

Awareness of Modern Biotechnology and Media Coverage

^{1,2}Latifah Amin, ^{1,3}Nurul Ilyana Rezali, ^{1,4}Mus Chairil Samani and ²Noor Ayuni Ahmad Azlan

¹Social Impact of Biotechnology Development in Malaysia Research Group (SIMBIO),

²Centre for General Studies, ³Faculty of Social Sciences and Humanities,

⁴Faculty of Social Sciences, Universiti Malaysia Sarawak,
94300 Kota Samarahan, Sarawak, Malaysia

Abstract: Modern biotechnology has expanded rapidly around the world and it has been considered as a very important industry in helping Malaysia to achieve its goal of becoming a highly industrialized nation by 2020. Thus, assessment of people's awareness on biotechnology is very important and according to a theory on decision making, people only form attitudes about technologies when they have acquired relevant information. The purpose of this study is to study the awareness level of the Malaysia public in the Klang valley region to analyze the coverage of biotechnology issues in four mainstream Malaysian newspapers and to relate the media coverage with Malaysian public awareness. A survey was carried out in the Klang valley region to 434 respondents stratified according to stakeholder's groups. Results of the survey showed that the overall mean score for awareness on modern biotechnology were moderate with a mean score of just slightly above the mid-point value. Content analysis was carried out on four Malaysian mainstream newspapers Utusan Malaysia, Berita Harian, New Straits Times and The Star. The level of media coverage on the real content of biotechnology issues were considered to be low. This explains the moderate level of awareness by the respondents.

Key words: Modern Biotechnology, awareness, media coverage, perception, knowledge, Malaysia

INTRODUCTION

Modern biotechnology has expanded rapidly around the world especially in developing countries through the application of these techniques in the fields of medicine, pharmaceuticals, agriculture and livestock and industrial (James, 2009; Rosenberg-Yunger *et al.*, 2008; Walsh, 2004). Most developing countries have been able to produce and commercialize biotechnology products to the world markets. 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 and Powell, 2000) but there have been few similar studies in developing country. General consumer awareness towards biotechnology varies according to countries and type of biotechnology applications or questions asked. It is important to assess people's 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 and Merkhofer (1993) 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.

Most studies around the world show that public awareness is in line with the development of modern biotechnology. According to McCann-Erickson Worldgroup (2000), consumers in the United States, Canada and Southern Europe have a high level of awareness but users in Southeast Asia, Asia and Latin America have low levels of awareness. The public at large are aware of the modern biotechnology development with 80% of respondents in the United Kingdom have heard of cloning and organ transplant (Xeno-transplantation) while 70% of them have heard of GMF and genetic testing (genetic testing) (Gaskell *et al.*, 2003), 96% of teachers of geography in Turkey (Demirci, 2008), 90% of respondents in the Swedish (Hursti *et al.*, 2002), 75% of students and 18% of non-students in Iran (Sheikhha *et al.*, 2006), 70% of respondents in Italy (Soregaroli *et al.*, 2003), 67% (23%

always and 44% at times) than consumers who live in urban areas in China (Huang *et al.*, 2006) and 46% of respondents in Kenya (Kimenju *et al.*, 2005) stated that they had heard of modern biotechnology.

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 Malaysia government sees the important and influential role of newspapers in disseminating information to the general public. It also allows readers to share their ideas and views which will contribute towards a better perception and understanding of the technology. Wariya (2010) argued that newspapers could become alternative media for public to voice out their opinions and views. On the other hand, newspapers have the power to communicate important issues to the general public (Dudo *et al.*, 2011; Macer *et al.*, 2000). This potential has always been realized by owners of newspapers in highlighting important issues affecting the general public. The reading public will better understand issues that may have a direct and profound impact on their life (Samani *et al.*, 2010; Bauer, 2005).

