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Consumer Religiosity and Its Influence on Their Uptake and Consumption of Edible Insects Among Selected Communities in Western Kenya

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Global food demand is expected to rise due to the population increase estimated to reach 9.5 billion by the year 2050. As a result, the available natural resources such as water sources and land will become scarce and overused. Indisputably, other sustainable food resources need to be identified and practised to solve the problem of food inadequacy. The world population will be encouraged to eat less consumed food resources. Edible insects have been identified as sustainable food resource that is rich in protein and other nutrients. Even though it is still facing rejection among certain consumers due to unknown reasons, factors influencing entomophagy have now been studied from different angles of the world communities. A descriptive research design with both qualitative and quantitative methodology was employed, using a semi-structured questionnaire loaded in an Open Data Kit (ODK) Collect software. Additionally, a simple random sampling technique was used to measure the following constructs. Demographics, religiosity on the consumption of insects, contrasting beliefs among the selected religious societies on edible insects' consumption. There was an association between religious restriction and the consumption of edible insects at a P-value less than 0.05. However, it is unclear why individuals from religious groupings would choose not to consume insects while others condone the practice. The eating of insects is cited in religious doctrines. Nonetheless, there is still low consumption of edible insects among different religious believers. Religiosity has deterred individuals from indulging in certain food items. How comes they do not indulge in what their doctrines recommend? We, therefore, wish to find out why religion has not encouraged persons to adopt entomophagy. This study, therefore, seeks to examine the influence of religiosity on the consumption and uptake of edible insects among the selected communities in Western Kenya. The data for this study will be collected through the administration of a well-formulated electronic questionnaire and multivariate qualitative models.

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INTRODUCTION

The global population is estimated at 9.5 billion by 2050, and this population will need food (Alexandratos et al., 2012). Much of this population growth is expected in developing countries. For the population to be fed, agricultural production must double, and meat production must go up to 60-70% to meet the demand (Lal, 2016). However, natural resources that support agricultural systems are already strained because they are overused and, in some cases, misused (Winpenny, 2005). There is, therefore, a need for climate-smart agriculture sources of food, which edible insects have demonstrated (Imathiu, 2020).

Insects are very rich in protein and minerals than meat hence a potentially superior alternative to conventional meat. The consumption of edible insects conserves the environment because they are exceptionally efficient in feed conversion into consumable tissues (Losey & Vaughan, 2006). Insects feed on a wide range of plants, and rearing insects requires less space, unlike rearing livestock (Van Huis & Vantomme, 2014). Rearing and consuming insects appear to be more desirable for developing countries (Liu et al., 2020). Particularly for a country such as Kenya, where agricultural

production faces many challenges to feed 52.57 million people due to limited farmland and natural resources which have become scarce and overused. In Western Kenya, the most consumed insects are locusts, termites, grasshopper, and crickets though it is still facing rejection among certain consumers.

Consumption of edible insects is a sustainable approach that is being promoted in all parts of the world as a remedy to the high population growth rate experienced. Edible insects are potentially less burdensome protein sources in the environment than livestock (Halloran et al., 2016). According to FAO (2018), edible insects are great sources of protein, vitamins, fibres, and minerals. Several countries in the west are now tweaking policies to embrace entomophagy. However, the potential contribution of edible insects to food security in Africa is under even more threat. A decrease in the prevalence of traditional practices of eating insects has been reported in communities of developing countries where insect consumption used to be common (Dube et al., 2013; Meyer-Rochow and Chakravorty, 2013; Obopile and Seeletso, 2013; Looy et al., 2014). Edible insects are facing rejection due to unknown reasons. Factors influencing entomophagy have now been studied

from different angles of world communities. However, it is unclear why individuals from religious groupings would choose not to consume insects while others condone the practice in support of food security. Nonetheless, there is still low consumption of edible insects among different religious believers (Ramos-Elorduy, 2009). In the western part of Kenya where consumption of edible insects is not a new thing, some purported. Christian religious sects have disapproved of edible insects, albeit approval by the Bible which they follow. This study, therefore, seeks to examine the influence of religiosity on the consumption and uptake of edible insects among the selected communities in Western Kenya and why adherence to religion has not promoted the production and consumption of crickets.

