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Comparative Analysis Between Impact Factor and h-Index for Reproduction Biology Journals

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Abstract: The Journal Impact Factors (JIF) has become nowadays one of the most frequently used scientometric indictor, the Hirsch's index (h-index) has also got positive reception in the scientometric literature. In this study, the journals of reproduction biology were compared with JIF and h-indices computed from the ISI Web of Science. This h-index (2001-2008) exhibited a high correlation with the 5 years JIF (2004-2008) ($r = 0.64$, $p = 0.001$), the relative h-index showed a weak correlation with the JIF ($r = 0.42$, $p = 0.049$). A ranking of 25 reproduction journals is presented on the basis of this JIF or h-index.

Key words: Journal, reproduction, ranking, hirsch index, impact factor, China

INTRODUCTION

Science of biomedical publication has rapidly changed with the advent of information technology. Journal Impact Factor (JIF) assesses the performance of a biomedical journal which monitored periodically by an organization called Thomson Scientific, USA founded by Eugene Garfield (Garfield, 1955, 2006). Garfield introduced the term JIF in 1963 (Garfield, 2006). Citation indicates a study has influenced scientific community. Greater the frequency of a study being cited, higher will be its influence on the scientific community (Dong *et al*., 2005). Citation is the total number of times a study is used as a reference and cited in the previous 2 years from the given year for which it is calculated (Garfield, 2006).

The Hirsch's index (h-index) was introduced by Jorge Hirsch as an indicator for lifetime achievement as measured by the number of received citations (Hirsch, 2005). H-index is an original and simple new measure incorporating both quantity and visibility of publications (Egghe and Rousseay, 2006). A further advantage seen for the h-index is that the necessary data for calculation is easy to access in a database without the need for any off-line data processing (Batista *et al*., 2006).

The proposed new measure of research performance has immediately provoked reaction in research community (Ball, 2005; Holden, 2005) and it is an advantageously supplement to assess the outcoming of scientists when associating with the number of citations and JIF. After the short time, some researchers have adapted h-index into journals (Braun *et al*., 2005), institutions (Bar-Ilan, 2007; Smith, 2008) and topics which is an effective supplement to only use JIF to assess journals. This study presents an analysis of the JIF and h-index of journal utility with a view to ranking reproduction biology literature.

MATERIALS AND METHODS

This study drew on JIF from the 2008, 2004-2008 Journal Citation Reports (JCR) and on h-indices computed automatically from the ISI Web of Science (Thomson Scientific). The item of Reproduction Biology Journals from Subject Category Selection, JCR was retrieved, sorted by the JIF and the Impact Factor and 5 years JIF of all 25 journals were recorded.

Every one of all 25 journals of Reproduction Biology were retrieved sorting them by the number of Times Cited from Web of Science database, the highest rank number can be found which is still lower than the corresponding Times Cited value. This is exactly the h-index of the journal for the given year (Braun *et al*., 2005). The h-index of reproduction biology journals was checked for 9 years (2001-2008) on August 1, 2009 reviewed independently by two investigators.

The relative h-index of reproduction biology journals was adapted from Rousseau (2006) which calculated from the h-index divided by the numbers of publications and multiply 100 for easy analysis. The SPSS13.0 software was used to analyze the linear relationship between the JIF and h-index.

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RESULTS AND DISCUSSION

The correspondence between JIF and h-index of 25 reproduction biology journals recognized by ISI Web of Science was assessed. As shown in Table 1, the journals quality was ranked using JIF (2008), 5 years JIF, h-index and relative index. We can found that there was a very high correlation between JIF (2008) and 5 years JIF (2004-2008), the correlation coefficient (r) is 0.98 ($p<0.001$), suggest that the 2 years JIF (2008) or 5 years JIF (2004-2008) can reflect the quality of journals.

However, there also was a few discrepancy between 2 years JIF (2008) and 5 years JIF (2004-2008). For example, the top 3 journals from JIF (2008) is human reproduction update, fertility and sterility, human reproduction. The top 3 journals from JIF (2008) is the same with 5 years JIF but rank 2 and 3 is different, there are human reproduction, fertility and sterility (Table 1). If the journals quality of reproduction journals was ranked using h-index (2001-2008), the top 3 reproduction journals is biology of reproduction, human reproduction and human reproduction update (Table 1). Using relative h-index, the journals rank is different from the 2 years JIF (2008), 5 years JIF (2004-2008) and h-index (2001-2008). For example, the top 3 journals is human reproduction updat, invertebrate reproduction and development and animal reproduction science.

