

## COMPARISON OF QUESTIONNAIRES AND LABORATORY TESTS IN THE DETECTION OF EXCESSIVE DRINKERS AND ALCOHOLICS

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### ABSTRACT

225 alcoholics in village and 149 alcoholics in a mental hospital outpatients were administered screening questionnaires for alcoholics status (MAST) dependence (SADD), and consumption data (Q.F. Index). All of them underwent GGT and MCV estimation within 48 hours of last drinking. Comparison of laboratory test with the questionnaires revealed that questionnaires were more useful in community and the laboratory test in hospital where they could also be used in diagnosing monitoring and follow-up assessment of patients.

**Key Words :** Alcoholism, dependence, quantity-frequency (Q.F.) index, biochemical markers (GGT & MCV), sensitivity, specificity

Chronic alcohol abuse and heavy drinking leads to many cellular and tissue abnormalities as well as to numerous haematological and biochemical alterations (Holt et al., 1981, Whitfield, 1981). To enable us to intervene at an early stage of drinking, the search began for identifying biochemical markers of alcoholism. In this regard GGT and MCV (Gamma Glutamic Transferase and Mean Corpuscular Volume) have been found to be extremely useful. Questionnaires like MAST (Michigan Alcoholic Screening Test) have also been used to detect alcoholics in hospitals and community.

Though WHO study group in 1977 (Murray, 1977) itself recommended comparative studies of biochemical markers and questionnaires to find out their relative efficacy in identifying alcoholics, only a few such studies have been undertaken throughout the world. Shoji Harada et al. (1989) have stressed the importance of early detection of alcoholism to enable us to develop proper treatment strate-

gies. Alcoholics even without chronic liver disease tend to have raised GGT & MCV (Jonathan et al., 1981).

Though MAST (Selzer, 1971) and CAGE (Mayfield et al., 1974) have been used extensively in identifying alcoholics successfully, objective clinical and chemical measure of short term and long term alcohol consumption is considered an important factor in the diagnosis and treatment monitoring of alcoholism.

Skinner et al. (1986) while acknowledging the usefulness of laboratory test as biochemical markers have stressed that simple clinical measures could produce greater accuracy. That is, Lab. test as biological markers, simply serve as tools to aid rather than eliminate the decision process.

Hence the present study was undertaken to test the relative efficacy of the lab test and questionnaires in detecting alcoholics in a community and among mental hospital out-patients.

Among the biochemical makers GGT and MCV are the widely assessed ones. GGT level

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increases in blood following chronic alcoholic consumption as a result of hepatic induction of GGT at the site of endoplasmic reticulum and it catalyses the formation of 5-amino 2-nitrobenzoate depending on its level in blood and this is utilised in its estimation (Szasz and Persijn method).

MCV of red cells increases due to the action of alcohol on erythroblasts though associated folate deficiency may also lead to increased MCV of red cells.

Both estimation of GGT and MCV have been found to be useful in supplementing self report regarding assessment and follow up of problem drinkers as outpatients.

The present study aims to compare the usefulness of Lab Test (GGT & MCV) as indices of alcoholism with that of questionnaires in a community and mental hospital outpatients department.

### MATERIAL AND METHOD

The study population consisted of 229 adult drinkers aged 19 to 63 in a village near madras where the first author after his Ph.D work (Mathrubootham, 1989) was conducting a follow up drinking survey in 1990 and also 146 drinkers aged 22-64 who sought treatment during May-June 1991 at Institute of mental Health, Madras. Both the groups were administered MAST (Selzer et al., 1971), Quantity Frequency Index (Q.F. Index) Questionnaire (Edwards et al., 1972) and SADD schedule (Duncan et al., 1983) as part of a semi-structured interview by the author well trained in the procedure.

A thorough physical examination was done to rule out any physical condition or drug intake which might affect GGT and MCV levels. Their weights were taken and history regarding duration of drinking and smoking was also elicited. After ensuring that the respondents had taken alcohol within 48 hrs. before the interview, blood samples were collected for estimation of GGT and MCV. The conventional scores of the questionnaires used were taken as indicators of alcoholism.

