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Mothers and Their Relation with Pupils' Mathematics Anxiety

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ABSTRACT

It was aimed to find out the relationship between mathematics anxiety and mothers in this study. Qualitative research strategy was used in this study. In order to get the data semi-structured interviews were conducted with five mothers and five pupils. The results indicated that mothers have impacts on creating mathematics anxiety and on increasing the level of anxiety. Such factors as ignoring anxiety, lack of knowledge, lack of support at home and compulsion of mothers were found as the reasons of pupils' mathematics anxiety.

KEYWORDS : Mathematics anxiety, Compulsion of mothers, Pupils, Lack of support

INTRODUCTION

I am not sure who knows or who doesn't know. To my mum, I can do better in maths. To me, I can't. [...] My mum doesn't want to see that I have problems in maths. She wants me to be as my aunty's son. But he never ever feels similar feelings as I do in maths. It's a major headache! [...] My aunt always helps her son in maths but my mum isn't well enough. Whenever I ask for her help, she has many things to do. [...] If my attitudes towards maths doesn't relate to genetically situations, I am sad to say this but I think my mum is the one of the victim of my disease. [...] a disease because the virus is the maths affecting my stomach, heart and hands. I want to be a good mathematical problem solver and maybe a relax person in maths classes. But this is a dream. I need a person –not my mum because I can be motivated as poorly as she does. She loves me too much but not enough for my maths. I need a person who can understand my difficulties in maths, who can help me when I need extra information, who can explain concepts or maybe some equations in maths in an easy way. (Pupil Serenay)

Mathematics anxiety is an "inconceivable dread of mathematics that can interfere with manipulating numbers and solving mathematical problems within a variety of everyday life and academic situations" Buckley and Ribordy (1982, p. 1). This definition emphasizes that when facing with a mathematical problem, an anxious individual feels "powerless, out of control, lacking in self-esteem" (Zaslavsky, 1999, p. 19). According to Kitchens (1995), facing with mathematics or mathematical tasks causes an individual experiencing extreme discomfort.

In the short term, anxiety in mathematics can cause achievement problems in mathematics (Ma, 1999) but, in the long term this can cause avoidance of mathematical operations, self-confidence and self-efficacy problems (Hembree, 1990). Yet, if this anxiety is not reduced, its negative outcomes may be sustainable. In order to reduce or overcome mathematics anxiety, the causes of mathematics anxiety should be known.

Much research (Alkan, 2009; Armstrong and Price, 1982; Fotoples, 2000; Mulenga, 1990; Tobias, 1978; Zaslavsky, 1999) has been extended towards identifying the causes of mathematics anxiety. In terms of these studies, mathematics anxiety is attributable to different factors such as personality, teacher, peers and parents. Also, some of these studies indicated that each of these factors have sub-factors such as self-efficacy, teaching strategies, lack of peer cooperation and negative parental support respectively causing mathematics anxiety.

There have been conducting several studies emphasizing parents' significant roles in children's education (Eccles, Jacobs and Harold, 1990; Muller, 1998; Carter and Wojtkiewicz, 2000) as well as in their social, psychological and cognitive development (Aunola and Nurmi, 2005). For instance, Aunola and Nurmi (2005) investigated the effects of mothers' and fathers' parenting styles like affection, behavioural control and psychological control on their children's internal and external problem behaviours. The results of their study indicated that parents had impact on children's behavioural reactions.

Another study indicated that the children experiencing higher levels of parental support were more motivated to learn and better behaved, devoted more time to schoolwork and fared better in school than children receiving lower levels of parental support (Schneider and Lee, 1990). Additionally, Muller (1998) stated that parental support contributed positively to pupils' academic outcomes such as better grades and higher mathematics test scores. On the other hand, the lack of parental support and negative parental beliefs about mathematics influence the anxiety level of pupils (Eccles and Jacobs, 1986; Norwood, 1994; Stuart, 2000).

This study was conducted to add to this body of knowledge and to find out the relationships between mathematics anxiety and mothers in Turkish context. Since most of given studies earlier were conducted in countries apart from Turkey. In the study of Aunola and Nurmi (2005), it was found that mothers play important role in children's development. When we consider the Turkish context, it can be similar to the given study in that culturally and traditionally it is more mothers' duties to look after children and follow their progress in education. Therefore, mothers were involved in this study. Furthermore, even though it is known that pupils are dealing with mathematics anxiety in Turkey, there has not done any study with the sample of mothers, yet. Therefore, this study is important to get both mothers' views and their relation to anxiety. Thus, this study entailed an attempt to make an additional contribution to existing studies and to add mothers' lenses to the earlier studies.

