

Attitude toward the cloning of animals for food in Hungary

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1. Summary

There are a number of publications assessing the cloning of humans and animals, but for the time being there are only a limited number of articles investigating the attitude toward the cloning of animals for food or toward the incorporation cloned animals in the food chain.

The goal of our survey was to identify and characterize Hungarian consumer groups on the topic in question, on the basis of a detailed questionnaire. In the course of the statistical evaluation, main component and factor analysis, as well as K-Means cluster analysis were performed. Data measured using the ecological orientation scale (NEP scale [1]) were also included in the cluster formation, assuming that this will be helpful in the interpretation of the attitude toward cloning.

Four consumer clusters were distinguished, and these were named as “technocrat”, “utilitarian”, “naive resistant” and “risk sensitive”. A connection was revealed between ecological orientation and the attitude toward cloning, the measurement of ecological orientation was helpful in explaining and better understanding the consumer perception of cloning.

The results of the survey showed significant differences according to the qualifications of the subjects (relevant degree), their level of knowledge and their interest in the topic as well.

Thus, it was confirmed that attitudes are affected by several factors, and our results can provide a basis for starting a consultation with consumers, and for shaping and changing consumer views.

2. Introduction

The cloning of animals opens up great scientific perspectives in a wide variety of applications. According to various surveys, public opinion is more supportive of application for human therapeutic uses (e.g., organ transplantation, treatment of serious diseases), however, reproductive cloning is rejected strongly [2], [3], [4]. Several new opportunities are attributed to the cloning of livestock for food by science (e.g., improved meat quality, favorably modified nutrition, resistance to diseases, lower livestock farming costs) [5], [6], [7]. At the same time,

research into the consumer acceptance of animal cloning for food found stronger rejection compared to medical or therapeutic applications in all cases both in the European Union [8], [9], [10], [11] and the United States [12], [13], [14]. In the 2008 risk assessment of the Center for Veterinary Medicine of the Food and Drug Administration (FDA), taking into consideration several years of literature analysis, primary tests and theoretical considerations [15], no cause for food safety concern was found regarding the meat of the cloned animals investigated (pork, beef, goat).

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According to this risk assessment: “Extensive evaluation of the available data has not identified any subtle hazards that might indicate food consumption risks in healthy clones of cattle, swine, or goats. Thus, edible products from healthy clones that meet existing requirements for meat and milk in commerce pose no increased food consumption risk(s) relative to comparable products from sexually-derived animals. The uncertainties associated with this judgment are a function of the empirical observations and underlying biological processes contributing to the production of clones.”

A similar conclusion was reached by the 2008 resolution of the European Food Safety Authority (EFSA) [16], according to which the consumption of foods made from cloned cattle and swine does not pose an increased food safety risk.

The risk awareness of consumers seems to differ significantly from official positions. Only 9% of those interviewed would buy meat products from cloned animals, even if they were considered safe by the FDA, while 60% of people would not consume cloned meat products at all [13]. According to the study of Lusk [14], US citizens who consume genetically modified foods with no labeling obligations, would be willing to pay more for products (e.g., milk) that come from non-cloned animals. According to the research of Nonis et al. [17], the intention to purchase correlates significantly and negatively with the moral rejection of cloning, i.e., the greater the moral objection of a person to the technique, the lower their willingness to buy was.

When introducing new technologies, moral considerations have to be taken into account as well. It has come up already a decade ago that the technique applied raises a number of ethical concerns (significant pain, unviable offspring, etc.), so the cornerstone of using the cloning technique for food is to address ethical concerns [18]. According to the resolution of the expert body of the chairman of the European Commission on the ethics of science and new technologies, the European Group on Ethics (EGE) [19]: “Considering the current level of suffering and health problems of surrogate dams and animal clones” there is a doubt whether animal cloning for food is morally justified. The EGE’s resolution was incorporated in the 2010 report of the European Commission [20], according to which further scientific research is required on the question of the ethical justification of the offspring of clones, and they did “not see convincing arguments to justify the production of food from clones and their offspring. Actions causing pain to moral subjects are considered morally problematic. Therefore, if cloning or any other breeding or farming technique affects animal welfare and health, then this use is difficult to accept.”

Also cannot be overlooked that several companies in

the world, for example, in the USA, China, Australia and Argentina, have been using cloning techniques in livestock farming for a decade [5]. In the European Union, cloning of animals for food was first planned to be regulated in connection with the revision of the regulation regarding novel foods [21], but because of unsuccessful negotiations it was decided that the use of cloning in livestock farming will be controlled by a separate regulation [22]. The regulation should be passed by legislators in a so-called co-decision procedure, however, this regulation has been forthcoming for nearly a decade.

