The Egyptian Society
for
Animal Reproduction and Fertility

Twenty First Annual Congress

Cairo / Hurgada
February 7 - 11, 2009
A COMPARATIVE STUDY ON TWO SPAWNING-INDUCTION AGENTS, OVAPRIM AND CARP PITUITARY EXTRACT IN THE COMMON CARP (CYPRINUS CARPIO)

AMER1, M. A., A.M. AKAR2, O. A., SALEH2 AND A. E., EISSA3

1Animal Production Department, Faculty of Agriculture, Ain Shams University, Cairo, Egypt.
2Central Laboratory of Aquaculture Research (CLAR), Agriculture Research Center (ARC), Abassa, Abou Hammad, Sharkia, Egypt and 3Department of Fish Diseases and Management, Faculty of Veterinary Medicine, Cairo University, Giza, Egypt.

ABSTRACT

Hormonal treatments were used to stimulate gamete maturation in commercial cyprinid production through the administration of carp pituitary extract (CPE) and Ovaprim. Three experimental groups of female common carps were intraperitoneally injected with one of the following treatments: a single dose (3.0 mg/kg) of CPE; two successive doses of 0.3 mg/kg (as a preliminary dose) and 2.7 mg/kg of CPE; one single dose 0.5 ml Ovaprim. Males of equivalent female numbers were simultaneously induced, although they received one single dose only (2 mg CPE/male) as stimulating dose at the time of the females' first injection. Spawning parameters included latency time, spawning index, fertilization and hatching rates were observed in the experimental groups.

Significantly (P<0.05) lower reproductive performance was observed in fish group received one single CPE injection when compared to those received two CPE doses as indicated by the experimental spawning parameters. No differences (P<0.05) in fertilization and hatching rates between Ovaprim and CPE (double dose) treated fish. However, traditional hypophysation technique (double CPE doses) was remarkably efficient than Ovaprim. Furthermore, the results revealed that the hypophysation technique is more economic and productive than that of Ovaprim. CPE is an important management-production tool in the propagation of cyprinid as well as many commercial aquaculture species. Ovaprim is recommended as spawning inducer that may help in minimizing fish stress due to necessary
handling and in reducing the total time required for artificial induction of spawning.

Key Words: GnRHa, Ovaprim, Carp pituitary, Dopamine Antagonist and Induced Spawning.

INTRODUCTION

Fish reproduction is regulated by a number of environmental factors that trigger internal mechanisms into action. The final product of the reproductive cycle is the release of eggs and sperm, which can be controlled by either placing fish in an appropriate environment or by changing the fish’s internal regulating factors. This can be obtained by the injection of hormones or other substances (Rottmann, et al., 1991). Many fishes spawn in environments that are impossible to simulate in a hatchery, therefore, hormone-induced spawning is the only reliable method for reproduction in these fishes. One of the most commonly applied spawning agents is carp pituitary extract (Yaron, et al., 1984; Thalathiah, et al., 1988; Akar, 2006 and 2008). Injected pituitary material evades the brain-pituitary link by acting directly on the ovaries and testes, leading to the surge in blood GtH levels that normally precede spawning (Rottmann, et al., 1991). Although the Carp pituitary injection was one of the earliest methods of ovulation induction and spermiation in fish, it is still the most preferable method utilized by many fish culturists. In some situations, it has been found to be the most efficient and reliable method of inducing final gamete maturation (Erdahl, 1996).

Fish handling during the spawning season may aggravate stressful circumstances coupled with that already characterize artificial culture conditions. Minimum handling is beneficial for the health of broodstock and one injection technique that leads to gamete production is certainly advantageous. Recently, a synthetic superactive analogue of gonadotropin releasing hormone (GnRHa) frequently with strong dopamine antagonists (DA), became a popular choice for releasing fish endogenous gonadotropin (GtH) (Yaron, 1995).