METHOD

A qualitative research responds to *"how social experience is created and given meaning"* (Denzin and Lincoln, 2003, p. 13). I decided to conduct a qualitative research as it is exploratory (Creswell, 2003), which helped me to explore participants' complex perspectives, experiences and feelings. My study tried to investigate *'the relationships between mothers and pupils'* anxiety in mathematics at primary school' which had not been effectively studied formerly (Morse, 1991) in Turkish context.

Sample

Studies indicated that mathematics anxiety is a problem in primary schools (Gierl and Bisanz, 1995), in high schools (Hembree, 1990; Campbell and Evans, 1997) and in colleges (Betz, 1978; Hembree, 1990; Tobias, 1990). It is likely that anxiety in mathematics is progressive as indicated in the study done by Melancon et al. (1993) that means it increases as grade levels increase. Furthermore, studies showed that pupils' attitudes towards mathematics in early grades began to change by fourth grade from positive to negative (Scarpello, 2007; Steele and Arth, 1998; Swetman, 1999; Tankersley, 1993). This shows that pupil' anxieties in mathematics and in turn their avoidance in mathematics increase by fourth grade.

Based on the results of abovementioned studies, in order to select the sample of this study, I used *purposive sampling* method. The needs of my study were to get the views of 5th grade pupils at primary school and their mothers. In terms of purposive sampling (Fraenkel and Wallen, 2006) rules, one primary school in Denizli, a city of Turkey was selected. The results of previous studies suggested that mathematics

anxiety and pupils' achievement have a correlation (Hembree, 1990 and Skemp, 1986). Therefore, the statictical data gathered from the National Education Department leaded me to select the school. Having informed the head of the school about the study and the data collection process, he gave permission to conduct my study in one of the classroom in which the number of anxious pupils was more than those in other classrooms.

Even though the names of anxious pupils were given to me by the teacher, I gave these pupils a structured form asking two questions as *"I do like mathematics. Because……", "I do not like mathematics. Because……".* Firstly, the pupils using such metaphors indicating their negative attitudes or feelings towards mathematics were selected. Then, six pupils defining their feelings in detail and relating their negative feelings about mathematics to their mothers were selected out of that sample. As a consequence of this selection, their mothers were automatically selected. It should be noted that I used pseudo-names during presentation.

Data Collection Tool

Kvale (1996, p.11) pointed out that "…through [interviews] we get to know other people, get to learn about their experiences, feelings and hopes they would live in". Therefore, I chose a semi-structured interview approach and developed questions for the interviews allowing for the inclusion of other questions depending upon the situation (Glense 1999, p.69). The semi-structured format allowed me to ask any relevant unplanned questions in response to the interviewee's answers, and change or add questions during the interview (Bryman, 2004). As Robson (1993) suggest, I found that this flexible tool gave me sufficient freedom to tailor the interview to my research goals. This was also helpful as I could modify my questions based on the feedback given, and I was able to follow and understand the interviewee's views.

Piloting

Another school which had a closer achivement level with the main sample school was selected for piloting. After getting permission from the head of the school, 5th grade teachers were given the form including interview questions for pupils and asking their views about whether those questions were clear for pupils' level and whether I could get enough information by those questions. Based on teachers' feedbacks, I rephrased some questions. Subsequently, I interviewed with three anxious pupils from that school and with their mothers. Piloting both interviews enabled me to construct additional probes for interview. Probes are used in interviewing to "[…] deepen the response to a question, to increase the richness of the data being obtained and to give clues to the interviewee about the level of response that is desired" (Patton, 1990, p. 324).

Reliability and Validity

In order to increase the validity of data, I used semi-structured interviews both with mothers and pupils. Triangulation refers to *"the attempt to get a 'true' fix on a situation by combining different ways of looking at it or different findings"* (Silverman, 2000, p.177). The reliability was increased by piloting the research tools, and the generalisability was provided by using purposive sampling (Silverman, 2005).

