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Report of an EU-US symposium on understanding nutrition-related consumer behavior: strategies to promote a lifetime of healthy food choices

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Abstract

This report summarizes an EU-US Task Force on Biotechnology Research symposium on healthy food choices and nutrition-related purchasing behaviors. This meeting was unique in its

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transdisciplinary approach to obesity and for bringing together scientists from academia, government, and industry. Discussion relevant to funders and researchers centered on: (1) increased use of public-private partnerships; (2) the complexity of food behaviors and obesity risk and multilevel aspects that must be considered; and (3) the importance of transatlantic cooperation and collaboration that could accelerate advances in this field. A call to action stressed these points along with a commitment to enhanced communication strategies.

INTRODUCTION

Obesity prevention and nutritional sciences have been a focus within the European Union and United States (EU-US) Task Force on Biotechnology Research (http://ec.europa.eu/research/biotechnology/eu-us-task-force/index_en.cfm) since the addition of this topic in 2005. It was important to achieve additional transatlantic cooperation of public and private sectors on this topic through dialogue and collaboration and these efforts were not limited to the specific focus of biotechnology. To advance the research agenda, this EU-US symposium on determinants of healthy food choices and nutrition-related purchasing behaviors was held in Gent, Belgium, in May 2013. The emphasis was on areas of research that could significantly benefit from EU-US partnerships and particularly from public-private partnerships involving three key scientific sectors – academia, government, and the food and beverage industry (Key participants listed in Appendix A). It was the stated aim of the organizers that by convening an innovative transdisciplinary group of scientists new ideas would emerge, both in prevention and management strategies, and in directions for future obesity research. This report provides a synthesis of information from this symposium, including identification of key research gaps and priorities in nutrition education, policy development, marketing research, and community-based intervention strategies in enhancing healthy food choice behaviors and preventing obesity. It should be noted that “healthy food choices” were not expressly defined in this meeting but were expressed in terms of a varied diet including fruits and vegetables and a low salt intake, a diet generally believed to help reduce the incidence of obesity and cardiovascular disease.

DISCUSSION OF STATE-OF-THE-SCIENCE

COMPLEXITY OF THE PROBLEM

There is common concern in the EU and US about nutrition- and obesity-related chronic diseases such as type 2 diabetes, arthritis, cardiovascular disease, kidney disease, and some forms of cancer. Food choices are central behaviors affecting health and wellness, yet our understanding of the key factors to improve selection of healthy foods is incomplete. Dietary behaviors, especially in reference to prevention of obesity, represent opportunities for health interventions that are well positioned for action, if only the science were more mature. For many years it was assumed that consumers simply needed better nutrition knowledge and exhortations to eat a healthier diet. A recurrent theme of the symposium was that relatively few individuals are likely to be helped in this manner, with food intake motivated by many factors other than health concerns, and these influences in turn are multifactorial and must be considered at every level of determination, from the individual to the community to the broader culture.

To discuss the many interrelated topics in a systematic way, the symposium attendees deliberated on topics that escalated through three levels, beginning with childhood influences on lifelong food behaviors, then expanded out to the factors affecting adult food choices, and culminating in the broader community and cultural context affecting opportunities for healthy food habits. Attendees discussed the current state of policy and intervention measures in terms of their success or lack thereof. Finally, symposium participants crafted a call to action summary and synthesis (Table 1).

CHILDHOOD INFLUENCES ON LIFELONG FOOD BEHAVIORS

Food patterns established in the first years of life have a profound effect on adult dietary behaviors. Central to the discussion was the assumption that early experience with exposure to a wide variety of tastes and flavors would increase later acceptance of foods such as fruits and vegetables, which would be beneficial because it may help to reduce energy density of the diet and be less obesogenic.