It was surprised to find the rank of invertebrate reproduction and development, the journal is the last one or the third from the last ranked using JIF (2008) or 5 years JIF (2004-2008). The data showed that there was no correlation ($r = 0.19$, $p = 0.35$) between h-index (2001-2008) and relative h-index (2001-2008).

Figure 1 showed the correlation between 2 years or 5 years JIF and h-index (2001-2008) or relative h-index (2001-2008) of 25 reproduction biology journals. It can be found that there is a high correlation ($r = 0.64$, 0.60) between h-index (2001-2008) and 5 years JIF (2004-2008) or 2 years JIF (2008) ($r = 0.64$, 0.60; $p = 0.001$, 0.002) (Fig. 1a, c) there is a weak correlation between relative h-index (2001-2008) and 5-years JIF (2004-2008) or 2 years JIF (2008) ($r = 0.42$, 0.38; $p = 0.048$, 0.057) (Fig. 1b, d).

JIF is primarily a measure of scientific utility rather than scientific quality. Originality and merit are the fundamental principles that determine the quality of a study. Biomedical journals offering priority to them are highly cited and ranked. The reliability of JIF as an indicator for journal quality is sometimes recognized limitations (Dellavalle *et al*., 2007; Dong *et al*., 2005; Kurmis, 2003; Moed, 2005). For example, JIF has many defects such as excessively high JIF on review of the journals, an unfair assessment toward some journals of slowly developing fields too sensitive few journals which

Table 1: Journal impact factors and h-index of 25 reproduction biology journals

Journals	Impact factor 2008	Rank	5 years impact factor	Rank	Articles 2008	h-index 2001-2008	Rank	Articles 2001-2008	Relative h-index 2001-2008	Rank
Human reproduction update	7.590	1	7.996	1	49	48	3	443	10.84	1.00
Fertility and sterility	4.167	2	3.782	3	573	64	5	13208	0.48	20.00
Human reproduction	3.773	3	4.035	2	392	68	2	5643	1.21	16.00
Seminars in reproductive medicine	3.512	4	3.051	6	52	23	6	392	5.87	4.00
Biology of reproduction	3.469	5	3.778	4	265	67	1	9021	0.74	9.00
Reproduction	3.073	6	3.356	5	164	53	12	1557	3.40	11.00
Reproductive toxicology	2.957	7	2.669	10	108	30	17	812	3.69	24.00
Reproductive biomedicine online	2.954	8	-	24	240	31	10	1517	2.04	12.00
Journal of reproductive immunology	2.778	9	2.775	9	58	33	14	575	5.74	25.00
Placenta	2.775	10	2.922	8	156	38	9	3105	1.22	7.00
Reproductive biology and endocrinology	2.634	11	-	24	56	15	19	263	5.70	6.00
Molecular human reproduction	2.537	12	3.045	7	83	43	8	946	4.55	15.00
Reproduction fertility and development	2.439	13	2.200	16	91	22	7	2088	1.05	21.00
Molecular reproduction and development	2.287	14	2.340	13	188	38	15	1439	2.64	14.00
American journal of reproductive immunology	2.172	15	2.223	15	111	29	22	931	3.11	19.00
Reproduction nutrition development	2.167	16	2.471	11	0	20	4	306	6.54	8.00
Theriogenology	2.041	17	2.285	14	314	43	13	2904	1.48	17.00
Reproductive sciences	1.951	18	1.951	17	104	7	23	1151	0.61	10.00
Animal reproduction science	1.890	19	2.395	12	263	32	16	1513	2.12	3.00
Sexual plant reproduction	1.610	20	1.629	20	22	19	20	266	7.14	13.00
Journal of reproduction and development	1.609	21	1.619	21	85	18	21	679	2.65	22.00
European journal of obstetrics gynecology and reproductive biology	1.565	22	1.718	19	242	27	24	2582	1.05	5.00
Reproduction in domestic animals	1.526	23	1.910	18	191	21	11	2823	0.74	23.00
Zygote	1.067	24	1.359	22	42	17	25	337	5.04	18.00
Invertebrate reproduction and development	0.673	25	0.841	23	11	12	18	317	3.79	2.00

