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SHORT COMMUNICATION

SOCIO-ECONOMIC AND ENVIRONMENTAL VIEWS ON GENETICALLY MODIFIED FOODS

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Introduction

Considerable research and efforts have successfully led to the development of Genetically Modified (GM) Foods (Shaw, 2002; Purchase, 2005; Rollin *et al*., 2011). Since then it has been a controversial issue in the UK and around the world (Rowland, 2002; Shaw, 2002; Purchase, 2005; Dean and Shepherd, 2007). This was, as a result of uncertainties, risks and benefits surrounding it. This information has been widely disseminated to the general public. The information, which emerge from different sources ranging from scientists, health professionals, food industry, society leaders, farmers, policy-makers and public interest groups, have further contributed to the controversy. This is based upon the fact that the opinions are from diverse views. Sequentially, the intense media coverage on these views, scientific arguments have further compounded the misunderstanding. Hence the non-acceptability of GM foods technology becomes problematic (Shaw, 2002; Dean and Shepherd, 2007). Consequently the general public (consumers) is being trapped, especially in the area where there are knowledge limitations (Rowland, 2002; Dean and Shepherd, 2007). Though it has been argued that the approach in which the media amplified its content is rather confusing and contradictory as the case maybe, instead of informing (Dean and Shepherd, 2007).

Opinions about public perceptions and attitudes to GM foods have indicated that people are skeptical about (Purchase, 2005). According to the Eurobarometer that have been applied to different countries, it's known that European consumers are risk-averse while US consumers were less so (Finucane and Holup, 2005; Rollin *et al*., 2011). It follows that people's attitudes and perceptions are determined by both psychosocial and cultural factors (Finucane and Holup, 2005; Purchase, 2005; Rollin, *et al.,* 2011). Another plausible explanation for change in public perceptions and attitudes might be the shift in information disclosures by the media. Mismanagement of Bovine Spongiform Encephalopathy (BSE) in Beef has shifted the media perception from benefit-oriented information to more 'risk-oriented' information disclosure (Finucane and Holup, 2005; Vilella-Vila and Costa-Font, 2008). Regardless of the consumer's right policy that has been in place to protect and restore public health and confidence respectively (Shaw, 2002; Rollin *et al*., 2011). Information provided by media with respect to environmental impact and consumer safety were found to be crucial and of great importance. On the other hand, a well-publicized anxiety about the power and influence of multinational industries, especially in chemical and biotechnology areas, can change in perception and attitude. There is also the issue of who stands to be the beneficiary of GM foods; the

biotechnology companies, who make a profit from selling the seed or the farmers who can benefit from improvements in agricultural practice (Rowland, 2002). This further compounded the general skepticism of Politicians, Scientists, "Experts" and the Media (Finucane and Holup, 2005; Azadi and Ho, 2010). Consequently, GM foods appear to weigh heavily on the risk side, however small that may be (Rowland, 2002; Rollin *et al*., 2011). The public is presently confused on the advantages that GM foods stands to offer more so when genetic modification process is ambiguous to them (Shaw, 2002; Costa-Font *et al.*, 2008). But this is no indication that a GM food is out rightly bad or good. This article presented general overview of the science of GM foods, while enlightening the populace on the potentials of GM foods.

Genetically Modified foods (GM foods)

Genetic Modification (GM) is not really a new technology to man. From the onset of time, man was actually engaged in GM applications such as mutation, recombination etc (Rowland, 2002; Purchase, 2005). Furthermore, crops and animals have been genetically modified for thousands of years (Rowland, 2002). Genetic Modification is done with the sole purpose of obtaining agronomic benefits such as improved farm yield, enhancement of disease resistant plants, maximisation of plant growth in adverse conditions like drought, and altering (in some cases improving) taste, flavours of food in food production (Rowland, 2002; Purchase, 2005). The modifications occur as a result of an extensive cross-breeding between the same or related species with different phenotype (appearance of traits). In this method, some cases may require the treatment with mutagens. Thus there is possibly of DNA damage and mutations of wide range of genes, which could result into deleterious traits. On this account it is time intensive procedure and less accurate (Rowland, 2002).