This study is important to the food industry in Kenya as they will know the consumers' tastes and preferences as influenced by their religion. This will provide opportunities for adding value to the

insect's-based products. Furthermore, the study is vital to the local and international communities whose interest is knowing how religion influences the consumption of edible insects, especially during the formulation of policies that allows the marketing of edible insects within the food systems.

MATERIALS AND METHODS

Study Areas

The study was conducted in selected sub-counties in Siaya County. Siaya County is bordered by Busia County to the north, Kakamega county and Vihiga county to the northeast, and Kisumu County to the southeast. It shares a waterbody with Homabay County, which is located to the south. The total area of the county is approximately 2496.1 Kilometre Square. The county lies between latitude 0° 26' to 0° 18' north and longitude 33° 58' east and 34° 33' west (Siaya County Development Office, 2018).

Figure 1: Map of Siaya Sub Counties



Source: <https://siaya.go.ke/download/map-of-siaya-county>

Study Design and Sampling Procedure

A descriptive research design with both qualitative and quantitative methodology was used in this study. The data for this study was collected using a semi-structured questionnaire loaded in an Open Data Kit (ODK) Collect software. A simple random sampling technique was used for Constructs measured; demographics, religiosity on the consumption of insects, contrasting beliefs among the selected religious societies on edible insects' consumption, and insect consumption patterns among believers and non-believers. Collectively, out of 240 sampled participants from the population of 960,224 questionnaires retained a 93% response rate.

Data Analysis

The data collected was downloaded into a Ms Excel package, cleaned, and imported to R version 4.1.3 (R Core Team, 2022) in preparation for analysis. Descriptive statistics such as frequencies, percentages, means and standard deviations and graphics were used to report the analysis and visualisation of the general trends in each of the variables measured. The Chi-square test of association (Rana, R., & Singhal, R. 2015) was used to establish the relationship between the consumption of edible insects (crickets, locusts, grasshoppers, and termites) and the religious beliefs, three main sects (Christians, Moslems and Legion Maria) and establish their significance towards consumption. Descriptive analysis was done concerning participants' place of residence, age, sex, ethnic background, household income, highest attained education level, and current

employment status with regard to insect consumption. Furthermore, regression analysis was used to assess the influence of religiosity on the uptake and consumption of edible insects among selected communities in Western Kenya.

Ethical Approval

This study was ethically reviewed and permitted by the Ethical Review Committee and Board of Postgraduate Studies of JOOUST. Permission to collect data from the study county was obtained from the Board of Graduate Studies. Consumers who took part in the study completed consent forms and were assured of anonymity.

RESULTS

Socio-Demographic Traits of the Participants.

The descriptive statistics are presented in relative percentages and counts, as shown in *Table 1* below. Out of 180 participants, 141 were from Alego Usonga, and 39 were from Bondo. Females greatly participated in this study with a proportion of 55.6%, and males were 44.4%. Participants varied age-wise; 52.2% were in the bracket 18-35 years, 25% were 36-50 years and those above 50 recorded the least numbers of 22.8%. Marital status statistics indicate that married people led 62.2%, unmarried at 19.4%, complicated at 16.7% and finally divorced at 1.7%. The highest education level of most participants was the secondary school at 50.8%, then informal at 26.7%, primary school graduates at 23.9% and those at the tertiary levels were 12.2%. Christians are the largest religious group, with a proportion of 82.8%, followed by Muslims at 13.3% and other religions at 3.9%.

