Although these results are only indicative as the rat and mouse models are not specific for human allergenicity testing (WHO/FAO, 2001), in the case of cloning, changes in the primary protein structure or the presence of novel proteins in the edible products of clones and their progeny are not expected,.

5.4. Conclusions on food safety

Considering that:

- Healthy clones show no significant differences in physiological parameters from their healthy conventional counterparts (see Chapter 4).
- Any animal including clones, showing evidence of clinical disease would be detected during routine inspections and quality controls, since all food animals must meet existing regulatory requirements in order to be lawfully marketed in Europe. It is assumed that such inspections and quality controls would exclude from the food chain animals with signs of disease, lesions or abnormalities, regardless of whether they are clones or sexually-reproduced animals.
- No differences outside the normal variability have been observed in the composition and nutritional value of meat (cattle and swine) and milk (cattle) between healthy clones or clone progeny and their healthy conventional counterparts.
- No toxicological effects of milk and meat have been observed in the studies performed.

It can be concluded that it is unlikely that clones from cattle and swine, their progeny, and food derived from them, might differ from their conventional counterparts with regard to parameters which may affect food safety.

6. Impact on the environment and genetic diversity

Cloning offers opportunities to save endangered species or livestock breeds and can be used to restore populations from infertile or castrated animals. This implies preservation of the DNA in frozen cells. Cryopreserved tissue samples (for example skin), which are easier to obtain than gametes or embryos, or tissue obtained from infertile animals, can be used to generate reproductively capable animals that could be used in subsequent breeding programs to expand endangered populations.

There is no expectation that clones or their progeny would pose any new or additional environmental risks compared to conventionally bred animals. There is also no information to suggest that such risks may exist. Cloning does not involve changes in DNA sequences and thus no new genes would be introduced into the environment.

Cloning does not appear to have a direct effect on genetic diversity in that no new genetic modifications are introduced, but there could be an indirect effect due to overuse of a limited number of breeding animals in breeding programmes. An increased homogeneity of a genotype within a population may increase the susceptibility of an animal population to infection and other risk factors. This would also be the case in conventional breeding schemes and is not caused by cloning as such. Reduction of genetic diversity of an animal population has happened in the last 100 years when the number of livestock breeds has been significantly reduced because of the rapid spread of intensive livestock production (Commission on Genetic Resources for Food and Agriculture, 2007).

In the event of an overall increase in the use of veterinary medicinal products in clones due to SCNT there might be an impact on the environment, but no reliable data are available comparing veterinary medicinal product use in SCNT with ARTs or with conventional production.

6.1. Conclusions on Impact on the Environment and Genetic diversity

Based on current knowledge:

- There is no expectation that clones or their progeny would pose any new or additional environmental risks compared to conventionally-bred animals. There is also no information to suggest that such risks may exist.
- SCNT technology as such is not expected to adversely affect the genetic diversity of domestic species. However, as with other ARTs, SCNT could, by extensive or inappropriate use, increase homogeneity of a genotype within a population, and therefore increase susceptibility of the animal population to infectious agents and other risk factors.

OVERALL CONCLUSIONS AND RECOMMENDATIONS IN RELATION TO CATTLE AND PIGS

CONCLUSIONS

Somatic cell nucleus transfer (SCNT) is a relatively new technology and the available data for risk assessment are limited. Uncertainties in the assessment arise from the small sample sizes investigated in most studies and the biological variability underlying the SCNT process. Although the studies assessed in this scientific opinion were not conducted to address a systematic set of questions, they are, however, convergent in their general results. In the present opinion, the current available data allowed an assessment of cattle and pig clones and their progeny.

Healthy clones and their offspring indicate that SCNT can be successfully used as a reproductive technique in cattle and pigs. These healthy clones and healthy offspring do not show any significant differences from their conventional counterparts in any of the measures that have been evaluated, such as physiological parameters, behaviour, and clinical examination.

The health and welfare of a significant proportion of clones has been found to be adversely affected. The proportion of adversely affected clones could decrease as a result of good animal management and as the technology improves. Unhealthy clones must not be used for breeding.

The main uncertainties associated with the assessment of SCNT come from determining whether the reprogramming of the genome from a differentiated state is successful, since epigenetic dysregulation may have a major impact on the health and physiology of the clone.

Unhealthy clones are presumed to be removed at clinical inspections and quality controls and therefore should not enter the food chain, as also unhealthy conventionally bred animals are excluded. Food products obtained from healthy cattle and pig clones and their offspring, i.e. meat and milk, are within the normal range with respect to the composition of similar products obtained from conventionally-bred animals. It is very unlikely that any difference exists in terms of food safety between food products from clones and their progeny compared with conventionally-bred animals. Currently no environmental impact is foreseen but there are only limited data available.

Based on current knowledge there is no expectation that clones or their progeny would introduce any new food safety risks compared with conventionally bred animals.