Dopamine inhibits the release of hormones from the pituitary and effectively blocking the pituitary’s positive response to injected LHRHAs. There is a family of drugs that act as dopamine blockers, either by preventing the release or by inhibiting the binding of dopamine.
Experimental results indicate that the use of dopamine blockers prevent this negative feedback and enhance the effectiveness of LHRHa to induce spawning (Drori et al. 1994; Dorafshan et al., 2003 and Arabaci et. al. 2004). To facilitate the GtH releasing activity of GnRHa in cyprinids, it is necessary to combine it with a dopamine receptor antagonist such as Domperidone, Pimozide or Metoclopramide (Peter et al., 1988). Induction of spawning in fish using a superactive GnRH analogue together with one of these dopamine antagonists is known as the Linpe method (Peter et al., 1988) which is now used in many parts of the world. The success of using GnRHa alone or in combination with dopamine antagonist in spawning induction of various fish has been reviewed by Peter et al., (1988), Yaron, (1995), Zohar and Mylonas, (2001) and Szabo et al., (2002).

The objectives of the present study were: a) to examine the effects of Ovaprim on induction of spawning in common carp; b) to compare two methods of spawning induction, i.e. hypophysation either in one dose or in two successive doses and Linpe method (Ovaprim injection), with respect to the spawning parameters.

MATERIAL AND METHODS

Fish: A spawning experiment was conducted during April 2006 on 2-3 years old common carp (C. carpio) broodstocks, at the hatchery of Central Laboratory of Aquaculture Research (CLAR). Thirty adult fish, 15 females, weighing 2.3–3.8 kg body weight as recommended by Brzuska (1999) and 15 males with body weight of 1.75–2.0 kg were used in the present experiment. Experimental fish were randomly distributed in 3 indoor fiberglass tanks provided with running water (23°C±1). Other water quality parameters were as follows: dissolved oxygen, 8.2; pH, 8.6; nitrate 0.01 mg/l and nitrite 0.02 mg/l, and fish were adapted to these conditions for 24 hours. Prior to injection, fish were individually weighed and anesthetized (1 ml Quinaldine/40L water bath) according to Bowser (2001).

Hormonal treatment: Ovaprim (Syndel Lab., Ltd., Vancouver, British Columbia) which is a mixture of 20 μg/ml salmon gonadotropin-releasing hormone analog (sGnRHa [DAArg6-Pro9-NEt sGnRH]) with 10
mg/ml dopamine antagonist, Domperidone. Carp pituitary (CPE, Argent, Philippines), at a dose of 3 mg/kg in 0.6% saline solution was used for spawning induction according to Billard (1990). The required weight of dried pituitary glands were calculated, weighed and grounded thoroughly in a porcelain mortar to produce a fine powder which was then suspended in a physiological solution (0.6%). The suspension was centrifuged for 15 min at 3000 r.p.m., and the amount of injected supernatant was adjusted to be 3 mg/ml.

Experimental fish were divided into three groups, The first two groups were intra peritoneally injected with pituitary homogenate, the first with a single dose (3.0 mg/kg) according to Billard (1990), while the second received two successive doses: 0.3 mg/kg (as a preliminary dose) and 2.7 mg/kg (as a resolving dose), with 8 hours intervals (Arabaci et al., 2001). Fish in the third experimental group received one single dose 0.5 ml Ovaprim according to Nandeesha et al. (1990) and Akar (2008). Males of equivalent female numbers were simultaneously induced, although they received one single dose only (2 mg CPE/kg) as stimulating dose at the time of the females' first injection and were then separately kept in 3 m³ circular fiberglass tanks under similar experimental conditions till the spawning time. The experimental design is illustrated in Table 1.

Table 1: Experimental substances and doses applied to stimulate spawning in common carp

<table>
<thead>
<tr>
<th>Group</th>
<th>Substances</th>
<th>Preliminary dose</th>
<th>Decisive dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Carp pituitary extract (CPE)</td>
<td>3 mg / kg</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Carp pituitary extract (CPE)</td>
<td>0.3 mg / kg</td>
<td>2.7 mg / kg</td>
</tr>
<tr>
<td>3</td>
<td>Ovaprim</td>
<td>0.5 ml / kg</td>
<td></td>
</tr>
</tbody>
</table>

**Egg stripping:** The injected females were left undisturbed for 6 hours, after which the water level in the spawning tanks was lowered to the depth was just enough to cover the dorsal fin of the spawning fish, although water flow was maintained at the same rate that allows at least
6-l/min/fish. Ovaries ripening were repeatedly checked 8 h after the first or the second injection, according to the experimental design described above. Manual stripping of the fish’s abdomen was performed every one hour at ovulation time. When spawning was successful, the latency time was recorded. For stripping, brooders were anaesthetized and placed on a thick layer of sponge on the spawning table, and their abdomens, vents and anal fins were thoroughly dried with clean dry towels. The ripened eggs were released from the ovaries into clean, dry and previously weighed plastic bowls by a gentle massage with slight pressure on the lower sides of the females from front to back until the ovaries were empty or when a drop of blood appeared. Particular care was taken to avoid any water contact with eggs during the egg collection procedure.

