

INFLUENCE OF SELECTED FACTORS ON DEVELOPMENT THE STUDENTS' OF THE BIOLOGICAL SCIENCES FACULTIES BIOETHICAL ATTITUDES TOWARDS EXPERIMENTAL ANIMAL STUDIES

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SUMMARY

Background: Although it may help to widen our knowledge, conducting experiments with use of animals, is very controversial, especially since the most recent technology enables us to significantly avoid their use. Currently, the European directives require researchers to reduce the using of animals in scientific experiments, but some studies suggest awareness of the problem is still insufficient. Thanks to examining students' attitude towards conducting scientific experiments on animals the authors wanted to discover and mark the most significant factors that might have impact on moulding students' opinions.

Subjects and methods: 217 subjects participated in the study. They were students of the Faculty of Medicine at the Silesian Medical University in Katowice and students of the Biology & Biotechnology Faculty at the University of Silesia. A proprietary questionnaire sent via the Internet was used. The authors created specific ratios and numeral 5-grade Likert-type scale showing the behavioural, cognitive and affective component of the respondents' attitudes on the issue being studied. It contained among other things the questions such as granting animals personality, consciousness, and the right to life. The method used allowed the investigators to show the general trends of all the studied responses and therefore the compilation of results.

Results: The study showed that the attitude of respondents on studied subject undergoes some changes related to gender. Furthermore, the results did not depend with statistical significance on previous experience in conducting such experiments, religious belief of respondent, his or her parents type and level of education. It also showed that students had little knowledge about current animal protection law and alternative methods to animal research.

Conclusions: The results show the complexity and multiplicity of factors influencing the attitudes of bioethics and point to the need to deepen our knowledge in the studied area.

Key words: bioethics - animal experimentation – student - attitude

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INTRODUCTION

The use of non-human animals (later called NHA) in teaching, research, and quality control and safety tests is a controversial topic and has been discussed from both the ethical and the legal point of view for many years (Ramalli 2012).

Ironically bioethics, that originated from a separate branch of knowledge in the early 70's in order to make human studies more humane, contributed to the increased interest at the issue of laboratory animals. In developed countries for several decades numerous regulations aimed at reducing the participation of NHA in scientific experiments have been introduced by animal rights activists (Singer 1975). The concern about animal welfare has become gradually important internationally, as indicated by the adoption in 1966 in the USA the Animal Welfare Act. Interest in animal protection law in society, appears to reflect interest not only among specialists in ethics, as well as practicing lawyers, legal scholars and law schools. For instance, in the 1990s the Animal Legal Defense Fund (California) was a relatively

small organization. None the less, together with the establishment of branches in at least 122 law schools in North America, the organization currently claims to have more than 100,000 members and many of them are practicing lawyers.

In Europe, law schools were overall less active than in the United States while embracing animal law, but lately some of the European courts and legislatures have become bolder in promoting perceived animal interests than their colleagues from the United States. For example, in 2008 Spanish lawmakers recently voted to grant apes rights to "life and freedom" (McNeil 2008). What is more, since July of this year (2015), pets in Barcelona are protected by law and treated like "non-human citizens" (Ramalli 2007).

In 2010, the European Union raised the minimum standards of care for animals used in biomedical experiments by recognising that vertebrate animals have a higher capacity to feel pain, suffering, and distress than previously was thought. Directive 2010/63/EU of the European Parliament requires minimization of the amount of pain, suffering, or distress experienced by

animals when used for research. Additionally, animals which are considered with the lowest capacity for pain should be selected when the choice is available (Ormandy 2014). However, it is important to note that the Directive defines "animal" as non-human vertebrates and cephalopods. Invertebrates, with the exception of cephalopods, are not included in this description due to the belief that they do not experience pain, suffering or distress. However, similarities in behaviour between invertebrates and vertebrates suggest that pain, stress, cognition, and personality traits are similar between the two groups, including their ability to suffer (Horvath 2013). Some animal welfare extremists believe that perhaps these observations will help in the resumption of discussions on the issue of our perception of animal's consciousness. They hope to change the law in such a way that it would also take into account the interests of all animals, not only vertebrates. The impact of their engagement is significant - eg. in Switzerland thanks to a change of law the number of animals subjected to biomedical experiments was reduced by 35% over five years, while a further reduction is being planned.