Table 1: Socio-demographic variables

Variable		Alego Usonga		Bondo		Total	
		N	%	N	%	N	%
Gender	Female	70	38.9%	30	16.7%	100	55.6%
	Male	71	39.4%	9	5.0%	80	44.4%
	Total	141	78.3%	39	21.7%	180	100.0%
Age	18-35	80	44.4%	14	7.8%	94	52.2%
	36-50	36	20.0%	9	5.0%	45	25.0%
	Above 50	25	13.9%	16	8.9%	41	22.8%
	Total	141	78.3%	39	21.7%	180	100.0%
Marital Status	Divorced	22	12.2%	11	5.4%	33	18.6%
	Married	85	47.2%	27	15.0%	112	62.2%
	Unmarried	34	18.9%	1	0.6%	35	19.4%
	Total	141	78.3%	39	21.7%	180	100.0%
Education level	Informal	41	22.8%	7	3.9%	48	26.7%
	Primary	24	13.3%	19	10.6%	43	23.9%
	Secondary	58	32.2%	9	5.0%	67	50.8%
	Tertiary	18	10.0%	4	2.2%	22	12.2%
	Total	141	78.3%	39	21.7%	180	100.0%
Religious group	Christian	110	61.1%	39	21.7%	149	82.8%
	Muslim	24	13.3%	0	0.0%	24	13.3%
	Other	7	3.9%	0	0.0%	7	3.9%
	Total	141	78.3%	39	21.7%	180	100.0%

Table 2: The distribution of respondents based on their religious groupings

Denomination	Count	Proportion
Catholics	25	14%
ACK	14	8%
SDA	10	6%
Other protestants*	63	35%
African Instituted Churches**	37	21%
Islamic	24	13%
Non-believer	7	4%
Total	180	100%

*(AIC, Apostolic, Baptist, Orthodox, Lutheran, Pentecostal, Full Gospel, Salvation Army, Maranatha, Methodist, Power, Redeemed Gospel, Skills for Living, Voice of Salvation and Healing and Repentance and Holiness)

** (Roho, African Nineveh, Kingdom Mission (Ayuagra), Israel, Nomiya, God's Last Appeal and Legio Maria)

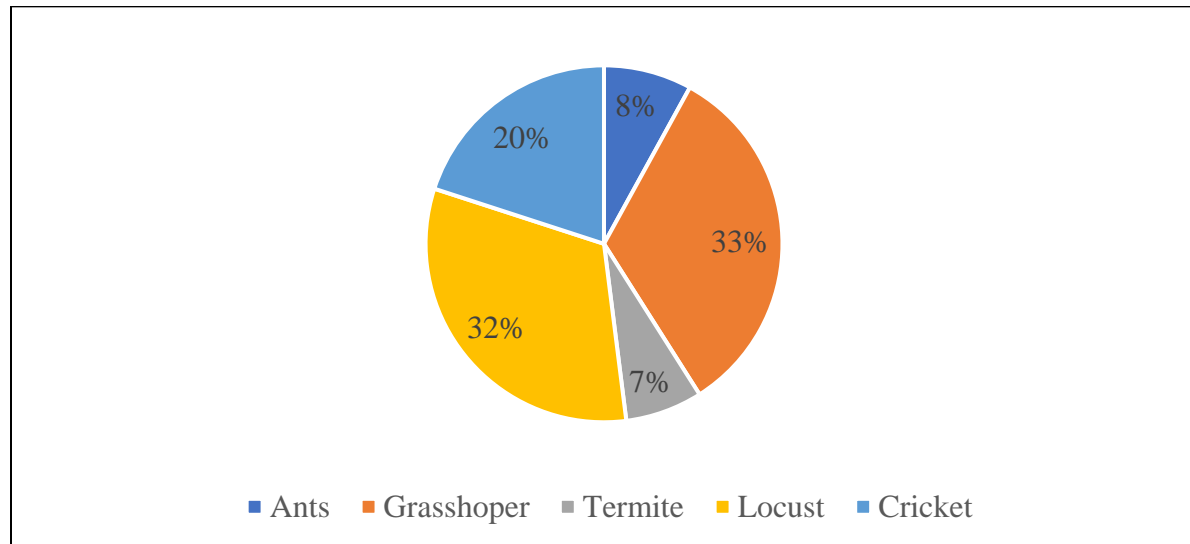
In *Table 3*. Approximately 52.2% of the participants state that they could advocate for insect consumption, whereas 47.8% believe that they cannot. All Muslims and Non-believers advocate for the consumption of edible food. Most SDAs and

other Protestants advocate for edible insects, whereas fewer Catholics, ACK and African-instituted churches advocate for insect consumption.

Table 3: Religious organisations would advocate for the consumption of edible insects.