Data Analysis

I transcribed all the recorded interviews for data analysis, and coded the data on the transcripts. The process used in this coding was first to review the transcripts as many times as I could to help me to put them into meaningful groups for interpretation. As suggested by Krueger and Casey (2000), I paid attention to the frequency of issues that came up in interviews. This helped me to identify themes and to put data into these themes based on information about how many different participants held a similar view, how they specified the phenomenon and how they show their opinions. Therefore, the process of coding helped me build up ideas inductively.

There are two ways of analysing qualitative data; one is categorising responses into two groups, namely external realities and internal experience, and the other is the treatment of the data using narratives (Silverman, 2000). In my study I used the first, coding and categorising the data based on similarities and differences, in suitable forms. Similar units of meaning were stored in the same category and provided me with a complete and comparative picture of pupils' and mothers' perceptions on the relation between mothers and pupils' anxiety in mathematics. After organizing and storing the data, I analyzed them by using inductive analysis.

RESULTS AND DISCUSSION

By following the ways of inductive analysis, I found the concepts that helped me make *'sense of what was going on'* (Hammersley and Atkinson, 1995, p. 209) in my data. The concepts and themes were identified from the interviews. The presentation and discussion of the results will be given based on following themes:

(1) Ignoring anxiety
(2) Lack of knowledge
(3) Lack of support at home
(4) Compulsion of Mothers

Ignoring anxiety

Even though the term *"anxiety"* is commonly used by most of the people in Turkey, as in the research done by Alkan (2009), the results of this study indicated that mothers were not happy to use this term for their children. They prefer to admit that their children sometimes make mistakes in solving mathematical problems. For example mother İlker said that *"Sometimes she doesn't do well in maths, her teacher told me as well. She needs studying more but doesn't do. [...]so she feels panic but not anxiety"*. Additionaly mother Gül said that *"I know that she has some difficulties in mathematics but I am sure that this will not be a big problem for her"*. These suggest that mothers believe that having some troubles in solving problems can be acceptable and cannot be related to anxiety.

On the other hand, the results gathered from students showed that these students were very brave to draw their problems in mathematics compared to their mothers. Thus, they expressed their negative feelings about mathematics and did not avoid to use words including meanings of panic or anxiety while they were clarifying their negative experinces. For instance, pupil Beray said that *"When I am asked to solve a problem, I feel that I am going to have heart attack".* Also, Koray said that *"many times I tried to tell my problems in maths to my Mom. But always had hesitation in expressing my feelings. [...] She doesn't understand why I feel stressful.* According to the findings, it could be said that there is a contradiction between mothers and pupils in defining *'anxiety'*.

It was seen that all pupils in the sample admitted that they felt particularly anxious when faced with mathematics. On the contrary, their mothers merely emphasized that their children displayed negative reactions than the other lessons when they were talking about mathematics, and when parents asked children to do their homework. The data also indicated that mothers connected pupils' troubles to both pupils' lack of time management skills and their teachers' giving homework after school. For example, one mother said *"Yes, she gets low scores from mathematics. I believe this is because she fails in controlling time. She spends nearly ten minutes to solve one problem. So, she can panic in one lesson time"* (Mother Hatice). Mother Seher added that *"[...]he doesn't like doing homework, but the teacher gives everyday. That's why he doesn't like mathematics"*.

The data suggests that mothers ignore the extent of the problem of *'anxiety'*. Significantly, rather than seeing the importance of this problem as a psychological state, mothers identify pupils' troubles in mathematics with their homework or time management skills. However, it was also seen through the data that mothers were aware of pupils' difficulties in mathematics. This situation shows that knowingly or unknowingly mothers disclaim dealing with pupils' difficulties. Therefore, mothers fail to be involved in the process to reduce pupils' anxiety in mathematics as well. On the other side, pupils' anxiety can be heighten as a result of their mothers' disinterest to their anxiety and of mothers' lack of emotional support.