McCombs (2004), McCombs and Shaw (1972), Vilella-Vila and Costa (2008), Macer (2001) and Wingenbach and Rutherford (2006) argued that the media does not directly influenced people's mind but focuses the public attention on reported issues. It explained that if the media focuses on a particular issue or story that is important, it will indirectly becomes an important issue in the community. McCombs (2004) states that the public uses issues focused by the media and create their own agenda by selecting which issue that is more

important. By creating a topic in the community, topic in the public agenda will exist which in turn become the main focus of the public to discuss or debate an issue actively. Dudo *et al.* (2011) did a study on food nanotechnology in US newspaper have pointed media as the public's primary source of information and plays an important role in shaping the awareness among public (Vanderschuren *et al.*, 2010; Holmgreen and Vestergaard, 2009; Torres *et al.*, 2006; Matthews *et al.*, 2003; Morris and Adley, 2001).

The objective of this study is to analyze the coverage of biotechnology issues in four mainstream Malaysian newspapers and to relate the coverage to the Malaysian public awareness on modern biotechnology.

MATERIALS AND METHODS

The research data for awareness was collected by means of survey to adults (age 18 years old and above) stakeholders who is residing in the Klang valley region. The questionnaires were administered face to face to 434 adult respondents (age 18 years old and above) in the Klang valley region. The respondents were stratified according to stakeholders' groups which consisted of eleven groups: producers, scientists, policy makers, NGOs, media, religious scholars, university students and consumers (Table 1). About 38% of the respondents were male, 62% female, age ranging from 17-64 years old, 13.6% of the respondents had at least secondary level of educations, 23.5% had pre-university education or diploma holders while the remaining 62.9% had tertiary level of education (Table 2).

The instrument to measure awareness in this study was constructed based on the work of earlier researches. The awareness concept used by Gaskel *et al.* (2003) was followed where the respondents were asked whether they had heard of seven applications of modern biotechnology and two related developments in Malaysia.

Table 1: The stakeholders involved

Stakeholders	Definitions
Producers	Officers who have a company or organization related to food, agriculture and pharmaceuticals. Company or organization directly involved in the production of products of modern biotechnology or has an interest to enter the field of modern biotechnology in the future
Scientists	Professionals involved in the research and development (R and D) of biotechnology or science
Policy makers	Individuals from organizations in which decisions and opinions would affect policy/national policies, laws and acts related to biotechnology as well as the country's biotechnology programs including production, research and trade
Group of Non-Governmental Organizations (NGOs)	Individuals who represent organizations that have an interest in biotechnology
Media	Media group consisting of editors and news reporters from local newspapers, especially in science and technology (including areas of environment and research and development)
University students	University students with science background, especially biology
Muslim scholars	Officials of the Islamic organizations
Buddhist scholars	Officials of the Buddhist organizations
Christian scholars	Officials of the Christian organizations
Hindu scholars	Officials of the Hindu organizations
Consumers	Individuals who often visit the supermarket to get daily necessities

The instrument has been pre-tested in the pilot study and considered to have an acceptable validity. The alpha value for awareness is 0.75. The SPSS 14.0 software was used for data analysis. Content analysis was used to analyze media coverage of biotechnology issues in four mainstream newspapers in Malaysia. The method was chosen because it allows the researcher to determine the type of content published. Four mainstream newspapers in Malaysia were chosen for this study because the majority of the reading public preferred these newspapers. All four newspapers are collected as a source of research on the period chosen, over the last 10 years starting 2001. The news is analyzed to see if there is a difference in mainstream media coverage over 10 year period. In order to facilitate the work of collecting materials of biotechnology for the past 10 years, other than getting the materials in the library, the researcher had to use National News Agency (BERNAMA) and The Star Online database to get the population of the writing on the issue of biotechnology in the four mainstream newspapers. The population was determined by using the keyword biotechnology in addition to the use of other themes, namely, cross breeding, fermentation, stem cuttings, hybrid and conventional breeding to biotechnology.