Denomination	Yes		No		Total	
	f	%	f	%	f	%
Catholic	7	3.9%	18	10.0%	25	13.9%
ACK	3	1.7%	11	6.1%	14	7.8%
SDA	7	3.9%	3	1.7%	10	5.6%
Other protestants	40	22.2%	23	12.8%	63	35.0%
African Instituted Churches	6	3.3%	31	17.2%	37	20.6%
Islamic	24	13.3%	0	0.0%	24	13.3%
Non-believer	7	3.9%	0	0.0%	7	3.9%
Total	94	52.2%	86	47.8%	180	100%

Figure 2: Commonly consumed insects.



The popularity of grasshoppers as edible is at 33%, locusts at 32%, cricket at 20%, ants at 8% and termites at 7%.

Table 4 below gives an overview of religious restrictions against insects. Approximately 12.2% stated that they were religiously restricted, whereas 87.8% responded no. For those who responded yes,

they were further asked the type of insect that they were restricted from eating. The insects under restriction were bees and hornets (honey), crickets, termites, lake flies, locusts, non-winged insects, and those that do not walk on fours. Various religious consequences followed the consumption of the insects; suspension from church activities, hatred by denominational members, rehabilitation,

incapacitation and for others, the Holy Spirit could dictate what could befall the consumer.

Table 4: Religious restrictions towards the consumption of insects

Denomination	Yes		No		Total	
	f	%	f	%	f	%
Catholic	2	1.1%	23	12.8%	25	13.9%
ACK	1	0.6%	13	7.2%	14	7.8%
SDA	0	0.0%	10	5.6%	10	5.6%
Other protestants	8	4.4%	55	30.6%	63	35.0%
African Instituted Churches	11	6.1%	26	14.4%	37	20.6%
Islamic	0	0.0%	24	13.3%	24	13.3%
Non-believer	0	6.1%	7	3.9%	7	3.9%
Total	22	12.2%	158	87.8%	180	100%

In reference to *Table 5* below. Religiously, it is believed that there are some rules regarding insect eating. Approximately 41.7% state that none is

documented, 29.4% point out the Bible, 7.2% quote the Quran, 2.2% recall the Canon law and 19.4% are not sure about the documentation.

Table 5: Documentation of rules regarding insect eating.

Documentation	Frequency	Proportion
None	75	41.7%
In the Bible	53	29.4%
Canon law	4	2.2%
In Quran	13	7.3%
Not sure	35	19.4%
Total	180	100.0%

Upon testing the hypothesis of whether denomination has an impact on the individual experience of consuming edible insects, it is found

that there is an association. Since the p-value, 0.026 is less than the alpha, the level of significance of the null hypothesis is rejected, as indicated in *Table 6*.

Table 6: Impact of denominational religiosity on the consumption of edible insects

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	14.343 ^a	6	.026
Likelihood Ratio	17.740	6	.007
N of Valid Cases	180		

The association between respondents' religious restriction and whether they have actually consumed the edible insects was analysed, as shown in *Table 7*. A p-value of 0.002 was obtained, which

is greater than the 0.05 level of significance. The null hypothesis is rejected, and the conclusion is that there is an association between religious restriction and the consumption of edible insects.

Table 7: Impact of religious restriction on consumption of edible insects

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	9.963 ^a	1	.002
Continuity Correction ^b	8.337	1	.004
Likelihood Ratio	8.630	1	.003
N Of Valid Cases	180		

Out of the 14.8% of Christians who stated that they are religiously restricted from consuming insects, 7.4% have tried consuming them. Generally, 75.8% of Christians have consumed insects. No Muslim cited a restriction on edible insects; 75% of the Muslims have consumed insects. For other

religions, none cited restrictions, and 100% of them have consumed edible insects. Despite 12.2% of the total sample believing that they were religiously restricted from taking edible insects, 76.7% actually consumed insects, as indicated in *Table 8*.

