group statistics *t*-test analysis using the raw and scaled score data of the active and control participants assessed by the Digit Symbol-Coding subtest (the test in which they were asked to match symbols and numbers within a 120-second time period). As Table 5 indicates, the control group averaged 63.67 correct answers compared with the active participants who answered 8.45 fewer at 55.22. When using the converted scaled score, the mean is 8.00 for the control and 6.22 for the active group (6.22 points less).

Table 5: Group statistics *t*-test analysis using the Digit Symbol-Coding raw and scaled score data for the active and control participants.

Score analysis	Participants	*N*	Mean	Standard Deviation	Standard Error Mean
Digit Symbol-Coding raw score	Control	18	63.67	20.167	4.753
	Active	18	55.22	10.814	2.549
Digit Symbol-Coding scaled score	Control	18	8.00	2.521	.594
	Active	18	6.22	1.517	.358

Table 6: Independent samples (2-tailed inter-group comparison) *t-test* showing the amount of difference between the control and active Digit Symbol-Coding subtest scaled score mean values.

	t-test for Equality of Means			
	Degree of freedom	*p*-value significance (2-tailed)	Mean difference	Standard Error difference
Digit Symbol-Coding scaled score	34	.015	1.778	.693

Finally, the Digit Symbol-Coding subtest scaled scores were analyzed using the independent-samples *t*-test, as shown in Table 6. As with the results of the Digit-Span test given above in Table 4, the critical figure for the purpose of this study is the *p*-value, which here is 0.015.

What, Finally, Do These Data Show?

In this study, the average time spent by the teacher-participants consuming kava on the night before cognitive assessment was almost six hours. (Like all averages, it hides interesting individual cases, including those who consumed for more than eight hours and one 26-year-old Indo-Fijian teacher from a rural school who reported drinking kava for 12.5 hours on the night before testing.) The Digit Symbol-Coding subtest raw scores given in Table 5 for the active and control groups indicate that the control participants averaged approximately 64 correct answers in two minutes compared with the average active participants who recorded 55, a difference of 9 correct answers. In terms of time, the active kava-drinking participants took approximately 0.31 seconds longer to answer each question compared with members of the control group, a difference of 16.5 percent.

A key finding is the difference between the *p*-values in the different tests. The present study calculated the *p*-value of the Digit-Span subtest results (the test of counting forward and backward) to be 0.723, but the *p*-value of the Digit Symbol-Coding subtest results (the test of matching symbols and numbers) to be 0.015. Pallant (2007:235) writes that when the value is 0.05 or more, it indicates "no significant difference between the two groups" being compared, but that a value below 0.05 shows "a significant difference in the mean scores between the two groups." In short, the Digit-Span subtest suggests that there was no significant difference between the active and control group members in terms of their cognitive processes of working memory as assessed at the time they would normally enter the classroom to teach, whereas the Digit Symbol-Coding subtest data indicates that the groups did, in fact, exhibit a statistically significant difference in their cognitive aspects of processing speed at that time. As explained earlier, both subtests measure specific functions; Aporosa's results suggest impairment to visual memory, psychomotor speed, short-term visual perception, visual-motor coordination and visual-scanning ability, functions measured by the Digit Symbol-Coding subtest.

Kava hangover, in short, seems to affect processing speed but not working memory. Clinical investigations hint at similar findings with participants who had used both benzodiazepine and anticholinergic drugs, which have analogous effects to kava (Bone 2002:306; Dean 2000:1–2; Mindell 1998:36–37).[8] Lawlor and colleagues (1991:100–101) noted that anticholinergics had no effect on working memory when assessed by the Digit-Span subtest, whereas "the storage of new memories [was] disrupted," and they noted similar effects following benzodiazepine use (1991:103). In a more recent study, Ancelin and colleagues (2006:458) concur with these findings. During their longitudinal study among elderly users of anticholinergics, they established that those taking this antihistamine-based medication "had significantly poorer performance on psychomotor speed, primary and secondary visuospatial memory, narrative

recall and visuospatial construction than non-users." They add that they "found no significant difference for implicit memory or logical reasoning ability" (in other words, working memory) in those same participants (2006:458). These results mirror those of Aporosa's kava study. Ancelin and colleagues were unable to offer an explanation for the difference in their findings between processing speed and working memory but suggested it may be linked with cholesterol (2006:456).

When compared with the kava trials run by Cairney and colleagues with indigenous Australians (2003b, summarized above), Aporosa's findings are both complementary and contradictory. For instance, Cairney and colleagues stated that the "thought processes [of their participants] remained clear," confirming Aporosa's findings that the cognitive processes of working memory appeared to be unaffected when measured by the Digit-Span subtest. However, the Digit Symbol-Coding subtest findings contradict Cairney and colleagues, suggesting significant impairment to processing speed. The reason for the clash between results is not clear and might be a result of different cultural practices (e.g., who habitually drinks more kava and whether kava is usually consumed by itself or in combination with other substances, such as tobacco or alcohol) or the difference between Aporosa's use of Digit Symbol-Coding and Cairney and colleagues' use of CANTAB. There is, it must be noted, a strong consensus among findings by Cairney and colleagues of "motor incoordination ... accompanied by a slight and specific visual attentional deficit," Waqainabete's (2003:16) report of "impaired neuropsychological function," and Aporosa's finding of impaired processing speed, which includes the measurement of visual sequencing as part of the overall Digit Symbol-Coding subtest evaluation (Kaufman and Lichtenberger 1999:100–101; see also n. 4, below). The similarities and differences among these findings should motivate further research on kava-induced impairment.