Although the relevant Commission draft legislation has emerged several years ago, the decision-making bodies of the EU have not started its discussion. Elaboration of the regulation has been significantly impeded by the fact that the topic goes well beyond food safety concerns, animal welfare and ethical considerations have to be taken into account, not to mention consumer perceptions. It has also been causing difficulties that there is no adequate technology available for the tracing of cloning and labeling based on it. Regulation based on public morality is the prerogative of Member States and this has remained unchanged under the new Treaty of Lisbon. Another reason for the delay was the considerable consumer concern, and the fact that neither the industry nor agriculture was sufficiently advanced to apply the technology [23].

Even after the publication of relevant food safety (FDA, EFSA) and ethical (EGE) expert opinions, i.e., almost a decade afterwards, the planned regulation still has not been developed. Because of this delay in regulation, consumer studies related to cloned animals and to application of the technology for food purposes in particular have stalled.

Consumer surveys show that the European public is familiar with the concept of cloning (80% of the respondents in the European Union associated the right concept with it in a multiple choice question [8]), however, their knowledge of cloning characteristics and applications is rather poor [24]. There is much less data available regarding the attitude toward cloning than in connection with genetic modifications. Given that both cloning and genetic modifications are included among modern biotechnological procedures, some of the studies contain a consolidated analysis [24].

Taking into account the case of genetically modified (GM) foods, in parallel with market appearance, an increased public interest can be expected [19]. It is the task and responsibility of researchers of consumer behavior to reveal groups with different attitudes and to explain to the highest possible degree their reactions.

Most of the consumer studies so far [2], [4], [8], [9], [13], [25] have focused on survey type investigations,

which have yielded different results in each country, but reached similar conclusions. It can be concluded that health and food safety concerns are more serious than those related to animal welfare. The majority of the surveys so far have only published the incidence of responses given to different questions related to cloning, not explaining the strong rejection of foods made from cloned animals and their consumption.

Furthermore, there is limited information regarding respondents' attitudes and the characteristics of their groups [26]. These pieces of information could serve as a guide to changing attitudes and to characterizing consumer groups.

In the course of our research, our goal was to identify respondent groups based on their attitude toward cloning for food, and also to map out the opinion of livestock farming experts. In the literature, we found only a single paper that contained data on the position of experts practicing in the field [27]. The community of professionals may be opinion-forming, that is why it is important to map their attitudes as well.

In Hungary, the cloning of animals has been the subject of public debate twice: when the first cloned mammal (sheep) known as Dolly was born (1996), and in 2006, in connection with the first cloned Hungarian mouse (Klonilla).

During the survey period (fall 2008) no major news related to cloning affected public opinion, but the topic was known to the general public because of the above-mentioned major news (FDA, EFSA, EGE positions). At that point, expecting the forthcoming birth of the relevant European regulation, we planned to gain information on the dynamics of the changes in public opinion by repeating the investigation 5 years later.

However, the repeat study has not taken place because, even though significant progress has been made in the field of animal cloning by the cloning of a primate (macaque) in early 2018, no significant advances have been made regarding the question of cloning for food due to legislative difficulties.

3. Methodology

3.1. Methodology principles

To complete our objectives, a questionnaire survey was chosen, supplemented by in-depth interviews in the case of livestock farming experts. Consumer attitude toward cloning was assessed with the help of statements to be answered using a five-point Likert scale (1 = disagree; 5 = completely agree). In addition to the assessment of benefit and risk factors, questions about ethical judgment were also posed.

According to our hypothesis, the attitude toward cloning is positively affected by the level of knowledge

and the degree of interest in the subject, as well as possessing a relevant degree. Therefore, the questionnaire was designed to allow for the separate examination of the effects of these factors and thus to present the same subject from several angles.

Our survey was also expanded to detect environmental problems, so that consumer attitude toward cloning could be placed in a broader context and evaluated more comprehensively.

The ethical judgment on the cloning of animals can be traced back to two different arguments: a reasoning based on consequences (e.g., it is painful for animals) and a reasoning based on principles (e.g., playing God) [28]. Given that religion was not identified as a variable explaining the attitude toward cloning to a significant extent by earlier studies [4], environmental awareness was assumed to be a factor affecting cloning attitudes. The results of Shepherd et al. [4] also referred to the mutual relationship with nature as the most important attitude-forming factor in focus group discussions. To measure ecological orientation, a "revised NEP" (New Ecological Paradigm) scale was applied [1], using a five-point Likert scale for the measurement as well.

3.2. Methods

3.2.1. Survey

For the survey, a closed questionnaire was developed (with 43 questions in 23 topics) partly with nominal and partly with Likert scale responses.

A sample that included a total of 357 people was interviewed, with 59 professionals with theoretical and practical knowledge in livestock farming among them. In the case of livestock farming professionals, questioning was carried out by self-filling in connection with a trade event, and using the snowball method in the case of the others. The survey was conducted between November 2008 and January 2009. In the media, cloning was not among the leading news in this period. Hungarian newspapers, internet news portals, radio and TV stations had reported factually about the above-mentioned resolutions of EFSA months earlier (January and August 2008).