What are the major maternal nutrition behaviors that shape in utero programming of subsequent adult food choices? Processes which shape food preference and choice begins *in utero*. Some dramatic examples have emerged, such as hyperphagia and excess body weight in the children of women with inadequate energy intake in early pregnancy(1). Maternal food intake provides exposure to odors sensed *in utero*, with later effects on vegetable acceptance; these influences continue after birth with exposure through mothers' milk during breast feeding (2). It was noted that even newborns demonstrate consistent aversion to smells generally characterized as unpleasant (e.g., rotten egg, shrimp/fish) consistent with protective instincts (3). Sweet and salt tastes are preferred from an early age over sour, bitter, and umami.

The first six months of life is a sensitive period of flavor learning, and 6–12 months appears to be a particularly responsive period influenced by variety and frequency of food offerings (2,4). Repeated exposure to new foods is very effective in improving acceptance in European and US infants and children (5–7). This represents a practical strategy which can be translated into simple guidance for mothers to be more persistent with offering new foods to an infant, and may be equal to or better than more complicated approaches. An important discussion included the transition to solid foods, the transition to autonomy in food choice, and other preschool influences from practices in the home. *Further study is needed on the longer term effects of early life eating practices on adult food behavior, appropriate weight management, and other health outcomes.*

Societal changes may be a challenge to modern parenting and produce some unintended consequences for food pattern development that predispose infants to later obesity. For example, the increased rate of dual working parents and other new parental time pressures may contribute to using food as a quick solution to calm fussy babies, especially with easily accepted foods and more frequent than necessary snacks. In a US study where parents were taught to distinguish between hunger cries and other factors stimulating crying and to use soothing techniques rather than feeding for non-hunger related events, infants had a more appropriate rate of weight increase (6). Other parental behaviors with unintended consequences appear to arise from well-intended actions such as food restriction or coercion,

while relatively simple steps such as serving smaller portion sizes increased the likelihood of consumption of lower density foods such as fruits and vegetables before satiety occurred with other foods (8). *There is a critical need to characterize actual food practices in the home, the context for those practices, and the impact on dietary intake.*

Industry has important data on infant feeding practices and has joined in several productive public-private partnerships to understand and promote good practices. The food intake of US infants and toddlers was surveyed in 2008 for comparison with an earlier 2002 survey that led to broad public nutrition education efforts. The results supported longer duration breastfeeding and delayed introduction of complementary foods to 4–6 months. They also indicated a decline in feeding of sweets, sweetened drinks, and salty snacks, suggesting public education programs may be beneficial, at least for this receptive group of mothers (9). *Expanded research partnerships with industry (e.g., private and public) may accelerate understanding and promotion of multilevel influences on healthy eating practices. Such partnerships are more urgently needed in this era of constrained research resources.*

School-age children have been a focus of a multinational obesity intervention and research project titled "Ensemble, prevenons l'obesite des enfants" (EPODE) (10). In one of the crucial initiating studies, a concerted school and community intervention produced a reduction in prevalence of overweight in 5–12 year olds over four years of consecutive assessments. In the fourth year, the prevalence of overweight was substantially lower for boys and girls in the intervention towns (8.8%), compared to non-intervention towns (17.8%)(11). The EPODE community-based intervention involving social marketing campaigns has now been implemented in other towns in France, as well as Belgium, Spain, and Greece, and other school-based interventions have found similar success (12). These successes are the basis for much larger networked multinational efforts which provide scientific and technical resources to communities joining the effort, while acquiring new data to analyze the complex multifactorial interactions and iteratively improve the interventions (10). Meeting participants emphasized the vital importance of these intervention assessments despite the continuing challenges of cost, effort, and the need for sustained interest and patience of funders, researchers, and participants. EPODE is an example of a pragmatic approach with demonstrated efficacy that is also acquiring data to better understand the multifactorial relationships in feeding behavior influences and pediatric weight management outcomes. Additional interventions and research are needed to further explore these multifactorial relationships and the impact on weight status.