Table 2: Background of respondents surveyed

Background	Frequency	Percentage
Stakeholders' group		
Producers	25	5.8
Scientists	32	7.4
Policy maker	39	9.0
NGOs	26	6.0
Media	29	6.7
University students	44	10.1
Islamic scholars	43	9.9
Buddhist scholars	32	7.4
Christian scholars	34	7.8
Hindu scholars	34	7.8
Consumers	96	22.1
Gender		
Male	165	38.0
Female	269	62.0
Educational level		
Secondary	59	13.6
Diploma/Pre-U	102	23.5
University	273	62.9
Age		
18-25 years	201	46.3
26-40 years	156	35.9
≥41 years	77	17.7
Race		
Malay	259	59.7
Chinese	78	18.0
Indian	72	16.6
Sabah natives	11	2.5
Sarawak natives	9	2.1
Others	5	1.2
Religion		
Islam	264	60.8
Buddha	52	12.0
Hindu	60	13.8
Christian	52	12.0
Free thinkers	6	1.4

While the themes of modern biotechnology are the biotechnology, cloning, transgenic, genes, genetics, Genetically Modified Food (GMF), Genetically Modified Organisms (GMO), modified organisms (genetically modified) *in vitro*, DNA, stem cells, tissue culture, genetic engineering and genomics.

RESULTS AND DISCUSSION

Awareness of modern biotechnology: Table 3 shows the level of awareness of modern biotechnology across stakeholder's groups in the Klang valley region in Malaysia. Overall, the level of awareness was classified as moderate with mean score of 5.06, just slightly above the mid-point value of 4.5. Majority of the stakeholder groups the producers, scientists, NGOs, media, Muslim scholars, Buddhist scholars, Hindu scholars, Christian scholars and the consumers are in this group.

Only two stakeholder groups, the policy makers and university students were found to have high level of awareness. This is not surprising as the policy makers were directly involved in the regulation of modern biotechnology in Malaysia while the university students have direct exposure on modern biotechnology issues through formal education.

Among the eight stakeholder groups, the Islamic scholars and the media group has the lowest mean scores which is lower than the midpoint value of 4.5. The low level of awareness among the Muslim scholars on the development of modern biotechnology is probably due to their day to day focus was more on existing religious issues. As for the media people, it is rather surprising for them to have the second lowest level of awareness. It is commonly expected that they would have greater awareness level due to their exposure in covering biotechnology news. The more reasonable explanation would be that they were only involved in covering limited number of biotechnology news for their newspapers which can be seen in the number of media coverage on modern biotechnology issues for the past 10 years (Table 4).

Table 3: The level of awareness on modern biotechnology

Stakeholders	Mean score±SD	Interpretation
Producers	5.16±2.06	Moderate
Scientists	5.06±2.48	Moderate
Policy makers	6.18±1.59	High
NGO	5.39±2.51	Moderate
Media	4.10±2.41	Moderate
University students	6.09±1.94	High
Muslim scholars	3.26±2.41	Moderate
Buddhist scholars	5.00±1.34	Moderate
Christian scholars	4.91±2.08	Moderate
Hindu scholars	5.12±2.52	Moderate
Consumers	5.15±2.06	Moderate
Overall	5.06±2.25	Moderate

Low = 0-2.99, Moderate = 3.00-6.00, High = 6.01-9.00

Table 4: Coverage of biotechnology issues by the mainstream newspapers in the past 10 years

Years	Frequency	Percentage
2001	29	4.0
2002	90	12.3
2003	76	10.4
2004	70	9.6
2005	207	28.4
2006	104	14.3
2007	47	6.4
2008	45	6.2
2009	30	4.1
2010	31	4.3
Total	729	100.0

The ANOVA tests showed that there is a significant difference in the mean score among the stakeholder groups' level of awareness on modern biotechnology ($F = 5.87, p < 0.001$). The Post-Hoc test confirm that the policy makers and university students have significantly high level of awareness compared to the media and Muslim scholars. The policy makers group also has a higher level of awareness compared to the Buddhist scholars. Four groups of stakeholders, the NGO, producers, consumers and Buddhist scholars also have a higher level of awareness compared with the Muslim scholars.

The marginally moderate level of awareness among the scientists (mean score 5.06) and the producers (mean score 5.16) are also initially puzzling. The explanation is that scientists normally focus their academic readings on their specific research area so when asked on broader modern biotechnology issues they professed to have almost similar level of awareness with the majority of the stakeholder groups. As for the producers, there are very few genuine modern biotechnology industries in Malaysia as most of the so call biotechnology industries in Malaysia mostly deal with pharmaceuticals, food or conventional biotechnology. Only a few companies were directly involved in plant tissue cultures or imported pharmaceutical products as modern biotechnology products in Malaysia are not being commercialized yet.