3.2.2. Main component and factor analysis

When analyzing our data, the primary consideration was the broadest possible exploration of the opinions of the respondents. This was accomplished on two levels: on the one hand, the environmental orientation of respondents was captured on the basis of the answers to the questions of the NEP scale, and on the other hand, with a group of questions consisting of fifteen elements, opinions related to animal cloning for the meat and dairy industry were mapped specifically. Factor analysis was applied to both sets of variables, to detect the structures inherent

in the responses. To analyze the data, the statistical program SPSS 18.0 was used.

Factor analysis in the case of the NEP scale was unsuccessful, no sharply distinguishable dimensions were created by the responses, therefore, using its partial results, related questions were summarized in the form of main components. Questions resolved into three components. These dimensions were referred to as “eco-ethics”, the „perception of limitations” and the “dominance over the environment”. Henceforward, for each major component, the scores belonging to the first component, retaining the largest amount of information, was used.

When analyzing the attitude toward cloning for food, during factor analysis, the two main reasons for the objection against cloning and foods produced by this procedure could be clearly distinguished: rejection based on animal welfare or ethical grounds, and objections based on other reasons. The latter reasons include fear of the adverse effects of cloning and the needlessness of the production of cloned products. In addition to these, the combined variable *Assessment of the usefulness of cloning* contained another component, which was also created as a main component.

3.2.3. Cluster analysis

Following this, we intended to create specific consumer segments from the three environmental main components and factors described above and the other three elements formulated specifically for cloned foods. For this purpose, non-hierarchical K-Means cluster analysis was used, according to the logic of which main component scores were grouped on the basis of the Squared Euclidian Distance between them. Finally, respondents could be grouped into four clusters. Subsequently, the characteristics of the members of each cluster were revealed and explained with the help of chi-square tests and ANOVA models.

4. Results

4.1. Socio-demographic composition

The questionnaire was filled in by 357 people, the socio-demographic distribution of our respondents is shown in **Table 1**. The majority of respondents were women (59.7%), the distribution by age group was nearly even, except the age group of people over 60 (meaning a higher proportion of young people in the sample compared to the national average), and in terms of qualifications, people with college degrees and college students were over-represented. This sample composition cannot be considered representative of the Hungarian population, but it did meet our investigation objectives. This is so, because the nature of the questions included in our study required the polling of a social stratum more

knowledgeable and informed than the average. In our sample, younger, more educated people living in the capital of Hungary who are better off were over-represented.

4.2. Overview of the results based on the entire sample

4.2.1. Environmental orientation of consumers

Results of the Dunlap ecological orientation scale [1] are summarized in **Table 2**. Based on the answers, the following statements can be made.

Respondents strongly reject human dominance in relation to nature. They see natural equilibrium as a fragile thing, in their opinion, the risk of an ecological crisis should be considered seriously. As a solution to the situation, they trust less in human knowledge and sense, but emphasize that mankind is part of nature and natural laws apply to us as well. They perceive the limitations of Earth’s capacity as a significant, but not yet serious problem, however, they are definitely optimistic about the future. With a small standard deviation they agree that the Earth has many natural resources, but we have to learn to manage them well.

The second greatest agreement and second smallest standard deviation was associated with the statement “Plants and animals have as much a right to existence as do people”. The practical interpretation of this is relevant to the assessment of animal cloning, which is covered by the latter part of the questionnaire. Answers of the Hungarian respondents showed significant standard deviations in the case of the other statements, indicating that it is worth analyzing the answers by a classification procedure as well (see Chapter 3.3).

In terms of the socio-demographic aspects, significant differences ($p \leq 0.05$) were found between the genders when carrying out the analysis using ANOVA, according to which women are more concerned about the state of our environment.

4.2.2. Consumers’ knowledge of cloning

In order to assess their general awareness, Hungarian respondents had to answer several questions, the results of which are given in **Tables 3** and **4**.

Compared to the 2008 Eurobarometer survey [8], both in terms of Hungary and the EU-27 average, Hungarian consumers interviewed in our present survey were more fully aware of the concept of animal cloning. This high level of recognition of the concept of animal cloning based on self-assessment was not confirmed by the answers given to other questions. According to the results of **Tables 3** and **4**, the knowledge of the respondents regarding cloning is rather uncertain and superficial.

In the case of statements 1, 4 and 7 in the “knowledge test” published in **Table 4**, there was a significant correlation ($p \leq 0.05\%$) between the level of education and the knowledge of the correct answer, the proportion of correct answers being significantly higher in the case of people with college degrees. Statements 3 and 7, bringing up animal suffering, was judged significantly differently ($p \leq 0.05\%$) by women, the empathy characteristic of females also affects perception.

The knowledge of the majority only extends to the fact that, during cloning, a copy of the animal is produced somehow. It is easy to remember and recall cloned animal species reported as sensations. However, in terms of the details (e.g., the difference between GM and cloning techniques; the susceptibility of cloned animals to diseases), there is a significant lack of knowledge and, accordingly, a large number of incorrect answers.