INDIVIDUAL DETERMINANTS OF FOOD SELECTION AND PURCHASING BEHAVIOR

At present, health goals are not a key determinant of food choice for most people, even when healthful choices are available and nutritional information is provided. Nutrition knowledge as well as access to healthy food is important to healthful food choices, but psychology and physiology moderators have emerged as vitally important. A key discussion point that emerged from this symposium was on the factors other than health salience that appear important to food choices. Representative studies identifying important psychosocial, neuropsychological, and metabolic factors were discussed.

Salt content of foods and salt intake is a major public health concern and an example that involves several of these factors. Physiology is important to food choices; salt makes food tastier and salt taste is also regulated by body salt balance. However, several examples were presented where labeling alone influences salt content preferences (13). Examples discussed included observations where reduced salt content was accepted (14) and could even become part of early learning and development of healthy food preferences (15). Public awareness campaigns to reduce salt intake have been demonstrated to be effective, using objective markers such as urine sodium measurements (16,17). Food industry scientists have investigated factors that go beyond sustained liking of foods and actually influence sustained choice of healthy foods such as a sustained high level of pleasantness (18). The conclusion from these presented studies was that some aspects of healthy eating such as reduced dietary salt intake can be achieved from an early age without compromising enjoyment but this requires a multilateral commitment across the commercial sector (e.g., prepared foods) and community (e.g., public health campaigns).

Another example of the complexity of factors affecting healthy food choices is the interplay of emotional, genetic and physiological (e.g., sleep status) contexts. For example, in response to images of high calorie foods such as cheesecake, obese women show greater activation of brain regions associated with reward and emotional decision-making (19). Inhibitory control of this interest in food intake is further compromised by inadequate sleep (20). Heritability also plays an important role in appetitive traits even in infants, with marked effects on enjoyment of food, food responsiveness, slowness in eating, satiety responsiveness, and fat intake (21). Thus, genetics, overweight, and sleepiness are examples of physiological states that may influence food choices and compromise rational healthy food decisions. Better understanding of these factors is important to personalized interventions.

Attempts to increase opportunity and interest in healthy foods have been examined with the use of incentives. Placing fruits and vegetables on the food tray at school produced a modest increase of children eating fruits and vegetables but a very large increase in plate waste. Combined with a small rewards program, more children ate fruits and vegetables; however, the behaviors declined within a few weeks after the incentives went away (22). Many innovative strategies have been shown to increase fruit and vegetable intake in children in the short term but without lasting effects (23), suggesting the need for modified strategies such as booster training and other forms of reinforcement. Future research is needed on the design of environments, such as smarter lunchrooms that may optimize opportunities for children to make healthy food choices and to better understand the cost effectiveness of incentive and other motivational programs.

OPPORTUNITY FOR HEALTHY FOOD HABITS – THE COMMUNITY AND CULTURAL CONTEXT

The effectiveness of European policies to support informed choice, especially measures that have been extensively adopted such as advertising regulation, public information campaigns, nutrition labeling, and nutrition education were discussed (24). Economic crises have shifted diets to cheaper energy-dense foods (e.g., more meat; less fish, fruit, and vegetables). The

meeting participants considered what economic policies can do to compensate and influence diet, especially if food choices are also being influenced by utility (25). Banning food vending machines in French schools reduced energy intakes during school breaks but had little apparent effect on overall daily intakes; should this effort have involved a replacement with healthy foods, rather than elimination? Taxing certain foods may simply increase substitution with cheaper foods in the same category and the response is likely to be different across social groups. Advertising bans on food messages to children ignore that TV advertising is only one source of information to children and may be more punitive to industry than effective in altering consumer behaviors. While there appears to have been a positive impact from many public policy actions on awareness and intention, the data is insufficient for firm conclusions about long-term benefits to food intake patterns and health outcomes. The assessment of public policy actions requires well designed longitudinal data involving meaningful outcome measures (e.g., sodium measurements, actual fruits and vegetables consumption, and body mass index). Such studies are expensive but essential to answering the relevant questions about lasting impact.