In 1992, Switzerland became the first country amended its constitution to recognize NHA as beings and not things (8). In this country animal experiments which cause pain or general distress may be conducted only with a special cantonal licence. Some other actions, such as instant killing to take organs and tissues do not need prior licence, but every time this occurs, a report to the cantonal licence bureau is required.

Swiss law promotes the use of alternative research methods as a more ethical approach. And although some opponents argue that the new law has resulted in reduction in the range of research methods and a general decline in the number of scientific publications in Switzerland, currently similar regulations have become very popular and are being gradually adopted worldwide (Wolf 1988).

As stated above, the use of animals in research provokes a diverse range of attitudes, with some people expressing desire for complete abolition of animal research practices, while others express strong support of them (Ormandy 2014). However, as some bioethicists point out, the fundamental arguments used to oppose or to support research on animals over time have little changed: as a rule, those who oppose animal studies tend to focus on the health of animals and the suffering that animals can experience, while those who are involved in research (e.g. scientists, researchers) tend to base their arguments on the benefits of such work and the lack of alternatives of using animals for those purposes.

Although there has been a lot written about the opinions towards animal experiments (Knight 2009), factors that cause the formation of those attitudes still seem to be unclear. The authors hope that this publication will shed some light on this question, especially in consideration of the fact that according to current

knowledge this is the first such study in Poland. The approaches to animal experimentation in each country differs, so it would be inappropriate to assume that cultural influence on the formation of bioethical attitudes among young people is irrelevant. The present study may help to find new factors influencing the development of ethical attitudes, or will confirm previously discovered correlations.

SUBJECTS AND METHODS

217 students were surveyed. 178 of them were studying medicine at the Medical University of Silesia in Katowice and 39 biology or biotechnology at the faculty of Biology and Environmental Sciences, University of Silesia. The sample was collected via the Internet, so it may be unrepresentative for the whole population of students.

The research tool was the author's questionnaire distributed via internet-forums of same-age-group through Facebook. Respondents were asked 25 questions, which were about such subjects as age, gender, conducting similar studies in the past and declare whether or not they wish to carry them out in the future. Participants in the Student Scientific Association were marked. They also were asked about knowledge of alternative research methods to animal testing and evaluation of their effectiveness. Students were asked about some additional topics, such as the type of education of their parents, the size of the city where they grew up, and philosophical/religious beliefs.

The core of the study consisted of 10 sentences (questions 9-18), to which respondents had to respond according to the scheme: 1- I totally agree, 2- I rather agree, 3 - I do not have a clear opinion on the subject, 4 I rather disagree, 5- I completely disagree. These sentences were as follows:

9. I believe it is essential that animal experiments should be conducted in such a way that the smallest possible number of animals had to suffer as little as possible.
10. I think people have the right to carry out experiments in which animals may die or be maimed, if it may result in rescue or prolonging of human lives.
11. I believe that currently experimental studies conducted on laboratory animals are always carried out in a humane way, so as to minimize their suffering and to reduce the number of animals which are subjected to experimentation.
12. I reckon that conducting experimental research on animals is unavoidable for obtaining new drugs and treatment methods in the future.
13. From an ethical point of view, there are better experimental research methods (which do not deprive life of animals), which we should use more frequently.