**Fertilization:** Fertilization was accomplished using the ‘dry’ method, i.e. the milt was added directly into the plastic bowl by stripping a male brooder. Eggs and milt were then gently stirred by a clean goose feather for a couple of minutes to ensure that they were thoroughly mixed. Fertilizing solution (4 grams of sodium chloride and 3 grams urea/l of water) was added thoroughly and continuously for more than one hour (Horváth et al. 2002). Fertilized eggs were treated with tannin solution (5 gm tannic acid/10 liters of water) for 20 seconds to remove traces of stickiness (Horváth et al. 2002). Eggs were rinsed several times with fresh water and fertilized eggs of several females from the same treated group were transferred into the incubator jars at a rate of 600 ml of partially swollen eggs per jar. Incubators were receiving fresh well aerated water at temperature of 25°C±1 and water flow rate in each incubator was adjusted so that the fertilized eggs rotate gently. Dead eggs were siphoned off several times a day to keep all jars clean and for disinfection of eggs; a prophylactic dose of formalin (150 ppm) was added to the header tank that feeds water to the incubating system (Peteri et al., 1992).

Stripped eggs were immediately weighed upon stripping and one gram eggs was taken and carefully counted to obtain an estimate number of eggs produced per female fish or an estimate for number of eggs produced per kg/body weight. The investigated traits included the ratio of brooders released eggs, latency period (the period between hormonal
injection and ovulation), the weight of obtained eggs in grams and as a percentage of female body weight (spawning index). The percentage of fertilized eggs (fertilization rate) was calculated after 12 hours incubation period, in three samples of the incubated eggs for each treated group. The hatching rate was calculated after 48 hours (Rothbard, 1981 and Brzuska, 2004). Absolute fecundity (number of larvae produced per each female), and relative fecundity (number of larvae produced per kg fish) as criteria of ovulatory response of carp broodstocks were calculated according to Brzuska and Adamek (1999). Finally, a simple economic evaluation was performed among the three experimental groups.

Statistical Analyses: Data were statistically analyzed using one-way ANOVA, followed by Duncan’s multiple-range test for multiple comparisons (P<0.05). Statistical analysis was performed with a StatView 4.1 software program for Macintosh (Abacus Concepts, Berkley, CA).

RESULTS
Spawning occurred in all female fish of the different experimental groups, although the spawning performance was superior in the experimental groups received either a double dose of CPE or ovaprim treatment. Latency period varied significantly (P<0.05) between the three experimental groups, where ovulation started 10 hours after treatment with ovaprim, and 8 hours in CPE (double dose) in female stimulated group and 15 hours in female stimulated with a single dose of CPE (Table 2). The present results showed that females treated with either ovaprim or a double dose of CPE yielded statistically higher numbers (P<0.05) of eggs when compared with those treated with a single dose of CPE.

The weight of the eggs obtained from the different experimental groups (either in grams or as a percentage of female body weight, i.e., spawning index) varied statistically (P<0.05) among the three treated groups (Table 2, Fig. 1). The highest values (18.40%) were recorded for fish treated with CPE (double dose) followed by ovaprim treated group, although the lowest value was recorded for fish treated with a single dose of CPE (4.38%). Similarly, (Table 2, Fig. 2) shows that fish received a double dose of CPE or treated with ovaprim showed improved
fertilization rates (86.0% & 87.0%, respectively) when compared to those received a single dose of CPE (71.0%).

Table (2): Statistical spawning data of common carp expressed as means ± SE.