Conclusion

Scholars outside of anthropology subscribe too often to static, structural-functionalist notions of culture that limit their appreciation of the dynamics of social change. For example, the development studies scholars Schech and Haggis (2008:53) argue that "development planners and scholars ... increasingly ... [recognize] culture as a kind of glue that holds societies together and gives them a coherent structure which can be used for development initiatives." Even when not invoking metaphors of solidity (glued-together or otherwise), many scholars err in seeing culture as merely a piece in a jigsaw puzzle, as in a UNESCO (1995:21) report that culture and identity are necessary "psychosociological components" in development, carrying the same weight as technical, economic and scientific elements in contributing to the "success of the development plans or projects." The project described in this article has, in contrast, tried to achieve a developmental goal—understanding how Fijian education can be improved—by treating culture as a strategy, something people *use* in organizing and debating their knowledge and practices. To achieve the project's goal, a culturally appropriate methodology was of the utmost importance, but such a methodology means the results obtained from testing cannot be "gold-standard science." A scientific approach can be enriched, however, when it does not depend on the decontextualization of data.

By administering Digit-Span and Digit Symbol-Coding subtests to indigenous Fijian and Indo-Fijian schoolteachers, some of whom had drunk kava the night before and some of whom had not, Aporosa found that kava hangover affects processing speed but not working memory. Specifically, the consumption of kava in normal amounts—normal for daily practice in Fiji, not normal for a laboratory test and extremely far above one pharmacology company's recommended dose—results in a hangover that causes a 16.5 percent disruption to cognitive function associated with processing speed, functions that are necessary to performing well as a teacher in the classroom. This provides some support toward the argument heard in Fiji that kava affects productivity negatively. We hope, however, that these findings will not add fuel to the fiery rhetoric of anti-kava campaigners.[9] In Fiji, kava plays such a prominent role in public life that many schools cannot do without it: when kava drinking is banned, parents' contributions to the schools drop dramatically and the entire school—principal, teachers, students—suffers. And yet complaints about excessive kava drinking do have a basis in measurable cognitive effects and need to be taken seriously by anyone hoping to improve Fijian education.

Kava is immensely significant in Fijian cultural practice and identity, a fact that anthropologists have long recognized and something development theorists can work with in critically engaged projects of national development and economic growth. Kava's role as an emblem of identity and a sacred substance needs to be seen in light of consumption patterns that appear to affect education negatively. The consumption of kava for six hours on nights before teaching causes a hangover effect measurable as a 16.5 percent disruption to processing speed as assessed by the Digit Symbol-Coding subtest measure. This fact presents a daunting

challenge to education officials in Fiji, one which, we argue, is best met not with calls for prohibition but rather with new debate on how to maintain kava's significance as a cherished social lubricant, while acknowledging the effects of overconsumption. We hope this study will encourage further research on kava drinking in all its facets—research that is culturally sensitive but grounded in data rather than moral assertion.

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Acknowledgements

Aporosa wishes to thank the Fijian Ministry of Education, Tevita and Evia Bainimoli, Sekove Degei from the Institute of Fijian Studies at the University of the South Pacific, Bob Gregory and Alasdair Noble from Massey University, and his wife, Jan, for her support, encouragement and clinical psychology expertise, which was invaluable to the cognitive assessment process. Tomlinson thanks the chiefs and people of Tavuki, Kadavu, for their generosity in sharing their expertise on matters of church, tradition and kava. Both authors also thank the anonymous reviewers for *Anthropologica* for their expertise and generosity. The fieldwork for the research described herein was funded by Education New Zealand (Postgraduate Study Abroad Awards), NZAID and Massey University (Graduate Research Fund). This article is dedicated to the memory of the late Ro Misiwaini Qereqeretabua, former Director of the iTaukei Institute of Language and Culture and Archives Department, Fiji, a model of *vakaturaga* character whose wisdom and insight guided this research.