14. Conducting animal experimentation is incompatible with my conscience or it is in my opinion unethical. I feel negative emotions when I think about it.
15. Animals, like humans, possess some inalienable and natural rights, such as the right to life and to realize their own interests.
16. Animal are governed by the survival instinct, and only humans assign to them a personality.
17. Speaking about invertebrate animals' (e.g. insects, crustaceans, molluscs) intelligence, any personality characteristics or consciousness is very difficult, so conducting research on these organisms is allowed from an ethical point of view.
18. Some animal species (e.g. primates, dolphins, elephants, magpies) are considered by biologists as conscious and very intelligent. Therefore, we are obliged to eliminate their participation in biomedical experiments in the future.

The response values were the basis for assessment of attitude towards animal testing, using two coefficients which could be by quantified and compared, provided by Likert-type scale. One, based directly on the definition of "attitude" (DBS) and second evaluating overall views on the animal testing (OAS). DBS consisted of three subscales describing affective, behavioural and cognitive components of "attitude".

Affective component (A) was represented by question 14, where respondents were asked whether they feel negative emotions while thinking about carrying out animal experiments. It is noteworthy that this ratio was designed in way that the higher value it registers, the smaller support for the animal research is. The behavioural component (B) consisted of responses on questions 4 and 7 in which the questions were asked about whether respondents conducted animal experiments in the past, and whether they wanted to carry them out in the future. Depending on the response, this coefficient could be a value 0, 1, or 0.5. The last cognitive component (C) consisted of the mean value of responses to questions 11 and 13. These two questions were about the students knowledge of the way of conducting animal experiments from an ethical point of view. The components A and C have been converted so that the value ranged from 0 to 1 to provide comparability with B.

OAS has been constructed on six of ten questions listed above. Support of research was represented by the mean value of responses to questions 10, 11 and 17 and opposition by the mean value of 13, 14, and 18. OAS was created by subtracting the value of support from the value of opposition. Cronbach's Alpha for this scale was 0.79.

RESULTS

There was no statistically significant difference between the attitudes towards animal testing between medical and non-medical students (Mann-Whitney's U

test with $p < 0.05$), as well as there was no correlation with age (Spearman's correlation with $p < 0.05$). What was interesting is that there was a significant difference in Mann-Whitney's U test, between the female and male respondents, and contrary to what was expected it was found that women tend to exhibit slightly more positive attitude than men (Figure 1). Participation in the students' scientific associations and academic career ambitions do not have a significant impact on the respondents' views while contact with the animal research in the past, seems to be linked with more positive attitudes.

If it comes to the analysis of the scales used in our research (OAS and DBS), a moderate, statistically significant correlation was found between them ($r = 0.5$; $p < 0.05$). What is interesting is that there is a strong negative correlation between OAS and affective component of DBS ($r = -0.81$; $p < 0.05$) (Figure 2). Similar, but considerably weaker correlation is between OAS and behavioural coefficient of DBS ($r = -0.3$; $p < 0.05$). There is no correlation between cognitive component and OAS ($p > 0.05$; $r = 0.01$).