The effectiveness of electronic media in marketing food messages to children was considered in this symposium (26). The potent reach and influence of television, internet, and social media on children, particularly in poorer communities, has led to specific attention of the food messages conveyed. While modern media makes it possible to provide highly effective personalized nutrition advice, this targeting bias may be in conflict with health goals. One graphic example is an advertisement with a small child's hand reaching out to an adult hand holding a French fry, with the caption "where will she have her first French fry?" While recognizing problems in the food and marketing environment, caregivers had mixed reactions about responsibility for children's unhealthy eating habits, with less blame to corporate marketing and more attribution to personal responsibility (27). This highlighted the importance of community involvement and the need for partnerships between communities and industry to promote community-based healthy eating. Policies targeting the market environment (e.g., nutrition standards; food taxes/subsidies; school meals) are largely lacking in appropriate outcome measures needed to assess effectiveness and studies need to be conducted to obtain objective evaluative data.

The number of families with more than one generation who no longer cook in the home or have traditional cooking skills has increased. It raises the larger question of how to teach appropriate culinary skills in a changing world environment with food technology advances and increased use of pre-prepared foods (28,29). Even more challenging is the complexity of the community and cultural overlay, especially in the understanding of consumer food patterns and health disparities in immigrant communities. This has been shaped by many factors including rapidly changing traditions within relatively few generations.

The meaning and importance of food, and racial disparities in overweight that reach deep into cultural identities, are not necessarily consistent with modern health goals. This relationship was discussed in the workshop in the context of studies of African-American cohorts. Obesity is typically viewed in physical terms in European and western culture and associated with physical illness and disgust. In Afrocentric views, the body and body embodiment may be very different, related to social and spiritual well-being and personhood

(30). In some of these communities there is a lack of trust in western recommendations and elements of resistance framed by new definitions of culture and attempts to maintain a Black redefined cultural integrity.

An evaluation of a US policy to try to nudge eating patterns particularly in the underserved populations was discussed using the example of the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) 2009 special food packages. The program serves half of all U.S. infants and had been revised to increase consumption of fruits and vegetables and reduce intake of saturated fat and sugar. Effectiveness has been evaluated in multiple studies, with observed reductions in saturated fat food purchases by low income participants in Massachusetts and Connecticut (31), and with modest benefits in low resource communities in Chicago (32). This “nudge” demonstrates the complexity of the issues and highlights that substantial change will not come from single programs. Additional research is needed in culturally diverse communities to develop the multidimensional understanding and system that will eliminate current health disparities.

It was suggested that changing unhealthful behaviors by consumers should be combined with stimulation of responsible product development by industry (33). Industry alliances could also improve cost efficiency in the types of longitudinal studies of consumer behaviors that are needed. This can be achieved through increased utilization of public-private partnerships, a process which could become a standard in future research (34). Specific principles for establishing public-private partnerships in nutrition research have been detailed in another document, with data derived from detailed assessment of best practices including several successful initiatives (34). There are promising examples such as the EPODE efforts (referenced above) that demonstrate how some of these multilevel changes can be effective as well as assessed for iterative improvements.

However, it was also noted that there are many challenges to partnerships with industry including different goals and research endpoints, proprietary nature of data and discoveries in the private sector, distrust of industry motives, and transparency issues (related to proprietary information and profit motive). Establishing partnerships with government and with academia can be a slow process, where the interest tends to be largely on scientific discovery more than on practical solutions, and bureaucratic processes and inefficiencies in establishing contracts and agreements can be burdensome.

Both sides of these public-private partnership also bring mutual benefits to an international partnership. Biomedical research is often viewed as an early level of engagement to demonstrate cooperation between governments and may even be encouraged as higher priority initiatives. Industry partnerships provide advantages where transnational industry is relatively unfettered in funding and collecting data that may provide vital insights into cultural comparisons.

