Malaysian public awareness & knowledge on modern biotechnology

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ABSTRACT

Bioteknologi merupakan salah satu daripada lima teknologi teras yang akan memacu transformasi Malaysia kepada sebuah negara perindustrian terulung menjelang tahun 2020. Mengikut teori pembuat keputusan, seseorang itu hanya membentuk sikap terhadap teknologi dan teknik setelah mereka mendapat maklumat yang berkaitan, justeru itu adalah penting untuk menilai pengetahuan atau kesedaran masyarakat terhadap bioteknologi moden. Bioteknologi moden telah diklaskan sebagai satu isu baru yang kompleks tapi amat menonjol yang kurang difahami oleh masyarakat awam. Tujuan makalah ini adalah untuk mengkaji tahap kesedaran dan pengetahuan masyarakat Malaysia di kawasan Lembah Klang dan membandingkan tahap kesedaran dan pengetahuan merentas kumpulan pemegang taruhan. Satu survei telah dijalankan ke atas 1017 responden yang terdiri daripada pelbagai kumpulan pemegang taruhan di Lembah Klang. Hasil kajian menunjukkan bahawa skor min keseluruhan bagi kesedaran dan pengetahuan terhadap bioteknologi moden adalah sederhana. ANOVA menunjukkan perbezaan yang signifikan bagi kesedaran dan pengetahuan merentas kumpulan pemegang taruhan.

INTRODUCTION

It is important to assess people's knowledge or awareness on modern biotechnology as according to a theory on decision making (Kelley 1995), people only form attitudes about technologies after they have acquired relevant information. Some researchers hold that more knowledge makes people more sympathetic to genetic engineering while other researchers proposed the opposite effect. Understanding has also been cited by Covello 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 has discussed biotechnology over recent months, but such perception is low amongst those with little knowledge.

Public perceptions of biotechnology have received extensive attention in recent years in most Western countries. There have been numerous surveys on public perceptions of biotechnology in Europe, USA and Canada (Gaskel *et al.* 2003; Kamaldeen & Powell 2000) but there have been few similar studies in developing countries. General consumer awareness towards biotechnology varies according to countries and type of biotechnology applications or questions asked. Overall the public in developing countries were found to be more aware of modern biotechnology compared to developing countries. Results from the Angus Reid World Poll in 1999 found that 95% of Germans, 94% of Britons, 85% of Australian, 89% Japanese, 79% French, 78% Canadian, 66% Americans and 39% urban Brazilians said yes when asked whether they have read or heard anything about GM food (Kamaldeen & Powell 2000). However other studies reported that the American and Canadian public was less aware of biotechnology with only 53% of Americans and 44% of Canadians acknowledged that they have read or seen a news story on biotechnology (Pollara & Earnscliffe Research 2003). Recently, Hallman *et al.* (2004) found that although 77% of Americans were aware that methods of modifying genes exist, only 57% have heard or read some or a great deal about GM food in 2004. Lin *et al.* (2004) reported that the awareness level of biotech foods among the consumers in China was also low with only slightly more than 20% of urban consumers indicated that they have frequently heard about biotech foods while another two-thirds of the consumers had only heard of biotech foods occasionally. The Koreans were more aware of GM food with 79% claimed to have heard or read some or a great deal about it (Hallman *et al.* 2004). A survey carried out by Asean Food Information Centre (AFIC) in 1998/1999 found that less than half of the Asean consumers were aware (have heard or read) of food biotechnology (Howden 2000). The highest score was obtained by the consumers in Philippines (about 39%), followed by the Thais (about 22%), the Indonesians (about 18%) and lastly the Malaysian consumers (17%).