4.2.3. Distribution of products cloned for food

Despite the fact that reproduction of animals by cloning for meat and milk production is not permitted in the EU, according to 7.6% of those interviewed, this activity is already a common practice in the EU. According to 5.9% of respondents, products made from the meat or milk of animals cloned in the EU can be purchased on EU markets, and a further 32.2% considers EU distribution of these products possible. 11.3% of our respondents presumed to have knowledge of EU distribution of imported cloned products, and 38.2% considered the import of cloned animal products a possibility. This means that consumers are preparing for the worst, assuming worse than reality, which is partly due to a peculiar risk perception and can partly be due to earlier, unfavorable experiences (e.g., lack of labeling of products containing GM soy in previous practice).

An important tool of consumer protection is the guarantee created by legal regulation. Regulation of the subject was planned in the period of the survey, and this was also reflected in the knowledge of the respondents: 44.8% of them could not recall any substantive information about the legal regulation, however, the rest of the respondents recognized certain elements of the regulatory problem among the possible answers. Most of them (27.8%) knew that there was a dispute between the EU and the US over the regulation of the subject.

The aversion of consumers toward the purchase of cloned animal products is indicated by the following figures. Despite the recommendation of a respectable information source, 24.4% of respondents would not consume such products, unlikely to consume foods made from cloned animals 17%, probably would consume 28.7%, possible that would consume 15.2%, very likely that would consume 14.7%. These percentages show a greater confidence than

the 2008 Eurobarometer survey [8], in which the proportion of people not willing to consume products made from the meat or milk of cloned animals in any case was 43% as an average for the 27 Member States, although the question in that case was not supplemented with the declaration of a respectable information source regarding food safety.

The opinion of our respondents was fairly homogeneous on the indication of the origin of the food made from cloned animals: 80.1% said that labeling should be mandatory, 16.9% said that it would be good to make it mandatory, and only 3.1% thought that labeling was not important. According to the 2008 Eurobarometer survey [8], the 27 Member State average of people absolutely requiring labeling was 83%, 7% thought that it would be a good thing to label foods made from cloned animals, and only 8% thought it unnecessary.

4.2.4. Views on the cloning technique

When reporting on the cloning of animals, the issue of the suffering of the animals is raised regularly in the media. We investigated to what extent this fact is known to our respondents and how concerned they are about such experiments.

83.5% of respondents have heard about the fact that animal experiments may result in deformed, unviable offspring or the animals may suffer other damages or injuries. The proportion of those who linked this information to the cloning of animals was 70%. Animal experiments resulting in the suffering of animals were disapproved by 63.8% of respondents, were not disapproved by 22.8%, and 12.5% were indifferent to the question. According to the 2008 Eurobarometer survey [8], cloning causes unnecessary suffering to the animal in the opinion of 41% of the respondents, while 42% were in disagreement and 17% answered “I don’t know”. Therefore, the Hungarian consumers interviewed disapprove of interventions aimed at cloning and accompanied by animal suffering to a larger extent which may be explained by the socio-demographic composition of our sample.

The other level of voicing objections and concerns regarding the application of cloning is based on general ethical considerations. On a five-point Likert scale, our respondents agreed with the statement that the cloning of animals for food is a cause for concern from an ethical point of view with an average score of 3.78. Cloning as an intrusion into the order of nature was considered to be a cause for concern to an extent greater than average by our respondents (with an average score of 3.43 on the five-point Likert scale). Uncertainty factors smoldering in the people interviewed, unanswered ethical questions and animal welfare concerns ultimately lead to the result that respondents are more likely than not to reject animal cloning for food (average score of 3.54). Because of the wording of the questions, these results

are not fully comparable to the 2008 Eurobarometer survey [8] where 61% of respondents, and 65% of Hungarians considered cloning objectionable. In both cases, results indicate the rejection of cloning for food.

4.2.5. Presumed risk of the consumption of foods made from cloned animals

New technologies bring new benefits and new risks. We need to be aware of the ideas that consumers associate with the unknown effects of a new technology. In our survey, six possible answers were listed to consumers regarding the risks associated with cloning, from which multiple responses could be selected at the same time. Results are summarized in **Figure 1**.

21.2% of the respondents stated that the consumption of foods made from cloned animals has no adverse effects. This information was also emphasized by the specialized press and mass media in the months before the survey, based on the positions of the EFSA and the EGE. The lack of knowledge and aversion is also indicated by the fact that most people (47.2% of respondents) reported fears that could not be explained. Following this, allergic reactions, genetic alterations in humans, a weakening of the immune system and disgust were listed in the answers in decreasing order. Nearly half of the respondents indicated several responses.