Notes

1 The term *vakaturaga* combines the adjectival prefix *vaka-* with *turaga*, the term for "chief" or, in markedly Christian discourse, "Lord." Acting *vakaturaga* (or for women, *vakamarama*) encapsulates indigenous Fijian ideals, comprising noble values that people are expected to honour regardless of their own actual status, such as expressing respect (*veidokai*), humility (*vakarokoroko*), knowing one's place (*kila na iyatu*), fulfilling obligations (*qaravi tavi*), sharing and caring (*veiwasei kei na veikauwaitaki*), forgiveness (*veivosoti*), helpfulness (*veivukei*) and a quiet demeanor (*yalo malua*) For a detailed discussion of the *vakaturaga* concept, see Ravuvu (1987:18–19, 235). Abramson's (2005) accurate observation that kava-drinking sessions are modified for tourists, presented publicly as an emblem of indigenous identity, does not detract from the practical and emotional force of non-commodified kava-drinking sessions.

2 The effects we describe are specifically for Fijian kava sessions and do not necessarily reflect effects experienced elsewhere; see Lebot, Merlin and Lindstrom (1997) for comparisons across Pacific Islands societies.

3 The work of Heinze et al. (1994:225) served as a reference point for participant numbers due to its use of similar cognitive assessments to measure 12 participants in a double-blind study using pharmacologically recommended doses of kavalactones. The age group of 25–29 years was chosen because it aligned with one of the 13 age scales within the WAIS-III and is above the age when most Fijians who drink kava begin doing so (usually in their mid to late teens). In addition, this age range increased the pool of available participants for cognitive testing as it commonly includes the "bachelor" demographic, whose members tend to be more socially active compared to other demographics.

4 Kaufman and Lichtenberger (1999:100–101) describe the cognitive functions measured by the Digit Symbol-Coding subtest as "perceptual organization, convergent production and evaluation of symbolic stimuli, sequential processing, encoding information for further cognitive processing, faculty with numbers, learning ability, reproduction of models, short-term memory (visual), visual sequencing [in order to access] processing speed, broad speediness, paper-and-pencil skill, visual-motor coordination, clerical speed and accuracy, [and] psychomotor speed."

5 These trials are reported in Russell et al. (1987:236); Saletu et al. (1989:170); Prescott et al. (1993:50); Foo and Lemon (1997:148); Heinze et al. (1994:225); Münte et al. (1993:43); and Thompson et al. (2004:244).

6 *Saccade* is "ballistic eye movements from one fixation to another ... a quick way to test how well someone's cerebellum [the area of the brain that aids motor control] is functioning" (Kalat 2005:243).

7 Other researchers have found fruitful results facing similar limitations. For example, Wyatt (1996) investigated work performance and industrial accidents in Papua New Guinea, administering the Digit-Span subtest to "28 male operators of earth movers ... after chewing *various* quantities of betel nut" (1996:451, 454–455, emphasis added). Participants were dispensed either one or one-and-one-half betel nuts prior to testing (1996:456), but dose accuracy could not be guaranteed or standardized as "all of the men were experienced betel nut chewers ... [who chewed] numerous times a day for more than five years" (1996:455).

8 Ashton (2002), in an online manual, describes "five major effects" of benzodiazepines: "anxiolytic, hypnotic, muscle relaxant, anticonvulsant and amnesic (impairment of memory)." These effects assist with an understanding of how kava works in the body and affects processing speed for subjects who are hung over. She adds, "Acquisition of new information is deficient, partly because of lack of concentration and attention. In addition, the drugs cause a specific deficit in 'episodic' memory, the remembering of

recent events, the circumstances in which they occurred and their sequence in time. By contrast, other memory functions (memory for words, ability to remember a telephone number for a few seconds and recall of long-term memories) are not impaired. Impairment of episodic memory may occasionally lead to memory lapses or 'blackouts.'" Lawlor et al. (1991:103) state that benzodiazepine use appears to affect "new memory formation without affecting access to previously learned information [although] it is difficult to say whether the effects of benzodiazepines on memory are specific or whether they are secondary to the sedative effect." In addition, Sadock, Kaplin and Sadock (2007:345) suggest that the heavy use of anxiolytic medications induces "impairment in attention." Yanagihara (1991:401) adds that benzodiazepine and anticonvulsant medications can cause "hazy memory ... affect[ing] concentration and decision-making, as well as delayed recall."

9 This occurred following the presentation of Aporosa's research findings at the Pacific History Conference held at the University of the South Pacific in December 2008. Although Aporosa stated on numerous occasions throughout the presentation that there was a need to balance the cultural importance of kava with its effects on education, a reporter from the *Fiji Times* focused on a single comment and quoted it out of context in a front-page article the following day. The article was titled "Kava abuse: Academic blames poor results on teachers" (Ratubalavu 2008:1; note, Aporosa's surname is misspelled in the article), a serious misrepresentation of the argument developed from the research. The publication of this newspaper article, which made no reference to the cultural importance of kava-drinking practice, resulted in Aporosa having to present several *matanigasau* (traditional apologies, accompanied, importantly, by kava) to groups who had been offended by his alleged opinion. Following a complaint to the editor of the *Fiji Times*, it was suggested to Aporosa that the reporter had been motivated by anti-kava sentiment influenced by religious beliefs. By way of an apology, Aporosa was invited to rebut the article in a two-page weekend special in the newspaper (Aporosa 2008a:15–17).

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