Q.F. index was especially incorporated in the interview to assess the consumption of alcohol by the subjects.

The above mentioned biochemical investigations were done in a Govt. approved fully equipped and quality controlled laboratory. Enzymatic method of Szasz and Perzijn, was used to estimate GGT and Baker's counter method with haematology analyser was used to estimate MCV. Based on the results, 6 groups were formed with those who had normal or below normal values in GGT and MCV levels respectively, those who showed high values in both parameters respectively and those who had low and high individual values in GGT or MCV.

The high and low groups were compared with numerical values of the questionnaire and the results were analysed to find out the sensitivity, specificity, predictive value, false positive and false negative percentage using a standard formula (Table 1) (Geoffrey et al., 1985). The intercorrelations to describe the relationships between GGT and Q.F. index; age and weight and MCV and Q.F. index, age, weight and smoking were studied in both hospital and community samples as age, weight and smoking are known to affect GGT and or MCV (Table 1 (A)).

### RESULTS AND DISCUSSION

Total sample taken up for study consisted of 229 villagers and 146 hospital patients. Mean age of community sample was 33 years with the range of 19 to 63 years and that of hospital sample was 34 years with the range of 22 to 64 years (Table 2). Majority in the village (52%) and in the hospital (60%) earned less than Rs. 300/- in a month. In the community 40% of them were weavers and 30% of them agricultural labourers and 50% of the hospital patients were either skilled or semi-skilled labourers.

Mean weight of villagers was 51 kg (range 48 to 75 kg) and that of hospital patients was 44 kg (range 45 to 75 kg.)

173 of the villagers smoked more than

TABLE 1

	Alcoholic	Borderline
GGT	a	b
MCV	c	d

Sensitivity =  $a/(a+c) \times 100$  (%)Specificity =  $d/(b+d) \times 100$  (%)Predictive values =  $a/(a+b) \times 100$  (%)False positive =  $b/(a+b) \times 100$  (%)False negative =  $c/(c+d) \times 100$  (%)Overall accuracy =  $\frac{a+d}{a+b+c+d} \times 100$  (%)Negative predictive value =  $\frac{d}{c+d} \times 100$  (%)

TABLE 1 (A)

GGT &amp; MCV correlated well with Q.F. Index

MCV (r 0.523 (c) &amp; .512 (H))

GGT (r. 412 (c) &amp; 528 (H))

Sig. 1% level

Weight, smoking, age did not correlate with GGT or MCV

TABLE 2

	Hospital	Community
Mean age	34 years	33 years
Range (age)	22-64 years	19-63 years
Income	Below Rs. 300 (50%)	Below Rs. 300 (52%)
Occupation	50% skilled or semi-skilled	40% weaving 30% agriculture
Weight (mean)	44 kg	51 kg
Weight (range)	42-75 kg	48-75 kg

10 beedies or cigarettes/day and 120 hospital patients smoked 10 or more beedies/day. 98% of the villagers drank either arrack or illicit liquor. In the hospital sample 64% drank arrack including illicit arrack and 36% used to take Indian made foreign liquor. Mean duration of drinking were 7.5 years (community) and 10.3 years (hospital) respectively (Table 3).

Serum GGT correlated significantly with Q.F. index in both community ( $r=0.427$ ) and hospital sample ( $r=0.528$ ). Similarly MCV and Q.F. index correlated significantly at 1% level in community ( $r=0.523$ ) and hospital sample

TABLE 3

	Hospital	Community
Smoking more than 10 beedies /cigarettes	120/146	173/229
Drinking	64% drank Arrack/illicit liquor and 36% IMFL	98% drank Arrack/illicit liquor and 2% IMFL
Mean duration of drinking	10.3 years	7.5 years

TABLE 4

	Hospital (n=146) Mean S.D.	Community (n=229) Mean S.D.	t' value d.f. 373	p
GGT	78.55±119.142	24.88±30.39	6.49	.01
MCV	81.71±9.38	82.82±6.8	1.32	NS