4.2.6. Consumer attitude toward cloning

15 statements were formulated to assess the opinion on cloning to increase meat and milk production, with which we wanted to characterize consumer attitudes. Results are shown in **Table 5**. Five of our questions (11, 12, 13, 14, 15) were the same as those in the 2008 Eurobarometer survey, but to obtain a more differentiated view of the opinions, a Likert scale evaluation was performed, and so the results are not directly comparable.

Based on the answers of the respondents, the following statements can be made. Consumers do not see the advantages or benefits (e.g., improved nutrient composition, larger quantities of goods, cheaper production, etc.) that would accompany the introduction of a new technology, consumer scores for usefulness (statements 7, 8, 9 and 10) were all below 3.0. At the same time, among the risks associated with new technologies, long-term health and food safety risks were considered to be significant by respondents (average score of 4.20). The second biggest threat was perceived to be interference with the order of nature and damage to biodiversity (3.79). In the respondents, the fear for human health (3.36), as well as rejection due to ethical (3.38) and animal welfare (3.20) considerations were of nearly equal strength. As potential beneficiaries of the technology, economic operators were indicated

(3.36), and cloning for food was altogether considered unnecessary (3.31).

In terms of socio-demographic characteristics, there was again a significant difference (at the $p \leq 0.05$ level) between the sexes in the case of 13 of the 15 statements. Women are more dismissive than men. There was no difference in the interest in the subject (statement 6) and in the assessment of cloning that results in better nutritional values (statement 7).

By comparing the results of the statements that appeared both in the Eurobarometer survey [8] and this one it can be concluded that the order of agreement with the statements was the same in the two surveys. The greatest agreement was with the statement that there was insufficient knowledge regarding long-term risks, and the statement that was least supported was that cloning is necessary for the competitiveness of the EU food industry.

4.3. Internal structure and characterization of our sample

4.3.1. Development of consumer segments

Separation of our respondents into consumer segments was carried out based on the answers given to the Dunlap ecological orientation scale questions and to questions related to the attitude toward cloning (a total of 30 questions). As a first step, main component and factor analyses were performed for the two groups of questions. Evaluation characteristics for the separated main components (in the case of the Dunlap scale) and factors (cloning attitude questions) are summarized in **Table 6**.

Four consumer segments were identified, and they were named “technocrat”, “utilitarian”, “naive resistant” and “risk sensitive” (**Table 7**).

Tables 2 and **5** contain the average scores of the questions included in the cluster formation.

By comparing the clusters using one-way variance analysis (ANOVA), it can be stated that there is a significant difference between the clusters for each main component. Based on the F values, the most significant difference between consumer segments is regarding the usefulness of cloning.

In the following, the individual clusters are characterized, based on **Table 7**, also using the results listed in **Table 5** for interpretation and formulation.

“Technocrats” (26% of respondents) notice environmental problems and the constraints to their solutions less, and consider humans to be suitable for the proper management of the challenges of nature. They consider cloning fundamentally useful and express neither ethical, nor other concerns in

connection with it. “Utilitarians” (21% in the sample) consider environmental problems serious and think the constraints limiting the scope of action significant, but they are much more subdued when making statements about the omnipotence of human knowledge. In addition, they see in cloning one of the possible solutions to the growing need for proteins and foods, and so they approach it in a utilitarian way.

Although “utilitarians” also formulate moderate ethical concerns regarding cloning for food, based on the presumed benefits of the technology, they can be considered the most ardent supporters of cloning for food.

The group of “naive resisters”, accounting for only 13% of the respondents, does not look beyond its immediate environment. This is the segment that is least aware of the fact that the processes observed in nature can have adverse effects on mankind and, similarly to technocrats, does not consider environmental problems very significant. However, when confronted with the impact of technical achievements on everyday life, they take positions on an emotional basis. They doubt the usefulness of cloning, and in its dismissive attitude there is a stronger ethical (animal welfare) rejection than a rejection due to fear or a sense of danger. Thus, in the case of naive resisters, one can find a need for the preservation of the immediate environment in an unchanged state.

The largest segment (40%) is that of “risk sensitive” people. They see environmental problems the same way as utilitarians, but at the same time this view is coupled with a significantly different attitude toward cloning. The usefulness of cloning is rejected the most by this segment, and this is coupled with ethical and, in particular, other undefined fears.

It can be stated, therefore, that the ecological orientation scale helps in the interpretation of and complex approach to the acceptance and perception processes of cloning, but consumer reactions cannot be anticipated solely on the basis of this. 47% of respondents considered animal cloning for food more useful (“technocrats” and “utilitarians”), while 53% had opposing views (“naive resisters” and “risk sensitives”).

4.3.2. The composition of consumer segments and their positions on practical issues

In the “technocrat” and “utilitarian” segments, male respondents were overrepresented (57% and 47.5%, respectively, while the proportion of men in the entire sample was 40.3%). 46% of livestock farming experts were characterized by a “technocrat” attitude, they accounted for nearly one third of the “technocrat” group (31.6%). Contrary to our expectations, in terms of giving correct answers to the seven knowledge questions regarding cloning,

there was no significant difference at the $p \leq 0.05$ level between the four different attitude segments. The “risk sensitive” group can be characterized by having the best knowledge and possessing the most accurate information ($p \leq 0.10$).