Table 8: Insect consumer behaviour based on religious group and restriction

Religious Group			Religion restrictions insect		Total	
			No	Yes		
Christian	Tried consuming insects	No	Count	25	11	36
			% of Total	16.8%	7.4%	24.2%
		Yes	Count	102	11	113
			% of Total	68.5%	7.4%	75.9%
	Total		Count	127	22	149
			% of Total	85.2%	14.8%	100.0%
Muslim	Tried consuming insects	No	Count	6		6
			% of Total	25.0%		25.0%
		Yes	Count	18		18
			% of Total	75.0%		75.0%
	Total		Count	24		24
			% of Total	100.0%		100.0%
Other	Tried consuming insects	Yes	Count	7		7
			% of Total	100.0%		100.0%
	Total		Count	7		7
			% of Total	100.0%		100.0%
Total	Tried consuming insects	No	Count	31	11	42
			% of Total	17.2%	6.1%	23.3%
		Yes	Count	127	11	138
			% of Total	70.6%	6.1%	76.7%
	Total		Count	158	22	180
			% of Total	87.8%	12.2%	100.0%

Table 9 shows an analysis of the response to the adoption of edible insects as feeds and existing restrictions was done. At a 5% level of significance,

we reject the null hypothesis in favour of the alternative and conclude that there is an association between consumer beliefs and religious restrictions.

Table 9: Association between customer beliefs and religious restrictions.

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.182 ^a	1	.041		
Continuity Correction ^b	3.302	1	.069		
Likelihood Ratio	4.244	1	.039		
Fisher's Exact Test				.067	.034
N of Valid Cases	180				

DISCUSSIONS

Socio-Demographic Characteristics

In this study, participants of Bondo and Alego Usonga were selected, where 78.3% were from Alego, and 21.7% came from Bondo. The participants were distributed across various age groups, where 52.2% were aged 18-35, 25% were aged 36-50, and the remaining 22.8% were above 50 years. Most of the participants were married, 62.2%, those who were not married were 19.4%, and those who had complicated relationships and were divorced accounted for 16.7% and 1.7%, respectively. Half of the participants attained secondary school level, 26.7% had informal education, 23.9% had a primary school certificate, and 12.2% had proceeded to tertiary schools.

The participation of women in this study was high compared to that of men. In the African setting, including Kenya, women are responsible for feeding their families. Due to the high possibility of interacting with insects and insect-based foods while seeking foods for their families, the level of insect consumption familiarity among women is high (Smarzynski et al., 2019). Therefore, their high participation informed the likelihood of edible insects consumptions in many households. Young people are likely to participate in various unlikely studies because of their adventurous nature and new

experiences. In comparison to the study by Elena and other scholars, in terms of age, young individuals between 18 and 35 years participated in large numbers and according to the findings, a high percentage had consumed insects or insect-based foods once or numerous times. Additionally, a high percentage of the participants had attained secondary school education. Attainment of a secondary school education helped the majority of the participants to make informed decisions about the consumption of insects or insect-based foods. Finally, 54% of the participants were Christians, followed by Muslims at 35%, and 11% participants from other religions. The high number of Christian participants is because a high number of people living in the study area are Christians.

Influence of Religiosity and Other Factors on Consumption of Edible Insects

From the chi-square tests conducted, it was observed that consumption of insects was associated with religious restriction, whether the person advocates for consumption and religious denomination. A logistic regression was further conducted to examine the impact. Religion has an impact on the consumption of edible insects, a finding that corresponds with results carried out by van Huis et al. 2013. Christianity however had no impact on the consumption of edible insects, whereas Islam had a significant impact. Religious

restrictions however have a significant influence on religiosity. Those advocating for the consumption of insects significantly impact the uptake of edible insects. The female gender has a high tendency to consume insects as well as the educated (Elena et al., 2019; Smarzynski et al., 2019).

From this analysis, therefore, religiosity has an impact on the consumption of edible insects. Muslims and other religions significantly influence the consumption of insects. The non-significance of Christianity on the consumption of edible insects subject matter could be caused by its documentation in the Bible. The consumption patterns of insects are observed to be lower in believers compared to the 100% consumption by non-believers.

The denomination was found to have an impact on the individual experience of edible insect consumption. There exists a certain pattern within certain denominations pertaining to insect consumption. Consumption of insects is mainly determined by the restriction put in place by the religion. Alongside religion, people have differing views and attitudes towards the adoption of insects as food.