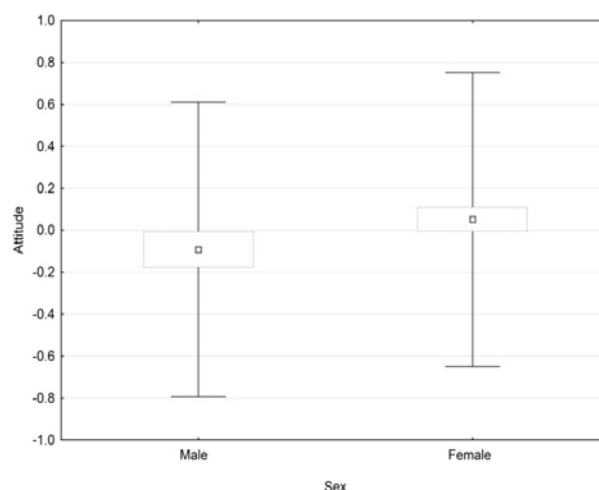


Figure 1. Comparison of attitude levels between female and male respondents

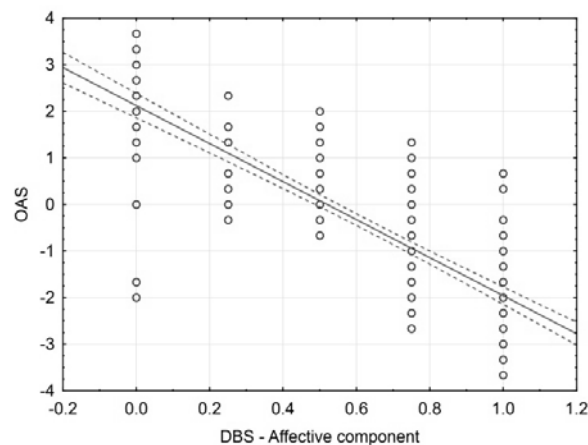


Figure 2. Correlation between the affective component of DBS and OAS

Another interesting finding, is linked with the knowledge, or lack of it, about methods alternative to animal testing. Contrary to what was assumed in the beginning of our study, there is no difference in outcomes of both scales, regardless of respondents' information about those alternative methods (Mann-Whitney's U test; $p > 0.05$). What is more, the cognitive component of DBS scale, seems to lack any correlation with questions 9-18, contrary to the affective component which exhibit plenty of moderate correlations with them. Behavioural part also correlates with most of the questions do not exceed $r = |0.4|$ (Table 1). There was no significant link between the attitude towards animals testing and religion, history of owning any number of animals, vegetarianism and parents' education.

Table 1. Correlations between each of the DBS components (A; B; C) and questions 9-18

	A	B	C
9	0.319160	i/s	i/s
10	-0.583255	-0.275880	i/s
11	-0.340027	-0.238209	0.668614
12	-0.495242	-0.242157	i/s
13	0.537990	0.241139	-0.456873
14	1	0.354135	i/s
15	0.575821	0.224244	i/s
16	-0.325714	-0.235467	i/s
17	-0.358146	-0.181747	i/s
18	0.503213	0.207694	i/s

i/s: insignificant; $p > 0.05$

DISCUSSION

Acquired data implies that demographical factors like religion, parents' education or habitual residence have no influence on formation of bioethical attitudes. Contrary to the authors' predictions, there was also no difference between the students of the medical faculty and those studying other biological sciences. People attending faculties like biology or biotechnology are usually more focused on empirical studies, animals research is almost their daily routine, while in the medical faculty only a few declare that they will follow a path of academic career. What is more, they have different motivations from students of other faculties, they hope to discover new medicine or treatment, and usually are not interested in discovering new mechanisms behind animals' functioning. In a medical faculty, students are under heavy influence of an anthropocentric approach, causing students to perceive research methods and tools as nothing more than means to achieve the greater good – humans' life, health and well-being. That leads to justifying animals research in medical experiments, even if they involve primates (Hagelin 2000). There is lack of such an approach in other biological sciences, where the object is studied for

it's own sake. Taking into account the above contradictions, it is even more interesting why there was no statistically significant difference between both groups of students. There is no doubt that this issue is complicated and demands explanation in more detailed studies.

Independent variables, such as gender or age seem to have no significant influence on outcome of selected answers. A slightly higher support for animal research was found among female respondents, however this may be an effect of an observational error – the study group was rather small and it would be irresponsible to try to draw conclusions antagonizing the available literature (Eldridge 1996, Swami 2008).

The cognitive component of DBS had very weak ($r < 0.3$) correlation with the majority of questions, what implies that knowledge about the usage of animals in science, and familiarity with alternative methods does not have significant influence on attitudes toward animal testing. Although some publications suggest a link between the understanding of laws describing animals' rights and formation of those attitudes (Metzger 2015), authors did not ask directly about knowledge of law but rather about believes and overall knowledge of the topic of conducting such research in accordance with the 3R rule.

Respondents were asked if they think that animal research should be performed and then to explain their views. The most common answer was that studies on animal models allow us to reduce damage to people and widen our knowledge faster. Opposition towards animal research was based on the believe that animals are capable of suffering and also on the view that this type of research possesses too weak a sensitivity to maintain supremacy over alternative methods.