There is a significant difference ($p \leq 0.001$) between the four segments in terms of the nature of the information that can be recalled regarding the topic (positive, neutral, negative). The information recall of “technocrats” and “utilitarians” was more positive or neutral (containing both positive and negative elements), while “naive resisters” and “risk sensitives” primarily link negative and neutral information to cloning. Two thirds of the “risk sensitive” people could only recall negative information. In our opinion, the difference in personal information processing plays a decisive role in this disparity, the differences in information channels are secondary.

Comparing the views of the different attitude groups to each other, the following significant differences can be highlighted.

There was a significant difference ($p \leq 0.001$) in the complex assessment of animal welfare issues as follows: more than three quarters of the “risk sensitive” segment and nearly two thirds of the “naive resister” segment heard about and disapprove animal experiments that cause suffering to animals. The disinterest of “technocrats” is striking: almost two thirds of them do not care about the suffering of animals (whether they had heard about it before or not), while “utilitarians” are divided: the proportion of disinterested people exceeds one third of the group, but more than 50% of them have heard about animal experiments accompanied by suffering and disapprove of them.

There was also a significant difference ($p \leq 0.001$) in terms of the health concerns related to the consumption of the milk and meat of cloned animals: in accordance with their attitudes, the risk perception of “technocrats” and “utilitarians” was more moderate (almost one third of them did not see any risk), while that of “risk sensitive” people was the highest. “Risk sensitive” people are characterized by an assumption of multiple risks (adverse health effects, unidentified fears, etc.).

Mandatory labeling of cloned raw materials for food use is very strongly supported by “risk sensitive” people, and even only 6.3% of “technocrats” consider this unimportant. This means that in terms of labeling, the four segments maintain a fundamentally uniform position.

Another notable difference, which also indicates a significant disparity with importance in practical life is the willingness to buy foods made from cloned animals. On the five-point Likert scale, it was indicated

by the “technocrat” and “utilitarian” segments (accounting together for 47% of respondents) with an average score of 3.65 the probability that they would accept a statement regarding the safety of these products from a trusted source (e.g., authority, consumer protection organization, scientist) and would buy from the product. For the other two segments (“naive resistant”, “risk sensitive”), no such source exists, they (53% of the sample) would not yet respond to any confidence-enhancing measures with an intent to purchase (average scores of 2.2 and 2.07, respectively).

Overall, it can be stated that clear animal welfare considerations characteristic of the “risk sensitive” group, accounting for 40% of the sample, coupled with food safety concerns and general fears indicate a very strong opposition camp, while the groups of “technocrats” and “utilitarians”, although may be regarded as those with a supportive attitude and with a combined share of 47% within the sample they cannot be overlooked, but their views seem to be less influential on public opinion for different reasons.

On the one hand, animal welfare issues may make certain people, particularly “utilitarians” uncertain, and on the other hand, even these supportive segments are not free from the presumption of unknown risks to the human body. The latter two segments, even though they can fundamentally recall more positive than negative information about cloning, because of their lack of involvement their knowledge level is lower than that of the “risk sensitive” segment with a strongly negative attitude. While the segment that rejects cloning has a well-defined value system and approach, the supportive attitude is less pronounced, and in public discourse the presence of anti-cloning sentiments is more decisive and stronger.

4.4. Other factors influencing consumer risk perception

4.4.1. The impact of knowledge and interest on the attitude toward cloning

Three questions were selected for the grouping of respondents in accordance with their knowledge and interest:

- Evaluate your knowledge in biology and genetics (on a five-point scale).
- What kind of information can you recall about the cloning of animals (on a five-point scale)?
- Indication of the sources of information from fixed list (based on the number and distribution of these, respondents were divided into four categories: 1: not educated and not interested; 2: not educated and interested; 3: educated and not interested; 4: educated and interested).

Using K-Means clustering, three segments were identified:

- “Educated skeptic” (30.9%). They are characterized by a good level of knowledge of genetics, based on self-assessment (3.73), the prevalence of negative information in the recalled knowledge (1.71), and an interest in the issue.
- „Not affected layman” (35.2%). They are characterized by superficial knowledge of genetics (3.03), the recall of mixed or neutral knowledge (2.72), and a lack of interest in the issue.
- “Interested positive” (33.9%). They are characterized by a thorough knowledge of genetics (3.89), the recall of more positive than negative knowledge (3.60), and a strong interest in the issue.

Women are overrepresented among “educated skeptics”, they are characterized by college degrees or ongoing studies. Members of the “not affected layman” group are typically older and have secondary education, while “interested positives” are more likely to be men and have college degrees. This result is in line with the analysis of Simon [29], according to which, regarding women’s attitude toward biotechnology, a higher level of knowledge does not make them more accepting, but rather encourages a more skeptical attitude. For men, the likelihood of a pessimistic attitude is much smaller in the case of a higher level of knowledge. The explanation for this phenomenon might lie in the different socialization of men and women, and their different values [30].