Biotechnology in the Malaysian media: A total of 729 news items on biotechnology were coded from the four mainstream newspapers. It was found that the distribution of items coded during the 10 years period is inconsistent. The breakdown of news item according to years is as follows: 29 items or 4% (2001), 90 items or 12.3% (2002), 76 items or 10.4% (2003), 70 items or 9.6% (2004), 207 items or 28.4 items (2005, 104 items or 14.3% (2006), 47 items or 6.4% (2007), 45 items or 6.2% (2008), 30 items or 4.1% (2009) and 31 items or 4.3% (2010) (Table 4). The slight surge in the reporting of biotechnology issues in 2002 and 2003 is due to the controversy relating to the cloning of a baby girl named Eve in 2002. There was an uproar in the media worldwide with objections coming from people of various walks of life. Reporting on biotechnology issues

Table 5: Coverage of biotechnology issues in the four mainstream newspapers

Newspapers	Frequency	Percentage
Utusan Malaysia	366	50.2
Berita Harian	298	40.9
New Straits Times	55	7.5
The Star	8	1.4

peaked in 2005 when the Malaysian government announced the launching of the National Biotechnology Policy. However, in 2008 when Dato' Seri Najib Tun Abdul Razak replaced Tun Abdullah Ahmad Badawi as the Prime Minister of Malaysia and introduced the 1 Malaysia concept the media reporting shifted to this concept, leading to a decline in the reporting of biotechnology issues.

Table 5 shows that >10 year period, biotechnology issues were mostly covered by the Malay newspapers with Utusan Malaysia 366 items (50.2%) and Berita Harian publishing 298 items (40.9%). The New Straits Times which is an English language daily, publishes 55 items (7.5%) with The Star recording the least amount of news items, a total of 10 articles (1.4%). The two Malay newspapers are more supportive of policies and efforts made by the government to help improve the field of biotechnology in the country on par with other developed biotechnology countries. This is not strange as the two Malay newspapers is owned by the government. Therefore, the media agenda is dependant on the agenda being played and created by the government (McCombs, 2004; Eyck and Williment, 2004; Dura *et al.*, 1998; Djankov *et al.*, 2003). In other words if the government focused on an issue such as biotechnology, the mass media especially the Malay newspapers will also focus on that issue. However, when the government turned to other issues or topics in line with the aspirations and reforms in the country, the media reports were also shifted to other issues or topics they feel more important than biotechnology. According to Smeltzer, this phenomenon is due to the media ownership by the government. This condition according to him caused the mainstream media to not playing their role and responsibility in reporting news but to report only the positive aspects of biotechnology and deliberately hide the negative issues from the public.

On the other hand, the English newspapers, the New Straits Times and The Star showed the least coverage on biotechnology issues compared to the two Malay newspapers. The organizational policy in these media which inclines towards privatization resulted in the newspapers, The Star in particular, to be not so keen on reporting the news on biotechnology. Instead the newspapers focused on other topics such as economics and business which are often well-liked by the newspaper readers. This statement is supported by Chua Yew Kay who is the Deputy Editor of The Star who explained that The Star Group policy is more focused on the

Table 6: Biotechnology themes covered in the four mainstream newspapers in the past 10 years

Themes	Frequency
Cross breeding	0
Genetically modified food	6
Implementation of biotechnology policy	272
Cloning	10
Technology	20
Food	6
Agro industry	54
Research	39
Economy	8
Health	5
Act	12
Award	40

development of the society's minds through newspaper reading. However, the issue of biotechnology is not an issue or topic that they feel is important to be reported to the reader.

Table 6 shows that the biotechnology theme mostly covered by the four mainstream newspapers was related to biotechnology policy and the government's efforts in implementing the policy. Although, there are various themes available in the field of biotechnology but the editors and journalist of the four mainstream newspapers predominantly the Malay newspapers seemed to focus more on selected themes in tandem with the government's agenda. There was little focus on the biotechnology proper such as the concepts and techniques as well the benefits and risks of biotechnology.