Lack of Knowledge

The results indicated that nearly most of the mothers had some difficulties in explaining and giving clues to their children. It was also found that mothers believed that they were trying to help their children. For example, *"I can't understand some exercises in my son's mathematics books. It seems that the content of the lesson was changed or the style of solutions was changed.[…]But I always help him in his homework […]Yes I have my own style to teach him, I hope I am helpful"* Mother İlker

In addition to this, mother Hatice said that *"Of course sometimes I have difficulties in helping my daughter with her homework.[...] I can say that I am good at maths but the way I am explaining seems unhelpful for her."*. The data from mothers appears to be suggesting that they do not have enough knowledge in mathematics or the knowledge they have is not sufficient to help their children. Furthermore, mothers stated that they forgot most of what they learnt at school years and realized that the presentation of what they learnt had changed. The results of my study suggest that mothers sometimes found themselves unable to encourage their children's understanding.

Similar to mothers' views, pupils stated that their mothers were insufficient in explaining some points when they struggled with mathematics at home. For instance, one of the pupils said that *"[…] When my mom tries to explain a problem, you can't clearly understand what she is telling.[...] sometimes she gets angry and shouts ' this is easy why you can't understand!'. [...] she doesn't know so gets angry.* Pupil Altan said that *"She doesn't know as my teacher […] I prefer my teacher rather than my mom even though he [teacher] makes me more stressful"*. It seems that due to mothers' limited knowledge of mathematics, pupils receive insufficient support. This, in turn, increases the level of pupils' anxiety in mathematics as they see mathematics more complex.

The data suggest that mothers could be aware of that they can cause some misunderstandings or problems in mathematics. However, according to the data, it seems that they do not think that they can cause anxiety as they consider that they try to explain them. My argument is that mothers do not have to know more about mathematics, but at least need to know basic points in mathematics and significantly need to recruit their children's interest in the lesson. Furthermore, if the main concern is to help pupils to do better in mathematics so that enhancing their confidence, mothers need to try their best to be more knowledgable in mathematics.

Lack of Support at Home

The results regarding mothers' involvement in pupils' progress in learning mathematics indicated that they were not supporting their children effectively. Mother Seher said that *"after dinner I always help him in his homework. We spend maybe two hours to explain mathematical concepts"*. In addition to this, mother İlker said that *"we spend all day after the school for doing his homework, but he felt tired of doing so much work. This may make him anxious"*. The results showed that some of the mothers tried to assist their children with their homework at home. On the other hand, findings also indicated that mothers failed to enthuse their children when helping with homework. Pupil Kutay said that *"I got bored and feel tired while my mom is explaining me some points"*. Also, another pupil said that *"I am saying my mom that she is explaining differently from my teacher. Off confusing, making me tense"*.

Some of the pupils complained about the way of their mothers' giving support during doing homework. They mentioned that asking 'have you finished your homerwork' was considered by their mothers as a kind of support at home. However, pupils stated that their mothers were just asking but doing nothing for them. They also emphasized that they were not happy with their mothers' support at home since mothers asked them to help while they were doing house works or doing something besides helping them. For example, pupil Akın said that *"my mum says 'let's do your homework together'. Yes, we start to do my homework but we can't go on together. Because she starts searching movies or her best TV programmes on TV. So beside she watches TV, we try to do my homework, or she says to me 'go on finish it quickly' because she wants to watch TV"*. Another pupil emphasized that "[...] she sometimes tell me to ask my teacher the point I couldn't understand. But she doesn't think that I can't ask him".

The results gathered from mothers' data showed that on the one hand they tried to help their children, but on the other hand they complained about their children asking them to help. Since they thought that they had to ask their teacher rather than them. This means as seen in given quotations some mothers seem as they are helping their children but in real they do not. Even though the lack of support is needed to be considered, the significant point here is that pupils are aware of their mothers' lack in supporting them and their preference. This situation can cause boosting pupils' anxiety in mathematics. Tobias (1978) claimed that pupils' unsatisfactory performance and anxiety in mathematics could be the result of their lack of parental support at home.

Compulsion of Mothers

The results showed that pupils complained about their mothers' forces to do their mathematics homework on time. Pupils also stated that they hate their mothers' insistences on doing homework as well as doing better in mathematics. For instance, pupil Serenay said that *"everyday my mom reminds me to solve all problems asked by my teacher. […] I think she can't consider that she makes me nervous. How I can do?"* The data gathered from mothers' interviews indicated that mothers expected so much from their children. The results suggested that mothers' expectations affect the levels of pupils' anxiety as pupils are under pressure.