<table>
<thead>
<tr>
<th>Treated Groups</th>
<th>Latency Period (h)</th>
<th>% Spawning Index</th>
<th>% Fertilization Rate</th>
<th>% Hatching Rate</th>
<th>Fry/Fish (10^3)</th>
<th>Fry/kg (10^3)</th>
<th>Dose Cost (LE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPE Single dose</td>
<td>15c ±0.20</td>
<td>4.38c ±1.38</td>
<td>71.00b ±2.34</td>
<td>50.00b ±3.67</td>
<td>28.21c ±1.32</td>
<td>11.05c ±1.32</td>
<td>22.10a ±1.94</td>
</tr>
<tr>
<td>CPE Double dose</td>
<td>8a ±1.42</td>
<td>18.40a ±1.81</td>
<td>86.00a ±1.77</td>
<td>81.00a ±6.97</td>
<td>213.00a ±4.16</td>
<td>88.93a ±4.16</td>
<td>20.97a ±0.94</td>
</tr>
<tr>
<td>Ovaprim</td>
<td>10b ±0.72</td>
<td>11.57b ±1.23</td>
<td>87.00a ±1.25</td>
<td>78.00a ±6.82</td>
<td>176.87b ±2.46</td>
<td>54.72b ±2.46</td>
<td>35.97b ±2.58</td>
</tr>
</tbody>
</table>

Within Columns, values with similar letters are not significantly different (P>0.05).

The percentage of live embryos (hatching rate) observed after 48hrs incubation period was significantly (P<0.05) lower in the group received a single dose of CPE (50.0%) than those injected with either a double dose of CPE (81.0%) or ovaprim (78.0%), although the latter two treatments were not statistically different (Table 2, Fig. 3). These results were in accordance with that estimated for absolute fecundity (number of larvae produced per each female and relative fecundity (number of larvae produced per kg fish), since both ovaprim (176 x10^3) and double dose (213 x10^3) treatments were significantly higher (P<0.05) than that found in the CPE single dose treatment, however, the ovaprim treatment produced a significantly (P<0.05) lower number of fry/kg (54.72 x10^3) (Fig. 4 and Fig. 5).

The ovaprim price for bottle contained 10 ml in Egypt is L.E. 440, while one gram of CP is L.E. 2900. The average cost for the three experimental groups was L.E. 22.10, L.E. 20.97 and L.E.35.97, for the CPE (single dose) group, CPE (double dose) group, and the ovaprim treatment, respectively.
Fig. 1: Spawning index (stripped eggs weigh/body weigh x 100) obtained from common carp (*Cyprinus carpio*) females after hormonal stimulation. Vertical bars show means ± SE. Data marked with the same letter do not differ statistically (P>0.05).
Fig. 3: Hatching rate obtained from common carp (*Cyprinus carpio*) females after hormonal stimulation. Vertical bars show means±SE. Data marked with the same letter do not differ statistically (P>0.05).

Fig. 4: Absolute fecundity (% of live embryos x total fertilized eggs) obtained from common carp (*Cyprinus carpio*) females after hormonal stimulation. Vertical bars show means±SE. Data marked with the same letter do not differ statistically (P>0.05).
FIG. 5: Relative fecundity (absolute fecundity/female body weight) obtained from common carp (Cyprinus carpio) females after hormonal stimulation. Vertical bars show means ± SE. Data marked with the same letter do not differ statistically (P>0.05).

DISCUSSION

Under normal conditions, there is a delay from the time of the decisive injection until the parent fish enter ovulation stage. This period is called the response time or the latency period. However, response time varies slightly depending on water temperature, the spawning inducing agent, the injection frequency, and the species induced.

The present results showed that all the experimental groups were significantly (P<0.05) different from each other, with the longest period was recorded for the single CPE injection (15 hrs) and the shorter (8 hrs) while the ovaprim treatment produced an intermediate estimate (10 hrs). Comparable findings were frequently reported in a number of fish species. Arabaci et al. (2004) reported a longer latency period (14–16 hrs) for Cyprinus carpio in LHRHa+DA-treated fish than that treated with CPE extract (12–14 hrs), which were corresponding to that observed in earlier studies (Drori et al. (1994); Arabaci et al. (2001).
It is known that CPE extract has a direct gonadotrophic effect whilst LHRHa stimulates the release of gonadotropins in a sequential process, therefore, latency time of CPE treated fish is always shorter than that treated with LHRHa agents. This may explain the significant difference in latency period observed between CPE and ovaprim treatments of the present study.