This study also found that there were some issues of biotechnology that have been reported using the same themes and issues although, its focus was different. This needs to be taken seriously by the newspapers editors and journalists in biotechnology in order to avoid confusion that might arise in the process of increasing understanding and awareness of the importance of biotechnology to the public. The scientists also have to play more significant role in providing more factual information to the newspapers to increase public awareness and knowledge.

CONCLUSION

This study showed that the level of awareness of stakeholders in the Klang valley is moderate with an overall mean score of 5.06 out of total mean score of 9.0. This could be related to the low coverage on biotechnology issues in the Malaysian mainstream newspapers. Even the Malay newspapers only covered about 30-37 articles per year i.e., the average of about 3 article per month. But the 3 articles spread across different themes with most coverage were on policy matters and the implementation of policy. So, the Malaysian public were exposed more to policy matters compared to the real content of modern biotechnology. 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 factual information to the general public on modern biotechnology concepts and issues through the general mass media. The media should cover more content issues and they can invite biotechnologists to write on modern biotechnology concepts and applications and they can invite people such as the Science philosophers and risk experts to give balance view on the social and ethical aspects, the economists to write on the economic impact, the religious experts to write on various religion perspectives. 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. Modern biotechnology has been associated with being novel and complex making it not an easy subject to be understood by the non-biologists and lay people. There is a need to disseminate more information on modern biotechnology in simple term that can be understood by the lay public and religious experts as well organizing open forums to discuss modern biotechnology issues. The religious experts such as the Muslim scholars are an important group of stakeholders in a country such as Malaysia where the major religion is Islam. People and the policy makers will consult them on issues of permissibility status of various modern biotechnology applications. Only when they are better understood on modern biotechnology principles and issues, then only they can give an inform decision.

ACKNOWLEDGEMENT

The researchers would like to thank Universiti Kebangsaan Malaysia for supporting this research under the UKM-AP-CMNB-21-2009/1 grant.

REFERENCES

- Barling, D., H. De Vriend, J.A. Cornelese, B. Ekstrand and E.F.F. Hecker *et al.*, 1999. The social aspects of food biotechnology: A European view. *Environ. Toxicol. Pharmacol.*, 7: 85-93.
- Bauer, M.W., 2005. Public perceptions and mass media in the biotechnology controversy. *Int. J. Publ. Opin. Res.*, 17: 5-22.
- Covello, V.T. and M.W. Merkhofer, 1993. *Risk Assessment Methods: Approaches for Assessing Health and Environmental Risks*. Plenum Press, New York, ISBN: 9780306443824, Pages: 319.
- Demirci, A., 2008. Perceptions and attitudes of geography teachers to biotechnology: A study focusing on genetically modified (GM) foods. *Afr. J. Biotechnol.*, 7: 4321-4327.