In line with the results from the current study, Chakravorty et al. 2013 and van Huis et al. 2013 found that religion greatly impacts personal views on insect consumption. Various religions have differing opinions when it comes to insect consumption. About 88% of the population cited non-restriction on edible insects, whereas the 12% who cited restriction gave reasons and insects. Bees and hornets for honey, termites, crickets, locusts, lake flies and non-winged insects that do not walk on fours were restricted by some religions. For every action, there must be a consequence. To uphold the rules and ethics of the religion, certain measures are put in place to act as a punishment for the lawbreakers. Insect eaters were punished by suspension and seclusion from church activities and members, incapacitation, and rehabilitation as an advance action. Religion believes in the existence of

a Supreme Being, and in some cultures, the Holy Spirit (Supreme Being) could decide what could befall the consumer since it was beyond human judgment.

A study carried out by Slater (2021) matches the findings of the study that restrictions on the consumption of insects and insect-based foods by religion are based on the identified insects' characteristics. According to the restrictions given in the holy books regarding the consumption of edible insects, restriction or permission to consume is based on the mode of locomotion of the said insects. It is argued that preference is given to hoping insects over crawling insects (Slater, 2021). Hoping insects are believed to be clean this is because they are herbivorous. In that case, the possibility of consuming blood is nil; therefore, when one consumes this type of insect would not be against the holiness law that prohibits the consumption of blood, acts of violence, and predation. On the contrary, crawling insects are considered unclean because of the high likelihood of blood consumption, violence, and predation. The consumption of these insects would go against the rules and regulations of religious teachings that restrict the consumption of these kinds of insects (Burnside, 2015; Slater, 2021).

The denomination was found to have an impact on the individual experience of edible insect consumption. There exists a certain pattern within certain denominations pertaining to insect consumption. Consumption of insects is mainly determined by the restriction put in place by the religion. In comparison to the study findings, this entails that alongside religion, people have differing views and attitudes towards the adoption of insects as food. Religion greatly impacts personal views on insect consumption.

Association between Customer Beliefs and Religious Restrictions

The results of the findings showed that there is an association between consumer beliefs and religious restrictions (5% level of significance) regarding the consumption of edible insects. The holy books are believed to have laws that direct the behaviour of individuals and God's promises to his people, a finding that is similar to a conclusion made by the study done by (Slater, 2021). In that case, the holy books act as a covenant between God and Humankind. Believers of religion, Christians and Muslims, are taught to keep and obey the laws provided in the holy books for them to be part of those who will reap from the promises of and remain in covenant with God. From the sheer belief that there is a need to obey God's commandments, believers, Muslims or Christians do not focus much on the characteristics of the nutritional benefits that are associated with the consumption of certain insects. Rather, single out the various insects pinpointed in the holy books and restricts themselves from consuming them (Burnside, 2015). This conclusion is similar to the findings made from this study. Therefore, it is observed that consumers, according to their beliefs, do not consume insects that are referred to as unclean. On the other hand, non-believers are not held back by any rules. Therefore, out of free will and knowledge about edible insect consumption, non-believers consume or do not consume insects.

CONCLUSIONS

Edible insects have been identified as a source of sustainable food source as well as nutrition for many individuals currently and will remain that way in future. According to Mancinin et al. (2019), the consumption of insects depends on gender, knowledge levels, and personal and social factors, such as religious beliefs. There has been a notable decrease in the global consumption of edible insects in many societies due to the same reasons cited as being determinants of insect consumption. It is

evident that the religious beliefs of individuals influence the decision to consume edible insects. There has been a lot of effort being put into the promotion of the consumption of edible insects around the world and majorly in developing countries, such as Kenya, where food scarcity is a major problem.

The consumption of edible insects is impacted by religious beliefs and the documented rules about the consumption of edible insects found in the holy books, the Bible and the Quran (Slater, 2021). Edible insects have been found to contain a high nutrient value compared to other available food resources currently. Also, they are environmentally friendly because their production requires little space, no application of farm products is used, have high biomass, and help in reducing the carbon footprint that is otherwise a result of the process of production of other food products. However, despite these benefits, some Christians and Muslims find it hard to consume insects citing the adverse outcomes they might be subjected to by their religious leaders or other religious followers. Others cite that they only follow the rules provided in the Holy books; hence, what they consume or do not consume is clearly indicated and documented in these books. Therefore, from the research findings, it can be concluded that the consumers' religious beliefs influence the consumption of edible insects.

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