The present data revealed a high significant difference in the proportion of spawning index and in the average eggs weight among the three experimental groups. Similar values for the average weight of eggs obtained were recorded in three strains of *C. carpio* (Hungarian strain, French strain and their cross-breed) (Brzuska and Bialowąs 2002). The authors reported higher egg weights (316.25, 441.57 and 410g) in fish treated with ovopel (LHRHa combined with dopamine antagonist) than that stimulated with a CPE (227.50, 347.25 and 334.25g), respectively. Corresponding values of percentage of female body weights were 7.63, 9.62 and 8.85%, and 5.20, 8.12 and 7.95 %, for ovopel and CPE treated fish, respectively. Working with grass and silver carp, Brzuska, (1999) failed to detect significant difference between fish treated with LHRHa plus dopamine antagonist (Pimozide) or CPE in spawning index. Similarly, Brzuska and Bialowąs (2002) showed no significant effects of Ovopel or CPE on egg weights. Nevertheless, in another study, Brzuska (2003), however, found high statistically significant values of egg weight for fish treated with three different treatments: CPE, Ovopel (mammalian GnRHα+dopamine antagonist, Metoclopramide) and CPE plus Ovopel, although they recorded lower egg weights than that of the current experiment. This could be probably due to that the latter authors used heavy females (10 –13.2 kg body weight). On the other hand, Dorafshan et al. (2003) reported that working fecundity (the number of stripped eggs “not larvae”/kg fish) in spawned common carp was approximately in the range of 50-150 thousands which was higher in GnRHα plus Domperidone as compared to fish treated with CPE.

Ovaprim or a double injection of CPE positively affected the quality of eggs, as indicated by improving of fertilization rates that reached 87%. The current values for fertilization rates observed in the present study were higher than those reported by Arabaci et al. (2004) for
common carp treated with LHRHa plus DA or CPE. Although high fertility of eggs has been reported as one of the advantages of the LHRHa+DA treatment over traditional CPE methods (Brzuska 1999), several authors were not able to detect statistical differences on such an effect (Kulikovsky et al. 1996; Brzuska and Grzywaczewski, 1999; Brzuska, 2003 and Arabaci et al. 2004) and represented data similar to that obtained in the current study.

The percentage of live embryos (hatching rate), after 48h period of incubation, was very low in fish treated with a single injection of CPE (50.0%). Similar low values for this parameter (52.1% and 63.0%) were also reported in grass carps by Brzuska (1999). Brzuska (2000) treated two groups of common carps with CPE and with LHRHa plus DA and obtained hatching rates of 67.64% and 44.94%, respectively. However, Brzuska (2004) obtained a high percentage of live embryos (90.5%) in fish treated with a double dose of CPE, which was significantly higher than those obtained from GnRHa+DA-treated fish (85.8%).

The number of larvae produced per female or per kg fish is a major important response for any spawning stimulating agent. In the present study, this parameter was significantly affected by both double injection of CPE and Ovaprim. According to the present results, both absolute and relative fecundity in spawned fish treated with a single CPE injection was significantly lower than those obtained after double injection of CPE or ovaprim treatment. It appears that 3 mg/kg of CPE was capable of inducing significant changes in the ovary when it is administrated in two doses in 8hrs intervals, although, one single dose was not enough to induce complete ovulation. It has been reported that this dosage is effective for complete spawning process in female common carp (Zohar and Mylonas, 2001).

In summary, the present study demonstrated that the use of GnRHa coupled with Domperidone is an effective and reliable procedure for induction of ovulation and spawning in common carp, Cyprinus carpio. However, traditional hypophysation seems to be more effective than ovaprim when administrated in a double injection protocol (10 and 90%, for the first and second injection, respectively) making a total dose of 3mg/kg fish. Furthermore, hypophysation method has some
advantages over ovaprim treatment (spawning index, higher fecundity and the lower cost). However it is probably useful to use ovaprim method to reduce handling stress and the total time required for artificial spawning. Finally, hypophysation could be more economic than LHRHa treatments.

ACKNOWLEDGMENTS
The author wishes to thank Dr. A. El-Gamal, Animal Production Department, Faculty of Agriculture, Ain Shams University for reviewing the manuscript.