There are many important research questions to pursue and community-based interventions to test on both sides of the Atlantic. This pursuit is accompanied by a need for understanding by the EU and US research funding agencies that addressing this important public health issue requires support of a research agenda that incorporates the complexity of adopting and

sustaining healthful eating habits in increasingly complex food environments (35). The stated EU program goal is a good vision for all to adopt: to allow all individuals to have the motivation, ability, and opportunity to consume a healthy diet from a variety of foods and beverages, along with maintaining healthy levels of physical activity and reduced incidence of diet-related diseases.

A CALL TO ACTION - PRIORITIES FOR FUTURE RESEARCH

The discussion at this exploratory symposium resulted in the identification of a number of high-level research recommendations to improve healthy food choices through science and implementation of emerging research findings (Table 1). As participants learned, the state-of-the-science has advanced significantly from concepts of simple energy balance and of simple decision-making focused on healthy choices. The issues are complex and ideally require coordinated multilevel understanding of the problems and coordinated application of the solutions. The improvement of healthy eating choices will involve multiple strategies, yet it would be unrealistic to expect wholesale modifications of human behavior. Presenters and participants at the symposium offered hope for effective interventions through examples of modest successes, recognizing that these have been hard earned, involving many levels of community involvement, realistic expectations, and an emerging appreciation for the interrelatedness of economic and commercial factors and many other social and environmental influences.

The call to action adopted at the conclusion of the symposium (Table 1) has unique challenges, but also unique opportunities, which will require creative engagement, cooperation, and collaboration among transdisciplinary research sectors. The critical findings and major calls to action are embodied in the last three broad conclusions of Table 1, addressing increased transatlantic collaboration for cross-cultural studies on long term outcomes and sustainable interventions, multilevel study designs, and the pivotal importance of public-private partnerships to taking advantage of the expertise that comes from all sectors including industry.

Table 2 reflects both the research and translational gaps and opportunities identified by participants throughout the conference. The hope is that investigators will pursue these areas in the future and their findings will provide a roadmap to help policy makers jointly develop strategies for long-term solutions.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Broad conclusions from the Gent, May 2013, symposium about transatlantic collaboration.

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- Standardize definitions and methodology in food intake assessment methodology
 - Better describe the problems related to diversity such as socio-cultural, socio-economic, environment, genetic, lifestyles factors
 - Disseminate knowledge of research findings (particularly to communities in which the studies occur)
 - Conduct cross-cultural longitudinal, observational studies and sustainable interventions, including transatlantic research coordination and collaboration
 - Design research projects to be multi-level, multi-disciplinary, and across sectors
 - Increase public-private partnerships, especially with expanded expertise that comes from trust with industry involvement, and that will help policy makers jointly develop strategies for long-term solutions
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Table 2

Specific research and translational challenges identified by the EU-US Gent symposium participants.

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- Research is needed on the longer term effects of pre-natal factors and maternal eating patterns influencing adult food behavior, appropriate weight management, and other health outcomes
 - There is a critical need to characterize actual food practices in the home, including the context for those practices and the impact on dietary intake
 - Expanded research partnerships with industry, especially in this era of constrained resources, may accelerate understanding and promotion of multilevel (e.g., private and public) healthy-eating practices
 - Some aspects of healthy eating can be achieved from an early age without compromising the objective of making healthy foods enjoyable but this requires a multilateral commitment across the commercial sector (e.g., prepared foods) and community (e.g., public health campaigns)
 - Better understanding of physiological states that may influence food choices and compromise rational healthy food decisions is important to personalized interventions
 - More research is needed on the long term benefits of incentive and other motivational programs to optimize the opportunities for children to make healthy food choices
 - Appropriate outcome measures to assess effectiveness are largely lacking in policies targeting the market environment (e.g., nutrition standards; food taxes/subsidies; school meals)
 - This research must be conducted in the context of a cultural understanding of the history, traditions, and practices of the individuals and groups involved
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