For these three clusters, **Table 5** presents cluster opinions regarding the attitude toward cloning, which resulted in significant differences ($p \leq 0.001$) for 14 statements.

Instead of the detailed comparison of the three distinctly different clusters, we focused on a comparison with the categorization according to attitude (**Table 8**). We wanted to clarify the relationship between these two opinion-influencing factors and draw the necessary conclusions.

The cross table shown in **Table 8** revealed a highly significant relationship between the two classifications. **Figure 2** highlights the main relationships between the two segmentations. Most of the “educated skeptics” and “not affected layman” belong to the “risk sensitive” group, while “interested positives” can be best characterized by the attitude of “technocrats” and “utilitarians”. It can also be concluded that the interested positive group, created on the basis of knowledge level and interest, can be linked to the technocrat and utilitarian attitude more strongly than vice versa. 45% of “naive resistants” can be classified into the “layman” group, based on knowledge level and interest. The conclusion

can be drawn from the distribution that there is a close, significant relationship between the attitude and the knowledge level and interest. However, this relationship is not mechanical, in the case of a negative attitude a rise in the level of knowledge does not necessarily mean increasing acceptance, it will strengthen antagonism.

4.4.2. Livestock farming experts versus lay people

Our sample consisted of 59 livestock farming experts and 298 lay people. In this chapter, these two groups are compared.

According to their self-assessment, 75% of the livestock farming experts participating in our survey knew the basic relationships of heredity, and this level of knowledge significantly exceeded that of the rest of our respondents. Professionals had more positive knowledge about cloning than lay people, but this was not statistically significant. In terms of information channels, professionals relied significantly more ($p \leq 0.05$) on their studies, the internet and on radio news, no difference was experienced in the case of other media. A surprising result was that the difference between cloned and genetically modified animals was not clear even for professionals (**Table 9**), most of the respondents considered cloning a special case of genetic modification. Because of this misconception, the attitude toward cloning was also influenced by the attitude toward GM products.

Experts knew significantly better that cloning is a modern biotechnological procedure that promotes the propagation of livestock with good properties. At the same time, however, certain effects of cloning that are disadvantageous to animals are considered to be less likely by livestock farming experts (e.g., cloned animals are more susceptible to diseases, cloning poses a greater health risk to animals than artificial insemination), so they have a false image, which is not only detrimental professionally, but with this preparedness they cannot effectively perform their leading role in their immediate community.

While there was no statistically confirmed difference between the two groups in terms of knowledge regarding the birth of deformed, unviable offspring after cloning, the fact that animal experiments may cause suffering to animals was significantly more acceptable to livestock farming experts.

The opinion of livestock farming experts on animal cloning for food is contained in **Table 5**. With the exception of Table 5, question 6, there is a significant difference between the opinions of zootechnical experts and lay people. Professionals look positively on cloning. They fundamentally consider it a useful research trend (cheaper and more food, better nutrient composition, etc.), while non-professional respondents do not support cloning even in view of these benefits. Professionals consider cloning

ethically acceptable and are not afraid of its adverse health effects, and they also consider the procedure as a possible solution to satisfying animal protein requirement. Reservations against cloning were formulated by the experts, on the one hand, because of the yet unknown long-term effects (impact on biodiversity, unknown long-term health and food safety risks). On the other hand, experts say that the efficiency, economical and technological benefits and the effects on the competitiveness of manufacturing animal products cannot yet be accurately assessed.

While no greater proficiency was found in the case of livestock farming experts in terms of knowledge regarding the cloning technology, however, it is an indication of a much better follow-up of professional news that significantly more of them knew, for example, that animal cloning for food is not yet permitted in the EU, there is a dispute between the USA and the EU regarding the authorization of cloning, and that the consumption of the meat of cloned animals is not a cause for concern from a food safety point of view according to the EU.

Therefore, the overall attitude of professionals toward the issue is positive, which we believe is due to their recognition of the need for innovation and the openness to new solutions, but neither the level of practical knowledge of the experts regarding cloning, nor the general scientific knowledge of cloning is sufficient for the experts to be committed to the technology.

5. Conclusions

Cloning for food is still only a reality that exists in scientific workshops. For the practical implementation and realization of the technique, many difficulties have to be solved and overcome. However, in addition to technical developments, learning from the examples of several food safety crises, much attention should be paid to the investigation of consumer perception and acceptance and the utilization of the results already during the experimental phase. Consumers tend to misjudge relative risks and food safety issues. In the case of factors that raise concerns of food safety, quite often there is a significant difference between the danger perceived by the consumer and its true scientific validity. Consumer acceptance and trust should not be taken for granted, especially if it exceeds the understanding of consumers, unless dangers/risks have been adequately explained by risk communicators [31]. Numerous studies warn that consumers will accept the risk of a new technology only within well-defined limits. In exchange for the uncertainty, consumers want to realize a profit and insist on free choice and the adequate labeling of the product.