The influence of a behavioral component of DBS was also studied. It is understood as willingness to perform them in the future. There was significant negative correlation, however it did not exceed $r = -0.3$. The possible reason why the correlation was negative, is that probably people who stated that they would like to perform such experiments, do not agree with testing on mammals and in the overall scale their attitude turned out to be negative, although they do not oppose justified research on f.e. amphibian. There was also a very subtle, positive influence of a former experience with experiments on animals on levels of acceptance for such studies. It would be interesting to take a deeper look at this topic due to the opposition of authors' outcomes to the former studies on this topic (Baluch 1995).

Undoubtedly the most interesting outcomes came from the mutual correlations of affective component of the DBS with OAS, where high negative correlation implies a deciding role of it in formation of bioethical attitude towards animal research. On figure 3 it is visible how strong is the influence of the affective

component. The behavioral component, despite significant correlation, has almost no effect on the OAS compared to it.

There was also a plenty of correlation with DBS, strongest ones are described below:

- **($r=-0.49$; $p<0.05$) question 12; ($r=0.54$; $p<0.05$) question 13**

People feeling remorse about the suffering of animals during this type of an animal research, think that those studies are unjustified and can be replaced with alternative methods. Contrary to that, people believing that it is impossible to replace animal research, do not feel remorse over it. Probably it is some kind of a defense mechanism which is a consequence of the accepted scientific approach (Brom 2002).

- **($r=0.57$; $p<0.05$) question 15**

People feeling remorse over animals tend to confer them more rights.

- **($r=0.50$; $p<0.05$) question 18**

... or even consciousness. However people who support animal research tend to think about animals as beings without consciousness or intelligence and therefore deny animals' rights.

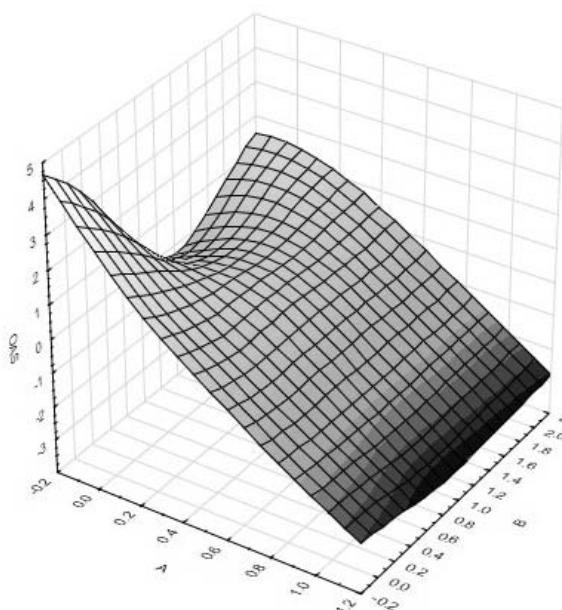


Figure 3. Mutual links between OAS, Affective (A) and Behavioral (B) component of DBS

One of the most important limitations of this study is the method of obtaining filled questionnaires. Paper questionnaires filled during lectures (with proper permissions), when people are usually more exhausted, have problems with concentration and also are in hurry, what may lead to the worse quality of the gathered data. Questionnaires gathered through the internet aim at the specific group of people – internet users – and disqualify

others. In the end we must remember that two different methods of obtaining the responses may lead to the significant differences in the conditions in which they are filled and may cause disparity and lower credibility of data.

CONCLUSIONS

- The Main influence on the formation of a bioethical attitude towards animal research is personal vulnerability, understood as empathy, independently from variables such as age, sex or demographics. It tends to confer intelligence and consciousness to the animals.
- Knowledge about alternative methods and animal research itself does not affect the formation of bioethical attitudes.
- Expertise with animal research seems to have a very loose link to the attitude towards it.

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