Most of the pupils emphasized that even though their mothers were failing in mathematics, they expected their children to be succesful in mathematics. For example, one pupil said *"I don't like maths but I don't like my mum's imposition more than maths."* Nearly most of the pupils mentioned that their mothers were forcing them to be more successful in mathematics whereas mothers were experiencing difficulties in helping them with their homework in doing and explaining the ways of some mathematical problems. Almost all pupils stated that their mothers were failing in supporting them as they did not know how to explain.

According to the results, mothers believed that pupils could learn better when they did their homework on time and studied extra for mathematics every day after school. Repetition could be helpful for pupils to comprehend what was given at school. However, the data also showed that pupils felt that their mothers putting pressure on them subsequenlty felt more anxious. Following quotations showes that pupils felt more stressful and in turn anxious resulted from their mothers' pressures;

"She always forces me to study. [...] she tells me they were very successful and clever in maths. [...] This means I am stupid" (Pupils Beray).

"I don't understand why I have to be succesful at maths. why math is important for them[...] why she can't notice that math is my nightmare" (Pupil Altan).

"If I do better in mathematics can someone names me as Einstein? [...] I can't be better in math when my mum forces me to study everyday. I hate mathematics; numbers always bears down on me." (Pupils Akın)

As abovementioned quotation, the results also showed that some mothers impose their own demands upon their children to be good at mathematics without thinking about the pupils' worries in mathematics. Specifically, the results gathered from pupils indicated that mothers' demands on their children made pupils more fearful and that it was this which subsequently led to a fear of mathematics. On the other hand, the data suggested that mothers did not realize that their children could worry when children faced with their insistence on doing homework or doing better in mathematics. It is likely that mothers are not aware of their contribution to their children difficulties and anxiety in mathematics.

CONCLUSION

This study was an exploration of the relationships between mothers and pupils' mathematics anxiety in Turkey. I explored the issue from the mothers' point of view with the views of pupils'. The data from mothers and pupils revealed that there was a relation between pupils' anxiety and mothers' parenting styles. The findings of my study proved that such factors as ignoring anxiety, lack of knowledge, lack of support at home and compulsion of mothers cause pupils' anxiety in mathematics.

The results imply that mothers fail in effectively supporting pupils' learning and enhancing their competence so that fail in decreasing the level of their anxiety. Vygotsky (1978) emphasized the importance of the support of a capable person-mothers here-. Pupils need cognitive and emotional support in order to deal with their anxiety in mathematics. Therefore, as teachers, mothers are significant in learning process of pupils. This means for their anxious pupils, mothers need to be a teacher, a learner and a parent at the same time. In order to help their children to reduce the level of anxiety so to do better in mathematics, mothers can be involved in pupils' learning by supervising their home-

work and spending time discussing their children's academic-related matters and specifically their academic progress. Further study could investigate this topic in detail and could use different samples and methods.