Normal values : GGT (8-38)/L  
MCV (77-93) FL

( $r=0.512$ ). There was no significant correlation between age and GGT ( $r=0.132$  in community and 0.012 in hospital). Similarly MCV and age did not correlate significantly (0.128 in community, 0.008 in hospital). There was no significant correlation between GGT and smoking ( $r=0.18$  in community and 0.20 in hospital) or between MCV and smoking ( $r=0.004$  in community and 0.012 in hospital). Mean GGT level in the village group was 24.88 and in the hospital sample it was 78.55. Mean MCV level in community was 81.77 and in the hospital it was 82.88 (Normal values; GGT 8-38/L; MCV 77-93/L for males (Table 4)).

Sensitivity, specificity and predictive value and false positive and negative and overall accuracy were calculated using standard formula (Geoffray et al., 1985) for GGT and MCV individually and with their combined values and were compared with regard to dependence (assessed by SADD) alcoholic status (assessed by MAST) and heaviness of drinking (assessed by Q.F. index). For this purpose two groups were formed with the blood levels high and normal/low and compared with the questionnaires

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whose values were also graded into two main groups.

**TABLE 5  
DEPENDENCE (COMMUNITY SAMPLE)**

	Severe	Moderate/low
GGT (N=24) ↑	23	1
GGT (N=205)	37	168

Sensitivity = 38.33%  
Specificity = 99.4%  
Predictive value 95.63%  
-ve predictive value = 81.9%

**TABLE 6  
DEPENDENCE (HOSPITAL SAMPLE)**

	Severe	Moderate/low
GGT (N=64)	50	14
GGT (N=82)	13	69

Sensitivity = 79.36%  
Specificity = 83.13%  
Predictive value 78.12%  
-ve predictive value = 84%

**TABLE 7  
DEPENDENCE (COMMUNITY SAMPLE)**

	Severe	Moderate/low
MCV (N=52)	9	43
MCV (N=177)	21	156

Sensitivity = 30%  
Specificity = 78.39%  
Predictive value 17.31%  
-ve predictive value = 88.13%

**TABLE 8  
DEPENDENCE (HOSPITAL SAMPLE)**

	Severe	Moderate/low
MCV (N=68)	40	28
MCV (N=78)	28	50

Sensitivity = 58.82%  
Specificity = 64.1%  
Predictive value 58.82%  
-ve predictive value = 64.10%

GGT with regard to dependence has more sensitivity in the hospital sample where as specificity, predictive value and overall accuracy are marginally better in community. Since sensitivity is more important for a screening device, GGT seems to be more useful to pick out severe dependence (Table 5 & 6).

Similar results are seen with MCV and dependence. But here again GGT seems to be slightly better in identifying severe dependence (Table 7 & 8).

With regard to GGT and MAST in community sensitivity is low, specificity and predictive values are high with no (0%) false positive. GGT has more sensitivity in finding alcoholics in the community (Table 9 & 10). With regard to the MCV and MAST in hospital similar results are seen but it is marginally better than GGT in finding out alcoholics. But in both cases sensitivity is not high especially in community (Table 11 & 12).

**TABLE 9  
MAST (COMMUNITY SAMPLE)**

	Alcoholic	Borderline
GGT (N=24) ↑	24	0
GGT (N= 205) ↓	168	37

Sensitivity = 12.5%  
Specificity = 100%  
Predictive value 100%  
-ve predictive value = 18%

**TABLE 10  
MAST (HOSPITAL SAMPLE)**

	Alcoholic	Borderline
GGT (N=64) ↑	62	2
GGT (N =82) ↓	80	2

Sensitivity = 43.66%  
Specificity = 50%  
Predictive value 96.87%  
-ve predictive value = 2.43%

With regard to Q.F. index GGT has more sensitivity in a hospital but in community, specificity and predictive value and overall accuracy are better (Table 13 & 14). Similar results are seen with MCV, both in community and hospital but better than GGT especially with regards to sensitivity. MCV seems to indicate alcohol consumption better both in community and hospital (Table 15 & 16).

