How aware and knowledgeable are Malaysians of modern biotechnology?

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Abstract

Modern biotechnology has been given priority by the Malaysian government for wealth creation in the 9th Malaysian Plan and in the Malaysia’s Science and Technology Policy for the 21st Century. However this technology has also been classified as a complex emerging issue that exhibits high salience combined with limited knowledge on part of the public. Some researchers stress the importance of assessing people’s knowledge on modern biotechnology as according to a theory on decision making, people only form attitudes about technologies and techniques after they have acquired relevant information. The purpose of this paper is to assess and compare the awareness, knowledge and engagement level of the Malaysian public in the Klang Valley across several demographic background such stakeholders’ groups, religion, races, ages, education levels and gender. A survey was carried out on 1017 respondents from various interest groups in the Klang Valley region. Results of the survey showed that the overall mean score for awareness, knowledge and engagement on modern biotechnology were moderate. ANOVAs showed significant differences in awareness, knowledge and engagement levels across stakeholders’ groups, ages and education level while knowledge and engagement differed significantly across religion and races. Result of t-test showed that the females tended to have significantly higher awareness than the males but were at par in term of knowledge and engagement with modern biotechnology.

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1. Introduction

Modern biotechnology has been given priority by the Malaysian government for wealth creation in the 9th Malaysian Plan and in the Malaysia’s Science and Technology Policy for the 21st Century. However modern technology has also been classified as a complex emerging issue that exhibits high salience combined with limited knowledge on part of the public. Some researchers stress the importance of assessing people’s knowledge on modern biotechnology as according to a theory on decision making, people only form attitudes about technologies and techniques after they have acquired relevant information (Kelley 1995). Some researchers hold that more

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knowledge makes people more sympathetic to genetic engineering while other researchers proposed the opposite effect. Understanding has also been cited by Covello and Merkhofer (1994) as one of the factors modulating risk perception. According to Barling et al. (1999), perception of risk is higher amongst those with greater objective knowledge and those who have discussed biotechnology over recent months, but such perception is low amongst those with little knowledge. The purpose of this paper is to assess and compare the awareness, knowledge and engagement level of the Malaysian public in the Klang Valley across several demographic background such stakeholders’ groups, religion, races, ages, education levels and gender.

2. Methodology

The people in the Klang Valley region were chosen as the targeted population as it is the centre of country’s economic and social development besides the respondents in this region meets the requirement of diverse background stated in the model. The respondents (n=1017) were adult representatives (age 18 years old and above) from various interest or stakeholders groups. In this study, knowledge was assessed by asking the respondents whether the nine statements regarding concepts and facts about biotechnology were true or false (Gaskell et al., 2000) with the omission of item one, “it is impossible to transfer animal genes into plants”. Item one was replaced with “there are useful bacteria which live in our body” while item six was slightly modified where the term “beer” from the original question “yeast for brewing beer consists of living organisms” was changed to “bread” to suit local culture where most of the respondents are Muslims and therefore do not drink beer. As for awareness, the concept used by Gaskell et al. (2000) was followed where the respondents were asked whether they had heard of seven applications of modern biotechnology and two related developments in Malaysia. Three items which refer to aspects related to reported and intended habits and behaviours related to information seeking were from Gaskell et al. (2003) but each item was measured on a 7-point scale, ranging from 1 (strongly disagree) to 7 (strongly agree). The ‘engaged’ public of biotechnology ($\alpha=0.69$) is defined as recommended by Gaskell et al. (2003), using a combination of knowledge, awareness of modern biotechnology and reported and intended behaviours related to modern biotechnology. Data analysis was carried out using SPSS version 12.0.

3. Results

3.1. Comparison across Stakeholders

The awareness level was marginally moderate (mean score 3.88 out of total score of 9.0). However various levels of awareness existed across different stakeholder groups. As expected the biotechnologists and policy makers were the most aware of the latest developments in modern biotechnology worldwide followed by the Biology students and Biologists. The lowest level of awareness were observed among the religious expert groups and the general public while the awareness level of the other stakeholders were somewhere in between those groups. ANOVA was significant for awareness towards modern biotechnology across stakeholders ($F=20.31$, $p<0.001$). Post Hoc tests showed that both the policy makers and biotechnologists have higher awareness level than the other stakeholders except for biology students whose awareness level were significantly lower than the policy makers but higher than the politicians, the religious experts and the general public. The lowest level of awareness were seen with the Buddhist, Christian and Islamic experts and the general public whose rating differed significantly with the biotechnologists, biologists, policy makers and biology students while the general public additionally differed with the producers. On the other hand, the Hindu experts differed in their awareness level with the biotechnologists, policy makers and biology students but not with the Biologists.