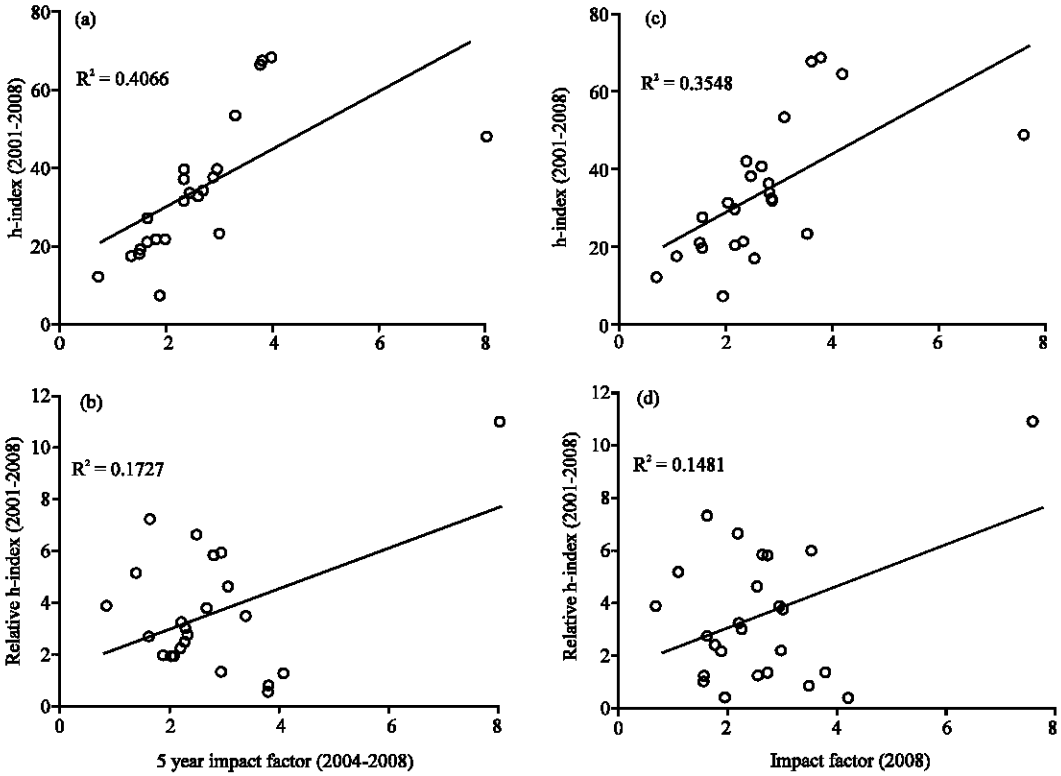

Fig. 1: The relationship between the journal impact factors and the h-index

have much accidental excess of no-cited publications etc (Kurmis, 2003; Garfield, 2006). Other providers offer alternative journal rankings but most deal with a small subset of the literature in any discipline. H-index has been suggested as an alternative that is reliable, robust and easily computed (Hirsch, 2005; Van Raan, 2006; Braun *et al*., 2005; Rousseau, 2007; Wei *et al*., 2009).

Although, the use of different performance measures (JIF vs. h-index) results in somewhat different rank orders of the journals, the correlations between the measures found in this and other studies indicate that the development of the journal h-index and its variants has resulted in hardly any empirical incremental contribution against each other and the JIF. Apparently, these findings from current study indicate a redundancy among the various indicators to measure scientific performance in empirical application.

The various indicators seem to measure similar aspects of scientific performance. The advantage of the h-index against the JIF (and against most of the h-index variants) is its manageability: it offers as an evaluative measure for assessing the research output of scientists (Hirsch, 2005), research groups (Van Raan, 2006) and journals (Braun *et al*., 2005) and due to a simple calculation based on Web of Science or other database. Any bibliometric indicator to measure scientific performance should be carefully checked for its validity and its ability to correctly represent scientific quality. There is no doubt that a relative h-index based on current study is imperfect. The relative h-index comes from the h-index divided by numbers of publications. The study showed that relative h-index has a weak correlation with JIF ($p \geq 0.05$) (Fig. 1), no correlation with h-index ($p > 0.05$). The reason may is that some reproduction journals include a large of meeting abstract which less is cited by researchers. The number of publications of journals is variable, the relative h-index is also variable. Therefore, the relative h-index may not reflect real publication citation.

CONCLUSION

As a basic principle, it is always prudent to use several indicators to measure research performance such as JIF and h-index. The study show that the JIF on the one hand and the h-index on the other, measure different things. The h-index is a useful supplementary indicator, enrichment for the bibliometric toolset but it is certainly not suited to substitute advanced indicators (JIF) which have long ago become standard in bibliometric research.

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