Modern biotechnology has been given priority by the Malaysian government to spearhead the country's economy and modern biotechnology products from other countries are slowly coming in. The future development and commercialization of modern biotechnology products in Malaysia depends heavily on public acceptance. If consumer acceptance issues are not adequately addressed, then the potential economic and social benefits of modern biotechnology may not be realized. The only study on public perception of modern biotechnology in Malaysia, at the start of this research was carried out by Asean Food Information Centre (AFIC) several years ago, in 1998/1999 (Howden 2000). Significant advancements in modern biotechnology in Malaysia and world wide have happened since then. Information on modern biotechnology has also been made more available to the public through the

internet as well as periodic coverage of modern biotechnology issues in the Malaysian general media. Malaysian Biotechnology Information Centre (MABIC) has also made an effort to provide on-line information on modern biotechnology issues and development in Malaysia and provide linkage to several international website on modern biotechnology education besides organizing public seminars in Malaysia (MABIC 2002). It is expected that the level of awareness on modern biotechnology issues should have been increased in the last few years. So there is a need to assess the current level of awareness and knowledge of the Malaysian public towards modern biotechnology.

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 (numerous existing universities and R&D institutions, biotechnology related industries) besides the respondents in this region meet the requirement of diverse background stated in the model. In this study, a wider range of interest groups including producers, scientists, policy makers, NGOs, media, politicians, religious experts, university students and general public were surveyed. They were chosen using multi-stage sampling technique. The respondents (n=1017) were adult representatives (age 18 years old and above) from various interest or stakeholders groups mentioned earlier. Each stakeholders group will have a minimum target sample of 40 respondents except for the general public. Since the majority of the Klang Valley residents comprised of the general public, this group was allocated 550 respondents. The general public was further stratified according to their occupations classification by Malaysian Standard Classification of Occupations 1998 (MASCO). The ratios for different gender, races and religion of the residents in the Klang Valley were also taken into account. Using the approach recommended by Kelley (1995) to carry out a base-line study in Malaysia, the respondents were first introduced to the basic concepts of modern biotechnology. The questionnaires were administered face to face to the respondents.

RESULTS

AWARENESS ON MODERN BIOTECHNOLOGY

Awareness is defined by the Merriam-Webster Dictionary (2003), as having or showing realization, perception of knowledge. In this study awareness is defined as what the public know about modern biotechnology applications world wide

and related developments in Malaysia acquired by study, investigation, observation or experience. The respondents in this study were asked whether they have heard of seven applications of modern biotechnology and two related developments in Malaysia. The overall mean score for awareness among Klang Valley's stakeholders was only 3.88, although classified as moderate, was below the mid-point of 4.5 (Table 1). As expected, biotechnologists and policy makers showed high level of awareness with modern biotechnology. Surprisingly the biologists and the biology student only claimed to have moderate level of awareness. On the other hand, the NGOs, media, politicians, the Hindu experts and the general public exhibited moderate level of awareness. The other three remaining religious experts showed low level of awareness.

TABLE 1: Awareness on modern biotechnology issues

Stakeholder	Awareness	
	Mean score ± std dev.	Interpretation
1. Producers	4.80 ± 2.36	Moderate
2. Biotechnologists	7.11 ± 1.89	High
3. Biologists	5.37 ± 2.19	Moderate
4. Policy makers	7.51 ± 1.73	High
5. NGOs	4.41 ± 2.99	Moderate
6. Media	4.64 ± 3.12	Moderate
7. Politicians	4.26 ± 2.40	Moderate
8. Islamic experts	2.85 ± 2.83	Low
9. Buddhist experts	2.96 ± 2.01	Low
10. Christian experts	2.96 ± 2.07	Low
11. Hindu experts	3.36 ± 2.89	Moderate
12. Biology students	5.99 ± 1.97	Moderate
13. General public	3.21 ± 2.56	Moderate
Overall		Moderate

ANOVA was significant for awareness towards modern biotechnology across stakeholders ($F=20.31$, $p < 0.001$) (Table 2). 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 (Table 3). The lowest level of awareness were seen with the Islamic, Buddhist and Christian 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.