REFERENCES

Asmah, H., Siti Balkis, B., Rafidah Aini, P.M., Noraida, A., Nor, Y. Y., Khairana, H., Zariyantey, A. and Jamaludin, M., 2011. Role of Oxidative Stress in the Protective Effects of Zingiber Zerumbet Smith Ethyl Acetate Extract against Paracetamol-Induced Hepatotoxicity In Sprague-Dawley Rats. Australian Journal of Basic and Applied Sciences, 5(8): 1519-1525. | Asif, H.M., Akram, M., Saeed, T., Ibrahim Khan, M., Akhtar, N., Rehman, R., Ali Shah, S.M., Ahmed, K and Shaheen, G., 2011. Carbohydrates. International Research Journal of Biochemistry and Bioinformatics 1(1): 001-005. | Atroshi, F., Rizzo, A., Sankari, S., Biese, I., Westermarcj, T and P. Veijalainan, 2000. Liver enzyme activities of rats exposed to ochrutoxin A and T- 2 toxin with antioxidants. Bull. Environ. Contam. Toxicol., 64: 586 – 592. | Banerjee, R., Pakrash, A., Sen, N.R., Sanyal, S and T. Ganguly, 1986. Preliminary toxicity studies of the extract Malvaviscus conzoth Green in male laboratory animals. Indian. J. Pharmacol., 18 : 117 – 123. | Caffall, K.H and Mohnen, D., 2009. The structure, function, and biosynthesis of plant cell wall pectic polysaccharides. Carbohydrate Res., 344(14):1879-1900. | Chandar, T and J. Siddique, 1987. A new recipe for liver injury. Ancient Science of life, 2: 99 – 102. | Duncan, B.D., 1957. Multiple range tests for correlated and heteroscedastic means. Biometrics, 13: 359-364. | Hawk, L., 1937. Hawk's Physiological Chemistry. Bile and liver function. 501 – 509. | Hazai, E., L. Vereczkey and K. Monostory, 2002. Reduction of toxic metabolite formation of acetaminophen. Biochem. Biophys. Res .Commun., 291: 1089–1094. | Hurkadale, P.J., Shelar, P.A., Palled, S.G., Mandavkar, Y.D and Khedkar, A.S., 2012. Hepatoprotective activity of Amorphophallus paeoniifolius tubers against paracetamol-induced liver damage in rats. Asian Pacific Journal of Tropical Biomedicine. S238-S242. | Hussain, K and M.A. Mirza, 1985. Changes in glucose and glycogen metabolism in the brain of rats during Diazinon induced convulsion. International conference in pesticide. Toxicity Safety and Risk Assessment ITRC., Lucknow, India. | Kemp, A. and Kitsvan Heijhinger, J.M., 1954. A colorimetric micromethod for the determination of glycogen in tissues. Biochem. J., 56: 646-648. | Lowry, O.H., N.J. Rosenbrough, A.L. Farr and R.J. Randall, 1951. Protein measurements with Folin – Phenol reagent. J. Biol. Chem. 193: 265-275. | Mandel, P.K., Bishayee, A and M. Chatterjee,, 1992. Stimulation of hepatic protein synthesis in response to Mikania cordata root extract in Ccl4 induced hepatotoxicity in mice. Ital. J. Biochem., 431 (ISS 6) : 345 – 351. | Muthulingam, M. 2002. Studies on the curative efficacy of Astercantha longifolia on carbon tetrachloride induced hepatotoxicity in rats. Ph.D. Thesis, Annamalai University. | Muthulingam, M., Mohandoss, P., Indra, N., Sethupathy, S., 2010. Antihepatotoxic efficacy of Indigofera tinctoria (Linn.) on paracetamol induced liver damage in rats. Int J Pharm Biomed Res, 1(1), 13-18. | Olaleye, M.T and Rocha, B.T.J., 2008. Acetaminophen-induced liver damage in mice: Effects of some medicinal plants on the oxidative defense system. Experimental and Toxicologic Pathology, 59: 319–327. | Roy S, Sehgal, R, Padhy., B.M and Kumar., V.L., 2005. Antioxidant and protective effect of latex of Calotropis procera against alloxan-induced diabetes in rats. J Ethnopharmcol, 102:470–473. | Savithramma N.C.H and Rao S.K.N.,2007. Treatment in asthma of dry powder of Indigofera tinctoria Linn. Ethanopharmacology, 113: 54-61. | Seshadri, C., Sitaraman, R., Revathy, R., Pillai, S.R and S. Venkataraghavan, 1980. Subacute toxicity studies with Agush 64 Ayurvedic antimalarial drug in rats. J. Res. Ay.Sid., 11: 357 – 364. | Shah, V.N and Deval, K., 2011. Hepatoprotective activity of leaves of Parkinsonia aculeata linn against paracetamol induced hepatotoxicity in rats. Int J Pharma, 1(2): 59-66. | Sobha, K., Poornima, A., Harini, P and Veeraiah, K., 2007.A study on biochemical changes in the fresh water fish, Catla catla (Hamilton) exposed to the heavy metal toxicant cadmium chloride. Kathmandu University. Journal of Science, Engineering and Technology, 1(4): 1-11. | Tyagi, P.K., Rai, V.K., Pahria, A.K., Sambath Kumar, S., Singh, Y., Sharma, M and Goyal, M., 2010. Preliminary phytochemical screening and Evaluation of Anti-inflammatory activity of Ethanolic extract of leaves of Indigofera tinctoria Linn. Journal of Current Pharmaceutical Research, 3(1): 47-50. | Vornanen, M., Asikainen, J and Haverinen, J., 2011. Body mass dependence of glycogen stores in the anoxiatolerant crucian carp (Carassius carassius L.). Naturwissenschaften, 98: 225- 232.