RECOMMENDATIONS

- The Scientific Committee recommends that the health and welfare of clones are monitored during their full natural life.

- It is acknowledged that other food species have also been produced via SCNT and risk assessments should be performed on these species when relevant data become available.
- The Scientific Committee also recommends that this opinion be updated in the light of developments with cloning and/or with new relevant data.

Additional recommendations arising from the specific sections

In relation to epigenetic and genetic aspects of SCNT it is recommended to:

- Confirm that epigenetic dysregulation occurring in clones is not transmitted to the progeny (F1).
- Investigate the extent to which SCNT may induce DNA mutations.
- Clarify the possible consequences of mitochondrial heterogeneity in SCNT.
- Investigate the reproducibility of telomere length in clones derived from different cell sources and the implications of these findings.

In relation to animal health it is recommended to:

- Consider the possible effects of SCNT on the longevity of cattle and swine clones and on the health of aging clones.
- Investigate the causes of unexplained pathologies and mortality observed in clones during the gestational and postnatal periods and occasionally observed in adulthood.
- Implement permanent surveillance and registration of the health conditions of clones to allow the identification of the possible sensitivity of clones and their offspring in regard to certain diseases and infectious agents.
- Compare the immune status and function of clones with conventionally bred animals, at different ages, before and following immune challenge under conventional husbandry conditions.
- Consider the health status of the animals being sources of the somatic cell nucleus and oocyte and the surrogate dams to avoid the transmission of specific agents and infections to clones.

In relation to animal welfare it is recommended to:

- Perform comparative studies on animal welfare, including behavioural studies, in healthy clones under normal husbandry conditions.
- Measure in the pregnant bovine surrogate dam, specific maternal pregnancy serum proteins (e.g. PSP60) at an early pregnancy stage (Day 50 or even Day 34) as an early predictor of abnormal foetal development and which could lead to a more specific care of the surrogate dam.

In relation to food safety it is recommended to:

- Collect additional data on the health of clones (F0) at different life stages, as well as data on the characteristics of meat from cattle and swine clones and milk from cattle clones.
- Routinely monitor the levels of chemical contaminants, in particular of veterinary medicinal product residues, in the meat and milk of cloned animals, to ensure that such meat and milk from cloned animals entering the food chain do not exceed permitted levels.

In relation to the impact on the environment and genetic diversity it is recommended to:

- Take specific care of genetically-transferred conditions and disease susceptibility when setting up breeding programs involving SCNT.
- Use SCNT technology in such a way as to prevent the reduction of genetic diversity.

INFORMATION MADE AVAILABLE TO EFSA

EFSA published a call for data on its website between 27 April and 29 May 2007. Information was received from the following organisations:

AAVS (American Anti-Vivisection Society), USA

- Comments on the FDA Draft Risk Assessment. 47 pages.

BIO (Biotechnology Industry Organisation), Belgium

- BIO Comments to EFSA, Implications of animal cloning, May 29, 2007. 5 pages

Center for Food Safety, USA

- Report: Not Ready for Prime Time. FDA's Flawed Approach To Assessing The Safety Of Food From Animal Clones. 25 Pages
- Citizen Petition before the United States Food and Drug Administration. Petition seeking regulation of cloned animals. 24 Pages.

CIWF (Compassion in World Farming), United Kingdom

- Report: Farm Animal Cloning from an Animal Welfare Perspective. 10 pages

Danish Centre for Bioethics and Risk Assessment Institute of Food and Resource Economics, Denmark

- Information on current research activities and selected references.

EFFAB (European Forum of Farm Animal Breeders), The Netherlands

- The importance of cloning in bovine selection. 2 pages
- The European Perspective for Livestock Cloning. 19 pages
- Summary. 2 pages
- Possibilities and Concerns – Perspectives of Farm Animal Breeders. 24 pages

Faculty of Agricultural Sciences at Aarhus University, Denmark

- Information on current research activities and selected references.

IETS (International Embryo Transfer Society), USA

- Terms of Reference for Food Safety Subcommittee of the International Embryo Transfer Society (IETS) Health and Safety Advisory Committee (HASAC). 2 pages

- Terms of Reference for Research Subcommittee of the International Embryo Transfer Society (IETS) Health and Safety Advisory Committee (HASAC). 2 Pages

Institut national de la recherche agronomique INRA (Jouy-en-Josas), France

- Information on current research activities and selected references.

I-SiS (Institute of Science in Society), United Kingdom

- Is FDA Promoting or Regulating Cloned Meat and Milk? 7 pages
- Cloned BSE-Free Cows, Not Safe Nor Proper Science. 8 pages

ViaGen Inc, USA

- Letter. 3 pages
- Data (29 files, XL and Word) provided to US FDA. This data is publicly available in the US FDA 2006 Report. "Animal Cloning: A draft risk assessment", Appendix F, which can be found at: http://www.fda.gov/cvm/CloneRiskAssessment.htm (Accessed 14 December 2007)

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