Contrarily, the modern molecular-biology techniques (genetic engineering) involve the identification of a specific traits thereafter cloned and insert into a plant (Whitman, 2000; FSA, 2010). Thereafter, the transformed plant is bred via conventional means (Rowland, 2002). For example, a plant geneticist can isolate a gene responsible for drought tolerance and insert that gene into a different plant. The new genetically modified plant will gain tolerance as well. Not only can genes be transferred from one plant to another, but genes from non-plant organisms also can be used (Whitman, 2000). Examples of available GM foods are apple, carrot, beetroot, rice, maize etc. Apparently, genetic engineering can be inferred to be done under a precise controlled and rapid procedure (Rowland, 2002). On that account, GM foods are termed to exhibit this features- safe food security, improved food quality and extended shelf- life characteristics (Azadi and Ho, 2010). However, divergent views have been raised to question this 'distinct characteristics'. More so, the substantial equivalence of GM foods is questioned (Rowland, 2002; Darnton-Hill *et al*., 2004; Azadi and Ho, 2010). This body of issues resolved around three main categories - Environmental, Human health and Economic views (Rowland, 2002; Darnton-Hill *et al*., 2004).

Environmental Views

In the year 2000, the world's population topped 6 billion people, it was estimated then that by the year 2050, the figure will likely double (Whitman, 2000; BBC, 2010).

Thus, ensuring an adequate supply for this booming population will be a major challenge in the years to come. However, GM foods could adequately meet this need (Purchase, 2005; Kvakkestad, 2009; Azadi and Ho, 2010). This is possible, considering GM crops' agronomic benefits indicated earlier. Furthermore, farmers will enjoy reduced production cost and limitation of agricultural waste run-off incidence in the environment (Whitman, 2000). Also countries as a whole, with respect to food security and its nutrient availability will benefit especially, the third world countries, whose staple food lacks the necessary vitamins, minerals and possibly other nutrients required for good health (Purchase, 2005). For instance, production of GM rice, to contain additional vitamins and minerals can eradicate nutrients deficiency. This equally could contribute significantly to cost of living reduction in the country (Whitman, 2000; Purchase, 2005). It has been argued that the beneficial action of GM foods will be hindered in these countries (Azadi and Ho, 2010), this in consideration of their relatively poor state-of-art with respect to knowledge on nutrition and food toxicology. At the same time they lack civil society forces to effectively consider, monitor and enforce bio-safety policies on GM foods. Also, critics of GM crops have drawn attention to the environmental hazard caused by genetic engineering; the unintended harm to other organism. Research has shown that apart from the target pest, a GM crop bred for pest resistance is likely to kill other insect larvae indiscriminately (Azadi and Ho, 2010; Whitman, 2000). Likewise, there is possibility of pest developing resistant to GM crops, in the same manner that mosquito develop resistant to now-banned pesticide (DDT) (Whitman, 2000). The rise of this secondary pest is an indication of unforeseen ecological changes that might be caused by the cultivation of GM crops (Azadi and Ho, 2010).

There is likely to be serious environmental risk if GM crops cross-breed with wild species, for instance a weed. This will result into gene transfer to a non-target species. The resultant, "super-weed" will be herbicide tolerant (Uzogara, 2000; Whitman, 2000). Ultimately, if the "super-weed" becomes an invasive plant, there is possibility of crop yield reduction and disruption of natural ecosystems (Uzogara, 2000).

Human Health Views

As indicated, GM foods have the tendency to improve the quality of diets (Darnton-Hill *et al*., 2004; Azadi and Ho, 2010). This is one of the promising needs for GM foods. It follow that good health will be promoted via healthy diets. Nevertheless, GM foods have shown some lapses. This includes allergenicity, toxicity, carcinogenicity and the unknown effects that GM foods may potentiate on human health (Azadi and Ho, 2010). Regarding allergenicity, research indicated that many people in US and Europe have allergic reactions (Whitman, 2000). Thus, the availability of GM foods to public holds a possibility of introducing a gene that may create a **new** allergens (Uzogara, 2000). Regrettably, the assessment of allergic potential of GM foods poses a major problem, since there are no reliable tests for allergenicity determination (Rowland, 2002). This equivocally causes disquiet about GM foods having some unexpected, negative impact on human health via introduction of foreign gene. However, Scientist believe that such occurrence is unlikely though possible (Rowland, 2002; Whitman, 2000). As consequence, the safety of GM foods is further questioned.