When we take the groups with high values of both GGT & MCV as opposed to both with low values; with regard to dependence the combined lab results seems to be the ideal biochemical marker in a hospital setup with high

**TABLE 11**  
**MAST (COMMUNITY SAMPLE)**

	Alcoholic	Borderline
MCV (N=52) ↑	48	4
MCV (N =177) ↓	155	22

Sensitivity = 23.64%  
Specificity = 84.61%  
Predictive value 92.30%  
-ve predictive value = 12.4%

False positive = 7.69%  
False negative = 87.57%  
Overall accuracy = 30.56%  
-ve predictive value = 12.4%

**TABLE 12**  
**MAST (HOSPITAL SAMPLE)**

	Alcoholic	Borderline
MCV (N=68) ↑	67	1
MCV (N =78) ↓	75	3

Sensitivity = 47.18%  
Specificity = 75%  
Predictive value 98.52%  
-ve predictive value = 38.46%

False positive = 1.47%  
False negative = 96.15%  
Overall accuracy = 47.9%  
-ve predictive value = 38.46%

**TABLE 13**  
**Q.F. INDEX (COMMUNITY SAMPLE)**

	Heavy	Other(Light frequent,Light infrequent & Moderate)
GGT (N=24)	24	0
GGT (N=205)	145	60

Sensitivity = 14.2%  
Specificity = 100%  
Predictive value 100%  
-ve predictive value = 29.26%

False positive = 0%  
False negative = 70.73%  
Overall accuracy = 36.68%  
-ve predictive value = 29.26%

**TABLE 14**  
**Q.F. INDEX (HOSPITAL SAMPLE)**

	Heavy	Other(Light frequent,Light infrequent & Moderate)
GGT (N64) ↑	33	31
GGT (N 82) ↓	75	7

Sensitivity = 30.55%  
Specificity = 18.42%  
Predictive value 51.56%  
-ve predictive value = 8.53%

False positive = 48.43%  
False negative = 91.46%  
Overall accuracy = 27.39%  
-ve predictive value = 8.53%

sensitivity, specificity, predictive value, overall accuracy and low false positive and negatives. In community sensitivity and predictive value are low whereas false positives are high. This may be because there are only few persons with both GGT and MCV values high in the community whereas in individual test there are more peo-

**TABLE 15**  
**Q.F. INDEX (COMMUNITY SAMPLE)**

	Heavy	Others
MCV (N=52) ↑	37	15
MCV (N=177) ↓	21	156

Sensitivity = 63.79%  
Specificity = 91.22%  
Predictive value 71.15%.  
-ve predictive value = 68.13%

False positive = 28.84%  
False negative = 11.86%  
Overall accuracy = 84.27%  
-ve predictive value = 68.13%

**TABLE 16**  
**Q.F. INDEX (HOSPITAL SAMPLE)**

	Heavy	Others
MCV (N=68) ↑	29	39
MCV (N=78) ↓	11	67

Sensitivity = 72.5%  
Specificity = 63.20%  
Predictive value 42.64%  
-ve predictive value = 85.89%

False positive = 57.35%  
False negative = 14.10%  
Overall accuracy = 65.75%  
-ve predictive value = 85.89%

ple with raised values. Thus for finding out dependence combined lab results (GGT & MCV) are good biochemical markers especially in hospital (Table 17 & 18).

With regard to finding out alcoholics as measured by MAST the combined lab investigation are not better than the individual tests. In fact even in the early stage of drinking MAST will be able to pick up those with social familial, occupational or other problems, whereas the lab test will be positive and sensitive only when physiological changes occur in the alcoholics, which may take a longer time. That is why the lab test either individually or in combination are not as good as MAST as a screening device (Table 19 & 20). Similar views have been expressed by Skinner et al. (1986).

With regard to Q.F. index once again MCV & GGT have high sensitivity, specificity, predictive value and accuracy in hospital whereas in community individual tests are better than the combination (Table 21 & 22).