The overall level of biotechnology knowledge for the Klang Valley stakeholders was moderate (4.70 out of total score of 9.0). As expected, the Scientists (biotechnologists and biologists), policy makers and biology students again have high basic knowledge level of modern biotechnology than majority of the other groups, but surprisingly the Buddhist experts were also in the high category group. The other stakeholders were found to have moderate knowledge of modern biotechnology. The result of ANOVA for knowledge across stakeholders was also significant ($F=17.56$, $p<0.001$). Five groups with the highest knowledge scores were the four science-based stakeholders: the policy makers, biotechnologists, biology students and biologists and the Buddhist experts. Post Hoc tests confirmed that their knowledge about modern biotechnology were significantly higher than Islamic experts and the general public. Knowledge rating of the policy makers was also significantly higher than the politicians and the NGOs.
The overall mean score for all stakeholders were about the mid-point level, indicating moderate engagement level (mean score of 3.47 out of total score of 7.0). As expected, the biotechnologists and policy makers have high level of engagement with modern biotechnology while majority of the other stakeholders except for the Islamic experts showed moderate engagement. ANOVA for engagement with modern biotechnology across stakeholders was also found to be significant (F=23.21, p < 0.001). Two of the most highly engaged groups were the policy makers and biotechnologists. Post Hoc tests showed that both stakeholders have significantly higher engagement than majority of the other groups except for the biology students and biologists. The policy makers’ rating was also higher than the Biologists. The engagement level of the Biology students and the Biologists were found to be significantly higher than three religious expert groups: the Islamic, the Buddhist and the Christian and the general public while the students’ rating was also additionally differed with the NGOs and the politicians. On the other hand, although the producers were less engaged than the policy makers and biotechnologists but their mean score was significantly higher than the Islamic experts and the general public.

As expected, biotechnologists and policy makers showed high level of awareness, knowledge and engagement with modern biotechnology. These two stakeholders groups were directly involved in modern biotechnology either through research and development (R&D) or involved in policy matters. Although the biologists and the biology students possessed high level of biotechnology knowledge but they showed only moderate level of awareness and engagement most likely because they were less involved in modern biotechnology R&D and policy-making activities. On the other hand, the NGOs, media, politicians, the Hindu experts and the general public exhibited moderate level of awareness, knowledge and engagement. The activities of the NGOs in Malaysia tended to be diversified, only very limited number covering modern biotechnology issues so the finding is rather predictable for them. As for the media, again Science editor in Malaysia covers all disciplines in Science where modern biotechnology is just one of them, so again the result is rather expected. With limited exposure to modern biotechnology activities in their daily lives, the moderate level of awareness, knowledge and engagement is again predictable for politicians and general public. Low level of awareness among the other three remaining religious experts is expected as their nature of work were more involving religious aspects. However it is interesting to note that they performed better with the knowledge quiz where the Buddhists obtained a high mean score while the other two groups were in the moderate category. Some of the religious experts were academicians or might have had Science education background. The moderate level of engagement professed by the Buddhists and the Christians experts and the low level of engagement scored by the Islamic experts is again expected and could be due to their being engrossed in religious issues.

3.2. Comparison across Religions
Awareness and engagement levels did not differ much across different religions but knowledge level did differ. Respondents from all religions were moderately aware of modern biotechnology developments and have moderate engagement with modern biotechnology. ANOVA did not show any significant differences in their awareness level but was significant for knowledge (F=14.76, p < 0.001) and engagement (F=3.76, p < 0.05) across religions. Post Hoc tests showed that knowledge level of the Buddhists and the Christians were significantly higher than the Muslims, while rating of the Buddhists was also higher than the Hindus. Although ANOVA was significant for engagement across religions but Post Hoc tests could not detect specific differences.

3.3. Comparison across Races
Respondents from all races were found to have moderate level of awareness and the level of awareness did not differ much across races. However, biotechnology knowledge and engagement differed across races. ANOVA was not significant for awareness across races but were significant for knowledge (F= 27.76, p < 0.001) and engagement (F=7.79, p < 0.001). Post Hoc tests confirmed that knowledge level of the Chinese was significantly higher than the other two races while the Malays seemed to be less engaged with modern biotechnology compared to the others.

3.4. Comparison across Ages
The levels of awareness of modern biotechnology were found to differ across ages (Table 4). The youngest respondents (18-29 years) were found to be more aware of modern biotechnology compared to the oldest group (≥ 55 years). Biotechnology knowledge also differed across ages. ANOVAs were significant for awareness (F=2.96, p <0.05 ), knowledge (F=2.74, p <0.05 ) and engagement (F=3.34, p <0.05 ) across ages but Post Hoc tests were only able to detect significant difference in the awareness level of the youngest (18-29 years) and the oldest group of
respondents (≥55 years). The younger subjects seemed to be more aware of modern biotechnology developments compared to those aged 55 years and above. This could also be due to the younger generation were either still studying in universities or just beginning their career where they were more likely involved in information seeking. Lorence and Park (2006) reported that younger participants (18-29) exhibited the highest rates in the use of internet.