- Djankov, S., T. Nenova, C. McLiesh and A. Shleifer, 2003. Who owns the media. *J. Law. Econ.*, 46: 341-381.
- Dudo, A., D.H. Choi and D.A. Scheufele, 2011. Food nanotechnology in the news. Coverage patterns and thematic emphases during the last decade. *Appetite*, 56: 78-89.
- Dura, J., M. Bauer and G. Gaskell, 1998. *Biotechnology in the Public Sphere: A European Source Book*. Science Museum Press, London.
- Eyck, T.T. and M. Williment, 2004. The more things change. Milk pasteurization, food and biotechnology in the New York Times. *Soc. Sci. J.*, 41: 29-41.
- Gaskel, G., N. Allum and S. Stares, 2003. Europeans and biotechnology in 2002. A Report to the EC Directorate General for Research from the Project, Life Sciences in European Society. QL7-CT-1999-00286.
- Holmgreen, L.L. and T. Vestergaard, 2009. Evaluation and audience acceptance in biotech news texts. *J. Pragmatics*, 41: 586-601.
- Huang, J., H. Qiu, J. Bai and C. Pray, 2006. Awareness, acceptance of and willingness to buy genetically modified foods in Urban China. *Appetite*, 46: 144-151.
- Hursti, U.K., M.K. Magnusson and A. Algers, 2002. Swedish consumers' opinions about gene technology. *British Food J.*, 104: 860-887.
- James, C., 2009. Global status of commercialized biotech/GM crops: 2009, The first fourteen years, 1996 to 2009. ISAAA Briefs No. 41, ISAAA, Ithaca, New York.
- Kamaldeen, S. and D.A. Powell, 2000. Public perceptions of biotechnology. Food Safety Network Technical Report no.17. Department of Plant Agriculture, University of Guelph.
- Kelley, J., 1995. Public perceptions of genetic engineering: Australia, 1994. Final Report Department Ind., Sci. Technol., May 1995.
- Kimenju, S.C., H. Groote, K. Joseph, S. Mbogoh and D. Poland *et al.*, 2005. Consumer awareness and attitudes toward GM foods in Kenya. *Afr. J. Biotechnol.*, 4: 1066-1075.
- Macer, D.R.J., 2001. Bioethics: Perceptions of biotechnology and policy implications. *Int. J. Biotechnol.*, 3: 116-133.
- Macer, D.R.J., J. Azariah and P. Srinives, 2000. Attitudes to biotechnology in Asia. *Int. J. Biotechnol.*, 3: 312-332.
- Matthews, J., J. Sheekha and K. Finlay, 2003. Effective risk communication? A content analysis of four Canadian newspapers. *Can. J. Dietetic Practise Res.*, 64: 93-93.
- McCann-Erickson WorldGroup, 2000. Lack of consensus and understanding reveal opportunity for marketers to shape and define biotech debate. McCann-Erickson WorldGroup, New York. <http://www.mccann.com/news/pr18.html>.
- McCombs, M., 2004. *Setting the Agenda: The Mass Media and Public Opinion*. Polity Press, UK.
- McCombs, M.E. and D.L. Shaw, 1972. The agenda setting function of mass media. *Publ. Opin. Q.*, 36: 176-187.
- Morris, S.H. and C.C. Adley, 2001. Irish public perceptions and attitudes to modern biotechnology: On overview with a focus on GM foods. *Trends Biotechnol.*, 19: 43-48.
- Rosenberg-Yunger, Z.R.S., A.S. Daar, P.A. Singer and D.K. Martin, 2008. Healthcare sustainability and the challenges of innovation to biopharmaceuticals in Canada. *Health Policy*, 87: 359-368.
- Samani, M.C., L. Amin, J. Maliki and N.I. Rezali, 2010. Isu bioteknologi dalam akhbar arus perdana. *Malaysian J. Media Stud.*, 12: 23-36.
- Sheikhha, M.H., S.M. Kalantar, A.R. Vahidi and M. Faghihi, 2006. Public knowledge and perceptions of biotechnology and genetically modified organisms in Iran. *Iranian J. Biotechnol.*, 4: 130-136.
- Soregaroli, C., S. Boccaletti and D. Moro, 2003. Consumer's attitudes towards labeled and unlabeled GM Food products in Italy. *Int. Food Agribusiness Manage. Rev.*, 6: 111-127.
- Torres, C.S., M.M. Suva, L.B. Carpio and W.B. Dagli, 2006. Public understanding and perception of an and attitude towards agricultural biotechnology in the Philippines. University Philippines Los Banos.
- Vanderschuren, H., D. Heinzmann, C. Faso, M. Stupak and K.Y. Alga *et al.*, 2010. A cross-sectional study of biotechnology awareness and teaching in European high schools. *New Biotechnol.*, 27: 822-828.
- Vilella-Vila, M. and J. Costa, 2008. Press media reporting effects on risk perceptions and attitudes towards genetically modified (GM) food. *J. Socio-Econ.*, 37: 2095-2106.
- Walsh, G., 2004. Second-generation biopharmaceuticals. *Eur. J. Pharm. Biopharm.*, 58: 185-196.
- Wariya, C., 2010. *Kewartawanan Malaysia: Daftar Media Edisi 2010*. Malaysian Press Institute, Kuala Lumpur.
- Wingenbach, G.J. and T.A. Rutherford, 2006. National agricultural and Texas journalists' attitudes toward and information source of biotechnology issues. *J. Agrobiotechnology Manage. Econ.*, 9: 42-50.