Investigation of the social acceptance of cloning is complicated by the fact that, in addition to the perception and evaluation of the cost/benefit or risk/benefit, the image is shaded by a further dimension

of perception, ethics. The transgression, tacit acceptance of breaching or overwriting of ethical norms that have crystallized over several centuries requires social discussion and a broad consensus. It is legally prohibited to cause suffering to animals, and so carrying out cloning experiments may be a cause for concerns.

As part of the investigation of the attitude toward cloning, we also incorporated in our survey the evaluation of experiments that cause suffering to animals, and the ecological orientation scale was also included in the analysis. Following factor and main component analysis, the number of variables was reduced to six (human dominance over nature, perception of limitations, perception of problems, usefulness of cloning, ethical rejection of cloning, rejection of cloning because of its hazardousness) and, using K-Means cluster analysis, two segments that rather favored cloning (47% of respondents) and two segments clearly opposed to cloning (53% of respondents) were isolated. A deeper understanding of the perception of cloning was achieved with the help of the ecological orientation scale. The segment with a “technocrat” attitude (26%), that is, people with a world view based on human dominance over nature, considered cloning useful, and no strong ethical concerns were formulated either. The thinking of the “utilitarian” segment (21%) is more subtle, but it reaches a similar conclusion in terms of the perception of cloning. They perceive ecological problems significant, and consider cloning as a possible solution.

The main reason for the objection of the “risk sensitive” segment (40%) are fear and health concerns; animal welfare and ethics play a somewhat smaller role in their case. The “naive resistant” segment (13%) does not perceive the ecological crisis, for them, ethical considerations are more pronounced in the perception of cloning than the fear for their personal health when consuming cloned meat.

According to our survey, the attitude toward the cloning of animals for food is also influenced by other factors as well, such as the level of knowledge and the interest in the issue. This statement is consistent with the experience of Aiziki et al. [26]. Their observations show that, in people with a positive attitude and a higher level of knowledge, providing information led to a strengthening of the attitude. In our investigations, a significant part of the respondents who are most knowledgeable about cloning and at the same time are able to recall mostly positive knowledge belong to the “technocrat” cluster, while skeptics who recall mainly negative information belong to the camp of “risk sensitive” people.

We agree with the statement of Brooks and Lusk [32], according to whom the economic viability of animal cloning for food is not only driven by technological developments, but also a progress in the consumer

acceptance of the technology. This is not a simple communication task. IFIC demonstrated the slow erosion and changing of consumer resistance over four years [25]. A counterexample to this could be the case of food irradiation and genetic modification which have been rejected for decades. According to Siegrist [33], consumer perception may affect the spread of new technologies directly or indirectly. A direct effect is when the technology is explicitly rejected, and there are cases when stringent requirements are sought to be enforced by government regulation, thereby gaining the trust of consumers. Regarding the issue of introducing cloning for food, the regulation has not yet been adopted by the European Union, even though we have been waiting for it for a decade, discussion of the draft has not yet started. This could largely be due to ethical and consumer concerns.

Our investigation also indicate that consumers are very divided on the issue and it is advisable to practice caution during introduction to the market.

Based on our research, the “risk sensitive” segment that rejects cloning although looks for credible information on the subject, which creates a favorable communication situation, but meeting their legitimate need for information and influencing their opinion do not seem to be a simple task. It can also be stated that although significant differences have been observed in the perception of our respondents, the overall attitude toward animal cloning for food is negative, discouraging. It has to be emphasized that even the two segments that are considered supportive have reservations regarding long-term health and food safety risks.

The professional circle that can be considered opinion leaders (livestock farming experts) had an accepting attitude toward cloning in our study. At the same time, the professionals interviewed did not have a solid theoretical basis (e.g., a lack of knowledge of the difference between cloning and genetic modification), and so overall they are not prepared for knowledge transfer and to conduct a meaningful dialogue with the public.

Given that there are ways to ensure the protein supply of the growing population of Earth other than animal cloning for food (e.g., meat produced in the laboratory, insect protein use, breeding of legumes and increasing the range of foods made from them), it would be advisable to handle this issue in public discourse in a complex way.

The mutual learning process serves the benefit of all concerned and can help in finding a solution.

Our investigations have shown that respondents are characterized by a lack of thorough knowledge and, though using different approaches, a mostly negative attitude. This gives weight to the assumption that,

when facing complex ethical choices, a meaningful discussion of the subject and a dialogue with stakeholders are of great importance in the decision-making process regarding this dilemma [34]. In our opinion, one of the primary examples of this can be the decision-making on animal cloning for food.

Note

This article reflects the opinion of the authors and should not be considered as the official position of ILSI Europe or NARIC FSRI.

6. Literature

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