Furthermore, the fear of evolvement of antibiotic resistance as result of GM food consumption poses another threat to human health. In the early stages of genetic

modification process, a marker gene is introduced into a target organism. This might have conferred resistance to the antibiotics used. Under any circumstances, if transferred to the pathogenic gut bacteria will cause reduction in effectiveness of antimicrobial therapy (Uzogara, 2000; Rowland, 2002). This could eventually result into antibiotic resistant microbes in the population, and contribute to the growing public health problem of antibiotic resistance.

Economic Views

The resultant effect of increasing food production efficiency, improving the economic situation of farmers and improving the patterns of food consumption via the availability of GM foods, is to ensure food security (Azadi and Ho, 2010). However, it seem that the agri- biotech corporations are into, obtaining profitable return on their investment in GM food research (Kvakkestad, 2009; Azadi and Ho, 2010). Since most agri-biotech corporations have patented their GM plants (Kvakkestad, 2009). Hence the problem of patent infringement currently constitutes around their investment However, consumer advocates are worried that parenting these new plant varieties will raise the price of seeds so that small farmers and third world countries will not be able to afford seeds for GM crops. It expected that in a humanitarian gesture, more companies and non-profits would follow the lead of the Rockefeller Foundation and offer their products at reduced cost to impoverished nations. On the contrary, Genetic Modification is an expensive investment so; logically it required that they have some returns on their investment. Hence, one way to combat possible patent infringement is to introduce a "suicide gene" into GM plants. These plants would be viable for only one growing season and would produce sterile seeds that do not germinate. Farmers would need to buy a fresh supply of seeds each year. However, this would be financially disastrous for farmers in third world countries who cannot afford to buy seed each year and traditionally set aside a portion of their harvest to plant in the next growing season (Whitman, 2000).

Conclusion

Apparently, the debate on GM foods is more complex than the mere observable media propaganda. According to Kvakkestad (2009), the statement below reflects further the approach to the adoption of GM foods. The statement stated, “To date the transatlantic debate on this issue is often perceived in terms of a general and vague ‘yes’ or ‘no’ position. Yet issues are more complex on both sides of the Atlantic and understanding current differences appears to be a pre-requisite for bridging the existing gap between opinions". This has always been the foundation of confusion and misconception about GM foods. All the parties involved in the debate on GM foods try justifying it; simply in right or wrong scenarios. However, the situation is far more complicated than that. Clearly, while genetic experts may measure risk primarily as a function of probability, social scientific research has shown that public perceptions of food risks incorporate many other non-technical factors (Finucane and Holup, 2005).

Forthwith, the risk and benefit perception of GM foods by the public is crucial to its acceptance (Finucane and Holup, 2005; Purchase, 2005). The uniformity of genetic expert’s view can help to create this necessary perception. Then the antagonistic media

publicity can be averted. Also, this must be balanced with respect to the stakeholders (Consumer organization and Government agency) that will ensure safety measures. Until risk assessment procedures improved, the public will not have confidence in the system. Therefore, stakeholders must restore public confidence in their ability to regulate GM foods by setting up special commissions to advise politicians on long-term impacts of GM crops to human health, agriculture and the environment. Policy makers and researchers are expected to carefully assess environmental risks (such as the major risks to biodiversity, the prospects of insufficient out-crossing distances, the relative absence of clear labelling and other threats to seed purity, adjacent traditional food production) before farmers change their conventional farming methods to GM (Azadi and Ho, 2010). In as much as GM food is important and beneficial, it must be adopted under strict conditions that will avoid potential risks. To this extent, time and effort must be devoted to both field and laboratory trials before any interventions.

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