REFERENCES


مقارنة بين مستخلص الغدة الخصامية والأوفرامير كمحفزات للتثبيض في أسماك المبروك

العالي

محمد عبد الباقى عامر 1, عادل محمد عكر 2, أسامة عبد الرحمن صالح 3, علاء عيسى 3

1-قسم الإنتاج الحيواني، كلية الزراعة، جامعة عين شمس، مصر 2-المعمل المركزي لبحث الثروة السمكية بالعابد 3-مركز البحوث الزراعية، الكلية البيئية، جامعة القاهرة

المختصر العربي

من أهم معوقات التوسع في الزراعة السمكى هو مدى توافقت الزراعة الجيدة. لذا من أن التثبيض الطبيعي في أسماك المبروك العادي يمكن أن يتم تقليبا في الأحوال إلا أن الاحتكاء الصناعي للتثبيض والنزاع يمنع إنتاج الكفاءة النافعة. ويمكن من الحصول على زراعة ذات جودة عالية. لذا يتم استخدام المعاملات الهربونية لتنبيه النشاط. وبهذا اكتسب الاسمك على النزاع والثروت. أجريت هذه الدراسة في فرع العمل المركزي لبحث الثروة السمكية بالعابد.، أبو حمد، محافظة الشرقية خلال موسم تغري 2006 على أمهات أسماك المبروك العادي لمقارنة كفاءة مستخلصات الغدة الخصامية والأوفرامير (مركب تخليق حذاف الأفواه) العديدة. كما يحتوي على مضادات اللهائيون في استخدام التثبيض. استخدمت الدراسة 30 سلكة (15 أنثى و 15 ذكر). 14 نسمة بتراج ب2.3 كجم للأميات تحت 5 سنوات. فستستعمل مجموعات حفنة المجموعة الأولى بحجم كجم مستخلص الغدة الخصامية بجرعة واحدة و المجموعة الثانية بنفس الجرعة ولكن موزعة على حفنة كلها، بينما 8 سعات، أما المجموعة الثالثة فتكون جرعة واحدة بجرعة واحدة بـ 0.5 كجم من محلول الأوفرامير. أما الذكور فتكون بجرعة واحدة من مستخلصات الغدة الخصامية (1 مجم/كم من وزن الجسم) وحول القمة الأولى إناث.

أظهرت النتائج فوق واضح للمعاملتين الثانية والثالثة على المعاملة الأولى (جريزة واحدة من مستخلص الغدة الخصامية في كل مراحل الكفاءة النشاطية. كذلك أظهرت النتائج فوق واضح للمعاملة بتفوق من مستخلصات الغدة الخصامية على المعاملة جريزة واحدة من الأوفرامير في جميع أنماط الكفاءة التناسلية. فكان الفرق معنوي في وزن البيض التحلصية علاج بين دليل التثبيض (وزن البيض/وزن الأم) 100% كانت نسبة انخفاض طفيفة بـ 18.4% نسبة 11.5% كانت نسبة زيادة كبيرة في معدل إنتاج الثروة. فاذا الراتنج ساءة الأخصائي 210 أف مقارنة بـ 177 ألف، أو الناحية النسبية 80 ألف مقارنة بـ 55 ألف. وأيضاً بعض معدلات الإصابة والوقوع تم دفع فرق معروفة بين المعاملتين (ثانية والثالثة). علاج على ذلك كانت تكليف الحفنة بـ 3 مجم/كم غدة متكاملة في 300 كجم، حيث كان متوسط كلفة هذه المادة (0.70) 80 جنية مقارنة بـ 22 جنية/كم حيث كان مستوى كلفة معاملة الأوفرامير بالمالية 200 جنية مقارنة بـ 36 للمعاملة بالأوفرامير.

بالنسبة للمادة الأولى (جريزة واحدة من مستخلصات الغدة الخصامية كمحفز للتثبيض مازال يعتبر الوسيطة الأفضل لتثبيض الأسماك صناعيا. كما أن استخدام المواد التثبيضية المحتوية على الأوفرامير تعتبر من الوسائل الجيدة في التثبيض خصاة إذا توافرت بساعدة نسبة لأميات متحفزة بكفاءة كجزء واحد من الوقت يتيح الأسماك الإجهاز الذي تبرع له نتيجة للمساهمة في عملية التثبيض الصناعي خاصة في الأ묘ت عالية القيمة الاقتصادية.