3.5. Comparison across Education Levels

Education has a significant impact on the public awareness, knowledge, engagement with modern biotechnology. The respondent with higher level education tended to be more aware of modern biotechnology, have higher biotechnology knowledge level and more engaged with modern biotechnology. On the other hand, the respondents with only secondary level of education were found to have low level of awareness and engagement with modern biotechnology compared to those educated at least up to diploma or pre-University level, who showed moderate level of awareness, knowledge and engagement with modern biotechnology. This is not surprising as modern biotechnology has been labelled as a complex issue that include terminologies not easily understood by the less educated people. ANOVAs were highly significant for awareness ($F=68.36$, $p<0.001$), knowledge ($F=83.57$, $p<0.001$) and engagement ($F=94.57$, $p<0.001$) across education. Post Hoc tests confirmed that those with higher level of education have higher level of awareness, knowledge and engagement with modern biotechnology.

3.6. Comparison across Gender

Both the male and female respondents in the Klang Valley region have moderate level of awareness, knowledge and engagement. However result of t-test showed that the females tended to have significantly higher awareness than the males but were at par in term of knowledge and engagement with modern biotechnology. This could relate to their information seeking behaviour. Lorence et al. (2006) found that higher percentage of females were seeker of health information compared to the males.

4. Discussion

It is difficult to compare the awareness level in this study with majority of earlier surveys because of the difference in instrument used and respondents’ category. Most of the other studies analyzing public awareness in USA, Canada, Japan, Australia, Europe, Brazil, China and Malaysia were based on a single question on self-rated general awareness of either biotechnology or genetic engineering (Kamaldeen & Powell 2000; Macer & Chen 2000). The closest comparison that can be made for the level of awareness in this study is with the Eurobarometer survey on the Europeans attitude towards biotechnology as the instrument used to measure awareness in this study was developed based on their style. The overall mean for awareness level among the Malaysians residing in the Klang Valley region was only 3.88 lower than the mid-point of 4.5. This value is lower than the European public where the mean score for public awareness in 2002 was 1.79, higher than the mid-point of 1.5 (Gaskell et al. 2003). Again certain point has to be noted here, the European score was based on different set of biotechnology applications. Greater awareness in Europe has been fuelled by increased negative media coverage on GM food (Frewer et al. 2002) and also active anti-GMO lobbying by the NGOs (Bernauer & Meins 2001). In Malaysia, media coverage was rather periodic with limited articles written by columnists and anti-GMO reporting.

The biotechnology knowledge level of the Malaysian subjects in the Klang Valley region varied from moderate to high. An almost similar instrument for measuring biotechnology knowledge based on the Eurobarometer survey (Gaskell et al. 2003) was used by several other researchers (ISAAA-UIUC 2003; Hallman et al. 2004). The overall level of biotechnology knowledge for the Klang Valley stakeholders was 4.70 out of total score of 9.0 which is lower than the mean score for public knowledge in Europe and United States. The biotechnology knowledge mean score for Europe was 4.93 out of total score of 9.0 (Gaskell et al. 2003) while the Americans scored 7 out of 11 (Hallman 2004). This finding is reasonable comparing to Europe and United States as they are developed countries, so it is expected that their citizens are more knowledgeable related to scientific issues compared to developing countries like Malaysia. The Klang Valley stakeholders’ knowledge score in this study is however slightly lower than the Malaysian consumers knowledge in the ISAAA-UIUC study where the consumers knowledge level was 6.89 out of 12 (2004). This difference is again expected as their consumer respondents were urban supermarket goers who tend to be middle-class and have at least some college education while in this study, the respondents come from mix education background.

The overall mean score for engagement was about the mid-point level, indicating moderate engagement level. The only other research that have studied engagement variable was the Eurobarometer 58.0 (Gaskell et al. 2003).
level of engagement in the Klang Valley region could not be compared with the study by Gaskell et al. as they did not report their result in mean score. But the engagement level is expected to be at par with the awareness and knowledge as both variables are components of engagement with the addition of reported and intended behaviour items.

5. Conclusion

The overall mean showed that the Malaysian stakeholders in the Klang Valley region have moderate level of awareness, knowledge and engagement with modern biotechnology applications indicating that they were interested and have accessed to some information about modern biotechnology. However, more efforts by relevant bodies and professionals such as the media, government agencies related to biotechnology, academicians and research scientists should be geared to disseminate more information to the general public and religious expert groups on modern biotechnology concepts and issues through the general mass media, pamphlets or public forums. This is important to prepare the Malaysian public in facing the biotechnology era where they have to make informed decisions regarding modern biotechnology issues in their everyday lives.

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