TABLE 2: One way ANOVA to compare awareness and knowledge on modern biotechnology across stakeholders

Variable	F-Value	Significance
Awareness	20.31	0.000***
Knowledge	17.56	0.000***

***$p < 0.001$

KNOWLEDGE ON MODERN BIOTECHNOLOGY

Knowledge is what we know or think we know (Gosschalk (2001). Another definition by Merriam-Webster Dictionary (2003), knowledge is the facts or ideas acquired by study, investigation, observation or experience. In this study knowledge is defined as the concepts and facts about biotechnology acquired by study, investigation, observation or experience. Respondents will be asked whether each of the statement regarding concepts and facts about biotechnology is true or false (Gaskel *et. al.* 2003). One of the seven questions 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 many people do not drink beer. An additional new item "there are useful bacteria which live in our body" was introduced.

TABLE 3: Games-Howell Post Hoc tests to compare awareness of modern biotechnology across stakeholders

Stakeholder/ Mean score	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Producers / 4.80		**		***								*	
2. Biotechnologists / 7.11	**		*		**	*	***	***	***	***	***		***
3. Biologists / 5.37		*		***			**	**	**			***	
4. Policy makers / 7.51	***		***		***	**	***	***	***	***	***	*	***
5. NGOs / 4.41													
6. Media / 4.64													
7. Politicians / 4.26													
8. Islamic experts / 2.85													
9. Buddhist experts / 2.96													
10. Christian experts / 2.96													
11. Hindu experts / 3.36													
12. Biology students / 5.99				*			*	***	***	***	*		***
13. General public / 3.21													

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$

The overall mean score for knowledge of modern biotechnology was 4.70 (Table 4). As expected, biotechnologists and policy makers showed high level of knowledge with modern biotechnology. On the other hand, the NGOs, media, politicians, the Hindu experts and the general public exhibited moderate level of knowledge. Although the other three remaining religious experts showed low level of awareness but 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.

TABLE 4: Knowledge on modern biotechnology

Stakeholder	Knowledge	
	Mean score ± std. dev.	Interpretation
1. Producers	5.36 ± 1.84	Moderate
2. Biotechnologists	6.66 ± 1.65	High
3. Biologists	6.27 ± 1.86	Moderate
4. Policy makers	6.91 ± 1.84	High
5. NGOs	4.60 ± 2.31	Moderate
6. Media	4.69 ± 2.14	Moderate
7. Politicians	4.47 ± 1.60	Moderate
8. Islamic experts	3.83 ± 2.09	Low
9. Buddhist experts	6.25 ± 2.01	Low
10. Christian experts	5.88 ± 1.95	Low
11. Hindu experts	4.73 ± 2.27	Moderate
12. Biology students	6.58 ± 1.91	Moderate
13. General public	4.12 ± 2.24	Moderate
Overall	4.70 ± 2.24	Moderate

The result of ANOVA for knowledge across stakeholders was also significant ($F=17.56$, $p < 0.001$) (Table 2). Five groups with the highest knowledge scores were the four science-based stakeholders: the policy makers, biotechnologists, biology students, 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 (Table 5). Knowledge rating of the policy makers was also significantly higher than the politicians and the NGOs.

TABLE 5: Scheffe Post Hoc tests to compare knowledge of modern biotechnology across stakeholders

Stakeholder/ Mean score	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Producers / 5.36													
2. Biotechnologists / 6.66								**					***
3. Biologists / 6.27								**					***
4. Policy makers / 6.91					*		*	***					***
5. NGOs / 4.60													
6. Media / 4.69													
7. Politicians / 4.47													
8. Islamic experts / 3.83													
9. Buddhist experts / 6.25								*					**
10. Christian experts / 5.88													
11. Hindu experts / 4.73								**					***
12. Biology students / 6.58													
13. General public / 4.12													

***p < 0.001, **p < 0.01, *p <0.05

DISCUSSION & CONCLUSION

As expected, biotechnologists and policy makers showed high level of awareness and knowledge 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 most likely because they were less involved in modern biotechnology R&D and policy-making activities. On the other hand, the NGOs, media, politicians, Hindu experts and the general public exhibited moderate level of awareness and knowledge. 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 and knowledge is again predictable for politicians and general public. Low level of awareness among the other three remaining religious experts (Islamic, Buddhist and Christian) is rather predictable as their nature of work were focussing more on 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 overall mean showed that the Malaysian stakeholders in the Klang Valley region have moderate level of awareness and knowledge 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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