GGT has better sensitivity to find out dependence compared to MCV as reported by other workers also (Wu et al., 1974). As a screening device MAST is definitely a better tool in a community. The lab test only serve as sup-

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**TABLE 17  
DEPENDENCE (COMMUNITY SAMPLE)**

	Severe	Low & moderate
MCV,GGT, (N=8)	↑	4      4
GGT,MCV, (N=159)	↓	24     135

Sensitivity = 14.28%      False positive = 50%  
 Specificity = 97.12%      False negative = 15%  
 Predictive value 50%      Overall accuracy = 83.23%  
 -ve predictive value = 84.9%

**TABLE 18  
DEPENDENCE (HOSPITAL SAMPLE)**

	Severe	Low & moderate
GGT,MCV, (N=37)	↑	33      4
GGT,MCV (N=52)	↓	7        45

Sensitivity = 82.5%      False positive = 10.8%  
 Specificity = 91.8%      False negative = 13.46%  
 Predictive value 89.18%      Overall accuracy = 87.64%  
 -ve predictive value = 86.53%

**TABLE 19  
MAST (COMMUNITY SAMPLE)**

	Alcoholic	Borderline
GGT,MCV (N=8)	↑	8      0
GGT,MCV (N=159)	↑	132     27

Sensitivity = 5.71%      False positive = 0%  
 Specificity = 100%      False negative = 83.01%  
 Predictive value 100%      Overall accuracy = 21.34%  
 -ve predictive value = 16.98%

**TABLE 20  
MAST (HOSPITAL SAMPLE)**

	Alcoholic	Borderline
GGT,MCV (N=37)	↑	36      1
GGT,MCV (N=52)	↓	50      2

Sensitivity = 41.86%      False positive = 2.70%  
 Specificity = 66.66%      False negative = 96.15%  
 Predictive value 97.29%      Overall accuracy = 42.6%  
 -ve predictive value = 3.84%

plementary aids both in diagnosis and follow up of alcoholics. To find out heavy drinkers MCV is better than GGT in both community and hospital, but it is to be remembered that MCV level stays high even 3 months after stopping liquor whereas the GGT reverts to normal within few

**TABLE 21  
Q.F. INDEX (COMMUNITY SAMPLE)**

	Alcoholic	Borderline
GGT,MCV (N=8)	↑	7      1
GGT,MCV (N=159)	↓	70     89

Sensitivity = 9.09%      False positive = 12.5%  
 Specificity = 98.88%      False negative = 44.0%  
 Predictive value 87.5%      Overall accuracy = 57.48%  
 -ve predictive value = 55.97%

**TABLE 22  
Q.F. INDEX (HOSPITAL SAMPLE)**

	Alcoholic	Borderline
GGT,MCV (N=37)	↑	25     12
GGT,MCV (N=52)	↓	2        50

Sensitivity = 92.59%      False positive = 32.43%  
 Specificity = 80.64%      False negative = 3.84%  
 Predictive value 67.56%      Overall accuracy = 84.26%  
 -ve predictive value = 96.1%

days of stopping the drinks. Anyhow combined lab results seem to be the ideal screening device in hospital when compared to the questionnaires. This only means that more severe drinkers attended hospital which might be reflected better in lab test compared to questionnaires. This may also be because of the denial and under reporting of the drinking and the problem associated with it as the drinking pattern is more severe. Similar observations have been made by workers like Bernadt et al. (1982), Wu et al. (1974). Skinner et al. (1986) reported that 'chronic alcoholic clinical index' based on good clinical history and physical examination yielded better results. Still blood test will be very useful in the follow-up of alcoholics, who have given up drinking or switched over to controlled drinking.

Thus from the findings of the present study it could be concluded that lab tests are useful as biochemical markers of alcoholism and are more useful in hospital setup. MCV or GGT alone can be used as a supplement to questionnaires in community surveys and analysis of alcoholics in hospital especially during follow-up. Both tests combined together seem to be the ideal biochemical markers of alcohol-

ism, in a hospital in diagnosis, follow-up and monitoring of drinkers.

Hence we recommend questionnaires to be used in a community for identifying alcoholics and lab tests in a hospital for diagnosis of alcoholism. For follow-up monitoring of drinking. Lab tests are ideal in the hospital and useful in a community.

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